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Lao PDR: Monsoon Wind Power Project
Part 21: Appendix G

Prepared by Impact Energy Asia Development Limited (IEAD) for the Asian Development Bank.

Monsoon Wind Power Project, Sekong and Attapeu Provinces, Lao PDR

Environmental and Social Impact Assessment

29 April 2022

Project No.: 0598121

The business of sustainability

ERM

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APPENDIX G CRITICAL HABITAT ASSESSMENT

Monsoon Wind Power Project, Sekong and Attapue Provinces, Lao PDR

Appendix G: Critical Habitat Assessment

29 April 2022

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Appendix G: Critical Habitat Assessment

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Acronyms and Abbreviations

Name	Description
ADB	Asian Development Bank
ADB SPS	Asian Development Bank: Safeguards Policy Statement (ADB, 2009)
amsl	above mean sea level
AoI	Area of Influence
AZE	Alliance for Zero Extinction
BAP	Biodiversity Action Plan
BCCP	Biodiversity Conservation Corridor Project
CHA	Critical Habitat Assessment
CR	Critically Endangered (conservation/threat status for species, vegetation/habitat or ecosystem type)
DD	Data Deficient (conservation/threat status for species, vegetation/habitat or ecosystem type)
EAAA	Ecologically Appropriate Area(s) of Analyses
EIA	Environmental Impact Assessment
EN	Endangered (conservation/threat status for species, vegetation/habitat or ecosystem type)
EoO	Extent of Occurrence
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
GN	Guidance Note
IBA	Important Bird Area

Name	Description
IBAT	Integrated Biodiversity Assessment Tool
IEAD	Impact Energy Asia Development Limited
IFC	International Finance Corporation
IFC PS6	International Finance Corporation: Performance Standard 6: 'Biodiversity Conservation and Sustainable Management of Living Natural Resources' (IFC, 2012)
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
Lao PDR	Lao People's Democratic Republic
LC	Least Concern (conservation/threat status for species, vegetation/habitat or ecosystem type)
MW	Mega Watt
NE	Not Evaluated (conservation/threat status for species, vegetation/habitat or ecosystem type)
NT	Near Threatened (conservation/threat status for species, vegetation/habitat or ecosystem type)
PA	Protected Area
SPS	Safeguards Policy Statement
VU	Vulnerable (conservation/threat status for species, vegetation/habitat or ecosystem type)
WF	Wind Farm
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

This report presents the Critical Habitat Assessment ("CHA") for the approximately 600-megawatt ("MW") Monsoon Windfarm (the "Project") in the Lao People's Democratic Republic ("Laos"). The CHA was completed for the Project, in support of the Project's alignment with the applicable international standards, which include the Asian Development Bank's Safeguards Policy Statement ("ADB SPS"). Critical habitat is considered a subset of natural and modified habitat (identified irrespective of the condition of these areas), and encompasses areas with high biodiversity value associated with the presence of significant types of biodiversity (ADB SPS, 2009).

The approach to the CHA was as follows:

- EAAAs (Ecological Appropriate Assessment Areas) were identified and delineated for volant (flying) species, and non-volant (non-flying) species, respectively, to determine the spatial extent and scope of the CHA;
- Modified and natural habitats were identified / differentiated and mapped;
- A desk-based review of available information on the biodiversity features within the EAAAs was undertaken to inform the CHA;
- The key findings of the baseline biodiversity surveys for fauna and flora were reviewed, with a key focus on species of conservation importance such as Red Data listed plants and animals recorded, with consultation with specialist to verify results;
- Biodiversity features identified as present or likely to occur within the volant and non-volant EAAAs were screened against the six (6) qualifying criteria for 'critical habitat' provided in the ADB SPS and the ADB Environment Safeguards, 'A Good Practice Sourcebook' (aligned also with IFC PS6), including:
  - **Criterion 1** - *Habitat required for the survival of critically endangered (CR) or endangered (EN) species,*
  - ***Criterion 2*** - *Areas with special significance for endemic or restricted-range species,*
  - ***Criterion 3*** - *Sites that are critical for the survival of migratory species,*
  - ***Criterion 4*** - *Areas supporting globally significant concentrations or numbers of individuals of congregatory species,*
  - ***Criterion 5*** - *Areas with unique assemblages of species that are associated with key evolutionary processes or provide key ecosystem services,*
  - ***Criterion 6*** - *Areas with biodiversity that has significant social, cultural or economic importance to local communities, and*
  - *In addition, legally protected or officially proposed areas for protection.*

The Project area is located in a landscape mosaic of montane and evergreen forest, shifting cultivation, shrub land and grassland, waterbodies, and built-up areas. In several areas, there has been extensive modification for agriculture and clearance of forests, predominantly by local communities. The EAAAs assessed therefore contain both natural and modified habitat in terms of the ADB SPS definitions for these types (see ***section 1.2***):

- areas of natural habitat (least impacted) are concentrated in the northern and eastern sections and represent approximately 41% of the EAAA for non-volant species (109,665 ha) and 36% of the EAAA for volant species (86,753 ha); and
- modified habitat (59 - 64% of EAAAs for non-volant and volant species, respectively) is mostly found in the central and southern / south-western sections of the EAAAs, comprising primarily agricultural areas (currently or historically cultivated lands) that have been cleared and transformed through human activity and associated disturbance of the native vegetation and

soils. The volant and non-volant EAAAs both qualify as critical habitat in terms of the criteria assessed and therefore the Project is located entirely within an area classified as critical habitat. Areas of natural and modified habitat support populations of critical habitat-qualifying species (CR/EN, endemic and/or range-restricted) and/or provide for key ecosystem services, and are therefore considered to be 'critical natural habitat' and 'critical modified habitat' in terms of the sub-classification of these areas. Several Protected Areas and KBAs (Key Biodiversity Areas) also qualify as critical habitat. A summary of the main outcomes of the CHA, is as follows: In terms of **Criterion 1**: *Habitat required for the survival of critically endangered or endangered species*, several fauna species (mammals, reptiles, amphibians and birds) are represented with CR or EN threat status. One EN plant species was recorded for the forest habitats surveyed. Whilst modified forest habitat would typically support fewer species, some CR or EN species may utilise these habitats. Typically, the Natural Montane Forest and Wet Evergreen Forest habitats are considered the most important in supporting these species.

- In terms of **Criterion 2**: *Areas with special significance for endemic or restricted-range species,* several mammal and bird species are also endemic and/or range-restricted species. Whilst modified forest habitat would typically support fewer species, I some endemic or restricted-range species may utilise these habitats. Species recorded during field surveys as being potentially 'new to science' may also qualify as restricted-range or endemic.
- In terms of **Criterion 3**: *Sites that are critical for the survival of migratory species* and **Criterion 4**: *Areas supporting globally significant concentrations or numbers of individuals of congregatory species*, the requirements / thresholds for these criteria have not been met in terms of the key species identified.
- In terms of **Criterion 5**: *Areas with unique assemblages of species that are associated with key evolutionary processes or provide key ecosystem services*, the more intact (natural/primary) forest habitats are considered generally important for providing key ecosystem services at both a local/regional and global scale (these are also considered 'Priority ecosystem services' as per the definition provided in IFC PS6 for this criterion).
- In terms of **Criterion 6**: *Areas with biodiversity that has significant social, cultural or economic importance to local communities*, despite the potential socio-cultural importance of an area of 'Sacred Forest' identified in the project area, it was subsequently established that the cultural importance is associated with cemeteries (burial grounds) rather than the actual forest and biodiversity per say. After further consideration, forest habitat does not qualify as critical habitat in terms of criterion 6, strictly speaking.

Specific project requirements with respect to natural habitats, critical habit and protected areas in terms of the ADB SPS are as follows:

- There are several Project components that overlap with areas that are designated as 'natural habitat' and in these instances, the ADB SPS requires that the Project does not significantly convert or degrade areas of natural habitat, and mitigation measures are designed to achieve at least an overall no net loss of biodiversity.
- Where impacts occur within identified 'critical habitats' (modified and natural), the Project is required to fully exercise the mitigation hierarchy and demonstrate an overall net gain of critical habitat-qualifying biodiversity associated with Project site. This is aligned with ADB SPS, paragraph 28 – "*No project activity will be implemented in areas of critical habitat unless the following requirements are met:*

  i. There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function.

  ii. The project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised.

iii. Any lesser impacts are mitigated in accordance with para. 27', whereby mitigation measures will be designed to achieve at least no net loss of biodiversity."

- In addition, **legally protected areas or areas officially proposed for protection** are also to be considered as critical habitats in terms of the ADB SPS, and whilst several Protected Areas do occur within the EAAAs, these do not overlap with the Project development area. Since no project infrastructure is planned to be located within the legally protected areas, the requirements under ADB SPS Safeguard 1, paragraph 30 do not apply to this project.

1. INTRODUCTION

1.1 Purpose and scope of this report

This report presents the Critical Habitat Assessment ("CHA") for the approximately 600-megawatt ("MW") Monsoon Windfarm (the "Project") in the Lao People's Democratic Republic ("Laos"). This CHA is prepared in support of the Project's alignment with the applicable international standards, which include the Asian Development Bank's Safeguards Policy Statement ("ADB SPS").

This CHA builds on the Environmental and Social Impact Assessment ("ESIA") undertaken for the Project (ERM, 2022), and aims to:

- Assess for the critical habitat-qualifying biodiversity features associated with the Project based on a review of Project information, scientific literature and biodiversity expert consultation;
- Present the implications of the CHA findings for the Project; and
- Identify the recommended next steps for the Project.

1.2 ADB Safeguard Policy Statement (2009)

The ADB SPS is a consolidated policy framework that presents ADB's operational policies on mitigating and managing adverse environmental and social impacts, while serving to protect the rights of people that are likely to be affected or marginalized by the development process. Safeguard requirements pertaining to biodiversity and natural resource management are an integral consideration under Safeguard Requirement 1: Environment.

Of relevance to this CHA is the guidance provided by the ADB SPS on how to identify three categories of land and water areas based on its condition and biodiversity value. These categories include: (i) modified habitat; (ii) natural habitat; and (iii) critical habitat.

Distinguishing an area as natural habitat or modified habitat is based on the extent of human modification of the area, i.e. the condition of the area. Areas of natural habitat[1] comprise largely native plant and/or animal species, and where primary ecological functions are still relatively intact. In contrast, modified habitats[2] contain a large proportion of non-native species, and/or are substantially altered by human activity thereby disrupting an area's primary ecological functions and species composition (e.g. urban areas, monoculture plantations).

Critical habitat[3] is defined in the ADB SPS as being a subset of modified and natural habitat. These are "*areas with high biodiversity value*", that are associated with the presence of significant types of biodiversity and are identified irrespective of the condition of the area. Both areas of natural and modified habitats may contain globally important biodiversity values, thereby qualifying as critical habitat.

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[1] **Natural habitat** as defined in the ADB SPS (2009): "…*land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area's primary ecological functions*".

[2] **Modified habitat** is not defined explicitly in the ADB SPS (2009), however, there is reference made to areas "…*where the natural habitat has apparently been altered, often through the introduction of alien species of plants and animals, such as in agricultural areas…*". IFC Performance Standard 6 (IFC, 2012) defines modified habitat more substantively as comprising "…*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*" and which "…*may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands*".

[3] **Critical habitat** as defined in the ADB SPS (2009): "*A subset of both natural and modified habitat that deserves particular attention. Critical habitat includes areas with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; areas supporting globally significant concentrations or numbers of individuals of congregatory species; areas with unique assemblages of species or that are associated with key evolutionary processes or provide key ecosystem services; and areas having biodiversity of significant social, economic, or cultural importance to local communities.*"

1.3 Addressing ADB SPS and IFC PS6 requirements in this CHA

There is a high degree of overlap between the biodiversity requirements listed in the ADB SPS and IFC PS6 (*International Finance Corporation: Performance Standard 6: 'Biodiversity Conservation and Sustainable Management of Living Natural Resources'*). This CHA assesses biodiversity features together under equivalent requirements and criteria where possible (e.g. ADB SPS Paragraph 28, and IFC PS6 critical habitat criteria I-V). Where it is aligned with ADB SPS objectives, ERM utilised the IFC PS6 and its associated Guidance Note 6 to assist with refining the CHA approach where needed.

