



Bumbuna Phase II Project: Critical Habitat Assessment

March 2017

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Executive summary

Introduction

- i. This report is the Critical Habitat Assessment for the Bumbuna Phase II Project (the Project), a hydroelectric development in north-west Sierra Leone approximately 200 km from Freetown, under development by Joule Africa. The Project is aligning with International Finance Corporation (IFC) Performance Standards as a model of international leading practice, including Performance Standard 6 (PS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC 2012a). The Project comprises the Bumbuna Extension Project, the Yiben Dam project, and a range of construction-enabling supporting facilities including road upgrades, workers' camps, quarries and a non-hazardous landfill waste management facility (see [Section 1.3](#)). The new Transmission Lines (approx. 36 km) associated with the Project are being developed by the Government of Sierra Leone as part of a much larger transmission project that covers a length of 240km. This report aims to identify Natural Habitat and Critical Habitat-qualifying biodiversity associated with the Project; outline the implications of the outcome of CHA for the Project; and identify the recommended next steps for the Project.

IFC PS6 requirements

- ii. PS6 makes several stipulations for Critical Habitat, including achievement of a net gain for Critical Habitat-qualifying biodiversity. In Natural Habitat, no net loss is required, in practice where there are significant residual adverse impacts on Natural Habitat arising from Project development and persisting after appropriate avoidance, minimisation and restoration measures have been taken. PS6 also notes that given the sensitivity of Tier 1 Critical Habitat, a development located in such habitat may be challenged to align with PS6 requirements (IFC 2012a). This means that a robust Project-specific ESHIA baseline is vital, followed by iterative and thorough application of the mitigation hierarchy to ensure that impacts are avoided, minimised and restored as far as feasible, reducing the significance of any residual impacts and the requirement for offsetting.
- iii. PS6 also makes provision for Legally Protected Areas and Internationally Recognised Areas. Where a project is within such an area, the PS6 provisions for Natural Habitat and Critical Habitat apply, and the client is further expected to: demonstrate legal permission to develop in the LPA/IRA; ensure consistency with existing management plans; consult with relevant stakeholders; and to implement additional programmes to promote and enhance the conservation aims and effective management of the area.

Summary of the CHA process

- iv. Applying the PS6 criteria and thresholds for Critical Habitat involves the use of ecologically and/or administratively coherent Discrete Management Units (DMUs). Two Discrete Management Units have been identified: one aquatic and one terrestrial. The aquatic DMU

includes the entire Seli/Rokel catchment where the Project infrastructure will be located, extending from the source of the river to the coast to recognise the migratory ecology of many aquatic species. The terrestrial DMU has been identified from satellite imagery as an area largely separate from other wooded areas in the landscape. It encompasses two Chiefdoms potentially affected by the Project infrastructure, within which some communities affected by the Project will be resettled.

- v. This CHA is based on existing documentation, including the Project ESHIA and earlier baseline studies, interpretation of global and regional datasets (e.g. the IUCN Red List of Threatened Species), and consultation with internationally renowned specialists (for plants, amphibians, primates, mammals and freshwater species). The area assessed for Critical Habitat is not just the direct Project footprint, but considers a broader landscape. This precautionary approach ensures all Project risks are taken into consideration, and demonstrates transparency to relevant stakeholders.

Outcome of CHA

- vi. The Project is in Critical Habitat for a suite of species. Both the terrestrial and aquatic DMUs qualify as Tier 1 Critical Habitat - habitat of extreme importance for the survival of the qualifying species (see [Section 4.1](#) and [Section 5.1](#)). The Critical Habitat-qualifying taxa comprise: mammals, birds, amphibians, reptiles, freshwater fish, freshwater plants and terrestrial plants. Critical Habitat-qualifying species are summarised in Table A. Full details are in Sections [4](#), [5](#), [6](#) and [7](#) and [Appendix 4](#).

Table A: Summary of CHA

Taxonomic group	Species	IUCN Red List category
Criterion 1, Tier 1		
Mammal	Ziama Horseshoe Bat, <i>Rhinolophus ziama</i>	EN
Freshwater fish	<i>Enteromius liberiensis</i> ⁺ ¹ , <i>Epiplatys lokoensis</i> and <i>Marcusenius meronai</i>	EN
Freshwater plants	<i>Ledermanniella yiben</i>	NE; Evaluated as EN by RBG Kew experts
Criterion 1, Tier 2		

Mammal	Diana Monkey, <i>Cercopithecus diana</i> * and Western Black-and-White Colobus, <i>Colobus polykomos</i> *	VU
	Western Chimpanzee, <i>Pan troglodytes verus</i>	CR
	Western Red Colobus, <i>Piliocolobus badius</i>	EN
Birds	Hooded Vulture, <i>Necrosyrtes monachus</i> and White-backed Vulture, <i>Gyps africanus</i>	CR
Amphibian	Freetown Long-fingered Frog, <i>Arthroleptis aureoli</i>	EN
Reptile	Slender-snouted Crocodile, <i>Mecistops cataphractus</i>	CR
Terrestrial plant	<i>Vepris felicis</i>	NE; Evaluated as EN by RBG Kew experts
Freshwater plant	<i>Ledermanniella aloides</i>	VU; Evaluated as EN by RBG Kew experts
Criterion 2, Tier 1		
Freshwater fish	<i>Epiplatys sp. aff. njalaensis</i> #	NE
Freshwater plant	<i>Ledermanniella yiben</i>	NE; Evaluated as EN by RBG Kew experts
Criterion 2, Tier 2		
Mammal	Ziama Horseshoe Bat, <i>Rhinolophus ziama</i>	EN
Dragonfly	Yellow-fronted Threadtail, <i>Elatoneura dorsalis</i>	VU
Freshwater fish	<i>Epiplatys sp.</i> # and <i>Scriptaphyosemion cf. chaytori</i> #	NE
	<i>Epiplatys lokoensis</i> and <i>Marcusenius meronai</i>	EN
	<i>Rhexipanchax kabae</i>	VU
	<i>Synodontis tourei</i>	NT

*This species is known as *Barbus liberiensis* on the IUCN Red List (v. 2016.3), but is referred to here as *E. liberiensis* for consistency with the Project ESHIA.

* Species included because of the potential for upgrade to EN or CR status on the IUCN Red List soon, based on the assessment of primate specialists.

Species not yet formally described or assessed on the IUCN Red List

- vii. The Project study area overlaps with three protected or internationally recognised areas (Lake Sonfon IBA, Bumbuna Conservation Area, and Farangbaia Forest Reserve, see [Section 10](#)) and eight Natural Habitat types (see [Section 11](#)).
- viii. One species – Pygmy Hippopotamus - does not currently qualify under the criteria for Critical Habitat, but is of concern due to international/national stakeholder interest and non-Project

threats. Internationally-accepted good practice is to treat such biodiversity in the same way as Critical Habitat-qualifying biodiversity. There are a further eight species classed as Data Deficient or Not Evaluated on the IUCN Red List: three amphibians and five freshwater fish. These species may qualify as restricted-range under Criterion 2, Tier 2, but given the limited available information it is currently difficult to confirm this.

- ix. CHA is an iterative process. As the information base is developed, knowledge of the distribution, population/extent and threat status of individual species (DD/NE and otherwise) and habitats may change. Thus, the Critical Habitat-qualifying status of a given species may change in the future. The presence of Critical Habitat does not necessarily mean that the Project will impact Critical Habitat-qualifying features. Several scenarios are possible, from impacts that are negligible, readily avoided or temporary, to those that are significant, long-term and challenging to mitigate.

Next steps for the Project

- x. The Project is in Critical Habitat, which means special attention should be paid to management of biodiversity impacts. This CHA highlights the priority biodiversity features that the Project needs to consider. For these features, the Project should align with the requirements of PS6 paragraphs 17 and 18.
- xi. Both Modified and Natural Habitats can be Critical, whether they are occupied permanently or transiently by Critical Habitat-qualifying species. A priority task for the Project is additional baseline surveys to enable mapping of Critical Habitat-qualifying features in the Project area of influence. Surveys should consider both species and habitats, to support effective impact assessment and mitigation planning. This will enable the Project to distinguish between Natural Habitats where Critical Habitat-qualifying species are present and the net gain requirement applies, and Natural Habitats that do not support Critical Habitat-qualifying species where the no net loss requirement may apply.
- xii. Although there are several Critical Habitat-qualifying features in the Project landscape, they are not all equal priorities for further research and targeted mitigation. Some are much more likely to be impacted (directly or indirectly) by the project than others. Although good information is available for some, there are significant data gaps for others. It is important to prioritize these features for management action and monitoring effort, to ensure that resources are effectively applied and sound conclusions are reached. It is also important to consider which features need a species-specific focus and which can be collectively addressed through broader consideration of ecosystems, evaluating relevant ecological factors (e.g. dependencies on ecological processes) and taking a landscape-level perspective (e.g. issues around connectivity and movements). This prioritisation exercise has been carried out separately to this CHA, informed by the outcome of CHA and based on the risk of impact on each species. The prioritisation is detailed in (TBC 2017).

1 Introduction

1.1 Purpose of this report

This report is the Critical Habitat Assessment (CHA) for the Bumbuna Phase II Project (the Project), a hydroelectric development in north-west Sierra Leone under development by Joule Africa (JA). The Project is aligning with International Finance Corporation (IFC) Performance Standards as best practice for the Project, including Performance Standard 6 (PS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC 2012a).

The aim of this report is to:

- (1) **Identify** Critical Habitat-qualifying biodiversity associated with the Project;
- (2) **Outline the implications** of the outcome of CHA for the Project; and
- (3) **Identify the recommended next steps** for the Project.

1.2 IFC PS6

The objectives of PS6 are to: protect and conserve biodiversity; maintain the benefits from ecosystem services; and promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

PS6 identifies three classes of area based on (i) vegetation condition ('quality' or 'state') and (ii) significance for biodiversity (Table 1). PS6 uses the term 'habitat' to refer to these areas, rather than the actual vegetation within them. These classes are:

- Modified Habitat;
- Natural Habitat; and
- Critical Habitat. Critical Habitat is a subset of Modified and Natural Habitat.

Area condition is classified as either **Natural** or **Modified** based on the extent of human modification of the ecosystem. The threshold for classifying a habitat as Modified rather than Natural is high: only the most heavily disturbed habitats would be classified as Modified. Monoculture forestry plantations, arable fields and urban areas show "substantial modification" and would be classed as Modified; selectively logged tropical forest usually retains most original species and ecological processes and so would in most cases still be considered Natural Habitat.

Areas of **high biodiversity value** are termed **Critical Habitat** by the IFC PS6 requires an assessment of the presence of Critical Habitat, considering the principles of threat (vulnerability) and geographic rarity (irreplaceability). Critical Habitat Assessment (CHA), therefore, is a process for identifying significant biodiversity risks associated with the Project.

Identification of Critical Habitat is independent of the state of the habitat: Critical Habitat-qualifying biodiversity may be present even in heavily degraded Modified Habitat, such as rare frogs in human modified landscapes in Europe.

Table 1: Summary of the PS6 scheme for classifying areas

Three classes of area identified in PS6		Condition of the area	
		Natural	Modified
Significant types or quantities of biodiversity (Critical Habitat-qualifying features)	Present	Critical Habitat	Critical Habitat
	Absent	Natural Habitat	Modified Habitat

1.3 The Project

The Project is in the Northern Province of Sierra Leone, approximately 200 km from the capital Freetown (Figure 1). The Project comprises:

- The Bumbuna Extension Project:
 - Adaptation of the infrastructure of an existing HEP (Bumbuna Phase I), involving a new power intake structure, a new main headrace tunnel and a new powerhouse and switchyard
- The Yiben Dam project:
 - A new dam spanning the Seli River near the village of Yiben
 - A new reservoir covering approximately 115 km²

Approximately 36 km of new Transmission Line are associated with the Project, and will be developed by the Government of Sierra Leone as part of a much larger transmission project that covers a length of 240km. The lines associated with the Project are:

- Between the Bumbuna II Extension switchyard and the Yiben Dam project
- Between the Bumbuna II Extension switchyard and the proposed West African Power Pool Substation

A range of construction-enabling supporting facilities and activities are also involved, including: road upgrades, workers' camps, development of quarries and the construction of a new non-hazardous landfill waste management facility.

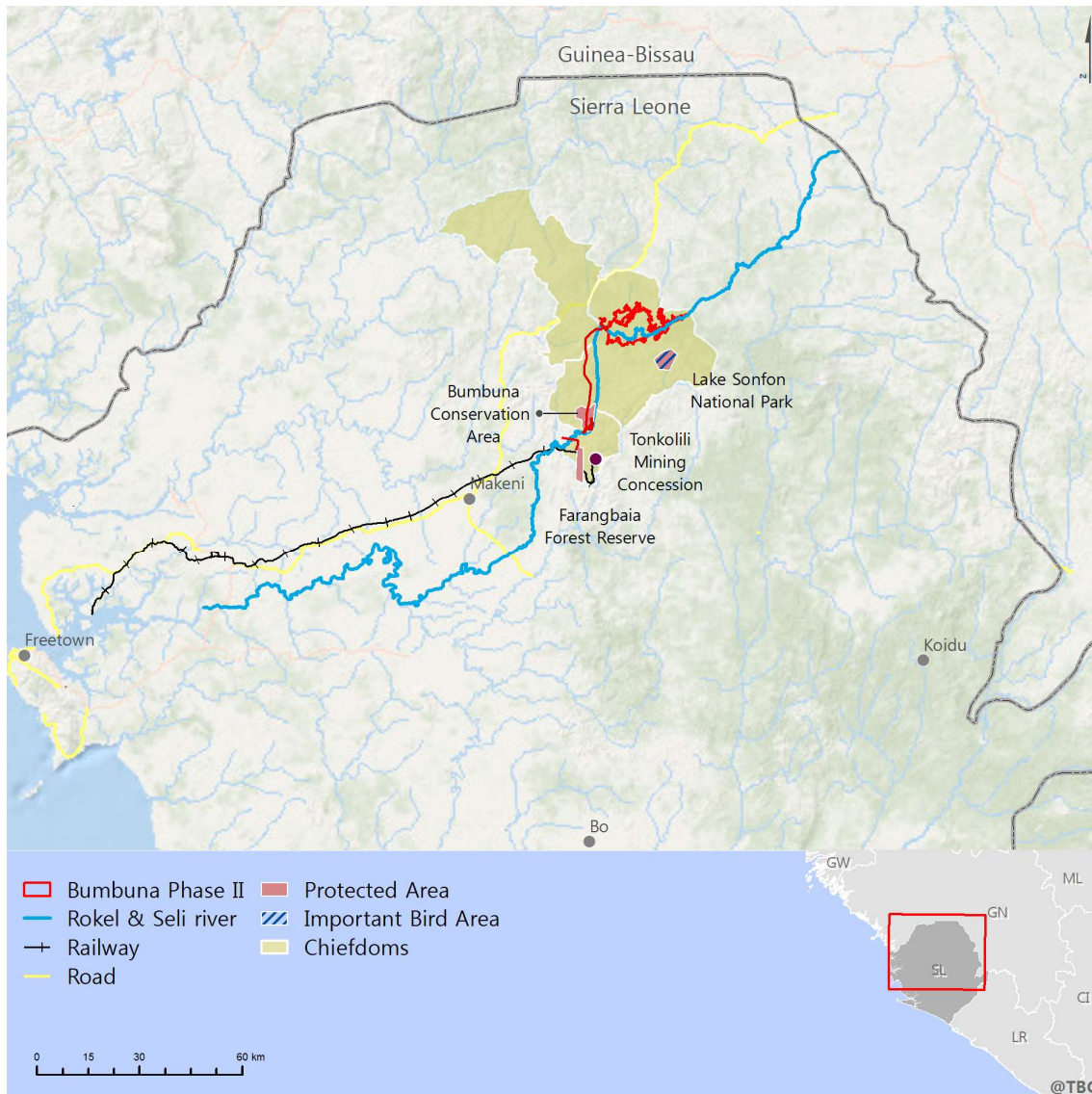


Figure 1: The Bumbuna Phase II Project location

2 The CHA process

2.1 Discrete Management Units

CHA is carried out at the landscape scale, using ecologically and/or administratively coherent Discrete Management Units (DMUs), which are a means for determining the presence or absence of Critical Habitat-qualifying features under PS6 criteria 1 – 3 (see [Section 2.2](#)). DMUs are defined by the IFC as 'areas with a definable boundary within which the character of biological communities and/or management issues have more in common with each other than they do with those in adjacent areas'.

Definition of DMUs should be informed by the biodiversity features of concern and their ecological requirements. DMUs are identified at a landscape scale, considering large-scale

ecological processes where appropriate, and are therefore often much larger than the project concession or lease area itself.

A preliminary review of the region's ecology is thus carried out during the identification of DMUs. This highlights any potential Critical Habitat-qualifying features which might be present, and informs delineation of DMUs at an appropriate scale. Despite the name, a DMU is not a unit of management or of impact assessment, and places no management obligations on a project. There are several approaches to defining DMUs, such as separate DMUs for individual species/sub-species, or (more commonly) for a suite of species with broadly shared requirements, but DMUs are not range maps for Critical Habitat-qualifying species.

2.2 Criteria for identifying Critical Habitat

PS6 has three criteria for which quantitative thresholds have been defined, and each criterion has two Tiers (see [Section 3.3.1](#) and [Appendix 1](#)):

- Criterion 1: Critically Endangered and Endangered species;
- Criterion 2: Endemic/ Restricted Range Species; and
- Criterion 3: Migratory/Congregatory Species.

The Tiers are defined by quantitative thresholds expressed as percentages of global and national population sizes, or of proportions of known species ranges or distributions. Tier 1 Critical Habitat contains a greater proportion of a qualifying species' population or range than Tier 2 Critical Habitat, and so is consequently more important for that species.

There are also two qualitative criteria (these criteria have one level only – they are not tiered):

- Criterion 4: Highly Threatened and/or Unique Ecosystems; and
- Criterion 5: Key Evolutionary Processes.

PS6 also makes provision for Legally Protected and Internationally Recognised Areas as Critical Habitat, including UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, Important Bird Areas and wetlands designated under the Convention on Wetlands of International Importance ('the Ramsar Convention'). Other areas of high biodiversity value (such as areas of primary/old growth forest, or areas required for the reintroduction of threatened species) may also qualify, as determined on a case-by-case basis by specialists and the IFC.

Thresholds and definitions for Critical Habitat criteria are given in the relevant report section, below, and summarised in [Appendix 1](#).

2.3 Implications of Critical Habitat for the Project

Being within Critical Habitat means that the Project needs to pay special attention to management of biodiversity impacts, and highlights the priority biodiversity features and processes that the

Project needs to consider. Table 2 shows the requirements of PS6 paragraph 17 and 18, with respect to Critical Habitat.

Table 2 IFC PS6 paragraph 17 and 18 on Critical Habitat

PS6 reference	PS6 text
PS6 paragraph 17	<p>'In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:</p> <ul style="list-style-type: none"> • No other viable alternatives in the region exist for development of the project on Modified or Natural Habitats that are not Critical; • The project does not lead to measurable adverse impacts on those biodiversity values for which the Critical Habitat was designated, and on the ecological processes supporting those biodiversity values; • The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time; • A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program'.
PS6 paragraph 18	<p>'In such cases where a client is able to meet the requirements defined in paragraph 17, the project's mitigation strategy will be described in a Biodiversity Action Plan (BAP) and will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated'.</p>

The Project will also need to meet the PS6 expectations for the management of impacts on Modified and Natural Habitat. Table 3 shows the requirements of PS6 paragraph 15 with respect to these.