1.4 Project Description

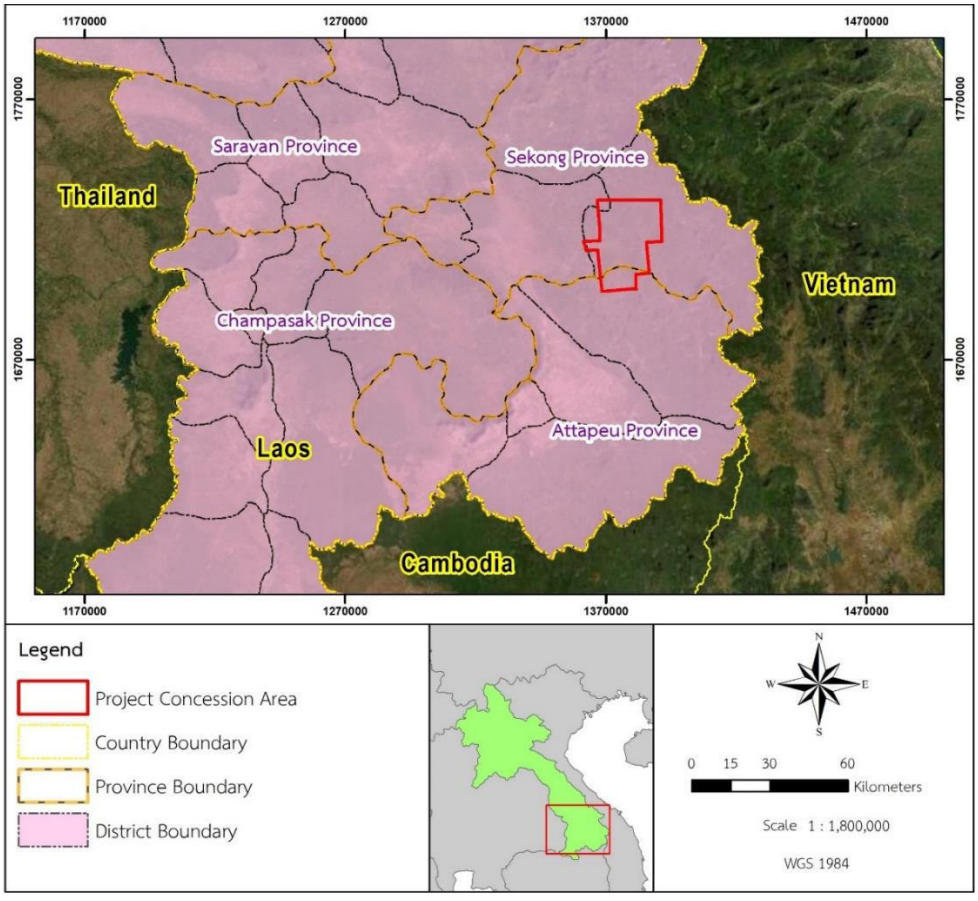
Impact Energy Asia Development ("IEAD" and/or "the Project Proponent") is developing the Wind Farm ("WF") Project in Dak Cheung District of Sekong Province and Sanxay District of Attapue Province in Laos. The Project will connect to the grid in Vietnam, and the generated electricity is expected to be sold to Vietnam Electricity ("EVN").

The Project will construct the following permanent structures: (i) wind turbines; (ii) overhead conductor's/transmission cables between wind turbines; (iii) a 22 km 500 kV transmission line, which connects to the existing power grid in Vietnam; (iii) site roads; and (iv) access road improvement and upgrades.

Temporary site facilities constructed for the Project include: concrete batching plants, stone crushing plants, construction laydown areas, worker accommodation areas, and spoil disposal areas.

The Project location is presented on the locality map in ***Figure 1.1***.

Figure 1.1: Project Location



Source of information: ERM (2021)

1.5 Ecological context of the Project

The Project is located within the '**Southern Annamites Montane Rain Forests'** ecoregion[4] (IM0152) as defined by the World Wildlife Fund ("WWF") and mapped by Olson *et al.* (2001), which is considered to be 'Vulnerable' in terms of conservation/threat status. Located along the border between Lao PDR and Viet Nam, the diverse ecosystems are dominated by remote montane forests that are considered globally significant in terms of biodiversity, harbouring some of the world's rarest plants and animals. Given the geological, topographic, and climatic complexities facing this ecoregion, highly variable forest ecosystems ranging from lowland areas with wet evergreen forests at elevations of 600-900m above mean sea level ("amsl"), to montane evergreen hardwood and conifer forests above 900m amsl, occur in the area. Where primary forest habitat remains in the region, such areas are distributed in small, isolated fragments or patches and are predominantly made up of the following two evergreen forest vegetation communities which are structurally and compositionally distinct:

- Wet evergreen forests at 600-900 m elevation are dominated by species of Fagaceae, Myrtaceae, and Lauraceae, with high overall species richness; and
- Montane hardwood forests above 900 m elevation in this ecoregion vary in structure and composition depending on geological substrate and moisture availability, best represented by species of Fagaceae and typically having tall forest canopies reaching up to about 30m height, with epiphytes and orchids forming a notable part of the biodiversity.

The Project is situated within the southern Annamite Mountains, in the Sekong and Attapeu provinces. Due to the high elevations and steep topography that characterises the ecoregion, the human population density is considered moderate, however anthropogenic impacts are pervasive in the form of regular burning to create open woodlands and shifting cultivation on the upper slopes. Wildlife poaching and excessive harvesting of forest products are also particularly threatening to the biodiversity of the region and according to the WWF, more than 75% of the ecoregion's natural habitat has been converted or degraded (WWF, 2021a).

The Project area is located in a mosaic of evergreen forest, shifting cultivation, shrub land and grassland, waterbodies, and built-up areas. In some areas, particularly those in the centre of the Project and associated with the Dak Cheung Plateau Key Biodiversity Area (KBA), there has been extensive modification for agriculture and clearance of forests.

Project baseline biodiversity surveys conducted confirm that the study area does indeed harbour sensitive habitats and associated species, and this is further detailed in ***section 7.4.3*** and **section *7.4.4*** of the ESIA.

2. APPROACH TO THE CRITICAL HABITAT ASSESSMENT

2.1 Delineate the Ecologically Appropriate Area(s) of Analyses (EAAA)

A preliminary review of information on the region's ecology was carried out to define the Project's Ecologically Appropriate Area(s) of Analyses ("EAAA"), so as to determine the presence of each species or ecosystem that regularly occurs in the project's Area of Influence ("AoI") that may qualify as critical habitat. Two EAAAs were identified for volant (flying) species, and non-volant (non-flying) species, respectively.

Delineating an EAAA requires consideration of: (i) the likely geographic area or extent of anticipated project activities and impacts; (ii) the full extent of ecosystems that might be affected in any way; and

[4] An **ecoregion**, as defined by the Olson *et al.* (2001) are biogeographic units "*which are defined as relatively large units of land or water containing a distinct assemblage of natural communities sharing a large majority of species, dynamics, and environmental conditions. There are 867 terrestrial ecoregions, classified into 14 different biomes such as forests, grasslands, or deserts. Ecoregions represent the original distribution of distinct assemblages of species and communities*."

(iii) any additional areas that have a functional role in supporting those ecosystems or their associated biodiversity (for example the limits of relevant river catchments or watersheds needed to support a wetland).

The spatial scope should be ecologically determined and defined, encompassing wider distributions of potentially affected biodiversity features and the ecological patterns, processes, and functions that are necessary for maintaining them throughout this distribution. EAAAs typically extend well beyond a Project's physical footprint and are usually anticipated to be greater than the AoI while taking into account individual species ecology. It is nevertheless permissible to have an EAAA that capture a number of species or to have a series of EAAAs depending on ecosystem or ecological factors.

2.1.1 EAAA for Volant Species

For wind farm developments, identifying the AoI can be particularly challenging. This is because unlike other developments, the primary impacts arise from mortality or displacement of mainly volant species (e.g. bats and birds) that interact with the collision risk zone, created by the rotation of the turbine blades. In such circumstances, one way of understanding the potential AoI, and delineating an EAAA is to identify the likely suite of volant species likely to interact with the turbines. Migratory birds in particular trigger a requirement to include KBAs and/or IBAs (Important Bird Areas) up to tens of kilometres from the project if there is a likelihood of migratory flows through the site and towards or between KBAs and IBAs. In this instance, however the IBAs and/or KBAs within 50km of the project are designated primarily for their endemic and/or restricted range species.

Scottish Natural Heritage (now 'NatureScot') pioneered the concept of connectivity to understand potential effects on birds in relation to normal foraging and daily movement ranges[5]. Similarly, bat workers have identified that many species of bats may have large foraging ranges but rely on core sustenance zones to support colonies[6]. Although some species have the potential to forage over long distances, most will rarely travel beyond 10km on a daily basis[7], becoming progressively more dispersed over the landscape where they do travel such distances. For volant species, an EAAA of a 10km buffer around the Project's concession area provides a reasonable ecological basis for analysis.

The EAAA for volant species (approximately 2,650 km) is presented on the map in ***Figure 2.1***.

2.1.2 EAAA for Non-Volant Species

The EAAA for non-volant species was delineated based on an understanding of habitat connectivity and continuity in the wider landscape, the extent of the Project's potential impacts across the landscape, and the presence of distinct geographical barriers such as mountains, large rivers, and catchments.

Forest areas that occur in the ecoregion are widespread but fragmented across the landscape due to several ecological and anthropogenic factors. Numerous conservation-significant species such as the Annamite Muntjac, and Annamite Striped Rabbit are almost exclusively associated with wet evergreen forest, while other species such as passerine birds are strongly influenced by wet evergreen forest loss/degradation (W. Duckworth, pers. comm., October 13, 2021). This forest type mainly occurs in the eastern slopes of the mountain range located in Vietnam due to the rain shadow effect in the Central Annamites.

Other montane forest types in the landscape are also important as they are known to harbour significant endemic species. Given the widespread nature of these habitat types, and that impacts on such areas are likely to affect the Project's priority biodiversity features, a reasonable contiguous area of these

[5] Pendlebury, C., Zisman, S., Walls, R., Sweeney, J., McLoughlin, E., Robinson, C., & Loughrey, J. (2011) Literature review to assess bird species connectivity to Special Protection Areas: Scottish Natural Heritage Commissioned Report No. 390.

[6] Collins, J. (Ed.). (2016) Bat surveys for professional ecologists: good practice guidelines. Bat Conservation Trust.

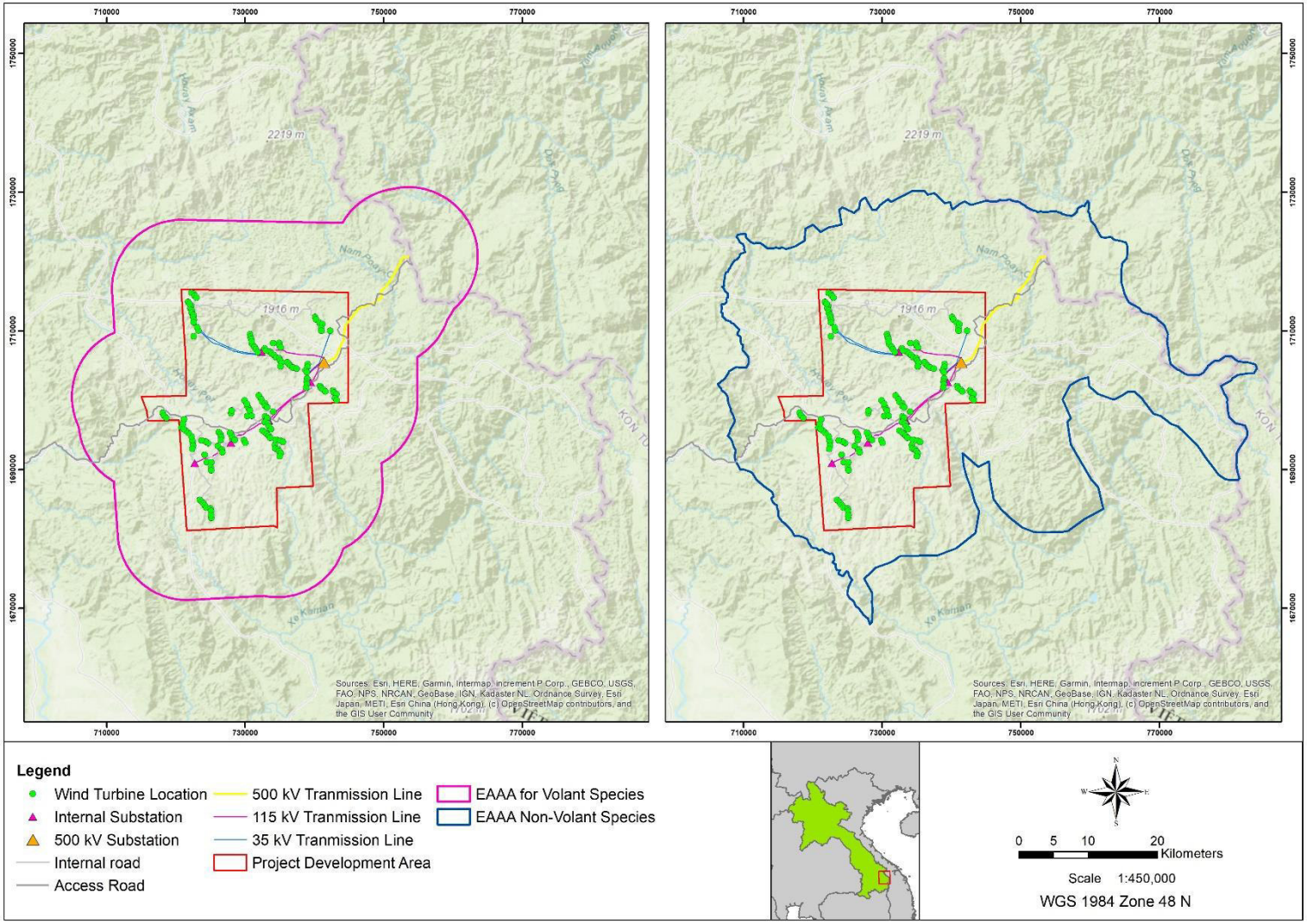
[7] Some examples of distances that volant species tend to travel can be found in the following document: Scottish Natural Heritage. (2016) Assessing Connectivity with Special Protection Areas (SPAs).