Table 3: IFC PS6 paragraph 15 on Natural Habitat

PS6 reference	PS6 text
PS6 paragraph 12	<p>'This Performance Standard applies to those areas of Modified Habitat that include significant biodiversity value, as determined by the risks and impacts identification process required in Performance Standard 1. The client should minimize impacts on such biodiversity and implement mitigation measures as appropriate.'</p>
PS6 paragraph 15	<p>'In areas of Natural Habitat, mitigation measures will be designed to achieve no net loss of biodiversity where feasible.'</p>
PS6 footnote 9	<p>'No net loss is defined as the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to</p>

	undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale (e.g. local, landscape-level, national, regional).
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Table 4 summarises broadly how the Project can approach alignment with PS paragraphs 15, 17 and 18. The Project will need to set out mitigation measures in line with the mitigation hierarchy (CSBI & TBC 2015) that can reasonably be expected to achieve these requirements.

Table 4: Approach to alignment with PS6 for Critical and Natural Habitat

PS6 requirement	Project responsibility
No other viable project alternatives exist outside Critical Habitat	Demonstrate (e.g. through preliminary Project design) that there are no feasible alternatives to achieving the Project aim/objective in habitat that is not Critical. For example, the Project should seek to show that there are no feasible alternative designs for Project infrastructure, and no alternative sites for location of Project components outside Critical Habitat.
No measurable adverse impacts	Ensure that ESHIA demonstrates: the application/ implementation of mitigation measures; no measurable residual impact on Critical Habitat-qualifying features; no net reduction in Critically Endangered or Endangered species, no net loss of Natural Habitat, and that impacts on significant biodiversity in areas of Modified Habitat have been minimized according to the mitigation hierarchy.
No net reduction of Critically Endangered or Endangered species' populations	
No net loss of Natural Habitat	
Minimize impacts on significant biodiversity values in areas of Modified Habitat	
Net gain for Critical Habitat-qualifying features	Ensure that ESHIA demonstrates, through application of the mitigation hierarchy, that the Project will achieve net gain for Critical Habitat-qualifying features, that there is a BAP in place to implement this, and that there is a monitoring & evaluation plan in place to track progress.
BAP and robust monitoring & evaluation plan	

Critical Habitat designation is an assessment of biodiversity importance of an area, based on the biodiversity values and *not* the potential impacts associated with a Project. The presence of Critical Habitat does not necessarily imply an impact from the Project, and does not necessarily mean that any specific mitigation will be required. Figure 2 illustrates when restoration and offsetting for a given biodiversity feature is likely to be necessary.

Where impacts do occur, PS6 requires Projects to fully exercise the mitigation hierarchy. In Critical Habitat, this means that overall net gains of Critical Habitat-qualifying biodiversity are required

(see Table 2). A high threshold of proof will be required to demonstrate that it is feasible to deliver these net gains.

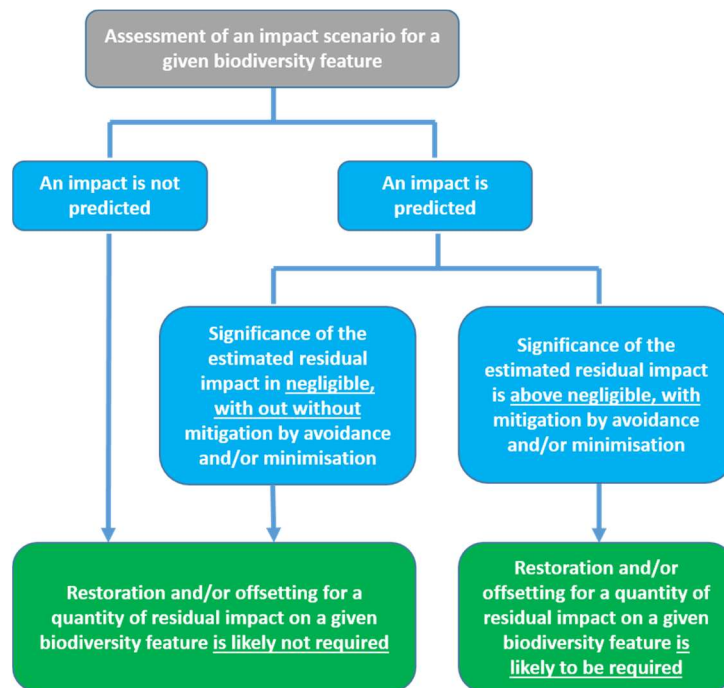


Figure 2: Identifying when offsets are likely to be required

3 Approach to CHA

Critical Habitat determination was based on the following steps (see IFC 2012b):

1. Identification of an appropriate DMUs:
 - To undertake the analysis for terrestrial and aquatic biodiversity values;
2. Collection and verification of available information on biodiversity:
 - From the ESHIA, baseline surveys, literature review, specialist consultation and analysis; and
3. Assessment against IFC criteria for species and habitats:
 - To identify which biodiversity features qualify as Critical Habitat.

3.1 Identification of DMUs

The area assessed for Critical Habitat is not just the direct Project footprint, but considers a broader landscape. This precautionary approach ensures all Project risks are taken into consideration, and demonstrates transparency to relevant stakeholders. It is sometimes appropriate to use different DMUs for individual biodiversity features (species, habitats, ecological processes, etc.) However, in practice, DMUs will be similar for many biodiversity features and as few DMUs as possible should be used to simplify the analysis. Two DMUs have been identified for the Project: one terrestrial and one aquatic.

3.1.1 Aquatic DMU

For aquatic species, freshwater habitat is the most important parameter to consider in the selection of an ecologically contiguous area. The Seli/Rokel² River is the primary river in the Seli/Rokel catchment where the Project infrastructure will be located. It flows from the Guinea highlands of north central Sierra Leone, 390 km to the coast, where it flows into the Atlantic Ocean next to the capital, Freetown.

The biodiversity features associated with freshwater may be affected by changes in the flow or quality of water in the Seli/Rokel River because of the Yiben reservoir and changes in the management of the Bumbuna dam. Whilst impacts from the construction and operation of the Project may dissipate with distance downstream of Project infrastructure, (as tributaries join the Rokel River and contribute to the overall flow in the river), both upstream and downstream implications are likely for aquatic species. Therefore, on a precautionary basis and in recognition of the migratory ecology of many aquatic species, the DMU includes the entire river catchment extending from the source of the river to the coast (Figure 3). The total area of the aquatic DMU is approximately 7,950 km².

3.1.2 Terrestrial DMU

The terrestrial DMU (Figure 3) has been defined based on consideration of habitat continuity and scale of potential impacts across the landscape. Natural Habitats within the area likely to support high conservation value species include gallery forest and wooded savannah³. An ecologically contiguous area of these habitats was identified from satellite imagery and GlobCover⁴, as shown in [Appendix 2](#). The DMU also encompasses several internationally and nationally recognized protected areas including Lake Sonfon National Park, the Bumbuna Conservation Area and Farangbaia Forest Reserve.

The habitat within the terrestrial DMU has good connectivity, but is largely separate from other wooded areas in the landscape. It is a sensible unit of analysis for the Project because impacts on any part of this area might negatively affect Project priority biodiversity, and thus present risks to the Project. The area encompasses the two Chiefdoms potentially affected by the Project infrastructure, within which communities affected by the Project will be resettled. The DMU is also considered large enough to account for potential cumulative impacts of the Project in

² The Seli/Rokel River is said to be called the Seli river above the Bumbuna falls and the Rokel river below the falls

³ Inselbergs may also be an important Natural Habitat but these occur sporadically across the landscape and therefore not considered to be an appropriate parameter to consider in delimiting a DMU.

⁴ [GlobCover, 2009](#)

combination with the nearby Tonkolili mining project. The total area of the terrestrial DMU is 2,980 km².

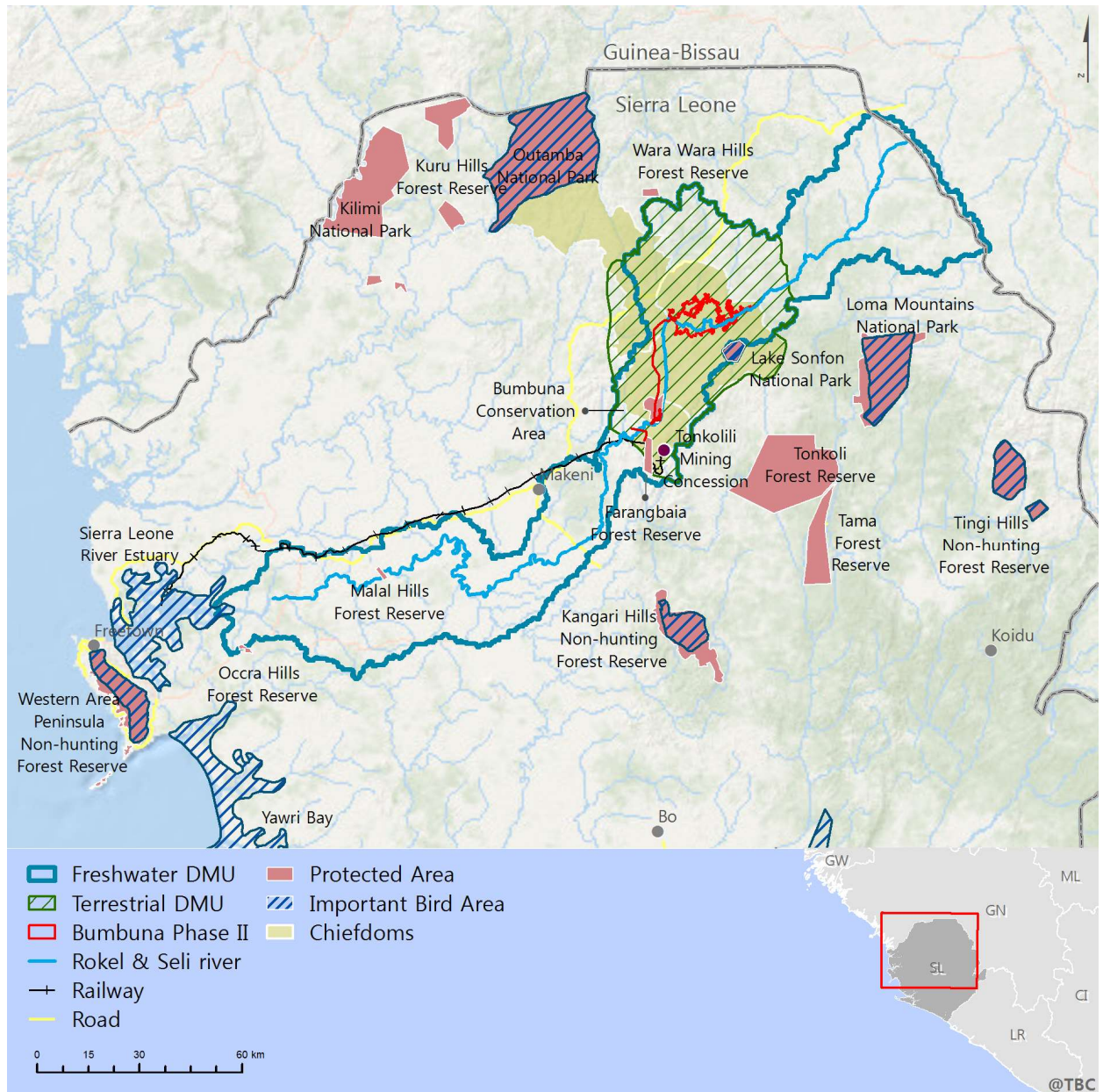


Figure 3: Freshwater and terrestrial Discrete Management Units (DMUs) for Project CHA.

3.2 Available information

The CHA is based on existing documentation and interpretation of global and regional datasets. Validation of the findings of the assessment has been undertaken for highest priority species with internationally renowned specialists (see [Section 3.2.1](#)).

During the early stages of the ESHIA process, biodiversity baseline surveys were carried out in a buffer area around the Project infrastructure. Studies were completed on several taxonomic

groups: large mammals, bats and primates, birds, plants, and aquatic ecology. The studies identified some species potentially new to science, and have contributed significantly to biodiversity knowledge of the area. Spatial analysis of these ESHIA data, global databases ([IUCN Red List](#) spatial data layers⁵ and [GBIF](#)⁶) was carried out to produce a candidate list of potential Critical Habitat-qualifying features known to occur within the aquatic and terrestrial DMUs, or whose distribution intersects with the DMUs.

3.2.1 Expert stakeholder consultation

IFC PS6 strongly recommends that a process of stakeholder consultation is integrated into a project's impact assessment and mitigation planning, including for the determination of Critical Habitat. Although stakeholder consultation was limited due to time constraints, the following expert stakeholders were consulted to support the assessment:

- **Martin Cheek**, Royal Botanical Gardens, Kew (RBG Kew): international botanical expertise;
- **Rosa Garriga, Prof. John Oates and Dr Genevieve Campbell**: national and international expertise on chimpanzees and primates;
- **Dr Jorg Freyhof and Rainer Sonnenberg**: international expertise on freshwater fish species
- **Prof. Neil Cumberlidge**; international expertise on freshwater crabs
- **Dr Annika Hillers**; national and regional expertise on amphibians and pygmy hippos

Consultation on West African plant species and freshwater fish species was particularly important. For both taxa, very few species have been assessed under IUCN Red List criteria, and therefore few range maps are available.

Prior to undertaking baseline surveys for the Project, RBG Kew assessed the plant species likely to be present in the area based on RBG Kew's ground surveys for other developments in the region, and literature held at RBG Kew⁷. This information was combined with plant specimens collected during baseline surveys, surveys and assessments undertaken for other development projects in Sierra Leone and Guinea and the results of the Red List assessment to inform CHA.

Freshwater fish are poorly surveyed in West Africa. Due to the surveys undertaken by Joule Africa and during Phase I of the Bumbuna Project, the Seli/Rokel catchment is one of the better surveyed

⁵ IUCN (2016.2). It should be noted that IUCN range maps are not available for all species, subspecies and populations on the Red List, and that the IUCN Red List is not an exhaustive list; many species, subspecies and populations have not yet been assessed under IUCN Red List criteria and therefore do not have threat status assigned to them. For example, there are very few global distribution maps available for plants which are assessed on the Red List.

⁶ [Global Biodiversity Information Facility](#)

⁷ *pers comm.* Martin Cheek, February 2017

catchments in the region⁸. The information gathered during surveys was therefore a primary source of CHA analysis, combined with Red List information and expert opinion.

3.3 Assessment against PS6 criteria

3.3.1 Criteria 1-3

The quantitative data available for the list of candidate species (see [Section 3.2](#)) has been screened against the DMUs and the thresholds defined in PS6 (IFC 2012b). These criteria are based on the proportion of a species' population or range found within the DMU. Assessment has also considered subspecies and populations that have been individually assessed on the IUCN Red List.

Although identification of Critical Habitat is largely based on global conservation priorities, Criterion 1 also considers the presence of nationally-important populations of Critically Endangered and Endangered species in the DMU (Criterion 1e, see [Section 4.2.1](#) and [Appendix 1](#)). Currently, there is no Sierra Leone national/regional Red List of threatened biodiversity, and therefore consultation with specialists is essential.

The ranges for endemic and restricted-range species under Criterion 2 were taken from IFC (2012b), except for plants, where IFC guidance does not provide such a threshold, recognising as more practical the concept of endemism, defined as species that have '*≥ 95 percent of its global range inside the country or region of analysis*' (IFC 2012b). These range thresholds are given in [Appendix 1](#).

For Criterion 3, the available information was screened for evidence of significant concentrations of migratory or congregatory species. The BirdLife International Important Bird Area (IBA) dataset⁹ is especially useful in this regard, as congregations are specifically considered in IBA criteria.

The outcome of assessment against Criteria 1-3 is detailed in [Section 4](#) (Criterion 1), [Section 5](#) (Criterion 2) and [Section 6](#) (Criterion 3).

3.3.2 Criterion 4 - Highly threatened and/or unique ecosystems

Highly threatened and/or unique ecosystems are defined in IFC GN6 (paragraph GN90) as:

- Those at risk of significantly decreasing in area or quality;
- Those with a small spatial extent; and/or

⁸ *pers comm.* Dr Jorg Freyhof and Rainer Sonnenberg February 2017

⁹ BirdLife International 2017, [Data Zone](#)

- Those containing unique assemblages of species including assemblages or concentrations of biome-restricted species¹⁰.

Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally-recognized NGOs) or that are recognized as such in existing regional or national plans, such as the National Biodiversity Strategy and Action Plan (NBSAP), also qualify as critical habitat per Criterion 4 (IFC 2012b, paragraph GN90).

IFC does not provide quantitative thresholds for assessment under this criterion. GN6 recommends the use of the criteria and thresholds developed for the new IUCN Red List of Threatened Ecosystems¹¹. This assessment has been guided by those criteria/thresholds (Rodriguez *et al.* 2015). There are eight categories:

- Collapsed (CO)
- Critically Endangered (CR)
- Endangered (EN)
- Vulnerable (VU)
- Near Threatened (NT)
- Least Concern (LC)
- Data Deficient (DD) and
- Not Evaluated (NE)

More detail on these criteria is given in [Appendix 1](#). To determine the appropriate category, the following factors are considered:

- A) Reduction in geographic distribution
- B) Restricted geographic distribution
- C) Environmental degradation
- D) Disruption of biotic processes or interactions and
- E) Quantitative analysis that estimates the probability of ecosystem collapse

All habitats/ecosystems¹² known from the DMU were screened against the IFC definition of highly threatened and unique ecosystems, and the Red List of Threatened Ecosystems criteria,

¹⁰ Such ecosystems/assemblages are usually considered at a relatively fine scale.

¹¹ IUCN [Red List of Ecosystems](#)

¹² The Red List of Threatened Ecosystems guidance notes that other terms [in addition to 'ecosystem'] applied in conservation assessments –such as ecological communities, habitats, biotopes, and (largely in the terrestrial context) vegetation types – are regarded

considering the entire extent of an ecosystem, together with areas in the wider landscape that are needed to maintain that ecosystem in a viable condition. In the absence of objective quantitative thresholds, expert opinion was sought for qualitative value judgement of this criterion.

3.3.3 Criterion 5 - Areas associated with key evolutionary processes

Guidance Note 6 (IFC 2012b), notes that the two key factors defining this criterion are '*the physical features of a landscape*' and '*subpopulations of species that are phylogenetically or morphogenetically distinct*'. Although key evolutionary processes may operate at various spatial scales, in the sense of PS6 these are usually considered at a relatively fine scale rather than broad biogeographic regions (e.g. an individual mountain that may have acted as a glacial refugium and thus hosted the evolution of a suite of endemic species). No quantitative significance thresholds exist for this criterion, so there is a reliance on expert opinion and qualitative value judgement. Areas associated with key evolutionary processes were screened using expert advice.

4 Criterion 1: Critically Endangered and/or Endangered species

4.1 Tier 1

4.1.1 PS6 criteria

Tier 1 Critical Habitat-qualifying species are the most sensitive biodiversity features in the Project landscape. Tier 1 Critical Habitat is of extreme global importance for the long-term survival of these species. Criterion 1 species meet the thresholds for Tier 1 because they are highly threatened (Criterion 1a or 1b). The IFC PS6 thresholds for Tier 1 Criterion 1 Critical Habitat are:

Tier	PS6 Criterion	Threshold/definition (IFC 2012b)
Tier 1	Criterion 1: CR or EN species	1a Habitat required to sustain ≥ 10% of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species
		1b Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management units for that species

as operational synonyms of ecosystem type, providing they are adequately defined in accordance with the procedures described in the assessment process (Rodriguez *et al.* 2015)

4.1.2 Qualifying features

There are **five** Critical Habitat-qualifying species under Criterion 1, Tier 1 (Table 5). [See Appendix 4](#) for species accounts.

Table 5: Tier 1 Criterion 1 Critical Habitat-qualifying features

Taxa	Species	IUCN	PS6 criterion	DMU	Confirmed in the DMU?
Mammal	Ziama Horseshoe Bat, <i>Rhinolophus ziama</i>	EN	1b (and 2b)	Aquatic	Y
Freshwater fish	<i>Enteromius liberiensis</i> ⁺	EN	1a		Y
	<i>Epiplatys lokoensis</i>	EN	1a (and 2b)		Y
	<i>Marcusenius meronai</i>	EN	1a (and 2b)		Y
Freshwater plant	<i>Ledermanniella yiben</i>	NE, but assessed as EN by RBG Kew experts	1a (and 2a)		Y

⁺This species is known as *Barbus liberiensis* on IUCN Red List (v. 2016.3), but is referred to here as *E. liberiensis* for consistency with the Project ESHIA.

4.1.3 Implications of Criterion 1, Tier 1 for the Project

Mitigation of impacts on highly threatened (Criterion 1) Tier 1 Critical Habitat features will be the highest concern of lenders and many stakeholders, especially in the international conservation community. There is significant onus on the Project to ensure that impacts on these species are avoided and minimised as far as feasibly possible, including via review of project design to optimise avoidance and minimisation, and consideration of timing and intensity of operational activities if appropriate. This means that a robust Project-specific ESHIA baseline is vital, followed by iterative and thorough application of the mitigation hierarchy to ensure that impacts are avoided and minimised, and the significance of any residual impacts is reduced as far as possible to minimise the requirement for offsetting.

A species prioritisation exercise has been carried out (TBC 2017) that identifies the appropriate level of management and monitoring action for these Criterion 1, Tier 1 species and other Critical Habitat qualifying features. See [Section 13](#) for more detail.

4.2 Tier 2

4.2.1 PS6 criteria

Species may qualify as Criterion 1, Tier 2 because they are globally threatened and listed on the IUCN global Red List, or because they are nationally threatened and listed on the Uganda Red List. The IFC PS6 thresholds for Tier 2 Criterion 1 Critical Habitat are:

Tier	PS6 Criterion	Threshold/definition (IFC 2012b)
Tier 2	Criterion 1: CR or EN species	1c Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally- important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/ subspecies
		1d Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.
		1e As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.

4.2.2 Qualifying features

There are **ten** Critical Habitat-qualifying species under Criterion 1, Tier 2 (Table 6). See [Appendix 4](#) for species accounts.

Table 6: Tier 2 Criterion 1 Critical Habitat-qualifying features.

Taxa	Species	IUCN	PS6 criterion	DMU	Confirmed in the DMU?
Mammal	Diana Monkey, <i>Cercopithecus diana</i> *	VU	1d	Terrestrial	N
	Western Black-and-White Colobus, <i>Colobus polykomos</i> *	VU	1d		Y
	Western Chimpanzee, <i>Pan troglodytes verus</i>	CR	1c		Y
	Western Red Colobus, <i>Piliocolobus badius</i>	EN	1d		N
Bird	Hooded Vulture, <i>Necrosyrtes monachus</i>	CR	1c		Y
	White-backed Vulture, <i>Gyps africanus</i>	CR	1c		N
Amphibian	Freetown Long-fingered Frog, <i>Arthroleptis aureoli</i>	EN	1d		Y
Reptile	Slender-snouted Crocodile, <i>Mecistops cataphractus</i>	CR	1c		Y

Terrestrial plant	<i>Vepris felicis</i>	NE, but assessed as EN by RBG Kew experts	1d		Y
Freshwater plant	<i>Ledermanniella aloides</i>	VU; but assessed as EN by RBG Kew experts	1d	Aquatic	Y

* Species included because of the potential for upgrade to EN or CR status on the IUCN Red List soon, based on the assessment of primate specialists.

4.2.3 Implications of Criterion 1, Tier 2 for the Project

Tier 2 species for which Critical Habitat has been identified will be of high concern to lenders, and to national and international stakeholders. Because these species are at high global risk of extinction, the Project must ensure activities do not contribute to a further decline of their conservation status. As for Tier 1 features, the Project must ensure that impacts on these species are avoided and minimised through iterative and thorough application of the mitigation hierarchy, to ensure that the significance of any residual impacts is reduced as far as possible to minimise the requirement for offsetting.

5 Criterion 2: Endemic and/or restricted-range species

5.1 Tier 1 and Tier 2

5.1.1 PS6 criteria

The IFC PS6 thresholds for Tier 1 and Tier 2 endemic/restricted range species are:

PS6 Criterion		Tier	Threshold/definition (IFC 2012b)
Criterion 2: Endemic/Restricted range species	2a	Tier 1	Habitat known to sustain \geq 95% of the global population of an endemic or restricted range species where that habitat could be considered a discrete management unit for that species (e.g. a single-site endemic)
Criterion 2: Endemic/Restricted range species	2b	Tier 2	Habitat known to sustain \geq 1 percent but $<$ 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement

5.1.2 Qualifying features

There are **ten** Critical Habitat-qualifying species under Criterion 2 (Table 7): two Tier 1, and eight Tier 2. See [Appendix 4](#) for species accounts.

Table 7: Tier 1 and Tier 2 Criterion 2 Critical Habitat-qualifying features

Taxa	Species	IUCN	PS6 criterion	DMU	Confirmed in the DMU?
Tier 1					
Freshwater fish	<i>Epiplatys sp. aff. njalaensis</i> [#]	NE	2a	Aquatic	Y
Freshwater plant	<i>Ledermanniella yiben</i>	NE. but assessed as EN by RBG Kew experts	2a (and 1a)		Y
Tier 2					
Mammal	Ziama Horseshoe Bat, <i>Rhinolophus ziama</i>	EN	2b	Terrestrial	Y
Dragonfly	Yellow-fronted Threadtail, <i>Elatoneura dorsalis</i>	VU	2b	Aquatic	N
Freshwater fish	<i>Epiplatys sp.</i> [#]	NE	2b		Y
	<i>Epiplatys lokoensis</i>	EN	2b		Y
	<i>Marcusenius meronai</i>	EN	2b		Y
	<i>Rhexipanchax kabae</i>	VU	2b		Y
	<i>Scriptaphyosemion cf. chaytori</i> [#]	NE	2b		Y
	<i>Synodontis tourei</i>	NT	2b	Y	

[#]Species not yet formally described or assessed on the IUCN Red List

5.1.3 Implications of Criterion 2 for the Project

Where species have very small ranges, this means that a large proportion of the global population might potentially be impacted by the Project. These species will be of concern for both national and international stakeholders. For species yet Not Evaluated on the global Red List, the exact species status requires clarification, but there is sufficient evidence to categorise them as Critical Habitat-qualifying (see individual species accounts in [Appendix 4](#)).

The primary implications for the Project of restricted range/endemic Critical Habitat-qualifying features in the landscape are the same as those for Criterion 1 species, focussing on freshwater river habitat, gallery forest habitat and hill slope forest.

6 Criterion 3: Migratory species and/or congregatory species

No Criterion 3-qualifying features have been identified for the Project. Thresholds for this criterion are detailed in [Appendix 1](#).

7 Other species of concern

7.1 Data Deficient and Not Evaluated species

Eight species are Data Deficient or have not yet been evaluated on the IUCN global Red List, thus there is very limited information available about them and it is currently difficult to confirm whether they are Critical Habitat-qualifying. Table 8 shows these species and the Critical Habitat criteria that potentially apply. See [Appendix 4](#) for species accounts.

Table 8: Data Deficient and Not Evaluated species in the study area

Taxa	Species	IUCN	Possible PS6 criterion	Potential tier	DMU	Confirmed in the DMU?
Amphibians	Cameroon Grassland Frog, <i>Ptychadena retropunctata</i>	DD	Possible 2b	Tier 2	Terrestrial	Y
	<i>Ptychadena sp. 1</i> [#]	NE	Possible 2b	Tier 2		Y
	<i>Ptychadena sp. 2</i> [#]	NE	Possible 2b	Tier 2		Y
Freshwater fish	<i>Archiaphyosemion cf. guineense</i> [#]	NE	Possible 2b	Tier 2	Aquatic	Y
	<i>Chiloglanis sp. aff. occidentalis</i> [#]	NE	Possible 2b	Tier 2		Y
	<i>Enteromius cf. trispilos</i> [#]	NE	Possible 2b	Tier 2		Y
	<i>Raiamas scarciensis</i>	DD	Possible 2b	Tier 2		Y
	<i>Scriptaphyosemion wieseae</i> [#]	NE	Possible 2b	Tier 2		Y

[#]Species not yet formally described or assessed on the IUCN Red List

7.1.1 Implications of DD and NE species for the Project

The species in Table 8 are not well known, either globally or nationally/regionally in Sierra Leone. They are all possible Criterion 2, Tier 2 species, meaning that the limited available evidence

suggests that they are restricted-range, with ≥ 1 percent but < 95 percent of the (known) global population in the DMU. In many cases (see [Appendix 4](#)), it is likely that further survey could find more records of many of these species in the appropriate habitat types, thereby increasing the known global range/population size and the information base. This could mean that the conservation status of a species is downgraded, or that the distribution is extended such that the species does not qualify as restricted-range. Suggested next steps for DD and NE species are given in (TBC 2017).

7.2 Stakeholder concern

One species has been identified that does not currently qualify under the criteria for Critical Habitat, but is of concern due to international/national stakeholder interest and non-Project threats (Table 9). See [Appendix 4](#) for the species account.

Table 9: Species of stakeholder concern (non-Critical Habitat-qualifying)

Taxa	Species	IUCN
Mammal	Pygmy Hippopotamus, <i>Choeropsis liberiensis</i>	EN

7.2.1 Implications of this species for the Project

Pygmy Hippo may have implications for Project biodiversity planning and management both now and in the future, for example as knowledge of species range and distribution increases, or if the global threat status changes. Populations are reported to be rapidly declining and are increasingly fragmented due to loss of habitat and hunting pressures (Ransom *et al.* 2015). As a secretive and primarily nocturnal mammal it is rarely seen, making surveying for the species difficult. It is a solitary animal (except when a female is accompanied by her young) and associated with primary and secondary forests close to rivers, streams and swamps. Within the Project area, the species has been recorded along from tributaries near Yiben along the Seli River in 2006 and 2013 (ERM 2016a). Although more recent surveys have not encountered the species, it is still reported by local communities. Thus, considering the challenges of surveying this species, it should still be considered as present in the Project study area.

8 Criterion 4: Highly threatened and/or unique ecosystems

A qualitative evaluation of landcover across Sierra Leone¹³ shows a largely a cropland forest mosaic, with generally greater broadleaf, evergreen or semi-deciduous forest and broadleaf deciduous forest cover in the north of the country. Tree cover¹⁴ in Sierra Leone (measured as canopy density) is between around 20% and 50% across the country, greater in the southeast. Canopy cover > 75% is rare in Sierra Leone and limited to some protected areas. Most forests in Sierra Leone (96%) are classed as Naturally Regenerated, meaning they are comprised of native species, but with clear indications of human activities (FAO 2015).

Sierra Leone is dominated by two ecoregions¹⁵ (not restricted to Sierra Leone): the Guinean forest-savanna mosaic, widespread and dynamic, and within which several large charismatic mammal species may be found; and Upper Guinea rivers and streams – also widespread – where wet conditions prevail and where topographical conditions have resulted in high freshwater species endemism (see also [Section 11.1](#)). PS6 Criterion 4 is not intended to be applied at the ecoregion level, so although both these ecoregions are considered by WWF as Critical/Endangered, they do not in themselves qualify as Critical Habitat *sensu* IFC PS6, in part because of their very large scale.

This high-level qualitative evaluation of the primary habitats across Sierra Leone suggests that there are none that meet Criterion 4. Although habitat mapping in the Project study area has been limited to date (in ESHIA very high level habitat classes were interpreted from 2013/2014 aerial photography (ERM 2016b)), RBG Kew have carried out more detailed botanical study (RBG, Kew 2016). This information has been reviewed against the definitions for Criterion 4 and the Red List of Threatened Ecosystem category definitions (e.g. CR, EN etc.) (Table 10). Whilst some are reduced in extent due to non-Project factors, and others contain Critical Habitat-qualifying species, it is not considered that any of these habitat types qualify under Criterion 4.

¹³ [GlobCover, 2009](#)

¹⁴ Semi-quantitative analysis using the [Global Forest Watch database](#)

¹⁵ As described in the [WWF Ecoregions](#) assessment

Table 10: High-level qualitative assessment of habitats in the Project study area against Criterion 4

RBG Kew survey		Assessment
Vegetation type	Summary description from RBG Kew (2016)	
<p>Gallery forest (forest along rivers and streams)</p>	<ul style="list-style-type: none"> • Approx. 50 m wide strips of closed-canopy rainforest with trees to 25 m high, along rivers and streams. • Important for some Critical Habitat-qualifying species (e.g. the plant <i>Vepris felicis</i> and mammals including primates (e.g. Chimpanzees); • Widespread in Sierra Leone • Insufficient evidence for it to be considered distinct from wider forest and woodland vegetation types present in the area 	<p>IFC GN6 definitions:</p> <ul style="list-style-type: none"> • Risk of significantly decreasing in area or quality No – whilst Gallery forest, like all forest habitats in Sierra Leone is reducing in extent and quality due to its wide distribution it is not currently considered to be at significant risk • Small spatial extent; No – widespread habitat type • Containing unique assemblages of species including assemblages or concentrations of biome-restricted species (fine scale) No – whilst Gallery forest supports species that qualify for Critical Habitat it does not contain unique assemblages <p>Red List of Threatened Ecosystems</p> <ul style="list-style-type: none"> • Reduction in geographic distribution No – there is no current evidence to suggest a significant reduction in distribution • Restricted geographic distribution No – widespread habitat type • Environmental degradation Yes – conversion of Gallery forests to farmland and degradation due to timber extraction is a threat but not currently considered to be significant due to the wide distribution of this habitat type. A finer-grained assessment of degradation could change this evaluation • Disruption of biotic processes or interactions No – there is no evidence of this • Quantitative analysis that estimates the probability of ecosystem collapse

		<p>Not possible using the currently available data, but given the widespread distribution of gallery forests, collapse is unlikely.</p> <p>Conclusion:</p> <ul style="list-style-type: none"> • Unlikely to meet Criterion 4
<p>Hill slope forest</p>	<ul style="list-style-type: none"> • Closed-canopy forest on hill slopes and summits away from streams, with trees to approx. 35 m high and an understory rich in woody species, but few/no grasses • Widespread habitat type in the Guinean forest-savanna mosaic, within the Project area patches occur but all such patches observed have been badly damaged by fire, linked to adjacent farmland. 	<p>IFC GN6 definitions:</p> <ul style="list-style-type: none"> • Risk of significantly decreasing in area or quality No – Hill slope forests are under threat due to farming and fire damage but remain widespread within the Guinean forest-savanna mosaic. A finer-grained assessment of degradation could change this evaluation • Small spatial extent; No – widespread habitat type • Containing unique assemblages of species including assemblages or concentrations of biome-restricted species (fine scale) No <p>Red List of Threatened Ecosystems</p> <ul style="list-style-type: none"> A. Reduction in geographic distribution No – hill slope forest is widely distributed in Sierra Leone and the wider Guinean forest-savanna mosaic B. Restricted geographic distribution No – hill slope forest is widely distributed in Sierra Leone and the wider Guinean forest-savanna mosaic C. Environmental degradation Yes – farming and fire damage D. Disruption of biotic processes or interactions Some – tree seedlings may not be resistant to future fires E. Quantitative analysis that estimates the probability of ecosystem collapse

		<p>Not possible using the currently available data, but given the widespread distribution of hill slope forests, collapse is unlikely.</p> <p>Conclusion:</p> <ul style="list-style-type: none"> • Unlikely to meet Criterion 4
<p>River channel community</p>	<ul style="list-style-type: none"> • Various herbaceous and woody species rooting on or between rocks in the river bed, or on sandy/muddy river banks • Very variable plant community, from weedy herbs growing on muddy river banks to tiny herbs growing on rocks in rapids. • Short stretches of the Seli River upstream of the proposed Yiben dam are fast-flowing, with rapids and small falls over a rocky bed supporting well-developed plant communities adapted to these conditions (rheophytic plants), including <i>Ledermanniella aloides</i> and the new species <i>Ledermanniella yiben</i> 	<p>IFC GN6 definitions:</p> <ul style="list-style-type: none"> • Risk of significantly decreasing in area or quality No – niche community in any case, but common in river channels • Small spatial extent; No, although nature of habitat (e.g. between rocks in river bed) makes this a niche habitat • Containing unique assemblages of species including assemblages or concentrations of biome-restricted species (fine scale) No <p>Red List of Threatened Ecosystems</p> <ul style="list-style-type: none"> • Reduction in geographic distribution No – river channel communities are widespread • Restricted geographic distribution No – river channel communities are common • Environmental degradation Some – related to river modifications associated with dam construction. • Disruption of biotic processes or interactions Some - related to river modifications associated with dam construction • Quantitative analysis that estimates the probability of ecosystem collapse Not possible using the currently available data, but given the extent of the river system, collapse is unlikely. <p>Conclusion:</p>

<p>Grassland: tree canopy cover <10%, Wooded grassland; canopy cover 10-40% and Woodland: canopy cover >40%</p>	<ul style="list-style-type: none"> Widespread habitat in the Guinean forest-savanna mosaic and in the Project area Dense, up to several metres high grasses with an open canopy of low trees, on well-drained soils Few rare plant species are expected to occur here. Grassland and wooded grassland, together referred to as savanna, form a mosaic in the Project area. Vegetation is characterised by fires in the understory, where only fire-adapted plants can survive. Woodland in this mosaic is often converted to agriculture, whilst the grassland and wooded grassland are usually burned during the dry season to promote re-growth of grasses for cattle to feed on. Useful plants are collected: firewood, construction wood for local use and export, edible and medicinal plants. 	<ul style="list-style-type: none"> Unlikely to meet Criterion 4 <p>IFC GN6 definitions:</p> <ul style="list-style-type: none"> Risk of significantly decreasing in area or quality No – widespread in study area Small spatial extent; No Containing unique assemblages of species including assemblages or concentrations of biome-restricted species (fine scale) No <p>Red List of Threatened Ecosystems</p> <ul style="list-style-type: none"> Reduction in geographic distribution No – widespread in study area Restricted geographic distribution No – widespread in study area Environmental degradation Yes – conversion to agriculture and collection of plants for local use Disruption of biotic processes or interactions No Quantitative analysis that estimates the probability of ecosystem collapse Not possible using the currently available data, but given the widespread distribution of grassland, wooded grassland and woodland, collapse is unlikely. <p>Conclusion:</p> <ul style="list-style-type: none"> Unlikely to meet Criterion 4
<p>Seasonally wet grassland</p>	<ul style="list-style-type: none"> Up to 1 m high grassland with other herbaceous species, in shallow depressions over flat bedrock and in areas of seepage over bedrock on hill slopes 	<p>IFC GN6 definitions:</p> <ul style="list-style-type: none"> Risk of significantly decreasing in area or quality No – this type of grassland tends to patchily distributed but widespread and unlikely to be at significant risk