habitats was therefore considered a sensible unit of analysis to capture species that regularly occur in the project's AoI. Limits of the EAAA were based on established areas of importance for the distribution of species and ecosystems, and/or the ecological patterns, processes, features and functions that are necessary for maintaining them. This was defined using the boundaries of the following areas of particular importance for biodiversity:

- **Northern boundary**: Phou Ahyon KBA, an area recognised for its biodiversity value, and delineated based on biodiversity elements which trigger the established biological criteria (International Union for Conservation of Nature: IUCN, 2016);
- **Southern and western boundaries**: Xekaman-Houay Ang-Houayvi watershed National Protection Forest Area, an area designated for the conservation of important national watersheds and a dense forested area; and
- **Southern and eastern boundary**: Southern Vietnam Lowland Dry Forests and Southeastern Indochina Dry Evergreen Forests ecoregions, including areas representing the distribution of distinct species and natural plant community assemblages which differ from the Southern Annamites Montane Rain Forests ecoregion the Project is located within.

The EAAA for non-volant species (approximately 2,670 km^2) is also presented on the map in ***Figure 2.1***.

Figure 2.1: Project's EAAAs defined for volant species (left) and non-volant species (right)



Source: ERM, 2021.

2.2 Review and verification of available information

A desk-based review of available information on the biodiversity features within the EAAA was undertaken to inform the CHA. This included a review of global biodiversity datasets, project-specific biodiversity information, and published and publicly available information (as needed).

A long list of biodiversity features (i.e. species, KBAs, and PAs), potentially present in the EAAAs was compiled from a spatial analysis of global datasets available through the Integrated Biodiversity Assessment Tool (IBAT). IBAT is a tool that draws from the IUCN (International Union for Conservation of Nature) Red List of Threatened Species, KBAs, and The World Database on Protected Areas (covering nationally and internationally recognised sites, including IUCN management categories I-VI, Ramsar Wetlands of International Importance and World Heritage sites).

Project biodiversity information was also reviewed to support the identification of biodiversity that may qualify the area as critical habitat and natural habitat. This included the following sources of information:

- **Local EIA Report** (English Translation), prepared by Innogreen Engineering Co., Ltd and Greener Consultant Co., Ltd, (Sep. 2020)
- **Rapid Ecological Assessment** at Monsoon Windfarm Power Project, Dakcheung District, prepared by Phiapalath, P., Khotpathoom, T., Soukhavong, M. and Phiravong, S., and Environmental Resource Management (ERM) (Feb. 2020)
- **Bird field survey** report on windfarm project at Dakchung District, Xekong Province, Laos, prepared by Xayyasith, S. and Khotpathoom, T. (Dec. 2020 to Nov. 2021)
- **Baseline Bat Assessment** 2021 Dry & Wet Seasons for the 600 MW Monsoon Wind Power Station, Xekong & Attapu Provinces, Lao PDR, prepared by Furey, N.M. and Douangboubpha, B. (Sep. 2021)
- **Mammal, Herpetofauna, and Plant Assessment** of the Monsoon Windfarm Power Project in Dak Cheung, Sekong Province (Final Draft Report), prepared by Phiapalath, P., Khotpathoom, T. and Souladeth, P. (Jan. 2022)

2.3 Assess biodiversity values against ADB SPS Critical Habitat criteria

2.3.1 Apply Critical Habitat criteria and thresholds

The biodiversity features likely to occur within the EAAAs were screened against the six (6) criteria provided in the ADB SPS paragraph 28 (footnote 5), and the ADB Environment Safeguards, *'A Good Practice Sourcebook'*, paragraph 151:

1. *"Habitat required for the survival of critically endangered or endangered species,*
2. *Areas with special significance for endemic or restricted-range species,*
3. *Sites that are critical for the survival of migratory species,*
4. *Areas supporting globally significant concentrations or numbers of individuals of congregatory species,*
5. *Areas with unique assemblages of species that are associated with key evolutionary processes or provide key ecosystem services,*
6. *Areas with biodiversity that has significant social, cultural or economic importance to local communities"*

In addition, footnote 5 to Appendix 1 of the SPS states that "…*Critical habitats include those areas either legally protected or officially proposed for protection, such as areas that meet the criteria of the World Conservation Union classification, the Ramsar List of Wetlands of International Importance, and*

the United Nations Educational, Scientific, and Cultural Organization's world natural heritage sites…". Such areas were therefore also included in the selection criteria for critical habitats.

To refine the approach, the screening process was further informed by additional guidance provided in GN69 to GN97 of the IFC Guidance Note (GN) 6: 'Biodiversity Conservation and Sustainable Management of Living Natural Resources' (2019). ***Table 2.1*** details the ADB SPS critical habitat criteria and corresponding requirements under the IFC: PS6 critical habitat criteria.

The six (6) criteria are 'triggers' in that if an area of habitat meets any one of the qualifying criteria, it will be considered critical habitat irrespective of failing to meet any other criterion. The critical habitat criteria therefore have two distinctive characteristics:

- firstly, components of biodiversity are essentially assigned to only two levels of conservation significance, those that trigger critical habitat and those that do not; and
- secondly, each criterion is applied separately and not in combination, meaning that the scores are not cumulative, such that a species may be screened in more than one criterion [e.g. a Critically Endangered (CR) species that is also endemic or range restricted].

In the absence of reliable population data, proxies such as the proportion of a species' distribution in the area, have been used to inform the critical habitat determination for criteria 1-3. Appropriate population surrogates including Extent of Occurrence ("EoO"), range, or known sites of occurrence (mainly derived from the IUCN Red List data), were used to determine significance with respect to the global population (see IFC, 2019: Guidance Note 77). Expert opinion and professional knowledge were sought to inform a reasonable judgement of potential significance. Where there is uncertainty about the population, range and distribution of potentially occurring biodiversity features within the EAAAs, a precautionary approach has been applied, and the feature is retained for further assessment.

Table 2.1: ADB SPS critical habitat qualifying criteria and corresponding IFC PS6 criteria

ADB SPS qualifying criteria for Critical habitat	Alignment with IFC PS6	
	Criteria	Thresholds
Criterion 1: Habitat required for the survival of critically endangered or endangered species.	Criterion 1: Habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species.	(a) Areas that support globally-important concentrations of an IUCN Red-listed EN or CR species (0.5 % of the global population **AND** 5 reproductive units of a CR or EN species); (b) Areas that support globally-important concentrations of an IUCN Red-listed VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a). (c) As appropriate, areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species.
Criterion 2: Areas with special significance for endemic or restricted-range species.	Criterion 2: Habitat of significant importance to endemic and/or restricted-range species.	(a) Areas that regularly hold ⩾ 10 % of the global population size AND ⩾ 10 reproductive units of a species.
Criterion 3: Sites that are critical for the survival of migratory species.	Criterion 3: Habitat supporting globally significant concentrations	(a) Areas known to sustain, on a cyclical or otherwise regular basis, ⩾ 1 % of the global

ADB SPS qualifying criteria for Critical habitat	Alignment with IFC PS6	
	Criteria	Thresholds
Criterion 4: Areas supporting globally significant concentrations or numbers of individuals of congregatory species.	of migratory species and/or congregatory species.	population of a migratory or congregatory species at any point of the species' lifecycle. (b) Areas that predictably support ⩾ 10 % of the global population of a species during periods of environmental stress.
Criterion 5: Areas with unique assemblages of species that are associated with key evolutionary processes or provide key ecosystem services.	Criterion 4: Highly threatened and/or unique ecosystems.	(a) Areas representing ⩾ 5 % of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. (b) Other areas, not yet assessed by IUCN, but determined to be of high priority for conservation by regional or national systematic conservation planning.
	Criterion 5: Areas associated with key evolutionary processes.	No set thresholds.
	GN6 (IFC, 2007)[8], G18. vii) areas recognized as particularly important for the protection of ecosystem services (such as aquifer protection).	Priority ecosystem services are considered to be two-fold: (i) those services on which project operations are most likely to have an impact and, therefore, which result in adverse impacts to Affected Communities; and/or (ii) those services on which the project is directly dependent for its operations (e.g., water). When Affected Communities are likely to be impacted, they should participate in the determination of priority ecosystem services
Criterion 6: Areas with biodiversity that has significant social, cultural or economic importance to local communities.	GN6 (IFC, 2007), G18. vi) areas that include biodiversity that has significant social, cultural or economic importance to local communities.	No set thresholds.
Additional: legally protected areas or areas officially proposed for protection (such as areas that meet the criteria of the World Conservation Union classification, the Ramsar List of Wetlands of International Importance, and the United Nations Educational, Scientific, and Cultural Organization's	IFC PS6, line 20: In circumstances where a proposed project is located within a legally protected area or an internationally recognized area, the client will meet the requirements for critical habitats.	Legally protected area: IFC PS6 recognizes legally protected areas that meet the IUCN definition: "*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*." This includes areas proposed by governments for such designation. Internationally recognised area: IFC PS6 recognises internationally recognised areas as

[8] GN6 (IFC, 31 July 2007). Biodiversity Conservation and Sustainable Natural Resource Management. This Guidance Note corresponds to IFC Performance Standard 6: 'Biodiversity Conservation and Sustainable Management of Living Natural Resources'

ADB SPS qualifying criteria for Critical habitat	Alignment with IFC PS6	
	Criteria	Thresholds
world natural heritage sites).		being "E*xclusively defined 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)".*

2.3.2 Consult with specialists to verify results

Since the determination of critical habitat requires professional expertise and judgment, expert stakeholders with relevant experiences or knowledge on the region and/or its biodiversity values were consulted to support the assessment of critical habitat-qualifying values. This was performed through filling information gaps and providing a better understanding of the potential occurrence of priority and lesser knowns species. The expert stakeholders consulted are listed in ***Table 2.2*** below, with details of the consultation provided in ***Appendix A***.

Table 2.2: Key experts consulted

No.	Name	Designation	Expertise
1.	Andrew Tilker	■ Chair of the IUCN SSC Large-antlered Muntjac Working Group ■ Doctoral student at Leibniz Institute for Zoo and Wildlife Research	Ecology and conservation of threatened Annamite endemic species
2.	Truong Nguyen	■ Professor, The Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology	Ecology of reptiles and amphibians in Southeast Asia
3.	Maurice Kottelat	■ Commissioner, International Commission on Zoological Nomenclature ■ Honorary Research Associate, Lee Kong Chian Natural History Museum, National University of Singapore	Eurasian freshwater fish
4.	Will Duckworth	■ Species Advisor, Asian Species Action Partnership ■ Member of 14 IUCN SSC Species Specialist Groups ■ IUCN SSC Red List Authority Coordinator for Small Carnivores	Mammals and birds of Lao PDR, and across Southeast Asia KBAs in Southeast Asia
5.	Robert Timmins	■ Species Advisor	Mammals of Lao PDR, and across Southeast Asia

2.4 Undertake field surveys to verify potential high priority species

Baseline field surveys were used to verify the presence, distribution and/or abundance of the potential high priority species that were initially screened based on desk-based information, expert consultation

and opinion, and professional knowledge. These field surveys were designed to target the potential high priority species in order to validate findings from desk-based analysis and identify any additional biodiversity features likely to qualify areas as critical habitat. Further details of the baseline survey methodology and findings are detailed in ***Section 7.4*** of the ESIA.

While a number of fish species have been identified as potentially critical habitat-qualifying species, field surveys have not been recommended for this animal group as there are no Lao based experts with expertise or sufficient skills to identify this rare and under-surveyed group of endemic and restricted range fish species. Covid-19 travel restrictions also prevented the deployment of external international experts into Lao. Options for eDNA sampling were also discussed with NatureMetrics, but the eDNA catalogue for many of Lao's endemic fish species is poorly developed. The Project will therefore take a pragmatic approach to manage risks to these fish species by undertaking expert consultation to help determine species presence and significance in the EAAA for non-volant species. Where data is equivocal, species qualifying the Project as critical habitat will be screened-in in accordance with the 'precautionary principle'.