	<ul style="list-style-type: none"> Support wetland communities distinct from the surrounding well-drained soils. 	<ul style="list-style-type: none"> Small spatial extent; No Containing unique assemblages of species including assemblages or concentrations of biome-restricted species (fine scale) No <p>Red List of Threatened Ecosystems</p> <ul style="list-style-type: none"> Reduction in geographic distribution No – whilst its global distribution is unknown there is no evidence to suggest any threats that would significantly affect its distribution Restricted geographic distribution Yes – but related to appropriate soil conditions and not due to threat Environmental degradation Some – affected by cattle grazing and burning in some areas Disruption of biotic processes or interactions No Quantitative analysis that estimates the probability of ecosystem collapse Not possible using the currently available data, but this patchy habitat type is widely distributed to collapse is unlikely. <p>Conclusion:</p> <ul style="list-style-type: none"> Unlikely to meet Criterion 4
<p>Inland valley swamp/freshwater swamp</p>	<ul style="list-style-type: none"> Swamps develop in river and stream valleys on sandy or muddy soils that are flooded during the wet season Only small areas of this habitat type found in the study area, because it is mostly hilly. Swamps are cultivated for rice, some maintained artificially through dikes 	<p>IFC GN6 definitions:</p> <ul style="list-style-type: none"> Risk of significantly decreasing in area or quality No – inland valley swamps are widespread in Sierra Leone although many are degraded due to farming activities it is not thought to be significant due to their widespread distribution Small spatial extent;

	<ul style="list-style-type: none"> • During fallow periods, secondary herbaceous vegetation develops – sedges, grasses and wetland herbs. Few woody species. • No rare herbaceous plants found 	<p>No – widespread but patchy distribution dependent on topography and drainage conditions. Limited in the area of the Project as the terrain is hilly</p> <ul style="list-style-type: none"> • Containing unique assemblages of species including assemblages or concentrations of biome-restricted species (fine scale) No <p>Red List of Threatened Ecosystems</p> <ul style="list-style-type: none"> A. Reduction in geographic distribution No B. Restricted geographic distribution No C. Environmental degradation Some – swamps are cultivated for rice D. Disruption of biotic processes or interactions No E. Quantitative analysis that estimates the probability of ecosystem collapse Not possible using the currently available data, but collapse of this widespread swamp ecosystem is unlikely. <p>Conclusion:</p> <ul style="list-style-type: none"> • Unlikely to meet Criterion 4
<p>Inselbergs</p>	<ul style="list-style-type: none"> • Inselbergs are rocky outcrops that are widespread but have a patchy distribution across the landscape. They occur on the coast and inland in for example Guinea, Sierra Leone the Ivory coast. There have been a number of recent studies undertaken on inselbergs, and those in Guinea are now well documented (e.g. Couch & Cheek (2014). Inselbergs often contain rare 	<p>IFC GN6 definitions:</p> <ul style="list-style-type: none"> • Risk of significantly decreasing in area or quality No – recent studies have greatly increased the number of known inselbergs (e.g. 52+ from coastal Guinea). Whilst some sites are threatened by quarrying activities they are not thought to be at significant risk • Small spatial extent; • Yes, due to limited occurrence of granite rock outcrops

	<p>species, some of which flower only during the wet season.</p> <ul style="list-style-type: none"> A few granite inselbergs occur in the study area, mostly at and around the site of the proposed Yiben dam quarry, with fire-resistant tussock forming sedge grasses. 	<ul style="list-style-type: none"> Containing unique assemblages of species including assemblages or concentrations of biome-restricted species (fine scale) A few inselbergs occur in the Project study area (see Section 11), mainly with sedge grasses. No species of conservation concern have been recorded in dry season surveys of these inselbergs by RBG Kew, or in wet season surveys by a local botanist (ERM 2016b). <p>Red List of Threatened Ecosystems</p> <ul style="list-style-type: none"> A. Reduction in geographic distribution No B. Restricted geographic distribution Yes, due to limited occurrence of granite rock outcrops C. Environmental degradation No D. Disruption of biotic processes or interactions No E. Quantitative analysis that estimates the probability of ecosystem collapse Not possible using the currently available data, but collapse is unlikely. <p>Conclusion:</p> <ul style="list-style-type: none"> Unlikely to meet Criterion 4
<p>Freshwater habitats – the Seli/Rokel River</p>	<p>(ERM 2016b):</p> <ul style="list-style-type: none"> The Seki/Rokel River is the dominant hydrological feature in the Project study area, and the third largest in Sierra Leone Generally, it is known as the Seli River above the Bumbuna falls, and the Rokel River below it. The Bumbuna falls is considered to separate the upper section from the lower section and historically has 	<p>IFC GN6 definitions:</p> <ul style="list-style-type: none"> Risk of significantly decreasing in area or quality No Small spatial extent; No Containing unique assemblages of species including assemblages or concentrations of biome-restricted species (fine scale) No

	<p>prevented species migrating upstream from the lower section</p> <ul style="list-style-type: none"> • The river begins at around 900 m above sea level in the interior plateau and hill ranges in the northeast of the country, near the border with Guinea • It flows southwest for approximately 100 km across the plateau, before going over the Bumbuna Falls at the edge of the Sula Mountains and continuing southwards towards Freetown, discharging into the Atlantic Ocean (ERM 2016b) • Upstream of the Bumbuna Dam, the Wankatana and Mawotoko Rivers are major tributaries of the Satana and Mawotoko Rivers are major tributaries of the Seli • Fishbase (Froese & Pauly 2016) records 82 species known from the Seli/Rokel River, not including all the species reported in the Project surveys • Water quality survey indicates uniform good quality from upstream of the inundation area to downstream of Bumbuna Dam. ESHIA water samples reflect well-oxygenated water with well-balanced pH (ERM 2016b) 	<p>Red List of Threatened Ecosystems</p> <ul style="list-style-type: none"> A. Reduction in geographic distribution No B. Restricted geographic distribution No C. Environmental degradation Yes – related to river modifications associated with dam construction D. Disruption of biotic processes or interactions Some: river flow modified by dam construction E. Quantitative analysis that estimates the probability of ecosystem collapse Not possible using the currently available data, but collapse is unlikely, given the extent of the river system. <p>Conclusion:</p> <ul style="list-style-type: none"> • Unlikely to meet Criterion 4
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9 Criterion 5: Areas associated with key evolutionary processes

This criterion is defined by the physical features of a landscape that might be associated with particular evolutionary processes, and/or subpopulations of species that are phylogenetically or morpho-genetically distinct and may be of special conservation concern given their distinct evolutionary history (IFC 2012b, paragraph GN95).

Although in West Africa, the presence of evolutionarily important forest refugia has been postulated for humid mountainous zones, it is unlikely in the lower regions where the Project is located, and thus is not considered to qualify under Criterion 5.

Inselbergs are also frequently associated with evolutionary processes, in part because of their distinctness from the surrounding environment. Inselbergs are granite outcrops often united by a unique group of shared species. A few inselbergs occur in the Project study area (see [Section 11.1](#)), mainly with sedge grasses. No species of conservation concern have been recorded in dry season surveys of these inselbergs by RBG Kew, or in wet season surveys by a local botanist (ERM 2016b). Therefore, they are not considered to qualify under Criterion 5.

The Seki/Rokel River is the dominant hydrological feature in the Project study area, and the third largest in Sierra Leone. The ESHIA has recorded several potentially new freshwater species in the Project study area, which have yet to be formally described and assessed for conservation status. However, flows in the Seli River have been controlled through the operation of Bumbuna Phase 1 Dam since in 1999. Immediately below the dam, the river channel and banks are heavily modified, reinforced with concrete and midstream boulders removed. The river below the dam has also been modified by agriculture along most of its length (ERM 2016b). Thus, the Seli River is unlikely to qualify under Criterion 5.

10 Protected areas and internationally recognised areas

10.1 PS6 criteria

IFC PS6 paragraph 20 addresses project activity in Legally Protected Areas¹⁶ (LPAs) and Internationally Recognised Areas¹⁷ (IRAs). Where a Project is within an LPA or IRA, the client should meet the requirements of paragraphs 13 to 19 of PS6 (paragraphs 13-15 relate to Natural Habitat, and paragraphs 16-19 to Critical Habitat) (IFC 2012a). In addition, the client should:

- ‘Demonstrate that the proposed development in the LPA/IRA is legally permitted;
- Act in a manner consistent with any government recognized management plans for such areas;
- Consult Protected Area sponsors and managers, Affected Communities, Indigenous Peoples and other stakeholders on the proposed project, as appropriate; and
- Implement additional programs, as appropriate, to promote and enhance the conservation aims and effective management of the area’.

10.2 Qualifying features

There are **three** LPAs/IRAs that qualify as Critical Habitat for this Project (see Figure 3):

- Lake Sonfon Important Bird Area (Table 11); and
- Bumbuna Conservation Area (Table 12)
- Farangbaia Forest Reserve (Table 13)

Table 11: Lake Sonfon IBA – summary description

Site	Lake Sonfon and environs
Status	IRA
Designation	Important Bird Area (ID SL002)
Area	8,072 ha
IBA criteria	A3: Biome-restricted species: the site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome.
IBA trigger species	<ul style="list-style-type: none"> • Pied-winged Swallow (<i>Hirundo leucosoma</i>) – Least Concern;

¹⁶ IFC PS6 footnote 16 defines an LPA as: ‘A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values’.

¹⁷ IFC PS6 footnote 17 defines IRAs as: ‘UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, and wetlands designated under the Convention on Wetlands of International Importance (the Ramsar Convention)’.

	<ul style="list-style-type: none"> • Emerald Starling (<i>Lamprolornis iris</i>) - Least Concern; • Splendid Starling (<i>Cinnyris coccinigastrus</i>) - Least Concern; • Red-winged Pytilia (<i>Pytilia phoenicoptera</i>) - Least Concern; • Yellow-winged Pytilia (<i>Pytilia hypogrammica</i>) – Not Evaluated; • Dybowski's Twinspot (<i>Euschistospiza dybowskii</i>) - Least Concern.
IBA 2013 monitoring assessment summary	<ul style="list-style-type: none"> • Threat score: Very high • 105 bird species recorded so far in this poorly-surveyed area • More species of the Sudan-Guinea Savanna biome expected to occur • Lake has been proposed as National Park, but no management plan exists for the area • Main threats: deforestation for agriculture; high hunting pressure; gold mining near the lake

Table 12: Bumbuna Conservation Area – summary description

Site	Bumbuna Conservation Area
Status	LPA
Designation	Nationally protected
Area	<ul style="list-style-type: none"> • 8,072 ha
IUCN Protected Area Management Category	Category Ia: Strict Nature Reserve . This category is strictly set aside to protect biodiversity where human use and impacts are strictly controlled and limited to ensure protection of conservation values.
Description	A 2008 the Bumbuna Watershed Management Authority (BWMA) and the Bumbuna Conservation Area (BCA) Act was created in Sierra Leone legislation, to provide for the establishment of the Watershed Management Authority, and to promote environmental management and biodiversity conservation in the BCA (amongst other things). The BCA is northwest of the existing Bumbuna Hydroelectric Project. It was designated for the management and protection of flora and fauna in its natural state and intended to address the environmental and social needs associated with the operation of the Bumbuna Dam (BWMA 2008). The provisions of the BWMA include requirements for the control of hunting, removal of timber, movement of people and domestic animals, plus general protection measures for biodiversity. In practice, the level of active management of the BCA is unclear.

Table 13: Farangbaia Forest Reserve – summary description

Site	Farangbaia Forest Reserve
Status	LPA
Designation	Nationally protected
Area	1,246 ha
IUCN Protected Area Management Category	Not allocated
Description	Farangbaia is in the Dansogoi Chiefdom of the Tonkolili District, approximately 10 km south-east of Bumbuna town. It was designated as a 'Production and Protection' Forestry Reserve in 1945. There is limited information available on the condition of this reserve,

except that following the 1991 civil war, much of the area has become farmland and bush forest with some sawmills in operation. Most of this reserve is likely to be grassland.

10.3 Implications of protected areas for the Project

The Project footprint is not within or overlapping the **Lake Sonfon IBA**, therefore the Project should be aware of the potential for indirect impacts on this site and apply the mitigation hierarchy to avoid and minimise them.

The Project should review the location of the Transmission Line to avoid direct impacts associated with intersecting the **BCA**. If this cannot be avoided, the Project should apply the mitigation hierarchy, and should ensure alignment with PS6 paragraph 20 (see [Section 10](#)) by: demonstrating legal permission for development in the protected area; aligning with any management plans for the BCA; consulting with relevant stakeholders; and implementing additional conservation actions in the area.

The available spatial information indicates that another Project Transmission Line may intersect the northern boundary of the **Farangbaia Forest Reserve**. It is likely that this is an artefact of the spatial data, and more probable that the Transmission Line follows the road that runs northeast-southwest outside the Reserve to the north. However, the Project should review the location of the Transmission Line to avoid direct impacts associated with intersecting the Reserve. As for the BCA, if such intersection cannot be avoided, the Project should apply the mitigation hierarchy, and should ensure alignment with PS6 paragraph 20 (see [Section 10](#)).

When the Transmission Lines are relocated outside these protected areas, the Project should be aware of the potential for indirect impacts on the protected areas and apply the mitigation hierarchy to avoid and minimise them.

11 Natural Habitat and Modified Habitat

11.1 Natural Habitat

IFC GN6 defines Natural Habitats as *'areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition'*.

Project botanical survey by the RBG Kew (2016) has identified **seven** Natural Habitats (Table 14) in the study area, and attributed a disturbance category to each of these habitat types. These disturbance categories are qualitative, and it is considered here that those of High or Very High disturbance are likely to be transitional habitats – i.e., habitats showing signs of modification, yet retaining a proportion of typical native constituent species, and which might recover if managed appropriately. Habitats of Very High disturbance may be close to Modified Habitat status, particularly where *'human activity has substantially modified an area's primary ecological functions and species composition'* (see [Section 11.2](#)). Further detail on these habitat types is available in the

RBG Kew report and in [Section 8](#), Table 10. In addition to the seven habitats identified by RBG Kew, the river itself is Natural Habitat (Table 14).

Table 14: Natural Habitat types in the Project area identified by RBG Kew

Vegetation type	Disturbance
Gallery forest	Medium
Hill slope forest	High (transitional)
River channel community	Medium
Grassland: tree canopy cover <10%, Wooded grassland: canopy cover 10-40% Woodland: canopy cover >40%	Medium
Seasonally wet grassland	Medium
Inland valley swamp/freshwater swamp	Very high (transitional)
Inselbergs	Medium
Freshwater habitats – the Seli/Rokel River	n/a

The WWF Global Ecoregions database has also been reviewed to evaluate presence/condition of Natural Habitats. WWF defines an ecoregion as a 'large unit of land or water containing a geographically distinct assemblage of species, natural communities and environmental conditions'. The Project is within the **Guinean forest-savanna mosaic** ecoregion and the **Upper Guinea Rivers and Streams** ecoregion, both of which are classified as Critical/Endangered by WWF. This status is not considered equivalent to the IUCN Red List of Threatened Ecosystem status, and therefore these ecoregions do not qualify as Critical Habitat under PS6. However, they are noted here as widespread Natural Habitats within which the habitats identified in Table 14 in the Project area are encompassed.

The forest, savanna and grassland of the Guinean forest-savanna mosaic is highly dynamic, and the proportion of forest versus other habitat components has varied greatly over time. The forest-savanna ecotones may offer important habitat for differentiation and speciation. Several large charismatic mammal species are found here. The wet conditions of the Upper Guinea Rivers and Streams ecoregion have allowed species to survive here when dry conditions dominated other portions of West Africa. The Guinean mountain range (> 1,500 metres) and its many waterfalls and rapids further limited the dispersal of aquatic species in the coastal basins into other West African basins. These isolated conditions have resulted in high species endemism; for example, this ecoregion has several fish species adapted to the turbulent, fast-flowing waters of the coastal rivers and streams

11.2 Modified Habitats

IFC GN6 defines Modified Habitats as '*areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition*'.

Project botanical survey by the RBG Kew (2016) has identified **two** Modified Habitat types (Table 15) in the study area. Detail on these habitat types is available in the RBG Kew report.

Table 15: Modified Habitat types in the Project area identified by RBG Kew

Vegetation type	Summary description	Disturbance
Secondary grassland, thicket and woodland	<ul style="list-style-type: none"> • Farm bush re-grown on fallow land after slash-and-burn farming • Extensive stands of invasive South and Central American weed <i>Chromolaena odorata</i> found on hill slopes. • Most other plant species are widespread, common and fast-growing • Habitat of minimal conservation concern for plant species. However, it may be used by priority species such as chimpanzees 	Very high
Agricultural land	<ul style="list-style-type: none"> • The result of slash-and-burn farming practiced by local communities, on hill slopes and inland valley swamps • Principal crops are rice and cassava • Many weedy plants associated with these lands • Likely there are few or no plant species of conservation concern in this habitat, and it is considered to be of lower importance for supporting other priority species 	Very high

11.3 Implications for the Project

11.3.1 Natural Habitat

PS6 requires that the Project should not significantly convert or degrade Natural Habitats, and that mitigation measures are designed to achieve no net loss of Natural Habitat, where feasible (IFC 2012a). Key mitigation in Natural Habitat includes:

- **Confirmation** that there are no alternatives for siting of Project infrastructure in areas of Modified Habitat.
- **Stakeholder consultation** with respect to the potential extent of conversion/degradation in areas of Natural/transitional Habitat.
- **Avoidance** of direct impacts on areas of Natural/transitional habitat.
- **Control** of indirect impacts on Natural/transitional habitat (such as dust and hydrodynamic changes).

In practice, no net loss will be required where there are significant residual adverse impacts on Natural Habitat arising from Project development and persisting after appropriate avoidance, minimisation and restoration measures have been taken.

11.3.2 Modified Habitat

In Modified Habitats with significant biodiversity value, the Project should minimise impacts on biodiversity and implement mitigation measures as appropriate. In the Project landscape, some areas of Modified Habitat may be important as actual or potential corridors connecting areas of Natural Habitat and allowing dispersal and gene flow within metapopulations. As for Natural Habitat, key mitigation includes:

- **Avoidance** of direct impacts and **control** of indirect impacts on areas of Modified Habitat where there are significant (Critical Habitat-qualifying) biodiversity features.

12 Robustness of this assessment

12.1 Limitations of the information available to date

This assessment was conducted using the best available information, complemented by expert consultations. However, it is acknowledged that new information may change the conservation status of a species, and therefore change the assessment.

For example, several of the potentially new fish species and restricted-range fish and plant species identified under Criterion 1 and 2 are poorly known. Further research may extend their known range, such that the significance of the Project DMU for these species is reduced, or may determine that they are not in fact new species.

However, it should be noted that whilst further research may affect individual species currently identified as Critical Habitat-qualifying, the overall assessment of Critical Habitat status will not change. This is because Critical Habitat is identified on a weakest link approach, whereby qualifying biodiversity under any criterion confirms the Project as Critical Habitat. Evaluations of formally described and well known species under Criterion 1 are particularly robust and unlikely to change based on further work.

12.2 Existing/other threats

Most of the Project area is thought to retain natural or semi-natural (transitional) habitat, although there is pressure on natural resources (e.g. farming and agriculture) that is resulting in habitat degradation and transformation. The current and historical rates of loss/degradation in different habitat types, and the drivers of these, are not well understood at present. Such drivers may include cattle grazing, increased agricultural use/conversion, biomass collection or burning. Understanding these non-Project drivers is important for the quantification of potential Project-related loss and degradation, and effects on habitat connectivity.

In addition, it is also important that the Project ESHIA considers the potential for cumulative impacts arising from the Project in combination with other developments in the region, including (but not limited to) the mining projects in Tonkolili and Marampa, the Addax Bioenergy project in Makeni and the West African Power Pool Project.

13 Conclusions

13.1 Critical Habitat summary

- A total of **21** species qualify under Criteria 1 and 2 (there are no qualifying features under Criterion 3; some species qualify under both Criteria 1 and 2). These are **Project priority biodiversity features** (Table 16)
 - **10** terrestrial species
 - **11** freshwater species
- Criterion 1
 - Tier 1: **5 species**
 - Tier 2: **10 species**
- Criterion 2
 - Tier 1: **2 species**
 - Tier 2: **8 species**
- In addition to the 21-qualifying species, there are **8** Data Deficient/Not Evaluated species that possibly qualify under Criterion 2, Tier 2, based on the limited available evidence. These are also Project priority biodiversity features (Table 16)
- There is **one** species – Pygmy Hippo - that is not currently Critical Habitat-qualifying, but is of stakeholder concern. This is also a Project priority biodiversity feature.
- **Three** LPAs/IRAs are within/intersecting the DMU (Table 17).

The Project is also associated with the following habitat types (Table 18):

- **Natural Habitat:**
 - Gallery and hill slope forest
 - Grassland, wooded grassland and woodland
 - Seasonally wet grassland
 - Inland valley/freshwater swamp
 - Inselbergs
 - River channel communities
 - Rivers and tributaries
 - Guinean forest-savanna mosaic (widespread ecoregion)
 - Upper Guinea Rivers and Streams ecoregion (widespread ecoregion)
- **Modified Habitat:**
 - Secondary grassland, thicket and woodland
 - Agricultural land

Table 16: Summary of Project Critical Habitat-qualifying species under Criteria 1-3, and Data Deficient/Not Evaluated species.

Tier 1 species are shaded and marked with *; CR = Critically Endangered, EN = Endangered, NT = Near Threatened, VU = Vulnerable, LC = Least Concern, DD = Data Deficient, NE = Not Evaluated

Group	English name	Scientific name	IUCN status	Confirmed in DMU?	Restricted range?	Critical Habitat criteria	Tier 1 or 2
Mammals	Diana Monkey	<i>Cercopithecus diana</i>	VU	N	N	1d	2
	Pygmy Hippo	<i>Choeropsis liberiensis</i>	EN	Y	N	n/a - stakeholder	n/a
	Western Black-and-White Colobus	<i>Cobus polykomos</i>	VU	Y	N	1d	2
	Western Chimpanzee	<i>Pan troglodytes verus</i>	CR	Y	N	1c	2
	Western Red Colobus	<i>Piliocolobus badius</i>	EN	N	N	1d	2
	Ziama Horseshoe Bat*	<i>Rhinolophus ziama*</i>	EN	Y		1b, 2b	1
Birds	Hooded Vulture	<i>Necrosyrtes monachus</i>	CR	Y	N	1c	2
	White-backed Vulture	<i>Gyps africanus</i>	CR	N	N	1c	2
Amphibians	Cameroon Grassland Frog	<i>Ptychadena retropunctata</i>	DD	Y	Y	Possible 2b	2
	Freetown Long-fingered Frog	<i>Arthroleptis aureoli</i>	EN	Y	N	1d	2
	n/a	<i>Ptychadena sp. 1</i>	NE	Y	Y	Possible 2b	2
	n/a	<i>Ptychadena sp. 2</i>	NE	Y	Y	Possible 2b	2
Reptiles	Slender-snouted Crocodile	<i>Mecistops cataphractus</i>	CR	Y	N	1c	2
Dragonflies	Yellow-fronted Threadtail	<i>Elattoneura dorsalis</i>	VU	N	Y	2b	2
Freshwater fish	n/a	<i>Archiaphyosemion cf. guineense</i>	NE	Y	Y	Possible 2b	2
	n/a	<i>Barbus liberiensis*</i>	EN	Y	N	1a	1
	n/a	<i>Chiloglanis sp. aff. occidentalis</i>	NE	Y	Y	Possible 2b	2
	n/a	<i>Enteromius cf. trispilos</i>	NE	Y	Y	Possible 2b	1
	n/a	<i>Epiplatys lokoensis*</i>	EN	Y	Y	1a, 2b	1
	n/a	<i>Epiplatys sp.</i>	NE	Y	Y	2b	2
	n/a	<i>Epiplatys sp. aff. njalaensis*</i>	NE	Y	Y	2a	1
	n/a	<i>Marcusenius meronai*</i>	EN	Y	Y	1a, 2b	1

	n/a	<i>Raiamas scarciensis</i>	DD	Y	Y	Possible 2b	2
	n/a	<i>Rhexipanchax kabae</i>	VU	Y	Y	2b	2
	n/a	<i>Scriptaphyosemion cf. chaytori*</i>	NE	Y	Y	2a	1
	n/a	<i>Scriptaphyosemion wieseae</i>	NE	Y	Y	Possible 2b	2
	n/a	<i>Synodontis tourei</i>	NT	Y	Y	2b	2
Freshwater plants	n/a	<i>Ledermanniella aloides</i>	VU (RBG Kew = EN)	Y	N	1d	2
	n/a	<i>Ledermanniella yiben*</i>	NE	Y	Y	1a, 2a	1
Terrestrial plants	n/a	<i>Vepris felis</i>	NE (RBG Kew = EN)	Y	N	1d	2

Table 17: Summary of LPAs and IRAs

Criteria/category	Qualifying features	Status
Protected and internationally recognized areas	Lake Sonfon and environs	IBA/IRA
	Bumbuna Conservation Area	LPA
	Farangbaia Forest Reserve	LPA

Table 18: Summary of Natural and Modified Habitat types in the Project study area (from RBG Kew 2016)

Habitat type	Description
Modified Habitat	Secondary grassland, thicket and woodland
	Agricultural land
Natural Habitat	Gallery forest (forest along rivers and streams)
	Hill slope forest
	River channel community
	Grassland, wooded grassland and woodland
	Seasonally wet grassland
	Inland valley swamp/freshwater swamp
	Inselbergs
	Rivers and tributaries

The Project DMUs support Critical Habitat-qualifying biodiversity, and therefore the Project is in Critical Habitat. As noted in [Section 2.3](#), this means the Project needs to pay special attention to management of biodiversity impacts, and highlights the priority biodiversity features that the Project needs to consider.

Both Modified and Natural Habitats can be Critical, whether they are occupied permanently (e.g. nesting) or transiently (e.g. for foraging) by Critical Habitat-qualifying species (see Table 1). Some habitats may support Critical Habitat-qualifying species in only part of the DMU. For example, forest patches are Critical Habitat where they support Chimpanzees (e.g. foraging), and Natural Habitat where there are no Chimpanzees (or other qualifying biodiversity) present. The distinction between Modified and Natural Habitats is an important one to make, because it informs the application of the appropriate PS6 requirements, some of which are more difficult than others. Figure 4 illustrates this. The PS6 requirements in Critical, Natural and Modified Habitats are outlined in [Section 2.3](#).

It is not possible at this stage, with the available data, to map the Natural Habitats and habitats that support Critical Habitat-qualifying biodiversity features within the area of influence of the Project. Additional baseline surveys will help provide the information needed to develop such a habitat map, and this is discussed further in the Species Prioritisation Report (TBC 2017).

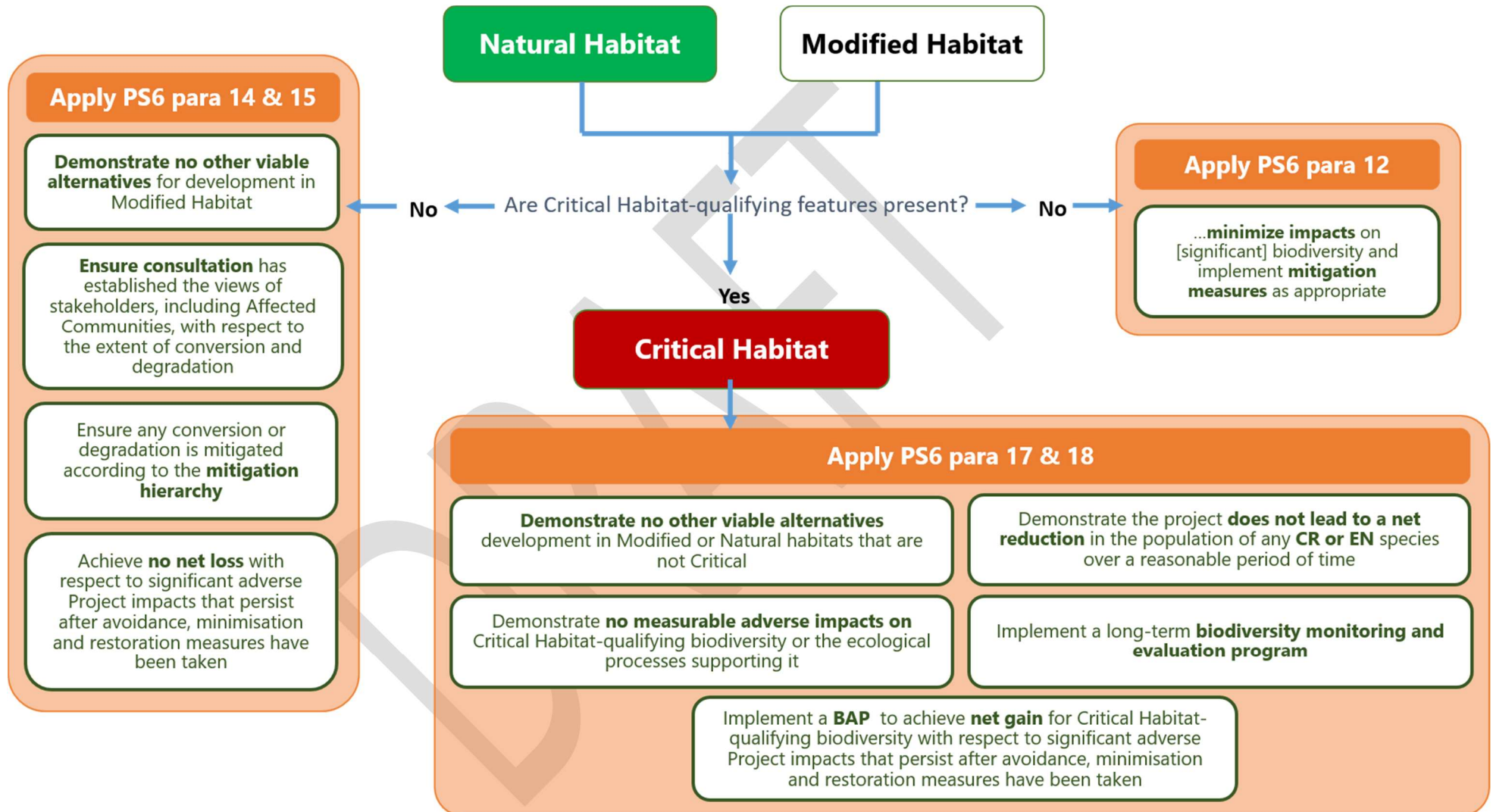


Figure 4: Distinguishing between Natural, Modified and Critical Habitats for the application of PS6 criteria

13.2 Next steps: species prioritisation

Although there are several Critical Habitat-qualifying features in the Project landscape, they are not all equal priorities for further research and targeted mitigation. Some are much more likely to be impacted (directly or indirectly) by the project than others. Good information is available for some, but there are significant data gaps for others. It is important to prioritize these features for management action and monitoring effort, to ensure that resources are effectively applied and sound conclusions are reached. It is also important to consider which features need a species-specific focus and which can be collectively addressed through broader consideration of ecosystems, evaluating relevant ecological factors (e.g. dependencies on ecological processes) and taking a landscape-level perspective (e.g. issues around connectivity and movements). This exercise has been carried out separately, informed by the outcome of this CHA and based on risk of impact, and is detailed in (TBC 2017).

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Appendix 1: IFC PS6 Critical Habitat criteria and thresholds

Criteria	Tier 1	Tier 2
<p>Criterion 1: Critically Endangered (CR)/ Endangered (EN) Species</p>	<p>(a) Habitat required to sustain ≥ 10 percent of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species.</p> <p>(b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species.</p>	<p>(c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally- important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/ subspecies.</p> <p>(d) Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.</p> <p>(e) As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing.</p>
<p>Criterion 2: Endemic/ Restricted Range Species</p>	<p>(a) Habitat known to sustain ≥ 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species (e.g., a single-site endemic).</p>	<p>(b) Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment.</p>
	<p>IFC GN6 provides the following guidance on Criterion 2:</p> <ul style="list-style-type: none"> • An endemic species is defined as one that has ≥ 95 percent of its global range inside the country or region of analysis • A restricted-range species is defined as: <ul style="list-style-type: none"> ○ For terrestrial vertebrates, extent of occurrence of 50,000 km² or less. ○ For marine systems, extent of occurrence of 100,000 km² or less. ○ For freshwater systems, standardized thresholds have not been set at the global level. However, an IUCN study of African freshwater biodiversity applied thresholds of 20,000 km² for crabs, fish, and molluscs and 50,000 km² for odonates (dragonflies and damselflies). These can be taken as approximate guidance, although the extent to which they are applicable to other taxa and in other regions is not yet known. 	

	<ul style="list-style-type: none"> ○ For plants, restricted-range species may be listed as part of national legislation. Plants are more commonly referred to as “endemic,” and the definition provided in paragraph GN79 would apply. Particular attention should therefore be paid to endemic plants of smaller countries which are likely, by definition, to be globally rarer and therefore of higher overall priority 	
<p>Criterion 3: Migratory/ Congregatory Species</p>	<p>(a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 percent of the global population of a migratory or congregatory species at any point of the species’ lifecycle where that habitat could be considered a discrete management unit for that species.</p>	<p>(b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species’ lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are available and/or based on expert judgment.</p> <p>(c) For birds, habitat that meets BirdLife International’s Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance.</p> <p>(d) For species with large but clumped distributions, a provisional threshold is set at ≥ 5 percent of the global population for both terrestrial and marine species.</p> <p>(e) Source sites that contribute ≥ 1 percent of the global population of recruits.</p>
<p>Criterion 4: Highly Threatened and/or Unique Ecosystems</p>	<p>IFC GN6 (paragraph 90-93):</p> <ul style="list-style-type: none"> • Those at risk of significantly decreasing in area or quality; • Those with a small spatial extent; and/or • Those containing unique assemblages of species including assemblages or concentrations of biome-restricted species. • Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organizations (including internationally-recognized NGOs) or that are recognized as such in existing regional or national plans, such as the National Biodiversity Strategy and Action Plan (NBSAP), also qualify as critical habitat per Criterion 4 (IFC 2012b, paragraph GN90). <p>IUCN Red List of Threatened Ecosystems:</p> <ul style="list-style-type: none"> • Eight criteria: 	

	<ul style="list-style-type: none"> ○ Collapsed (CO): An ecosystem is Collapsed when it is virtually certain (Table 3) that its defining biotic or abiotic features are lost from all occurrences, and the characteristic native biota are no longer sustained. Collapse may occur when most of the diagnostic components of the characteristic native biota are lost from the system, or when functional components (biota that perform key roles in ecosystem organisation) are greatly reduced in abundance and lose the ability to recruit ○ Critically Endangered (CR): An ecosystem is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered. It is therefore considered to be at an extremely high risk of collapse. ○ Endangered (EN): An ecosystem is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered. It is therefore considered to be at a very high risk of collapse ○ Vulnerable (VU): An ecosystem is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable. It is therefore considered to be at a high risk of collapse. ○ Near Threatened (NT): An ecosystem is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future. ○ Least Concern (LC): An ecosystem is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widely distributed and relatively undegraded ecosystems are included in this category. ○ Data Deficient (DD): An ecosystem is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of collapse based on decline in distribution, disruption of ecological function or degradation of the physical environment. Data Deficient is not a category of threat, and does not imply any level of collapse risk. Listing of ecosystems in this category indicates that their situation has been reviewed, but that more information is required to determine their risk status. ○ Not Evaluated (NE): An ecosystem is Not Evaluated when it has not yet been evaluated against the criteria. <ul style="list-style-type: none"> • CR, EN and VU are nested categories, so that a CR ecosystem also meets the criteria for EN and NT • Methodology for applying these criteria is given in Rodriguez <i>et al.</i> (2015)
<p>Criterion 5: Key evolutionary processes</p>	<p>This criterion is defined by the physical features of a landscape that might be associated with particular evolutionary processes, and/or subpopulations of species that are phylogenetically or morpho-genetically distinct and may be of special conservation concern given their distinct evolutionary history (IFC 2012b, paragraph GN95). Although in West Africa, the presence of</p>

	<p>evolutionarily important forest refugia has been postulated for humid mountainous zones, it is unlikely in the lower regions where the Project is located. Therefore, no features qualifying under Criterion 5 have been identified for the Project.</p>
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Appendix 2: Terrestrial DMU map

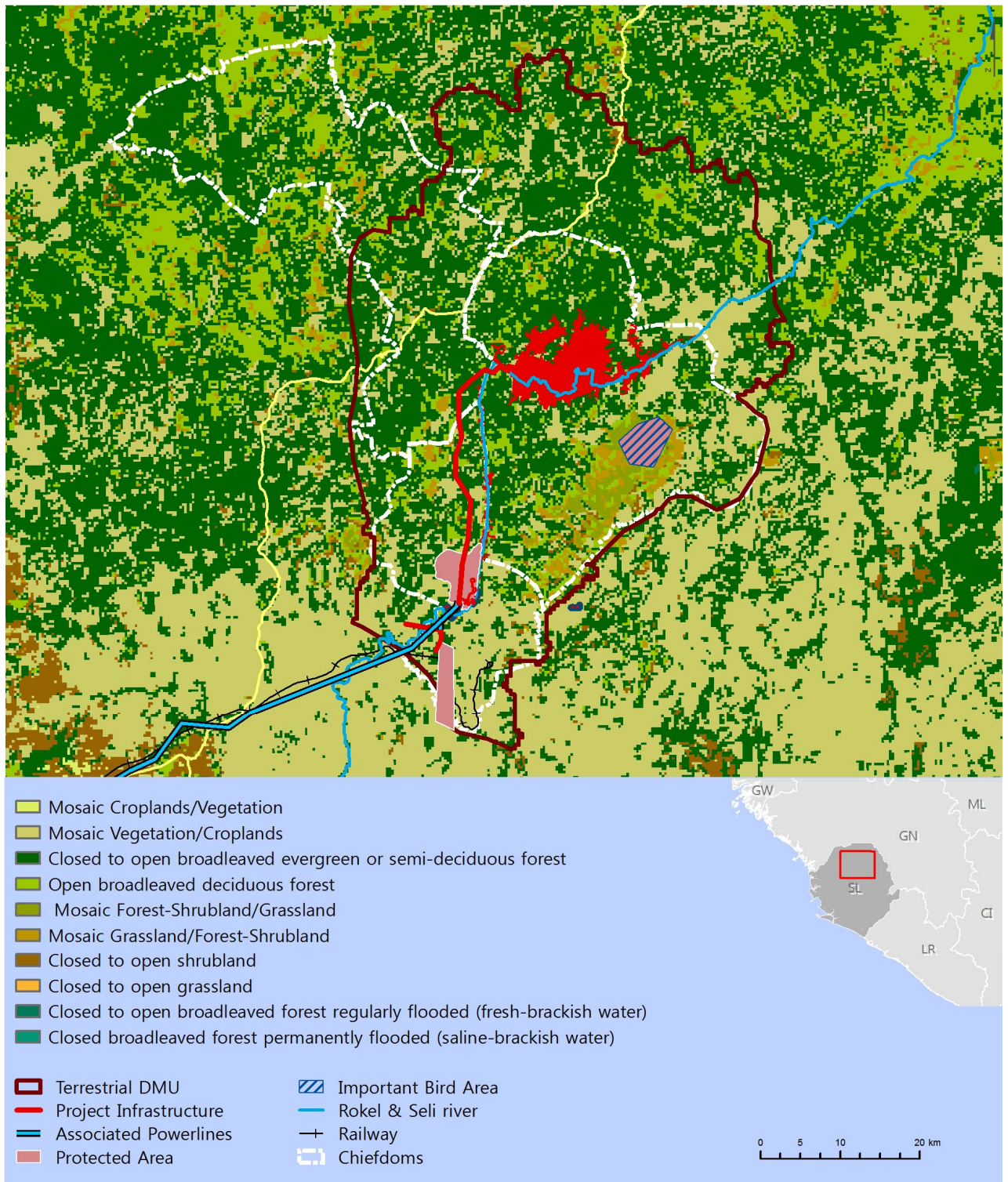


Figure 5: Vegetation cover in relation to the terrestrial DMU

Appendix 3: Candidate list of species for CHA

IUCN Red List status: NE – Not Evaluated; DD – Data Deficient; NT – Near Threatened; LC – Least Concern; VU – Vulnerable; EN – Endangered; CR – Critically Endangered