2.5 Identify Natural Habitat and Modified Habitat

Remote sensing and field investigations were undertaken to identify the distribution of land cover types within the Project Area and EAAAs. Remote sensing classification methods using Copernicus sentinel-2 satellite imagery (ESA, 2021) was first employed to generate a land cover map. Indices such as the Normalized Difference Vegetation Index (NDVI), water indices and Bare Ground Index (BGI) were also inspected to support the mapping process. To help further categorise different types of forest areas in the EAAAs, elevation information was used to refine the categorisation of forest areas based on the approach in Stibig, H-J. and Beuchle (2003). All forest labelled pixels between elevations of 500m-1500m amsl were reassigned as wet evergreen forest. Evergreen forest areas were subsequently classified as montane forest (>1000m elevation), and wet evergreen forest (<1000m elevation). This remotely sensed data was validated with ground-truthed data at pre-selected field survey points in each of the main turbine areas and the transmission line corridor, supplemented by information from available national land cover maps.

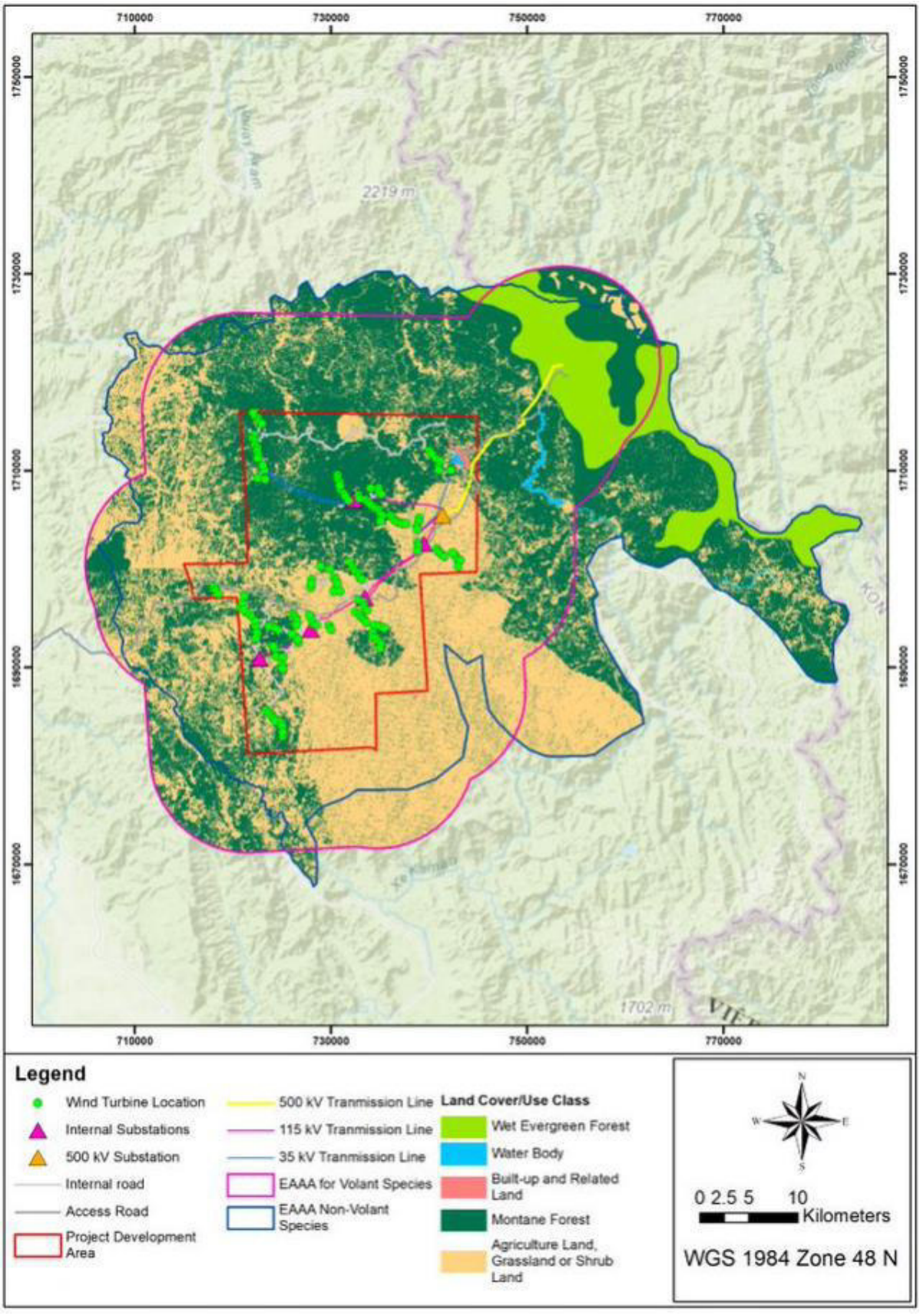
This produced a land cover map with the following five (5) categories (see ***Figure 2.2***):

- Montane Forest;
- Wet Evergreen Forest;
- Agriculture Land, Grassland or Shrubland (mosaic characterised by shifting cultivation);
- Waterbodies; and
- Built-up and Related Areas (infrastructure).

The reader is also referred to ***Section 7.4.3*** of the ESIA for the detailed baseline land cover and land sue descriptions.

Note that since no universal thresholds exist for classifying a habitat as natural habitat or modified habitat, expert analysis was relied on to assign the derived land cover categories from the mapping exercise described above as natural or modified habitat.

Figure 2.2: Land cover / land use types found in the EAAAs



Source of information: ERM (2022)

2.6 Identify Critical Habitat

In accordance with the ADP SPS (2009) guidance on CHA, critical habitats will be defined at the scale of the EAAAs, such that an entire EAAA would qualify as critical habitat, or not. This applies to the EAAAs identified for volant and non-volant species.

An approach has been taken towards also identifying the specific individual habitats or ecosystems considered critical for supporting key biodiversity (such as CR/EN, endemic, migrant species) and within which common environmental impact and management issues are defined relative to other adjacent areas.

3. FINDINGS OF THE CRITICAL HABITAT ASSESSMENT

3.1 Criteria 1-4

Criteria 1-4 of the ADB SBS deal primarily with species that are of conservation importance or concern (i.e. CR/EN status, endemic or restricted-range species, significant concentrations of congregatory species), the presence of which may typically qualify habitats as 'critical habitat'.

Initially, species potential occurrence (or likelihood of occurrence) was assessed at a desktop level based on available information and supplemented by the findings of the biodiversity baseline assessment (refer to ***Chapter 7.4*** of the ESIA). The habitat requirements/preferences for each plant/animal species of conservation concern were reviewed (based on the available literature) and was then compared against the known species distributions and habitat types documented for the Project area and EAAAs (see ***Section 2.5***) in order to estimate the potential occurrence of each priority species identified, using the matrix below in ***Table 3.1***.

Table 3.1: Generic matrix used to estimate species potential occurrence based on documented habitat preferences and species distributions

		SPECIES HABITAT REQUIREMENTS / PREFERENCES		
		Fully met	Largely met	Not met / Unsuitable
SPECIES DISTRIBUTION	Habitat occurs within documented species geographical/altitudinal range	Highly likely	Likely	Unlikely
	Habitat occurs on the edge of documented species geographical/altitudinal range	Possible	Possible	Unlikely
	Habitat occurs outside of documented species geographical/altitudinal range	Unlikely	Unlikely	Highly unlikely or Improbable

Table 3.2 (below) provides a summary of the candidate critical habitat-qualifying species of fauna and flora, which includes a combined total of 33 (thirty-three) candidate species that potentially qualified the Project habitats as critical habitat were considered in the assessment (11 species of mammals, 6 species of reptiles/amphibians, 3 species of birds, 2 fish species and 11 species of plants).

The complete table in ***Appendix A*** provides the associated justification for the likelihood of assessment undertaken for each candidate species. Species that did not qualify for further assessment (i.e. if available information clearly indicated that the species will not meet any of the critical habitat criteria or thresholds) were excluded from the assessment but are presented in ***Table 3.2.***

Table 3.2: Critical habitat-qualifying species of fauna & flora assessed

S/N	Common Name	Scientific Name	Status: IUCN Red Data List[a]	Potential Occurrence in the EAAA[b]	Critical habitat Qualifying Criteria (ADB SPS)	Associated Habitat
Mammals						
1	Bengal Slow Loris	*Nycticebus bengalensis*	EN	Confirmed	Criterion 1	Montane Forest, Wet Evergreen Forest (including secondary and degraded habitat)
2	Pygmy Slow Loris	*Nycticebus pygmaeus*	EN	Confirmed	Criterion 1	Montane Forest, Wet Evergreen Forest (including secondary and degraded habitat)
3	Northern Buff-cheeked gibbon	*Nomascus annamensis*	EN	Confirmed	Criterion 1	Montane Forest, Wet Evergreen Forest
4	Red-shanked Douc Langur	*Pygathrix nemaeus*	CR, range-restricted	Confirmed	Criterion 1 Criterion 2	Montane Forest, Wet Evergreen Forest (including secondary habitat)
5	Chinese Pangolin	*Manis pentadactyla*	CR	Confirmed	Criterion 1	Wet Evergreen Forest, Shrubland, Grassland (including secondary and degraded habitat)
6	Sunda Pangolin	*Manis javanica*	CR	Confirmed	Criterion 1	Wet Evergreen Forest, Shrubland, Grassland (including secondary and degraded habitat)
7	Owston's Civet	*Chrotogale owstoni*	EN	Confirmed	Criterion 1	Montane Forest, Wet Evergreen Forest
8	Large-antlered Muntjac	*Muntiacus vuquangensis*	CR, range-restricted	Highly likely	Criterion 1 Criterion 2	Montane Forest, Wet Evergreen Forest
9	Annamite Striped Rabbit	*Nesolagus timminsi*	EN	Possible	Criterion 1	Wet Evergreen Forest
10	Indochinese Silvered Langur	*Trachypithecus germaini*	EN	Possible	Criterion 1	Wet Evergreen Forest
11	Northern Yellow-cheeked Crested Gibbon	*Nomascus annamensis*	EN	Likely	Criterion 1	Montane Forest, Wet Evergreen Forest
Herpetofauna: Reptiles & Amphibians						
1	Red River Krait	*Bungarus slowinskii*	VU, range-restricted	Confirmed	Criterion 2	Wet Evergreen Forest (natural and modified)

S/N	Common Name	Scientific Name	Status: IUCN Red Data List[a]	Potential Occurrence in the EAAA[b]	Critical habitat Qualifying Criteria (ADB SPS)	Associated Habitat
2	Impressed Tortoise	*Manouria impressa*	EN	Confirmed	Criterion 1	Wet Evergreen Forest
3	Annam Keelback	*Hebius annamensis*	DD range-restricted	Possible	Criterion 2	Montane Forest, Wet Evergreen Forest, Waterbodies (streams)
4	-	*Quasipaa sp.*	NE potentially 'new to science'	Confirmed	Criterion 2 (possibly)	Unknown: potentially 'new to science' First record for Lao PDR
5	Maoson Horned Toad	*Xenophrys cf maosonensis*	NE potentially 'new to science'	Confirmed	Criterion 2 (possibly)	Unknown: potentially 'new to science'[9] First record for Lao PDR
6	-	*Rhacophorus sp nov*	NE potentially 'new to science'	Confirmed	Criterion 2 (possibly)	Unknown: potentially 'new to science' First record for Lao PDR
Avifauna: Birds						
1	Vietnamese Crested Argus	*Rheinardia ocellata*	EN	Confirmed	Criterion 1	Montane Forest, Wet Evergreen Forest (including secondary and degraded forest)
2	Black-crowned Barwing	*Actinodura sodangorum*	NT, endemic, range-restricted	Confirmed	Criterion 2	Montane Forest, Wet Evergreen Forest (natural and modified), shifting cultivation and scrub
3	Chestnut-eared Laughing thrush	*Garrulax konkakinhensis*	VU, range-restricted	Confirmed	Criterion 2	Montane Forest
Avifauna: Bats						
n/a (species screened are not CR/EN and typically not endemic or range-restricted)						
Fish						
1	-	*Schistura imitator*	LC, endemic, range-restricted	Possible	Possibly Criterion 2	Waterbodies (rivers & streams)
2	-	*Schistura clatrata*	LC, endemic, range-restricted	Possible	Possibly Criterion 2	Waterbodies (rivers & streams)
Plants						

[9] With respect to *X. cf maosonsensis*: there is some evidence that this species has been previously described from neighbouring Vietnam [Bourret, 1937: Amphibian Species of the World (amnh.org)]. This remains to be confirmed.

S/N	Common Name	Scientific Name	Status: IUCN Red Data List[a]	Potential Occurrence in the EAAA[b]	Critical habitat Qualifying Criteria (ADB SPS)	Associated Habitat
1	-	*Zingiber mellis*	EN	Confirmed	Criterion 1	Montane Forest
2		*Camellia sp.*	NE potentially 'new to science'	confirmed	Criterion 2 possibly	Unknown: potentially 'new to science'
3		*Garcinia sp.*				
4		*Lasianthus sp. 1*				
5		*Lasianthus sp. 2*				
6		*Machilus sp.*				
7		*Melastoma sp.*				
8		*Neolitsea sp.*				
9		*Polyosma sp.1*				
10		*Polyosma sp.2*				
11		*Smilax sp.*				

Key to table:

[a] **IUCN Global Red List status**: **CR** = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable; **NT** = Near Threatened; **LC** = Least Concern; **DD** = Data Deficient; **NE** = Not Evaluated. *Note that there is no national Red List available for Laos.*

Criterion 1: Habitat required for the survival of critically endangered or endangered species

28 out of these 33 candidate species are identified as qualifying as critical habitat under the ADB SPS qualifying criteria 1 for critical habitat (i.e. based on the associated CR or EN species threat status) *(refer to **Table 2.2** for critical habitat qualifying criteria and **Table 3.2** for the species summary table),* and these include:

- all 11 species of CR/EN candidate mammal species assessed (which includes 7 confirmed species and 4 species that could possibly occur in the non-volant species EAAA);
- 1 EN reptile species confirmed for the Project area (Impressed Tortoise, *Manouria impressa);*
- 1 CR bird species confirmed for the Project area and volant species EAAA (Vietnamese Crested Argus, *Rheinardia ocellata*); and
- 1 EN plant species confirmed for the Project area (*Zingiber mellis*).

Given that both volant and non-volant species (CR/EN threat status) have been identified as occurring or with a high probability of potentially occurring in the EAAAs defined for the Project, both the volant and non-volant species EAAAs essentially qualify as critical habitat by definition in terms of the ADB SPS.

Associated habitat types for supporting these species that qualify as critical habitat in terms of criterion 1 include the following[10]:

- Montane Forest: primary and secondary forest (including modified/degraded forest);

[10] This is based on confirmed or known/documented CR/EN species associations or affinities to the mapped habitat types.

- Wet Evergreen Forest: primary and secondary forest (including modified/degraded forest);
- Potentially grassland and shrub land vegetation (based on Pangolin's documented affinity for these areas and secondary and degraded habitat); and
- Waterbodies (forested streams).

Criterion 2: Areas with special significance for endemic or restricted-range species

19 out of these 33 candidate species are identified as triggering critical habitat under the ADB SPS qualifying criteria 2 for critical habitat (i.e. based on the associated species being endemics and/or range-restricted fauna) *(refer to **Table 2.2** for critical habitat qualifying criteria and **Table 3.2** for the species summary table),* and these include:

- 2 species of range-restricted mammals assessed (which includes 1 confirmed species and 1 species that is highly likely to occur in the non-volant species EAAA);
- 2 species of range-restricted reptiles (1 confirmed, 1 possibly occurring in the Project area);
- 3 species of herpetofauna (amphibians) confirmed in the Project area and which could potentially be 'new to science' and first records for Lao PDR (*note that these species were included as their endemism and range restrictions are unknown at this stage but may be significant to the project*[11]);
- 2 endemic/range-restricted bird species (Black-crowned Barwing and Chestnut-eared Laughing thrush) were identified;
- 2 species of range-restricted freshwater fish that may possibly occur in the EAAAs; and
- 10 species of plants confirmed for the Project area and which could potentially be 'new to science' and first records for Lao PDR (*note that these species were included as their endemism and range restrictions are unknown at this stage but may be significant to the project*).

Note that species not regionally endemic to Lao PDR were excluded from this assessment.

Endemic and/or range restricted mammal, reptile, amphibian, fish, bird and plant species have been identified and associated with the volant and non-volant species EAAAs, which qualify as critical habitat in terms of criterion 2.

Associated habitat types supporting key endemic and/or range-restricted species of flora/fauna in terms of criterion 2 include the following[12]:

- Montane Forest: primary and secondary forest;
- Wet Evergreen Forest: primary and secondary forest (natural and modified/degraded);
- Shifting cultivation and scrub (for Black-crowned Barwing); and
- Waterbodies (forested streams, rivers).

Criterion 3: Sites that are critical for the survival of migratory species

The requirements/thresholds for criterion 3 (areas critical for migratory species) have not been met in terms of the key species identified.

[11] Of note, the potentially new species records of selected amphibian and plant species have been included on a precautionary basis as being 'potentially new to science'. Samples of selected species have been collected and will be subject to further ongoing verification in an effort to confirm whether these are in fact first records for these species.
[12] This is based on confirmed or known/documented CR/EN species associations or affinities to the mapped habitat types.

Criterion 4: Areas supporting globally significant concentrations or numbers of individuals of congregatory species

The requirements/thresholds for criterion 4 (areas critical for congregatory species) have not been met in terms of the key species identified.

3.2 Criterion 5: Unique assemblages of species that are associated with key evolutionary processes or provide key ecosystem services

3.2.1 Highly unique ecosystems

Unique ecosystems encompass those natural systems and environments that are considered to be rare or one-of-a-kind and therefore not widely represented (depending on what scale these are assessed) and therefore may be considered to be of inherently great conservation importance and high irreplaceability value. What makes an ecosystem unique is somewhat open to interpretation, but typically requires a multi-faceted assessment of several supporting criteria. At the global level, IUCN has aimed to determine the conservation status of the world's terrestrial, freshwater, marine and subterranean ecosystems. No formal IUCN Red List of Ecosystems assessment has yet been performed for the ecosystems found in the EAAAs.

The Southern Annamites Montane Rain Forests (IM0152) ecoregion represents a large extent of lowland to montane evergreen forests and the conservation status of this ecoregion is 'Vulnerable' (VU) due to wide-scale forest conversion to agriculture and continues to be subject to significant land degradation activities. Nevertheless, this ecoregion encompasses a relatively large area estimated to be 46,620 km^2 and spans the trans-frontier area across Laos and Vietnam. The habitat types within the EAAAs are therefore widespread nationally throughout Laos and Vietnam and are not considered to be particularly unique or contain species assemblages that would be of particularly high conservation significance or with a high level of endemism.

The Project area is unlikely to comprise highly unique ecosystems or containing unique species assemblages that would otherwise qualify the Project as containing critical habitat in terms of criterion 5.

3.2.2 Key Evolutionary Processes

Although the Project is located within the Southern Annamites Montane Rain Forests (IM0152) ecoregion, the species assessments did not identify any species subpopulations known to be phylogenetically or morpho-genetically distinct that rely primarily on the project site and EAAAs. However, as previously discussed, the broader landscape contains a number of KBAs specifically designated for endemic species, which overlap with or are located within the EAAAs, including: Phou Kathong KBA and Upper Xe Kaman KBA in the south; Phou Ahyon KBA in the northeast; Song Thanh KBA and Ngoc Linh in east; and Dakchung KBA located in the EAAA. The EAAAs also overlap with the southern extremity of the Kon Tum Plateau Endemic Bird Area (EBA), identified as containing numerous range-restricted bird species. *There are also several species of plants and amphibians that were recorded during field surveys that may potentially be 'new to science', however their status remains to be confirmed.*

As a result of the potentially high level of animal and plant endemism associated with the ecoregion, it is considered likely that the Project Area and both the volant and non-volant species EAAAs may be important in the conservation of key evolutionary processes, and thus triggering qualifying criterion 5 for critical habitat.

3.2.3 Key Ecosystem Services

Generally speaking, forest ecosystems are known to provide a range of important ecosystem goods and services which society values; and in broad terms these typically include the following (adapted from Hassan *et al. (Eds),* 2005[13]):

- *Regulating and Supporting Services*: including the role of trees and soils in forests stabilising and regulating global and local climate, disease regulation, water purification, controlling soil erosion, mitigating floods, soil formation and nutrient cycling, pollination and supporting habitat for maintaining biodiversity;
- *Provisioning Services*: includes the role of forest components (biotic and abiotic) in the provision of food for animals and humans, sustaining livelihoods through the provision of 'clean' water, fuel, timber, medicinal plants, etc.; and
- *Cultural and Tourism Services*: importance as potential educational, research, aesthetically important sites and their use for recreation and tourism, including cultural heritage values attached to forests.

The specifics of course vary from site to site and depend on (amongst other factors), the status, structural and compositional characteristics, habitat quality, use by faunal species, extent, connectivity, local use context, position relative to other important sites and management of the particular forest ecosystem in question. Some services may be globally relevant, whilst other ecosystem services provided by the forests in the EAAA are likely to be largely of local importance, possibly of regional significance. These are described as follows:

- The role of forests in general in combating climate change is considered to be a service rendered as important on both the local and global scale, in light of the current climate-change crisis;
- National Protected Forest in the area is also designated as a protected area to protect the local catchment areas, which signifies the potential importance of the forests in the watershed in enhancing water quality and regulating stream flows, which likely has a strong influence on water resources lower down in the catchment; and
- The forest ecosystem therefore presents a potentially significant source of provisioning materials and goods for sustaining local livelihoods and this is highlighted in findings of the social assessment component of the ESIA (*the reader is referred to Chapter 8 of the ESIA, specifically sub-section 8.5.3 'Economic Displacement and Impacts to Livelihoods'*), where the social assessment team identified several concerns raised by the local villager's, one being the potential impact of the project on access to the forest as an important source of food, firewood, medicinal species and valuable forest products that can be sold to buyers from nearby cities and Vietnam

Given the potential for the forest ecosystems to provide key ecosystem services at both a local/regional and global scale, which are also considered 'Priority ecosystem services' as per the definition provided in IFC PS6 for this criterion (*as impacts to these ecosystems may result in adverse impacts to Affected Communities, in terms of undermining cultural values and conflicting with subsistence resource needs*), the evergreen forest ecosystems within the volant and non-volant species EAAAs are considered to qualify as critical habitat under criterion 5 from the perspective of key ecosystem services.

[13] Hassan, R, Scholes, R, and Ash, N., 2005. Ecosystems and human well-being: current state and trends: findings of the Condition and Trends Working Group. Part of the Millenium Ecosystems Assessment series, 2005.

3.3 Criterion 6: Areas with significant social, cultural or economic importance

The forest habitats have been flagged as being of potential significance from an economic and cultural/heritage perspective. One of the concerns of the local villager's being the potential impact of the project on access to the forest as an important source of food, firewood and valuable forest products that can be sold to buyers from nearby cities and Vietnam. The forest ecosystems at the project locality therefore present a potentially significant source of provisioning materials and goods for sustaining the livelihoods of local villagers (*the reader is referred to Chapter 8 of the ESIA, specifically sub-section 8.5.3 'Economic Displacement and Impacts to Livelihoods'*).

The role of 'sacred forest' sites in local culture and community's beliefs and practices was identified during the social assessment and relevant community/stakeholder engagement process, during which local villagers identified a 'Potential Intangible Cultural Heritage Area' in Phou Koungking to the south-west. After further investigation, the cultural importance appears to be tied to cemeteries (burial grounds) rather than the actual forest associated with the national protected area (Phou Kathong) and associated biodiversity (the cemeteries just so happen to be located within forest areas). *The reader is referred to Chapter 8 of the ESIA, specifically sub-section 8.5.8 'Impact on Cultural Heritage' for further information.*

Strictly speaking then, it was decided that the forest habitat does not qualify as 'critical habitat' in terms of criterion 6, however other critical habitat qualifying criteria do apply, as discussed in Sections 3.1 and 3.2.

3.4 Legally Protected Areas and Areas with Recognized High Biodiversity Values

In addition to the six qualifying criteria for identifying areas as comprising critical habitat, legally protected areas or areas officially proposed for protection are also included as critical habitats in terms of the ADB SPS.

Two legally protected areas and a total of six areas with recognised high biodiversity values overlap with, or are located within, the EAAAs. These are summarised ***Table 3.3****Error! Reference source not found.*, and shown in ***Figure 3.1***.

Note however that no project infrastructure is planned to be located within the 2 legally protected areas, and therefore the requirements under ADB SPS Safeguard 1, paragraph 30 do not apply.

Table 3.3: Legally Protected Areas, and Areas with Recognized High Biodiversity Values in the EAAAs

No.	Name	PA	KBA	IBA	AZE	Overlap with EAAAs?	Overlap with Project footprint?
1	Song Thanh	Y	Y			Yes	No
2	Phou Kathong	Y	Y			Yes	No
3	**Dakchung Plateau**		**Y**	**Y**		**Yes**	**Yes**
4	**Phou Ahyon**		**Y**	**Y**	**Y**	**Yes**	**Yes**
5	Ngoc Linh		Y	Y	Y	Yes	No
6	Upper Xe Kaman		Y	Y		Yes	No

Source: IBAT (2020).