Critical Habitat-qualifying species shaded grey

DD and NE species that potential qualify (see Section 7.1) are denoted with *

Species of stakeholder concern that are not Critical Habitat-qualifying are denoted with #

Terrestrial DMU

Group	Scientific name	Class	Order	Common name	IUCN Red List status	Total Range Area (km ²)	Range Area in SL (km ²)	Range Area in DMU	% Global Range in DMU	% National Range in DMU	CH criterion
Amphibian	<i>Phrynobatrachus alleni</i>	AMPHIBIA	ANURA	Allen's River Frog	NT	340601	34862	19	0.01	0.05	n/a
Amphibian	<i>Phrynobatrachus guineensis</i>	AMPHIBIA	ANURA	Guinea River Frog	NT	186448	39239	192	0.10	0.49	n/a
Amphibian	<i>Ptychadena superciliaris</i>	AMPHIBIA	ANURA	Sierra Leone Grassland Frog, Savanna Ridged Frog	NT	297627	56718	1658	0.56	2.92	n/a
Amphibian	<i>Arthroleptis aureoli</i> (formerly <i>Cadioglossa aureoli</i>)			Freetown Long-fingered frog	EN	not available	not available	not available	not available	not available	1d
Amphibian	<i>Ptychadena retropunctata</i> *			Cameroon Grassland Frog	DD	not available	not available	not available	not available	not available	Possible 2b
Amphibian	<i>Ptychadena</i> sp. (Sp1)*				NE	not available	not available	not available	not available	not available	Possible 2b
Amphibian	<i>Ptychadena</i> sp. (Sp2)*				NE	not available	not available	not available	not available	not available	Possible 2b
Bird	<i>Bycanistes cylindricus</i>	AVES	BUCEROTIFORMES	Brown-cheeked Hornbill	VU	476995	26165	3	0.00	0.01	n/a

Bird	<i>Ceratogymna elata</i>	AVES	BUCEROTIFORMES	Yellow-casqued Hornbill, Yellow-casqued Wattled Hornbill	VU	495225	69680	2981	0.60	4.28	n/a
Bird	<i>Circus macrourus</i>	AVES	ACCIPITRIFORMES	Pallid Harrier, Pale Harrier	NT	40981554	46637	2981	0.01	6.39	n/a
Bird	<i>Gallinago media</i>	AVES	CHARADRIIFORMES	Great Snipe	NT	38130079	72081	2981	0.01	4.14	n/a
Bird	<i>Gyps africanus</i>	AVES	ACCIPITRIFORMES	White-backed Vulture	CR	11559918	13847	1900	0.02	13.72	1c
Bird	<i>Illadopsis rufescens</i>	AVES	PASSERIFORMES	Rufous-winged Illadopsis	NT	266667	33133	84	0.03	0.25	n/a
Bird	<i>Lamprotornis cupreocauda</i>	AVES	PASSERIFORMES	Copper-tailed Glossy- starling, Copper-tailed Glossy-Starling	NT	345121	51166	844	0.24	1.65	n/a
Bird	<i>Limosa limosa</i>	AVES	CHARADRIIFORMES	Black-tailed Godwit	NT	55524444	71448	2981	0.01	4.17	n/a
Bird	<i>Merops mentalis</i>	AVES	CORACIIFORMES	Blue-moustached Bee-eater	NT	322946	28908	1623	0.50	5.62	n/a
Bird	<i>Necrosyrtes monachus</i>	AVES	ACCIPITRIFORMES	Hooded Vulture	CR	11456903	64177	2981	0.03	4.64	1c
Bird	<i>Neotis denhami</i>	AVES	OTIDIFORMES	Denham's Bustard, Stanley Bustard	NT	7685971	63138	2981	0.04	4.72	n/a
Bird	<i>Picathartes gymnocephalus</i>	AVES	PASSERIFORMES	White-necked Picathartes, White-necked Rockfowl, Yellow-headed Rockfowl, Bare-headed Rockfowl	VU	388876	51190	2981	0.77	5.82	n/a
Bird	<i>Polemaetus bellicosus</i>	AVES	ACCIPITRIFORMES	Martial Eagle	VU	14887175	24541	2873	0.02	11.71	n/a
Bird	<i>Psittacus timneh</i>	AVES	PSITTACIFORMES	Timneh Parrot	VU	291627	54195	954	0.33	1.76	n/a

Bird	<i>Rynchops flavirostris</i>	AVES	CHARADRIIFORMES	African Skimmer	NT	9717799	48659	593	0.01	1.22	n/a
Bird	<i>Stephanoaetus coronatus</i>	AVES	ACCIPITRIFORMES	Crowned Eagle, Crowned Hawk-Eagle, Crowned Eagle	NT	6608211	70733	2981	0.05	4.21	n/a
Bird	<i>Terathopius ecaudatus</i>	AVES	ACCIPITRIFORMES	Bateleur	NT	14021927	28660	2981	0.02	10.40	n/a
Crustacean	<i>Globonautes macropus</i>	MALACOSTRACA	DECAPODA	Tree Hole Crab	EN	51475	15718	2687	5.22	17.10	n/a
Mammal	<i>Aonyx capensis</i>	MAMMALIA	CARNIVORA	African Clawless Otter, Cape Clawless Otter	NT	11816825	71448	2981	0.03	4.17	n/a
Mammal	<i>Caracal aurata</i>	MAMMALIA	CARNIVORA	African Golden Cat, Golden Cat	VU	4042044	71449	2981	0.07	4.17	n/a
Mammal	<i>Cephalophus dorsalis</i>	MAMMALIA	CETARTIODACTYLA	Bay Duiker, Western Bay Duiker	LC	3569383	71159	2981	0.08	4.19	n/a
Mammal	<i>Cephalophus silvicultor</i>	MAMMALIA	CETARTIODACTYLA	Yellow-backed Duiker, Western Yellow-backed Duiker	LC	6159546	71449	2981	0.05	4.17	n/a
Mammal	<i>Cercocebus atys</i>	MAMMALIA	PRIMATES	Sooty Mangabey, Red-capped Monkey, White-naped Mangabey	VU	316314	71449	2981	0.94	4.17	n/a
Mammal	<i>Piliocolobus badius</i>	MAMMALIA	PRIMATES	Western Red Colobus, Bay Colobus	EN	286140.9894	71447.49	2980.62	1.04	4.17	1d
Mammal	<i>Cercopithecus diana</i>	MAMMALIA	PRIMATES	Diana Monkey	VU	210616	58965	1686	0.80	2.86	1d
Mammal	<i>Choeropsis liberiensis</i> #	MAMMALIA	CETARTIODACTYLA	Pygmy Hippopotamus	EN	139543	4050	103	0.07	2.55	stakeholder

Mammal	Colobus polykomos	MAMMALIA	PRIMATES	King Colobus, Western Black-and-white Colobus , Western Pied Colobus	VU	341022	71449	2981	0.87	4.17	1d
Mammal	Eidolon helvum	MAMMALIA	CHIROPTERA	African Straw-coloured Fruit-bat, Pale Xantharpy, Staw-coloured Flying Fox,	NT	11802622	71450	2981	0.03	4.17	n/a
Mammal	Genetta bourloni	MAMMALIA	CARNIVORA	Bourlon's Genet	VU	146863	17626	1540	1.05	8.74	n/a
Mammal	Genetta johnstoni	MAMMALIA	CARNIVORA	Johnston's Genet	VU	307023	71450	2981	0.97	4.17	n/a
Mammal	Hippopotamus amphibius	MAMMALIA	CETARTIODACTYLA	Hippopotamus, Large Hippo, Common Hippopotamus	VU	1882099	9430	2048	0.11	21.71	n/a
Mammal	Hipposideros jonesi	MAMMALIA	CHIROPTERA	Jones' Roundleaf Bat, Jones's Roundleaf Bat	NT	1270695	54903	2981	0.23	5.43	n/a
Mammal	Hydrictis maculicollis	MAMMALIA	CARNIVORA	Spotted-necked Otter, Speckle-throated Otter, Spot-necked Otter	NT	9962374	69351	2981	0.03	4.30	n/a
Mammal	Miniopterus schreibersii	MAMMALIA	CHIROPTERA	Schreiber's Bent-winged Bat, Schreiber's Long-fingered Bat, Common Bentwing Bat	NT	3707993	33509	2981	0.08	8.90	n/a
Mammal	Neoromicia brunnea	MAMMALIA	CHIROPTERA	Dark-brown Serotine, Brown Pipistrelle Bat, Dark-brown Pipistrelle Bat	NT	758356	45098	1522	0.20	3.38	n/a
Mammal	Pan troglodytes verus	MAMMALIA	PRIMATES	Chimpanzee, Robust Chimpanzee, Common Chimpanzee	CR	528018	71449	2980	0.56	4.17	1c

Mammal	<i>Phataginus tetradactyla</i>	MAMMALIA	PHOLIDOTA	Black-bellied Pangolin, Long-tailed Pangolin	VU	2711262	45050	3	0.00	0.01	n/a
Mammal	<i>Phataginus tricuspis</i>	MAMMALIA	PHOLIDOTA	White-bellied Pangolin, African White-bellied Pangolin, Tree Pangolin	VU	5933597	71449	2981	0.05	4.17	n/a
Mammal	<i>Rhinolophus guineensis</i>	MAMMALIA	CHIROPTERA	Guinean Horseshoe Bat	VU	180699	33428	2981	1.65	8.92	n/a
Mammal	<i>Smutsia gigantea</i>	MAMMALIA	PHOLIDOTA	Giant Ground Pangolin, Giant Pangolin	VU	3228439	71449	2981	0.09	4.17	n/a
Mammal	<i>Tragelaphus eurycerus</i>	MAMMALIA	CETARTIODACTYLA	Bongo	NT	2217257	56455	2981	0.13	5.28	n/a
Mammal	<i>Rhinolophus ziama</i>	MAMMALIA		Ziama horseshoe Bat	EN	not available	not available	not available	not available	not available	1b, 2b
Mammal	<i>Hipposideros marisae</i>	MAMMALIA		Aellen's Roundleaf Bat	VU	not available	not available	not available	not available	not available	n/a
Mammal	<i>Neoromicia</i> aff. <i>Nana</i> (<i>Pipistrelle</i> aff. <i>nanus</i>)	MAMMALIA			NE	not available	not available	not available	not available	not available	n/a
Plant	<i>Pseudovigna sulaensis</i>	MAGNOLIOPSIDA	FABALES		VU	1101	1101	752	68.27	68.27	n/a
Plant	<i>Raphionacme caerulea</i>	MAGNOLIOPSIDA	GENTIANALES		EN	2134	879	142	6.66	16.17	n/a
Plant	<i>Scleria robinsoniana</i>	LILIOPSIDA	CYPERALES		NT	4006	514	409	10.20	79.53	n/a
Plant	<i>Vepris felicis</i>				NE (EN Kew)	not available	not available	not available	not available	not available	1d
Plant	<i>Stylochaeton pilosus</i>				EN	not available	not available	not available	not available	not available	n/a
Reptile	<i>Mecistops cataphractus</i>	REPTILIA	CROCODYLIA	Slender-snouted Crocodile, African Slender-snouted Crocodile	CR	3344510	71837	2981	0.09	4.15	1c

Reptile	Osteolaemus tetraspis	REPTILIA	CROCODYLIA	African Dwarf Crocodile, West African Dwarf Crocodile	VU	4923542	72083	2981	0.06	4.14	n/a
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Freshwater DMU

Group	Binomial	Described?	Class	Order	Common names	IUCN Red List status	Total Range Area (km ²)	Range Area in SL (km ²)	Range Area in DMU	% Global Range in DMU	% National Range in DMU	CH criterion
Crustacean	<i>Caridina evae</i>	y	MALACOSTRACA	DECAPODA		LC	1249	148	145	11.61	97.97	n/a
Dragonfly	<i>Agriocnemis angustirami</i>	y	INSECTA	ODONATA	Liberian Wisp	VU	113448	65622	7945	7.00	12.11	n/a
Dragonfly	<i>Elattonaura dorsalis</i>	y	INSECTA	ODONATA	Yellow-fronted Threadtail	VU	46856	37941	7943	16.95	20.94	2b
Dragonfly	<i>Pseudagrion mascagnii</i>	y	INSECTA	ODONATA		CR	42526	41949	7940	18.67	18.93	n/a
Dragonfly	<i>Phyllogomphus bartolozzii</i>	y	INSECTA	ODONATA		DD	11259	11214	7931	70.44	70.72	n/a
Dragonfly	<i>Orthetrum sagitta</i>	y	INSECTA	ODONATA	Arrow Skimmer, Salone Skimmer	DD	18755	18603	7939	42.33	42.68	n/a
Fish	<i>Barbus bagbwensis</i>	y	ACTINOPTERYGII	CYPRINIFORMES		VU	25486	25428	7934	31.13	31.20	n/a
Fish	<i>Barbus bigornei</i>	y	ACTINOPTERYGII	CYPRINIFORMES	Carp	NT	63723	28928	7939	12.46	27.44	n/a
Fish	<i>Barbus liberiensis</i> / <i>Enteromius liberiensis</i>	y	ACTINOPTERYGII	CYPRINIFORMES	carps	EN	46935	27361	7934	16.90	29.00	1a

Fish	Callopanchax occidentalis	y	ACTINOPTERYGII	CYPRINODON TIFORMES		NT	97536	65621	7946	8.15	12.11	n/a
Fish	Epiplatys lokoensis	y	ACTINOPTERYGII	CYPRINODON TIFORMES		EN	8847	8786	7925	89.58	90.20	1a; 2b
Fish	Ichthyborus quadrilineatus	y	ACTINOPTERYGII	CHARACIFORMES		NT	128481	24287	7939	6.18	32.69	n/a
Fish	Malapterurus barbatus	y	ACTINOPTERYGII	SILURIFORMES		NT	142329	72312	7950	5.59	10.99	n/a
Fish	Malapterurus stiasnyae	y	ACTINOPTERYGII	SILURIFORMES		NT	148549	72312	7950	5.35	10.99	n/a
Fish	Marcusenius meronai	y	ACTINOPTERYGII	OSTEOGLOSSIFORMES		EN	25486	25428	7934	31.13	31.20	1a; 2b
Fish	Mastacembelus taniaensis	y	ACTINOPTERYGII	SYNBRANCHIFORMES		VU	44685	36657	7935	17.76	21.65	n/a
Fish	Pelvicachromis roloffi	y	ACTINOPTERYGII	PERCIFORMES		NT	130759	72313	7950	6.08	10.99	n/a
Fish	Petrocephalus levequei	y	ACTINOPTERYGII	OSTEOGLOSSIFORMES	Elephantfish	NT	110484	42485	7947	7.19	18.71	n/a
Fish	Raiamas nigeriensis	y	ACTINOPTERYGII	CYPRINIFORMES		NT	619316	71575	7952	1.28	11.11	n/a
Fish	Sarotherodon occidentalis	y	ACTINOPTERYGII	PERCIFORMES		NT	274453	72313	7950	2.90	10.99	n/a
Fish	Scriptaphyosemion bertholdi	y	ACTINOPTERYGII	CYPRINODON TIFORMES	Berthold's killi	EN	31429	30314	7932	25.24	26.17	n/a
Fish	Scriptaphyosemion roloffi	y	ACTINOPTERYGII	CYPRINODON TIFORMES		NT	77821	57900	7946	10.21	13.72	n/a

Fish	Tilapia joka (Coelotilapia joka)	y	ACTINOPTERYGII	PERCIFORMES	African Perch	VU	73512	50343	7939	10.80	15.77	n/a
Fish	Chiloglanis sp. aff. Occidentalis*	n				Not Eval	not available	not available	not available	not available	not available	Possible 2b
Fish	Epiplatys sp.	in press				Not Eval	not available	not available	not available	not available	not available	2b
Fish	Epiplatys sp. aff. njalaensis	in press				Not Eval	not available	not available	not available	not available	not available	2a
Fish	Scriptaphyosemion cf. chaytori	in press				Not Eval	not available	not available	not available	not available	not available	2b
Fish	Scriptaphyosemion wieseae*	y				Not Eval	not available	not available	not available	not available	not available	Possible 2b
Fish	Archiaphyosemion cf. guineense*	n				Not Eval	not available	not available	not available	not available	not available	Possible 2b
Fish	Ctenopoma sp.	n	not captured in ours			Not Eval	not available	not available	not available	not available	not available	n/a
Fish	Enteromius cf. trispilos*	n				Not Eval	not available	not available	not available	not available	not available	Possible 2b
Fish	Coelotilapia joka		ABOVE				not available	not available	not available	not available	not available	n/a
Fish	Rhexipanchax kabae	y				VU	not available	not available	not available	not available	not available	2b
Fish	Prolabeo batesi	y				DD	30187	28928	7939	26.30	27.44	n/a
Fish	Raiamas scarciensis*	y				DD	not available	not available	not available	not available	not available	Possible 2b
Fish	Leptocypris guineensis	y				NT	25,471	not available	not available	not available	not available	n/a
Fish	Synodontis tourei	y				NT	not available	not available	not available	not available	not available	2b
Mollusc	Neritina rubricata	y	GASTROPODA	CYCLONERITI MORPHA		NT	522008	53237	7940	1.52	14.91	n/a
Mollusc	Sierraia leonensis	y	GASTROPODA	LITTORINIMO RPHA		VU	38501	38425	7940	20.62	20.66	n/a
Plant	Ledermanniella aloides	y	MAGNOLIOPSIDA	PODOSTEMA LES		VU	117859	29991	7919	6.72	29.40	1d

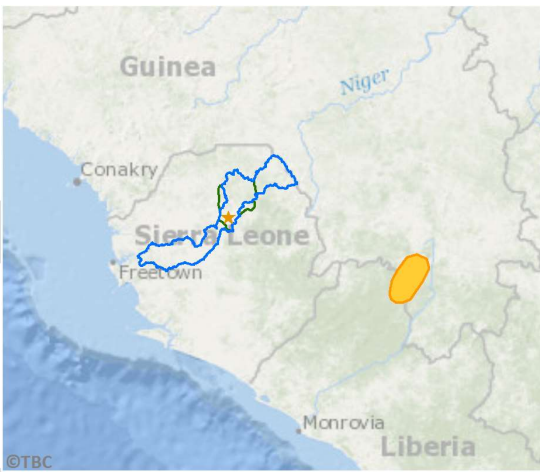
Plant	<i>Stonesia gracilis</i>	y	MAGNOLIOPSIDA	PODOSTEMA LES	DD	28545	23007	7941	27.82	34.52	n/a
Plant	<i>Ledermanniella yiben</i>	in press		PODOSTEMA LES	Not Eval	not available	not available	not available	not available	not available	1a, 2a,

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Appendix 4: Species accounts

Mammals

Tier 1: Ziama Horseshoe Bat (*Rhinolophus ziama*)

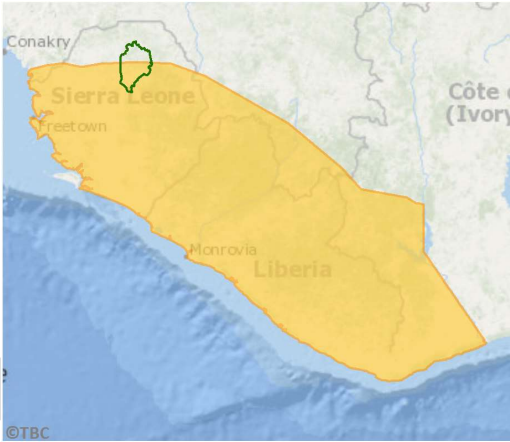
Species	Ziama Horseshoe Bat (<i>Rhinolophus ziama</i>)	 <p>©TBC</p> <p><i>Rhinolophus ziama</i></p> <ul style="list-style-type: none"> Species range Terrestrial DMU Freshwater DMU <p>1:10,000,000 IUCN 2016</p>
Status (IUCN)	Endangered (EN)	
Critical Habitat criteria	<p>Criterion 1b: Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management units for that species.</p> <p>Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</p>	
Critical Habitat tier	Tier 1	
Justification	<p>Ziama Horseshoe Bat is an EN species associated with both montane and lowland tropical moist habitat, using caves as roosting sites. Red List records are from Guinea and Liberia and from less than five locations in a relatively small area (5,000 km²), hence the species is also considered restricted-range. The record from Bumbuna increases the known distribution of this species and the number of locations to six, suggesting that if further surveys were undertaken in suitable habitat further locations may be found. T</p> <p>The species is threatened by deforestation of its habitat, largely through logging and mining operations, and conversion of land to agricultural use. It is also considered</p>	

possible that the species could be threatened by overharvesting for subsistence food in the future (Fahr 2008).

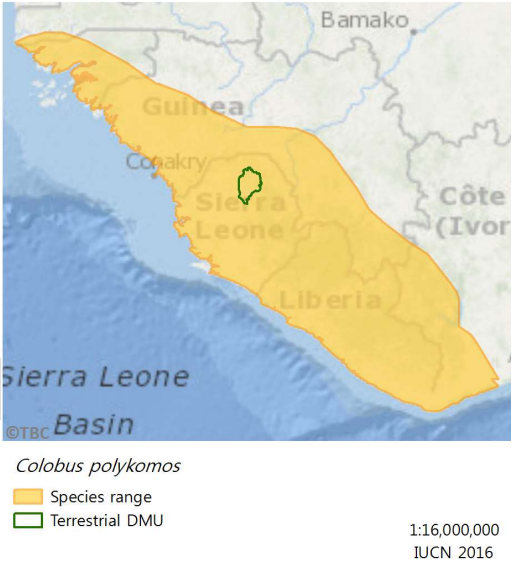
In the Project area, it was recorded in forest near the Bumbuna dam in 2006 and again in 2013 as well as in the Yiben area. Caves in the Yiben area were surveyed for roosting signs in 2016 but the species was not recorded.

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Tier 2: Diana Monkey, *Cercopithecus diana*

Species	Diana Monkey, <i>Cercopithecus diana</i>	 <p><i>Cercopithecus diana</i></p> <ul style="list-style-type: none"> Species range Terrestrial DMU <p>1:11,500,000 IUCN 2016</p>
Status (IUCN)	Vulnerable (VU)	
Critical Habitat criteria	<p>Criterion 1d: Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.</p>	
Critical Habitat Tier	Tier 2	
Justification	<p>Although this species is VU, it is assessed as Critical Habitat-qualifying because the IUCN Primate Specialist Group has indicated that it may shortly be upgraded to Endangered or Critically Endangered. It is listed as VU due to considerable loss of primary habitat over the past ~30 years, and in combination with the effects of hunting the population is presumed to have undergone a decline of 30% or more in this time (J. M. Oates <i>et al.</i> 2016).</p> <p>It is a mostly arboreal species living in the canopy of primary and old secondary lowland moist forest, and riverine and gallery forest. It is rare in degraded forest. Large-scale deforestation in the region, through logging, conversion to agricultural land and charcoal production, continues to reduce the habitat available to this species. It is a preferred game species due to its large size and the value of its meat and skin.</p> <p>The species has not yet been recorded in the DMU but its global range overlaps with the DMU and the area may contain suitable habitat for the species. Habitat loss, fragmentation and hunting across the species range make this species, like other primates, a high concern for the IUCN Primate Specialist Group and other stakeholders.</p>	


Tier 2: Western Black-and-White Colobus, *Colobus polykomos*

Species	Western Black-and-White Colobus, <i>Colobus polykomos</i>	 <p><i>Colobus polykomos</i></p> <p>Species range Terrestrial DMU</p> <p>1:16,000,000 IUCN 2016</p>
Status (IUCN)	Vulnerable (VU)	
Critical Habitat criteria	Criterion 1d: Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.	
Critical Habitat tier	Tier 2	
Justification	<p>Although this species is VU, it is assessed as Critical Habitat-qualifying because the IUCN Primate Specialist Group has indicated that it may shortly be upgraded to Endangered or Critically Endangered. The species prefers rainforest and forest galleries, and is rarely found in degraded habitat, though sometimes in secondary forests. Until recently this species was widespread, but is likely to have undergone a decline exceeding 30% over the past ~30 years given the habitat degradation and intensive hunting taking place across its range, especially since it does not persist well in degraded areas and requires some degree of primary forest available (Oates et al. 2008).</p> <p>Although the total range of this species is still extensive, habitat loss and hunting are becoming an increasing threat and fragmenting the remaining populations. The species is known to occur within the DMU, as noted through community interviews (ERM 2016b). Targeted surveys to understand species distribution within the Project area have not yet been undertaken.</p>	

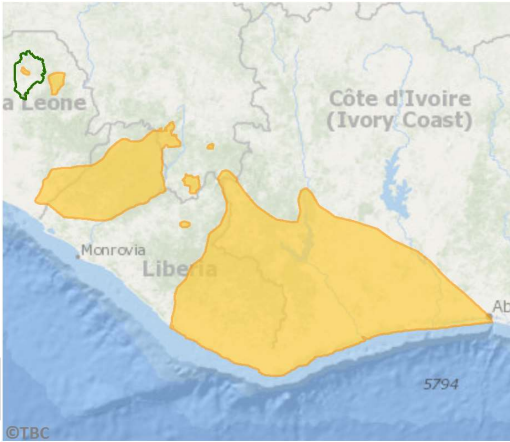
Tier 2: Western Chimpanzee (*Pan troglodytes verus*)

Species	Western Chimpanzee (<i>Pan troglodytes verus</i>)	 <p><i>Pan troglodytes verus</i></p> <ul style="list-style-type: none"> ■ Species range ■ Terrestrial DMU ■ Freshwater DMU <p style="text-align: right;">1:25,000,000 IUCN 2016</p>
Status (IUCN)	Critically Endangered (CR)	
Critical Habitat criteria	Criterion 1c: Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/subspecies	
Critical Habitat tier	Tier 2	
Justification	<p>IFC GN6 (IFC 2012b) notes that where populations of Critically Endangered or Endangered great apes exist, Tier 1 is probable irrespective of the DMU concept. A national chimpanzee survey (Brncic <i>et al.</i> 2010) estimated a total of 5,500 wild chimpanzees in Sierra Leone with more than half living outside of protected areas. Sierra Leone is likely to have the second largest population of West African Chimpanzees, after Guinea, emphasising the importance of conservation efforts outside of protected areas. A national population, habitat and viability assessment was undertaken in 2010, facilitated by the Conservation and Wildlife Management Unit of the Forestry Division. The assessment highlighted 11 core chimpanzee areas within Sierra Leone. The nearest important area to the project is the Loma mountains (a potential offset site for the project). In 2006 the Bumbuna primate study (Nippon Koei 2007) estimated there to be 35 to 58 individuals in the Bumbuna area in 4 communities, it is likely that Bumbuna phase I has impacted on this population but the extent of impacts is unclear at present. Surveys undertaken in the Yiben area in 2016 indicate at least 2 communities are present in the area but further surveys would need to be undertaken to confirm this and assess potential project impacts of phase II.</p>	

Tier 2: Western Red Colobus, *Piliocolobus badius*

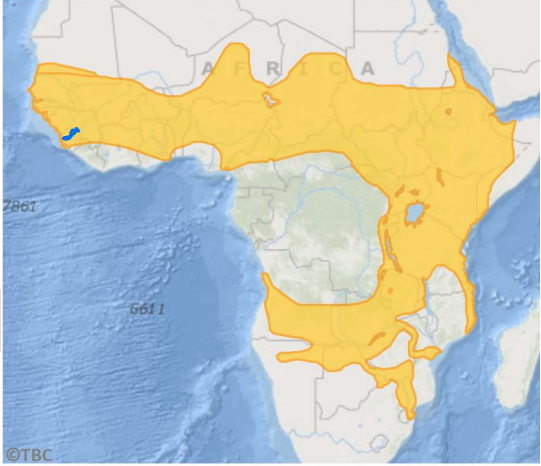
Species	Western Red Colobus, <i>Piliocolobus badius</i>	 <p><i>Piliocolobus badius</i></p> <p>Species range Terrestrial DMU</p> <p>1:14,000,000 IUCN 2016</p>
Status (IUCN)	EN	
Critical Habitat criteria	<p>Criterion 1d: Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.</p>	
Critical Habitat tier	Tier 2	
Justification	<p>The IUCN Primate Specialist Group have indicated that Western Red Colobus is likely to be upgraded to Critically Endangered soon. The species occurs as fragmented populations in Sierra Leone. It prefers primary or mature old growth moist forest. There are no overall population estimates, but the species appears to be declining over most of its range. The major threats to Western Red Colobus are habitat loss and hunting. Deforestation through logging, charcoal production, and clearance for agricultural land including plantations, has occurred over much of the species range, especially in the last century. In addition, both subsistence and commercial hunting have heavily impacted populations of this species (Oates et al. 2016).</p> <p>Western Red Colobus has not yet been recorded in the DMU, but its global range overlaps with the DMU and the area contains suitable habitat for the species. Habitat loss, fragmentation and hunting across the species range make this species, like other primates, a high concern for stakeholders such as the IUCN Primate Specialist Group.</p>	

Stakeholder concern: Pygmy Hippopotamus, *Choeropsis liberiensis*

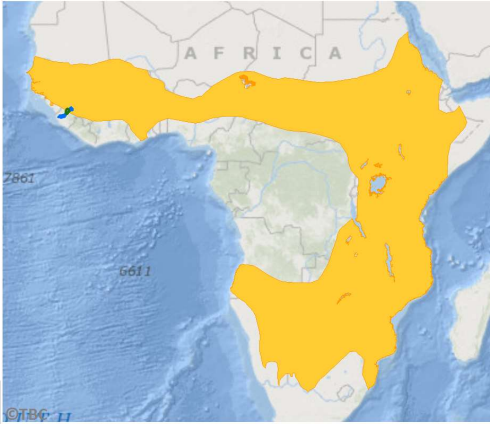
Species	Pygmy Hippopotamus, <i>Choeropsis liberiensis</i>	 <p>©TBC</p> <p><i>Choeropsis liberiensis</i></p> <ul style="list-style-type: none"> Species range Terrestrial DMU <p>1:12,000,000 IUCN 2016</p>
Status (IUCN)	Endangered (EN)	
Critical Habitat criteria	n/a – stakeholder concern	
Justification	<p>Populations of Pygmy Hippo are reported to be rapidly declining and are increasingly fragmented due to loss of habitat and hunting pressures (Ransom et al 2015). As a secretive and primarily nocturnal mammal it is rarely seen, making surveying for the species difficult. It is a solitary animal (except when a female is accompanied by her young) and associated with primary and secondary forests close to rivers, streams and swamps. Within the area of the project, the species has been recorded along from tributaries near Yiben along the Seli River in 2006 and 2013. More recent surveys have not encountered the species however it is still reported by local communities and due to the challenges of surveying this species, should still be considered as present in the area.</p>	

Birds

Tier 2: Hooded Vulture (*Necrosyrtes monachus*)


Species	Hooded Vulture (<i>Necrosyrtes monachus</i>)	 <p>©TBC</p> <p><i>Necrosyrtes monachus</i></p> <ul style="list-style-type: none"> Species range Terrestrial DMU Freshwater DMU <p>1:100,000,000 IUCN 2016</p>
Status (IUCN)	Critically Endangered (CR)	
Critical Habitat criteria	Criterion 1c: Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/subspecies	
Critical Habitat tier	Tier 2	
Justification	<p>Hooded Vulture is widespread in sub-Saharan Africa but the population is undergoing rapid decline, hence it has recently been upgraded to Critically Endangered. Recently published evidence suggests the population is experiencing an extremely rapid decline owing to indiscriminate poisoning, trade for traditional medicine, hunting, persecution and electrocution, as well as habitat loss and degradation (Birdlife International 2016a).</p> <p>The species is often associated with human settlements north of the Equator, but is also found in open grassland, forest edge, wooded savanna, desert and along coasts; and tends to occur at higher densities in areas where populations of larger <i>Gyps</i> vultures are low or nonexistent. It nests in tall trees. Hooded Vulture has been recorded in Loma, and frequently in the Yiben area.</p>	

Tier 2: White-backed Vulture (*Gyps africanus*)

Species	White-backed Vulture (<i>Gyps africanus</i>)	 <p><i>Gyps africanus</i></p> <ul style="list-style-type: none"> Species range Terrestrial DMU Freshwater DMU <p>1:100,000,000 IUCN 2016</p>
Status (IUCN)	Critically Endangered (CR)	
Critical Habitat criteria	Criterion 1c: Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/subspecies	
Critical Habitat tier	Tier 2	
Justification	<p><i>Gyps africanus</i> is the most widespread and common species of vulture in Africa but the population is undergoing rapid decline that is expected to continue, hence the species was recently upgraded to Critically Endangered (Birdlife International 2016b). The decline is due to habitat loss and conversion to agro-pastoral systems, declines in wild ungulate populations, hunting for trade, persecution, collisions and poisoning (vultures are a heavily persecuted group).</p> <p>The species is associated with wooded savanna, requiring tall trees for nesting. It is a gregarious species congregating at carcasses, in thermals and at roost sites, nesting in loose colonies. It has not yet recorded in the Project area but has been recorded in the nearby Loma mountains.</p>	

Amphibians

Tier 2: Freetown Long-fingered Frog, (*Arthroleptis aureoli*, formerly *Cadioglossa aureoli*)

Species	Freetown Long-fingered Frog, (<i>Arthroleptis aureoli</i> , formerly <i>Cadioglossa aureoli</i>)	 <p>©TBC</p> <p><i>Arthroleptis aureoli</i></p> <p>Species range</p> <p>Terrestrial DMU</p> <p>1:4,000,000 IUCN 2016</p>
Status (IUCN)	Endangered (EN)	
Critical Habitat criteria	Criterion 1d: Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.	
Critical Habitat tier	Tier 2	
Justification	<p>The Freetown Long-fingered Frog is associated with forest habitat and forest streams; recent records suggest the species will survive in degraded habitats. The IUCN Red List notes that this species is only known from the Freetown peninsular (Schjøtz & Rodel 2004), however the assessment is dated and subsequent surveys have found new locations for the species as far afield as Guinea.</p> <p>Project surveys have increased the number of known locations in Sierra Leone (Bumbuna, Yiben and the Loma mountains), suggesting that this species will be found at further sites containing suitable habitat if appropriate surveys are undertaken. It has been recorded both in the direct Project footprint and from outside (in the Yiben and Bumbuna areas).</p>	

Possible Tier 2: Cameroon Grassland Frog (*Ptychadena retropunctata*)

Species	Cameroon Grassland Frog (<i>Ptychadena retropunctata</i>)	A range map is not available for this species
Status (IUCN)	Data Deficient	
Critical Habitat criteria	<i>Possibly Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</i>	
Critical Habitat tier	Tier 2	
Justification	<p>Very little is known about the habitat and ecology of the Cameroon Grassland Frog. It is associated with savanna, grassland and more recently gallery forest habitats. Breeding probably takes place in shallow puddles (Rödel & Schiøtz 2004). It is known from the Loma Mountains and Mount Nimba (Guinea and Liberia). The species was recorded in the Yahorro stream at the edge of the Yiben reservoir footprint in 2016 and possibly recorded in 2013 from the Bumbuna area (ERM 2016b). The Yiben record represents a new location for this species, and finding further locations in considered likely if appropriate surveys are undertaken.</p> <p>Note: Specimens of Cameroon Grassland Frog have been recorded with colour and pattern variations on their back legs. Further studies are required to determine the taxonomic status of these specimens, which may represent a new species <i>Ptychadena cf. retropunctata</i>. At present, these specimens have not been assessed separately to <i>P. retropunctata</i>.</p> <p>With more information, this species might be considered as a Tier 2 restricted-range species, but at present it is not possible to confirm this.</p>	

Possible Tier 2: *Ptychadena sp. 1*

Species	<i>Ptychadena sp. 1</i>	A range map is not available for this species
Status (IUCN)	Not Evaluated	
Critical Habitat criteria	<i>Possibly Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</i>	
Critical Habitat tier	Tier 2	
Justification	<p>This potentially new species is yet undescribed. Very little information is known about it. It was found in forest habitat in both Yiben and Loma mountains in 2016 and possibly also recorded in 2013.</p> <p>With more information, this species might be considered as a Tier 2 restricted-range species, but at present it is not possible to confirm this.</p>	

Possible Tier 2: *Ptychadena sp. 2*

Species	<i>Ptychadena sp. 2</i>	A range map is not available for this species
Status (IUCN)	Not Evaluated	
Critical Habitat criteria	<i>Possibly Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</i>	
Critical Habitat tier	Tier 2	
Justification	<p>This potentially new species is yet undescribed. Very little information is known about it. It was found in forest habitat in both Yiben and Loma mountains in 2016 and possibly also recorded in 2013.</p> <p>With more information, this species might be considered as a Tier 2 restricted-range species, but at present it is not possible to confirm this.</p>	

Reptiles

Tier 2: Slender-snouted Crocodile (*Mecistops cataphractus*)

Species	Slender-snouted Crocodile (<i>Mecistops cataphractus</i>)	<p><i>Mecistops cataphractus</i></p> <ul style="list-style-type: none"> Species range Terrestrial DMU Freshwater DMU <p>1:75,000,000 IUCN 2016</p>
Status (IUCN)	Critically Endangered (CR)	
Critical Habitat criteria	Criterion 1c: Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally-important concentrations of a Red-listed EN species where that habitat could be considered a discrete management unit for that species/subspecies	
Critical Habitat tier	Tier 2	
Justification	<p>Slender-snouted Crocodile was most recently assessed on the IUCN Red List in 2014, when it was upgraded from Data Deficient to Critically Endangered (Shirley 2014). In West Africa, particularly, it is a shy species susceptible to human disturbance. Hunting pressure and habitat loss is believed to have significantly reduced the range and population size in West Africa in recent years. It is projected that this species will likely be lost from the non-true forested areas (i.e., the wooded, gallery savanna areas in the north) of its West African range in the next 10–20 years if it currently still exists in these northern extremes (Shirley 2014).</p> <p>The species is associated with forested rivers and densely vegetated bodies of water including lakes. In the Project study area, it has been recorded from the Mawoloko tributary (2013) (a tributary which will not be directly affected by the Project). Camera trap surveys in the Yiben area in 2016 did not record the species. Local communities reported its presence in the Lake Sonfron area only (ERM 2016b).</p>	

Dragonflies

Tier 2: Yellow-fronted Threadtail (*Elattoneura dorsalis*)

Species	Yellow-fronted Threadtail (<i>Elattoneura dorsalis</i>)	A range map is not available for this species
Status (IUCN)	Vulnerable (VU)	
Critical Habitat criteria	Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement	
Critical Habitat tier	Tier 2	
Justification	Yellow-fronted Threadtail is endemic to Sierra Leone, known from only four locations there (Dijkstra 2010). It is associated with forest streams in lowland forest habitat. It is Vulnerable, owing to a decline in population due to future agricultural expansion. Deforestation is a potential threat to the species (Dijkstra 2010). It has not yet been recorded by the Project, but is thought reasonable to expect this species to have a more widespread distribution than shown by current limited data.	