3.4.1 Legally Protected Areas

There are two legally protected areas, **Song Thanh Nature Reserve** and **Phou Kathong**, which overlap with the EAAAs for both volant and non-volant species. Both protected areas contain sufficient concentrations of key species to qualify the EAAA(s) as critical habitat.

Song Thanh Nature Reserve located on the Laos-Viet Nam border, that overlaps with the eastern boundary of the EAAA for non-volant species is not officially designated an IUCN management category, however it is known to be an important area of the Annamite Ranges, comprising one of the most extensive contiguous forests in Viet Nam. It reportedly contains a good population of the critical habitat-qualifying Vietnamese Crested Argus *Rheinardia ocellata* which is CR globally (Vu and Van Tran, 2020), and therefore qualifies the Reserve as comprising critical habitat.

Phou Kathong has been identified as a protected area, situated to the south-west and overlapping with the EAAA for volant species. Whilst the site is not officially designated an IUCN management category, from the perspective of mobile flying (volant) species the area is known to provide habitat supporting several key bird species of conservation importance. The **Song Thanh** (north-east) Protect Area overlaps with the project EAAAs for volant and non-volant species and qualifies both EAAAs as critical habitat. The **Phou Kathong** (south-west) Protected Area overlaps only with the volant species EAAAand qualifies this EAAA as critical habitat.

3.4.2 Areas with Recognized High Biodiversity Values

The area is situated within one of the designated biodiversity corridors of the ADB-funded Biodiversity Conservation Corridor Project (“BCCP”), in recognition of its importance in maintaining the forest ecosystem connectivity between Xe Sap National Protected Area (“PA”) in Sekong province, and Dong Ampham NPA in Attapeu province (ADB, 2021).

Six areas with recognized high biodiversity values are located within or overlap with the EAAAs. These include Song Thanh, Phou Kathong, Dakchung Plateau, Phou Ahyon, Ngoc Linh, and Upper Xe Kaman (***Table 3.3***). These are KBAs that are nationally important sites for, and/or hold globally important concentrations of, certain bird, mammal, plant, amphibian, and reptile species. The transmission line planned in the north-east towards then Vietnam border comes within close proximity to Song Thanh Nature Reserve and PA (within a minimum distance of approximately 1.6 km). The EAAA for volant species also overlaps with Phou Kathong PA to the south-west. Both PAs are discussed under ***Section 3.4.1***.

Dakchung Plateau, Phou Ahyon, and Ngoc Linh KBAs contain critical habitat-qualifying species, and therefore qualify the Project as being located in an area of critical habitat. Noteworthy is Dakchung Plateau and Phou Ahyon which overlap with the Project footprint and as a result, may directly affect the KBA and critical habitat trigger species. Details on these KBAs are as follows:

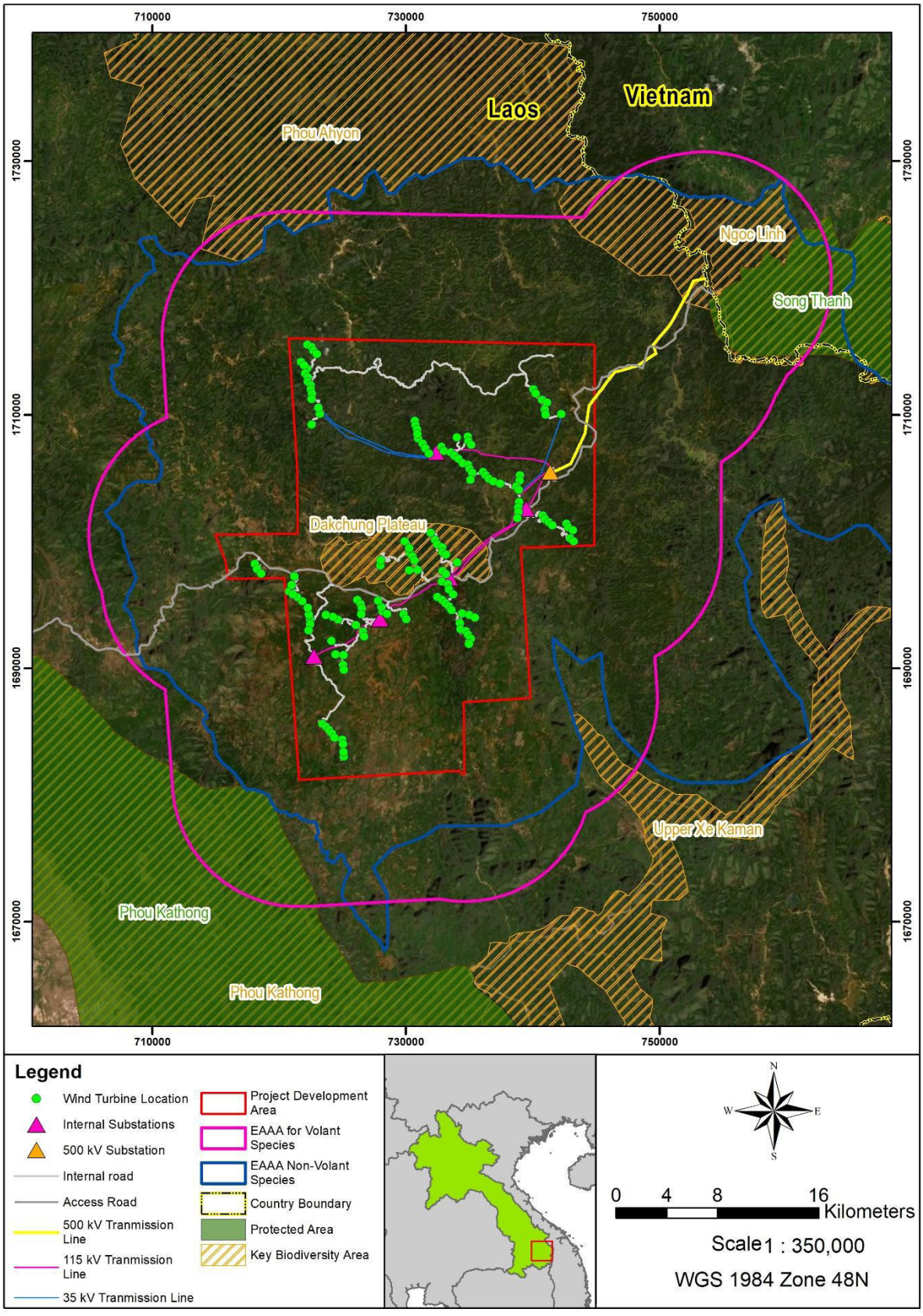
- **Dakchung Plateau** is both a KBA and IBA located in the Sekong Province of Laos. It is located entirely in the central section of the EAAAs. Although extensively degraded, it is thought to hold important concentrations of the critical habitat-qualifying Black-crowned Barwing (CR), and the stakeholder concern species Yellow-billed Nuthatch (NT) as these species have adapted to disturbed and secondary habitats. Both of these RDL species were recorded during bird surveys (see findings of the baseline assessment contained in ***Section 7.4.4*** of the ESIA).
- **Phou Ahyon** and **Ngoc Linh** are designated as KBAs, IBAs and Alliance for Zero Extinction (AZE) sites. They marginally overlap with the north-eastern section of the EAAAs and the transmission line towards the Vietnam border traverses the designated area for Phou Ahyon for a distance of approximately 2.5 km. These areas hold some of the last remaining populations of restricted-range bird species found in the Kon Tum Plateau EBA, such as the Vietnamese Crested Argus (CR), and Yellow-billed Nuthatch (NT), both of which are assessed as critical-

habitat qualifying species of the Project. Additionally, Ngoc Linh also contains populations of the Black-crowned Barwing (CR), which also qualify the Project as being located in critical habitat.

- **Upper Xe Kaman** is a KBA and an IBA supporting relatively intact old-growth semi-evergreen forest and riverine habitats. Key species include Masked Finfoot *Heliopais personata* (EN), hornbill species, a range of gibbon species and Siamese crocodile *Crocodylus siamensis* (CR).

The 6 KBAs identified within the EAAAs include the 2 PAs (Song Thanh and **Phou Kathong**) and an additional 4 sites: **Dakchung Plateau**, **Phou Ahyon, Upper Xe Kaman** and **Ngoc Linh.** All six sites qualify the EAAAs as critical habitats based on notable biodiversity value and capacity to support critical biodiversity, endemic species and range-restricted species potentially.

Figure 3.1: Legally Protected Areas, and Areas with Recognized High Biodiversity Values within and overlapping the EAAAs



3.5 Defining 'Critical Natural' and 'Critical Modified' Habitats

As discussed previously in ***section 1.5***, anthropogenic impacts in the region are considered pervasive, in the form of regular burning to create open woodlands and shifting cultivation on the upper slopes, wildlife poaching and excessive harvesting of forest products by local communities. According to the WWF, more than 75% of the ecoregion's natural habitat has been converted or degraded (WWF, 2021a). Where primary forest habitat remains in the region, such areas are distributed in small, isolated fragments or patches and are comprised predominantly of Wet Evergreen Forests at 600-900 m elevation and Montane Evergreen Forest at elevations above 900m amsl, with these two forest communities being structurally and compositionally distinct from each other. The Project area has been described to be located in a mosaic of evergreen forest, shifting cultivation, shrub land and grassland, waterbodies, and built-up areas. In several areas, particularly those in the centre of the Project and associated with the Dakchung Plateau Key Biodiversity Area (KBA), there has been extensive modification for agriculture and clearance of forests by local communities predominantly.

The EAAAs therefore contain both critical natural and critical modified habitat:

- areas of **natural habitat** are concentrated in the northern and eastern sections and represent approximately 36% to 41% of the EAAAs; and
- **modified habitat** (59% to 64**%** of EAAAs) is mostly found in the central and southern sections of the EAAAs, comprising primarily agricultural areas (currently or historically cultivated lands) that have been cleared and transformed through human activity and associated disturbance of the native vegetation and soils.

The habitat types within the EAAA that meet the ADB SPS definition of natural habitat or modified habitat are described in detail in ***Table 3.4***, and are shown spatially on the map in ***Figure 3.2***.

The natural forest habitats typically support populations of critical habitat qualifying species in terms of criteria 1 and 2 (CR/EN, endemic, range-restricted), however modified habitats are also considered important for some of the qualifying species that are also recognised as utilising these areas for foraging purposes in particular. . This was based on the findings of the CHA for criteria 1-6 and the location of Protected Areas and KBAs.

Input from recognised international experts has helped refine the understanding of the areas of highest conservation value within the wider EAAA landscape, and it is recognised that much of the faunal interest of the EAAAs have been compromised through human impacts, most notably shifting agriculture, hunting and logging. This is particularly marked at lower elevations, with the Dakchung plateau and areas to the south and west most heavily impacted. This was reflected in the condition scores generated during the REA survey. Areas of highest value are associated with the band of wet evergreen forest on the Lao-Vietnam border, where the transmission line will be located, close to the existing overhead line and main Lao-Vietnam road. The other important area was the less impacted Montane Forest associated with the Phou Koungking mountain ridge. These are shown in ***Figure 3.3***,