Freshwater fish

Tier 1: Carp (*Enteromius liberiensis* (*Barbus liberiensis*))

Species	Carp (<i>Enteromius liberiensis</i> (<i>Barbus liberiensis</i>))	A range map is not available for this species
Status (IUCN)	Endangered (EN)	
Critical Habitat criteria	Criterion 1a: Habitat required to sustain $\geq 10\%$ of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species	
Critical Habitat tier	Tier 1	
Justification	<p>This Endangered species is a ray-finned carp fish currently known from three catchments in Sierra Leone and Liberia, but its limits are yet to be defined (Entsua-Mensah 2010a). It is a benthopelagic species, meaning it lives and feeds near the bottom as well as in midwaters or near the surface. It grazes on aquatic plants and insects in streams and lakes (debris from forest canopy is important food source).</p> <p>This species was reported from ESHIA earlier surveys (2007 and 2010) but from the most recent survey (ERM 2016b), it is reported that these records are misidentifications and the specimens collected are of <i>E. cf trispilos</i> and not <i>E. liberiensis</i>. Sonnenberg (in litt. 2017) notes that <i>E. liberiensis</i> is likely to be a species with a mostly coastal plain distribution whilst <i>E. cf trispilos</i> occurs upstream, above Bumbuna falls.</p>	

Tier 1: *Epiplatys lokoensis*

Species	<i>Epiplatys lokoensis</i>	A range map is not available for this species
Status (IUCN)	Endangered (EN)	
Critical Habitat criteria	<p>Criterion 1a: Habitat required to sustain $\geq 10\%$ of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species</p> <p>Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</p>	
Critical Habitat tier	Tier 1	
Justification	<p>Endangered <i>Epiplatys lokoensis</i> is known from Sierra Leone and possibly recorded in one locality in Liberia and Guinea, found in swampy areas and small rivers, and known from the coastal plains in the Port Loko area. It is therefore a restricted-range species. Given the distance downstream of the Project where this species has been recorded, and the fact that it is associated with small rivers and swamps away from the main Rokel river, it is unlikely that the Project will impact this species (directly or indirectly).</p>	

Tier 1: *Epiplatys sp. aff. njalaensis*

Species	<i>Epiplatys sp. aff. njalaensis</i>	A range map is not available for this species
Status (IUCN)	Not Evaluated (NE)	
Critical Habitat criteria	Criterion 2a: Habitat known to sustain $\geq 95\%$ of the global population of an endemic or restricted range species where that habitat could be considered a discrete management unit for that species (e.g. a single-site endemic)	
Critical Habitat tier	Tier 1	
Justification	<p><i>Epiplatys sp. aff. njalaensis</i> is an undescribed species different from the EN species <i>Epiplatys njalaensis</i> from the South of Sierra Leone in vertical stripe pattern and coloration (Hullen & Koenig 2015). In 2014 <i>Epiplatys sp. aff. njalaensis</i> was found in the Yiben area, but was not recorded in the 2016 surveys. Hullen & Koenig (2015) note that the species is likely to be a tributary specialist. All specimens were captured from a small pool. Currently, it is only known from the area that is likely to be flooded by the Yiben reservoir.</p> <p>A manuscript describing this species is in preparation (Sonnenberg in litt. 2017). Considering this, and the EN status of the similar species <i>Epiplatys njalaensis</i>, this NE species is considered as Critical Habitat-qualifying under Criterion 2.</p>	

Tier 1: *Marcusenius meronai*

Species	<i>Marcusenius meronai</i>	A range map is not available for this species
Status (IUCN)	Endangered (EN)	
Critical Habitat criteria	<p>Criterion 1a: Habitat required to sustain $\geq 10\%$ of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species.</p> <p>Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement.</p>	
Critical Habitat tier	Tier 1	
Justification	<p><i>Marcusenius meronai</i> is a demersal (bottom feeding) fish from the Mormyrid or 'elephant fish' family. The species is fished for human consumption. It is known only from the Bagbé (Sewa catchment) and the Rokel/Seli catchment in Sierra Leone. The species is associated with permanent flowing rivers (i.e. the main rivers) and was recorded in Seli and Mawokoko rivers in 2006. It is considered very likely that <i>Marcusenius meronai</i> will be found in other catchments with more appropriate surveys, but based on current evidence it is considered restricted-range.</p>	

Tier 2: *Epiplatys sp.*

Species	<i>Epiplatys sp.</i>	A range map is not available for this species
Status (IUCN)	Not Evaluated (NE)	
Critical Habitat criteria	Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement	
Critical Habitat tier	Tier 2	
Justification	<p><i>Epiplatys sp.</i> is an undescribed species known from the Seli catchment and Bagbe (the Sewa catchment, potential offset area). It is thought to be a tributary specialist, associated with small, slow flowing rivers with low water levels and hiding places along the bank and ideally with canopy cover.</p> <p>In Yiben, <i>Epiplatys sp.</i> was collected in the Makerikeri, Magbon and Malondi rivers (in Magbon it was collected in a remnant pool). Although it is Not Evaluated yet, it is reported as 'common in the Yiben study area' and potentially endemic to the area (ERM 2016b). A manuscript describing the species is in preparation (Sonnenberg in litt. 2017). Considering this and the common occurrence in the Yiben area, this restricted-range NE species is considered as Critical Habitat-qualifying under Criterion 2.</p>	

Tier 2: *Rhexipanchax kabae*

Species	<i>Rhexipanchax kabae</i>	A range map is not available for this species
Status (IUCN)	Vulnerable (VU)	
Critical Habitat criteria	Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement	
Critical Habitat tier	Tier 2	
Justification	<p><i>Rhexipanchax kabae</i> is classed as VU on the IUCN Red List of Threatened Species, owing to its restricted range and the potential threat from deforestation (Lalèyè 2010). It is a benthopelagic non-migratory fish found in small rivers and brooks, and is part of the aquarium trade. It was previously only known from some small streams and rivers in the drainage systems of the Mamou River and the Upper Little Scarcies River, in South Central Guinea (Lalèyè 2010).</p> <p>This new Project record for the species represents a significant increase in its range. Project surveys in 2016 recorded it in both the Seli and the Sewa catchment (Bagbe) in both small and larger rivers with gallery forest along the edge. It is considered to meet the Tier 2 threshold for restricted-range species because just over 63% of the global range of <i>Rhexipanchax kabae</i> is within the DMU (based on the IUCN-published species Extent of Occurrence), thus it is reasonable to assume that more than 1% of the global population of <i>Rhexipanchax kabae</i> is likely to occur in the DMU.</p>	

Tier 2: *Scriptaphyosemion cf. chaytori*

Species	<i>Scriptaphyosemion cf. chaytori</i>	A range map is not available for this species
Status (IUCN)	Not Evaluated (NE)	
Critical Habitat criteria	Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement	
Critical Habitat tier	Tier 2	
Justification	<p><i>Scriptaphyosemion cf. chaytori</i> is yet undescribed. This species differs from the Data Deficient <i>Scriptaphyosemion chaytori</i>, found in the lower regions of river systems along the coast of Sierra Leone, in male pigmentation, which is an important characteristic for species differentiation.</p> <p>It was found in 2014 in small pools near a dried-up tributary below the confluence of the Seli and Mawokoko rivers, near the Transmission Line (Hullen & Koenig 2015). In 2016, it was recorded in the potential area of the Yiben reservoir: found in small flowing rivers with a mud or sandy bottom and leaf litter and wood, with an apparent preference for gallery forest along the edges. It is therefore considered to be a tributary specialist.</p> <p>Other species in this family are known to only have a small distribution area, but further surveys further upstream in the Seli catchment and in adjacent catchments could reveal increased distribution. A manuscript describing the species is in preparation (Sonnenberg in litt. 2017), therefore this restricted-range NE species is considered as Critical Habitat-qualifying under Criterion 2.</p>	

Tier 2: *Synodontis tourei*

Species	<i>Synodontis tourei</i>	A range map is not available for this species
Status (IUCN)	Near Threatened (NT)	
Critical Habitat criteria	Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement	
Critical Habitat tier	Tier 2	
Justification	<p><i>Synodontis tourei</i> is a demersal fish until now known only from upper Bafing (Senegal basin) and in the Fouta Djallon, Guinea (Entsua-Mensah 2010b). The Project records in the main Seli River downstream and upstream of Bumbuna falls and in the Bumbuna reservoir (ERM 2016b) extend the known distribution of <i>Synodontis tourei</i>. The species is harvested for human consumption.</p> <p>The Red List notes that the species may meet the threshold for Critically Endangered, based on its extent and area of occurrence (Entsua-Mensah 2010b), but as yet this is unconfirmed. Given its restricted range, this NT species is considered to qualify under Criterion 2.</p>	

Possible Tier 2: *Archiaphyosemion cf. guineense*

Species	<i>Archiaphyosemion cf. guineense</i>	A range map is not available for this species
Status (IUCN)	Not Evaluated (NE)	
Critical Habitat criteria	<i>Possibly Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</i>	
Critical Habitat tier	Tier 2	
Justification	<p>This undescribed species is potentially new and separate from <i>A. guineense</i> (a widespread, Least Concern species). It has been collected in small waterbodies with vegetation cover and leaf litter/wood for hiding places, and is a tributary specialist. It has also been recorded in the Bagbe drainage basin (Loma). Further samples from other regions are required to determine the taxonomic status of the River Seli specimens (Sonnenberg in litt. 2017).</p> <p>With more information, this species might be considered as a Tier 2 restricted-range species, but at present it is not possible to confirm this.</p>	

Possible Tier 2: *Chiloglanis sp. aff. occidentalis*

Species	<i>Chiloglanis sp. aff. occidentalis</i>	A range map is not available for this species
Status (IUCN)	Not Evaluated (NE)	
Critical Habitat criteria	<i>Possibly Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</i>	
Critical Habitat tier	Tier 2	
Justification	<p>Specialist expertise indicates that <i>Chiloglanis sp. aff. occidentalis</i> is related to, but separate from the widespread Least Concern species <i>Chiloglanis occidentalis</i>. Schmidt <i>et al.</i> (2016) note that different river systems are likely to represent different species and therefore <i>Chiloglanis occidentalis</i> should be split. Sonnenberg (ERM 2016b) notes that the species in the Seli catchment is likely to be the same as the one found in the Bagbe river catchment and potentially the same as that in the Little Scarcies. Schmidt <i>et al.</i> (2016) do not describe the new species or provide any diagnostic characteristics of the new species from each river system, therefore the specimens from Seli and Bagbe cannot be properly determined until the descriptions are published.</p> <p><i>Chiloglanis</i> species typically have oral suckers for attaching to objects in fast flowing streams. In 2016, <i>Chiloglanis sp. aff. occidentalis</i> was collected in the main rivers and in tributaries that tend to have sandy or muddy bottoms and gallery forest along the edges in the Seli River and the Bagbe River.</p> <p>There is currently insufficient information to conform <i>Chiloglanis sp. aff. occidentalis</i> as a new species, but based on the available evidence, it is possible it should be categorized as a Tier 2 restricted-range species.</p>	

Possible Tier 2: *Enteromius cf. trispilos*

Species	<i>Enteromius cf. trispilos</i>	A range map is not available for this species
Status (IUCN)	Not Evaluated (NE)	
Critical Habitat criteria	<i>Possibly Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</i>	
Critical Habitat tier	Tier 2	
Justification	<p><i>Enteromius cf. trispilos</i> is a potentially new species that is yet undescribed. It is known only from the Seli catchment in the Yiben area, and has been collected in large rivers as well as small rivers and pools. It is similar to the widely distributed Least Concern species <i>Enteromius trispilos</i>, but has 'minor differences in colour pattern', meaning that further studies are required to determine the species identity (ERM 2016b).</p> <p>There is currently insufficient information to conform <i>Enteromius cf. trispilos</i> as a new species, but based on the available evidence limited to Sierra Leone, it is possible it should be categorized as a Tier 2 restricted-range species.</p>	

Possible Tier 2: *Raiamas scarciensis*

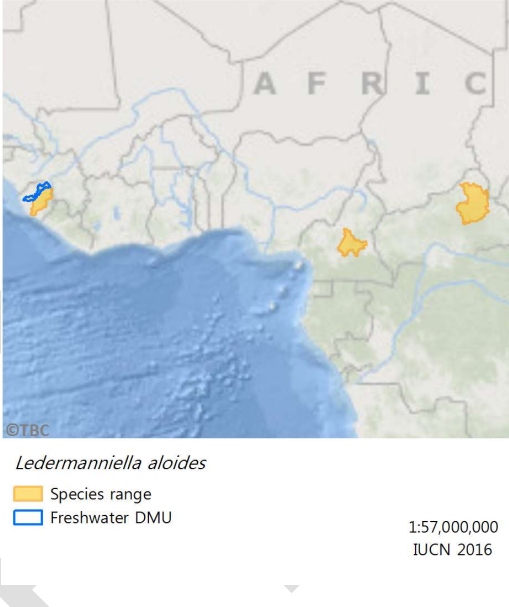
Species	<i>Raiamas scarciensis</i>	A range map is not available for this species
Status (IUCN)	Data Deficient (DD)	
Critical Habitat criteria	<i>Possibly Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</i>	
Critical Habitat tier	Tier 2	
Justification	<p>The Red List indicated that <i>Raiamas scarciensis</i> is only known from two catchments - one in the North of Sierra Leone/Southern Guinea and one in the South of Sierra Leone (Bouso & Laleye 2010). The further record from the Seli River (in between the two catchments mentioned above) increases the records to three catchments. The Seli/Rokel records are from above and below Bumbuna falls. The species has not yet been recorded in Bagbe (Sewa catchment, potential offset area). Since <i>Raiamas scarciensis</i> is Data Deficient, it is not possible to properly confirm Critical Habitat-qualification, but it is possible that it meets the criteria for restricted-range species.</p>	

Possible Tier 2: *Scriptaphyosemion wieseae*

Species	<i>Scriptaphyosemion wieseae</i>	A range map is not available for this species
Status (IUCN)	Not Evaluated (NE)	
Critical Habitat criteria	<i>Possibly Criterion 2b: Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgement</i>	
Critical Habitat tier	Tier 2	
Justification	<i>Scriptaphyosemion wieseae</i> is a Killifish species that has been described but not yet IUCN-evaluated. It is known from the Seli and Bagbe rivers, found in small rivers and a large rice swamp. It is a tributary specialist. There is insufficient evidence to confirm whether it meets Critical Habitat thresholds, but it is possible that this species should qualify as restricted-range under Criterion 2.	

Freshwater plants

Tier 1: *Ledermanniella aloides*

Species	<i>Ledermanniella aloides</i>	 <p><i>Ledermanniella aloides</i></p> <p>Species range Freshwater DMU</p> <p>1:57,000,000 IUCN 2016</p>
Status IUCN	Vulnerable (VU)	
Status Kew	Endangered (EN)	
Critical Habitat criteria	Criterion 1d	
Critical Habitat tier	Tier 1	
Justification	<p><i>Ledermanniella aloides</i> is a small tropical herb that grows on rocks in river rapids. It is assessed on the IUCN Red List as Vulnerable with a wide distribution (Sierra Leone, Central African Republic, Nigeria and Angola) and a reasonably large but localised population (Diop 2010). Based on the wide distribution, it could be found in other locations, and if so could be downgraded to VU (Diop 2010).</p> <p>In a separate assessment to the IUCN Red List, Kew specialists have assessed <i>Ledermanniella aloides</i> as Endangered (EN) (ERM 2015). It has been recorded in the DMU near Yiben; in the Makerikeri river and in the Seli River (at sites that will be impacted by the proposed Yiben reservoir). Due to the wide distribution but potential EN status it is considered to meet the Tier 2 threshold for Critical Habitat under Criterion 1.</p>	

Tier 1: *Ledermanniella yiben*

Species	<i>Ledermanniella yiben</i>	A range map is not available for this species
Status IUCN	Not Evaluated (NE)	
Status Kew	Critically Endangered (CR)	
Critical Habitat criteria	Criterion 1a	
Critical Habitat tier	Tier 1	
Justification	<p><i>Ledermanniella yiben</i> is a new species of herb, recently described by Kew (Cheek <i>et al.</i> In press) and considered to be Critically Endangered. It is associated with fast-flowing rivers and found growing on rocks within the river that are submerged during the rainy season, and may only be exposed in dry years (Cheek <i>pers. comm.</i> 2017). It is thus far only known from one location on the river Seli where it is abundant: however: this area will be under the Yiben reservoir footprint.</p>	

Terrestrial plants

Tier 2: *Vepris felicis*

Species	<i>Vepris felicis</i>	A range map is not available for this species
Status IUCN	Not Evaluated (NE)	
Status Kew	Endangered (EN)	
Critical Habitat criteria	Criterion 1d: Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.	
Critical Habitat tier	Tier 2	
Justification	<p><i>Vepris felicis</i> is a small species of tree found in lowland forests. Although not IUCN Red List evaluated, Kew and Missouri Botanical Gardens consider the species to be Endangered based on five known records in 2015. Its distribution is in Guinea, Sierra Leone, Liberia and Ivory Coast and is therefore not considered restricted-range (<i>MBG in litt.</i> 2015). Kew now reports between seven and nine locations, and the species as 'common within the [Project] inundation area' (ERM 2016b). Specimens cannot be transplanted but translocation via seed is possible (Kew). Based on the Kew EN assessment, <i>Vepris felicis</i> is considered to meet the threshold for Tier 2 Criterion 1.</p>	