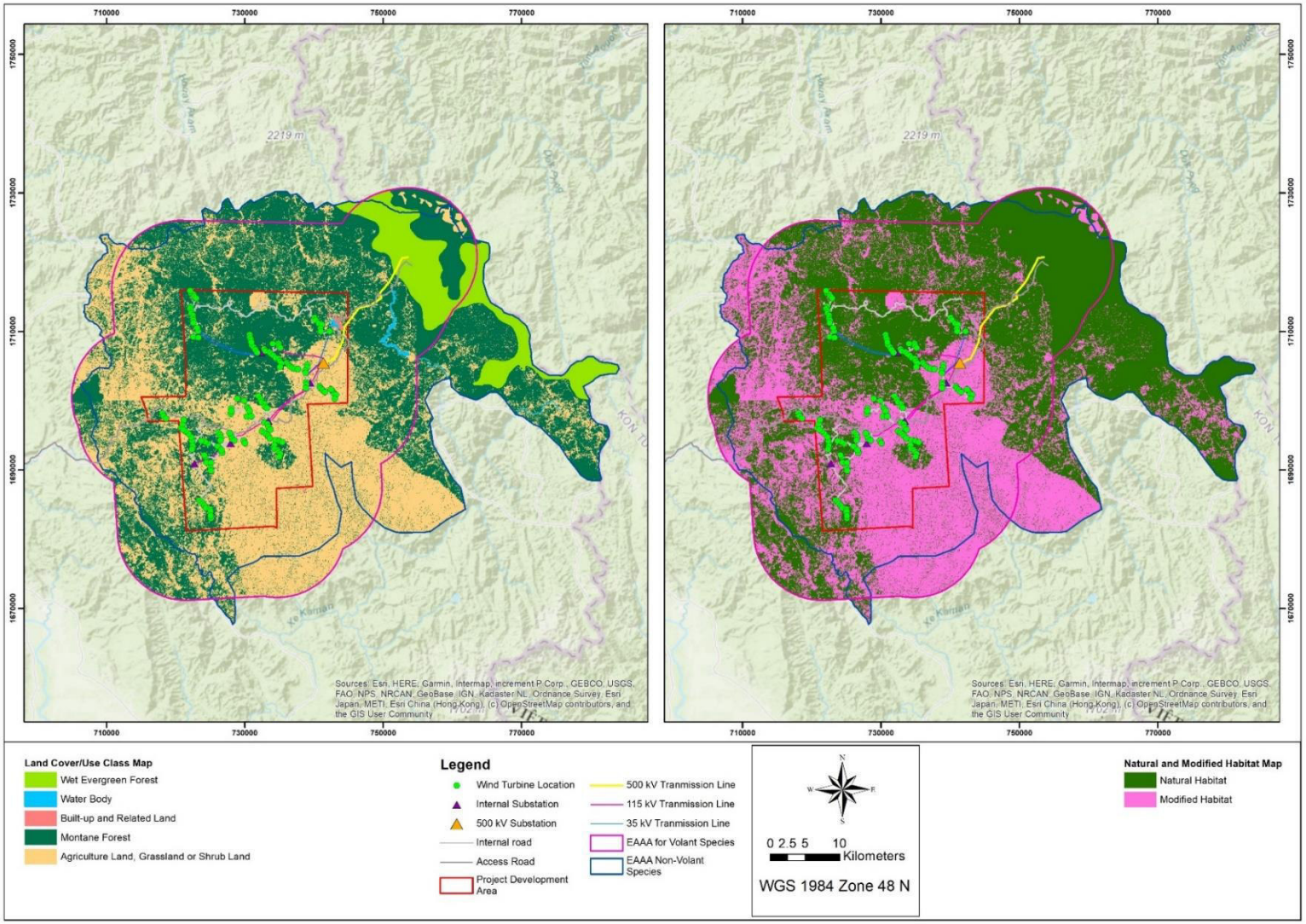
Table 3.4: Classification of Natural and Modified habitat types

Land cover type	Area (ha)	Description	Habitat Classification
1 Montane Forest	69.712 to 81,262	1a Evergreen Montane Forest represents the dominant land cover and forest type in the EAAAs. This forest type occurs in mountainous areas, at elevations above 1000 m amsl. The forest canopy is tall and typically dominated by evergreen tree species such as *Hopea pierrei*,*Cinnamomum iners*, and *Lithocarpus polystachyus*. These communities are found in the northern and eastern section of the EAAAs. Most of these areas are heavily degraded, except for the central and central-northern sections of the concession area which are considered to be in a less impacted state, characterized by patches of primary forest. The habitat provided by these forest communities are considered suitable for harboring and maintaining populations of the following critical habitat-qualifying species: • **7 mammal species:** Bengal Slow Loris, Pygmy Slow Loris, Northern Buff-cheeked gibbon, Red-shanked Douc Langur, Owston's Civet, Large-antlered Muntjac and Northern Yellow-cheeked Crested Gibbon; • **1 reptile species:** Annam Keelback • **2 amphibian species** that are 'potentially new to science'**:** *Quasipaa* sp. and *Xenophrys cf maosonensis;* • **3 bird species:** Vietnamese Crested Argus, Black-crowned Barwing and Chestnut-eared Laughingthrush; • **11 plant species***: Zingiber mellis* and 10 species potentially new to science, including *Camellia sp., Garcinia sp., Lasianthus sp. 1, Lasianthus sp. 2, Machilus sp., Neolitsea sp., Polyosma sp.1, Polyosma sp.2* and *Smilax sp.*	Natural Habitat
		1b Certain higher altitude forested areas belonging to the 'Montane Forest' category appear degraded and resemble a form of secondary or young/seral forest growth that appears to be on a recovering successional pathway following anthropogenic disturbance. These areas have been classified as modified habitat given their early successional state following disturbance. The habitat provided by these secondary/seral forest communities is still considered suitable for harboring and maintaining populations of the following critical habitat-qualifying species: • **3 mammal species:** Bengal Slow Loris, Pygmy Slow Loris and Red-shanked Douc Langur • **2 amphibian species** that are 'potentially new to science'**:** *Quasipaa* sp. and *Xenophrys cf maosonensis;* • **2 bird species:** Vietnamese Crested Argus and Black-crowned Barwing; and • **11 plant species***: Zingiber mellis* and 10 species potentially new to science, including *Camellia sp., Garcinia sp., Lasianthus sp. 1, Lasianthus sp. 2, Machilus sp., Neolitsea sp., Polyosma sp.1, Polyosma sp.2* and *Smilax sp.*	Modified Habitat

Land cover type	Area (ha)	Description	Habitat Classification
2 Wet Evergreen Forest	17,040 to 27,732	2a Wet Evergreen Forest has a similar forest structure and composition to evergreen mountain forest but receives less precipitation. These typically comprise a mix of broad-leaved tree species, with *Quercus* sp., *Lithocarpus* sp., and *Castranopsis* sp. being dominant, and coniferous tree species that include the dominant species *Pinus kesiya*, *Morella cerifere,* etc. Most of these areas were found to be natural but relatively heavily degraded and subject to existing fragmentation impacts, especially in the southern, central and central-northern sections of the project area. The habitat provided by these forest communities are considered suitable for harboring and maintaining populations of the following critical habitat-qualifying species: • **11 mammal species:** Bengal Slow Loris, Pygmy Slow Loris, Northern Buff-cheeked gibbon, Red-shanked Douc Langur, Chinese Pangolin, Sunda Pangoli, Owston's Civet, Large-antlered Muntjac, Annamite Striped Rabbit, Indochinese Silver Langur and Northern Yellow-cheeked Crested Gibbon; • **3 reptile species:** Red River Krait, Impressed Tortoise and Annam Keelback • **2 amphibian species** that are 'potentially new to science'**:** *Quasipaa* sp. and *Xenophrys cf maosonensis;* • **3 bird species:** Vietnamese Crested Argus and Black-crowned Barwing; and • **3 plant species:** *Lasianthus* sp. 1, *Lasianthus* sp. 2, and *Melastoma* sp.	Natural Habitat
		2b Several lower-altitude forested areas belonging to the 'Wet Evergreen Forest' category also appear degraded and resemble a form of secondary or young/seral forest growth that appears to be on a recovering successional pathway following anthropogenic disturbance. These areas have been classified as modified habitat given their early successional state following disturbance. The habitat provided by these secondary/seral forest communities is still considered suitable for harboring and maintaining populations of the following critical habitat-qualifying species: • **5 mammal species:** Bengal Slow Loris, Pygmy Slow Loris, Red-shanked Douc Langur, Chinese Pangolin, Sunda Pangoli • **3 reptile species:** Red River Krait, Impressed Tortoise and Annam Keelbackl • **2 amphibian species** that are 'potentially new to science'**:** *Quasipaa* sp. and *Xenophrys cf maosonensis;* • **3 bird species:** Vietnamese Crested Argus and Black-crowned Barwing; and • **3 plant species:** *Lasianthus* sp. 1, *Lasianthus* sp. 2, and *Melastoma* sp.	Modified Habitat
3 Waterbody	671 to 697	Rivers and streams occur throughout the EAAA (Innogreen Engineering Co., Ltd. and Greener Consultant Co., Ltd, 2020) and are considered suitable for maintaining populations of the two critical habitat qualifying fish species: *Schistura imitator* and *Schistura clatrata*. These areas also typically support important amphibian	Natural Habitat

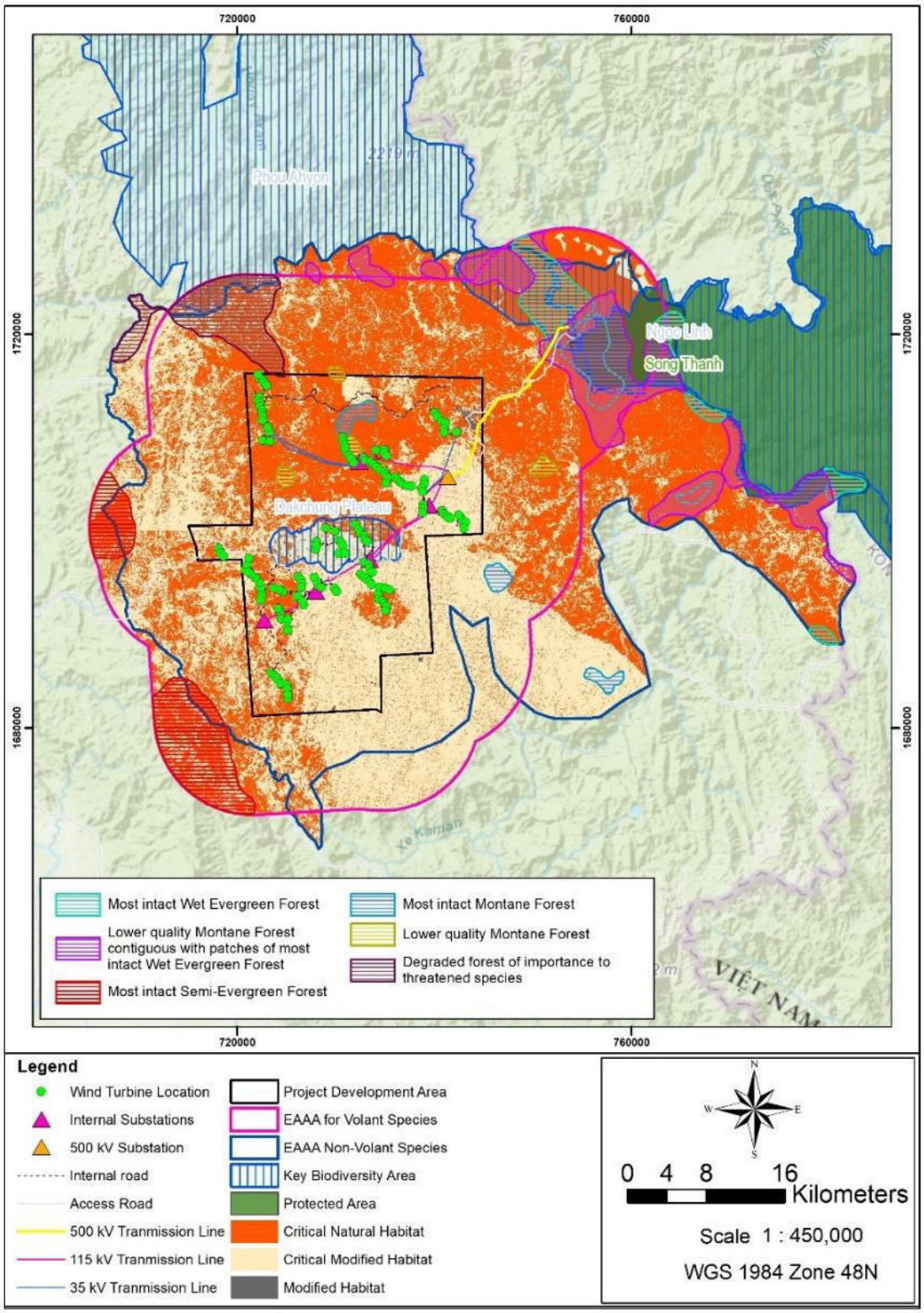
Land cover type	Area (ha)	Description	Habitat Classification
		species and are considered important water sources for the other species identified as contributing to the critical habitat status of forest areas in particular.	
4 Built-up and Related Land	492 to 590	Built-up land use in the EAAA comprise residential buildings and basic infrastructure (e.g., road, hospital, and school) (Innogreen Engineering Co., Ltd. and Greener Consultant Co., Ltd, 2020). These are artificial/transformed landscapes where the natural characteristics of the land has been irreversibly altered or totally lost in some instances. Whilst some of these arterially modified areas may be visited by species such as Pangolins, the possibility of these areas sustaining conservation-important plant or animal species is typically considered improbable and of little significance to the CHA assessment.	Modified Habitat
5 Agricultural Land, Grassland, Shrub land Mosaic	58,2	**5a Agricultural Land**: Agricultural areas are transformed habitats that are now used for active cultivation of food crops, including the growing of coffee, sugarcane, and maize (CEIC, 2021). Rice is grown in upland areas for mainly subsistence purposes (Alexander *et al*., 2018). Whilst some of these areas are visited by species such as Pangolins and certain birds of conservation importance (e.g. Black-crowned Barwing), the possibility of these areas sustaining conservation-important plant or animal species is typically considered relatively low to negligible.	Modified Habitat
	21,3	**5b Shrub Land:** Shrub land in the EAAAs include small patches of vegetation that represent transitional evergreen/semi-evergreen forest-shrub areas that have been subject to degradation, forest regeneration and/or natural succession. This habitat is dominated by grass and short shrub and tree species (Rundel, 1999). At lower elevations of >1000m amsl, these habitats are considered suitable for maintaining populations of the critical habitat-qualifying amphibian species, *Rhacophorus* sp nov. as well as for supporting the Black-crowned Barwing and also possibly important for burrowing endangered species of Pangolin observed in the Project area. **Note that given the small, isolated patches of shrub land and grassland which occur and are perceived to be linked with former anthropogenic disturbance, grassland and shrub land areas have been included as a mosaic land cover amongst the shifting cultivation amidst the forest communities.*	Modified Habitat
	1,3	**5c Grassland**: Grassland occupies a very small proportion of the EAAA and occurs as small patches scattered throughout the area investigated, typically occurring in the southern and central sections of the concession area. Grasslands are typical of fire-adapted ecosystems, or where or where herbivore activity maintains the short, herbaceous vegetation cover and woody species are notably absent. These are often found on the high-lying plateaus such as the Dakchung Plateau and are considered modified habitats that typically would not occur within the forest dominated region. *Note that given the small, isolated patches of grassland which occur and are perceived to be linked with former anthropogenic disturbance, grassland and shrub land areas have been included as a mosaic land cover amongst the dominant forest communities.*	Modified Habitat

Figure 3.2: Map showing the extent and distribution of Natural vs Modified Habitat



Source: ERM (2021)

Figure 3.3: Map showing the extent and distribution of Critical habitat classified for the Project, subcategorised into natural vs modified habitats



4. IMPLICATIONS FOR THE PROJECT

4.1 Natural Habitat and Modified Habitat Designation

The findings indicate that there are a number of Project components that overlap with terrestrial and aquatic areas that are designated as natural habitat. The ADB SPS requires that the Project does not significantly convert or degrade areas of natural habitat, and mitigation measures are designed to achieve at least an overall no net loss of biodiversity.

Key requirements of the ADB SPS with respect to natural habitat is presented below:

- **ADB SPS, paragraph 26** – "*In areas of natural habitat, the project will not significantly convert or degrade such habitat, unless the following conditions are met:*
  - *i. No alternatives are available.*
  - *ii. A comprehensive analysis demonstrates that the overall benefits from the project*
  - *iii. will substantially outweigh the project costs, including environmental costs.*
  - iv. *Any conversion or degradation is appropriately mitigated*."
- **ADB SPS, paragraph 27** – "*Mitigation measures will be designed to achieve at least no net loss of biodiversity. They may include a combination of actions, such as post project restoration of habitats, offset of losses through the creation or effective conservation of ecologically comparable areas that are managed for biodiversity while respecting the ongoing use of such biodiversity by Indigenous Peoples or traditional communities, and compensation to direct users of biodiversity*."

4.2 Critical Habitat Designation

This CHA found that the Project contains biodiversity values that would result in the categorization of the EAAAs for both volant and non-volant species as critical habitat. Where impacts do occur to the 'critical habitats' identified, the Project is required to fully exercise the mitigation hierarchy and demonstrate an overall net gain of critical habitat-qualifying biodiversity associated with Project site.

Key requirements of the ADB SPS with respect to critical habitat is presented below:

ADB SPS, paragraph 28 - 'No project activity will be implemented in areas of critical habitat unless the following requirements are met:

i. There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function.

ii. The project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised.

iii. Any lesser impacts are mitigated in accordance with para. 27', whereby mitigation measures will be designed to achieve at least no net loss of biodiversity.

4.3 Projects that overlap with Legally Protected Areas and Areas with Recognized High Biodiversity Values

Legally protected areas, and areas with recognised biodiversity values overlap with, or are located within the Project's EAAAs. Nevertheless, the project footprint does not overlap with legally protected areas therefore the requirements under ADB SPS Paragraph 28 and 30 do not apply.

A number of KBAs contain critical habitat-qualifying species, and therefore qualify the Project as being located in an area of critical habitat. The ADB SPS requirements listed in ***Section 4.2*** will also apply to these areas.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Key Findings

Desk study, field surveys and expert consultation indicate that the EAAAs for volant and non-volant species associated with the Project qualify as critical habitat. The Project area is located in a mosaic of evergreen forest, shifting cultivation, shrub land and grassland, waterbodies, and built-up areas. In several areas, there has been extensive modification for agriculture and clearance of forests by local communities. The EAAAs assessed therefore contain both natural and modified habitat in terms of the ADB SPS definitions. Areas of natural and modified habitat support populations of critical habitat-qualifying species (CR/EN, endemic and/or range-restricted) and/or provide for key ecosystem services, and are therefore considered to be 'critical natural habitat' and 'critical modified habitat' in terms of the sub-classification of these areas. A summary of the main outcomes of the CHA, per critical habitat qualifying criterion, is as follows:

- In terms of **Criterion 1**: *Habitat required for the survival of critically endangered or endangered species*, several fauna species (mammals, reptiles, amphibians and birds) are represented with CR or EN threat status. One EN plant species was recorded for the forest habitats surveyed. Whilst modified forest habitat would typically support fewer species, still some CR or EN species may utilise these habitats. Typically, the Natural Montane Forest and Wet Evergreen Forest habitats are most important in supporting these species.
- In terms of **Criterion 2**: *Areas with special significance for endemic or restricted-range species,* several mammal and bird species are also endemic and/or range-restricted species. Whilst modified habitat would typically support fewer species, still some endemic or restricted-range species may utilise these habitats for foraging in particular. Species recorded during field surveys as being potentially 'new to science' could also be local endemics.
- In terms of **Criterion 3**: *Sites that are critical for the survival of migratory species* and **Criterion 4**: *Areas supporting globally significant concentrations or numbers of individuals of congregatory species*, the requirements / thresholds for these criteria have not been met in terms of the key species identified.
- In terms of **Criterion 5**: *Areas with unique assemblages of species that are associated with key evolutionary processes or provide key ecosystem services*, the more intact (natural/primary) forest habitats are considered generally important for providing key ecosystem services at both a local/regional and global scale (these are also considered 'Priority ecosystem services' as per the definition provided in IFC PS6 for this criterion).
- In terms of **Criterion 6**: *Areas with biodiversity that has significant social, cultural or economic importance to local communities*, despite the potential socio-cultural importance of an area of 'Sacred Forest' identified in the project area, it was subsequently established that the cultural importance is associated with cemeteries (burial grounds) rather than the actual forest and biodiversity per say. After further consideration, forest habitat does not qualify as critical habitat in terms of criterion 6, strictly speaking.

The two natural forest types, Montane Forest and Wet Evergreen Forest, are considered the most important ecosystems in the EAAAs in terms of providing key ecosystem services, and equally the most important habitats for supporting CR/EN species, endemics and range-restricted species.

5.2 Next steps

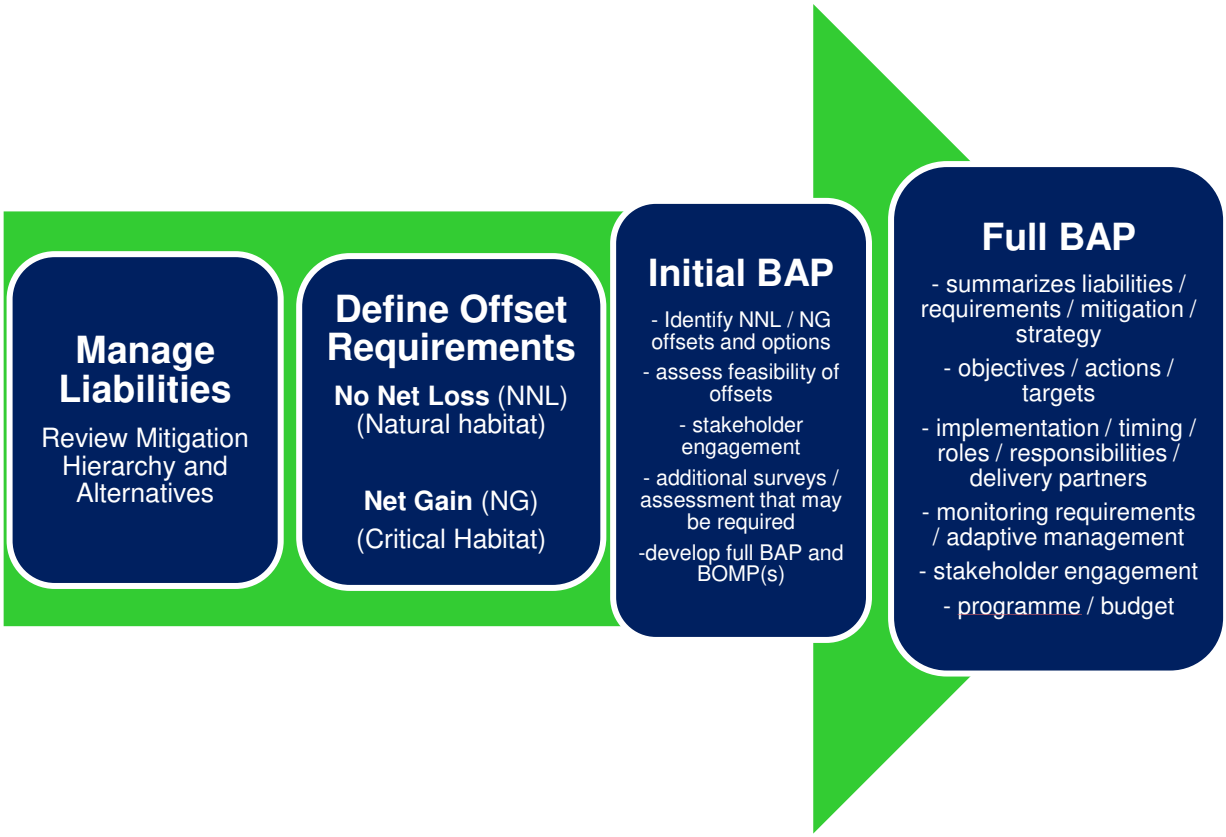
To demonstrate alignment with the ADB SPS, the following next steps are recommended:

1. Assess the ecological impacts on the critical habitat-qualifying biodiversity features, the habitat supporting those features, and stakeholder priority biodiversity. This include developing appropriate avoidance and minimisation measures and quantifying the residual impacts to

understand biodiversity losses and establish targets for biodiversity offset compensation that may be required to achieve 'no not net loss' or 'net gain' scenarios.

2. Investigate the possibility to further avoid/minimise significant impacts as predicted by the residual impact assessment with information flowing into an analysis of possible project alternatives (e.g. micro siting of specific project infrastructure, where considered technically and financially feasible).
3. Develop an initial Biodiversity Action Plan (BAP), including options to offset residual impacts (*where deemed necessary based on the outcomes of the Impact Assessment*) to demonstrate how the Project will apply the mitigation hierarchy and achieve either a 'no net loss' or 'net gain' for critical habitats and key biodiversity features of concern (e.g. fauna & flora of conservation importance). See outline of the BAP process in ***Figure 5.1.***
4. As part of the BAP, develop a Biodiversity Offset Strategy presenting the Project's framework for offset design and implementation considerations including broad actions that will be taken to meet necessary biodiversity offset targets (where necessary). The strategy can then be used to inform the development of specific Biodiversity Offset Management Plan(s) (BOMP) where required, that will sit within the overall BAP.

Figure 5.1: Initial and Final BAP Process



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7. APPENDICES

APPENDIX A FAUNA AND FLORA ASSESSED IN TERMS OF CRITICAL HABITAT QUALIFYING CRITERIA 1-4.

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
Mammals									
1	Bengal Slow Loris	*Nycticebus bengalensis*	EN	-	-	Criterion 1	Confirmed	Montane Forest, Wet Evergreen Forest (including secondary and degraded habitat)	This species occurs in Bangladesh, Cambodia West of the Mekong River, China (southern and western Yunnan and possibly in southwestern Guangxi), north-eastern India (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura), Lao PDR, Myanmar (including the Mergui Archipelago), Thailand north of the Isthmus of Kra, and Viet Nam. An arboreal, nocturnal species that inhabits tropical evergreen rainforest, semi-evergreen forest, and mixed deciduous forest. In Viet Nam it is found only in secondary forests, and on the edge of primary forests; the species also occurs in agricultural fields and plantations (V. Thanh pers. comm., Pliosongnoen et al. 2010, Kumar et al. 2014). In Laos, the species is found often in protected evergreen forests (Evans 2000, Coudrat 2012), and have also been observed in plantation forests (Pliosungnoen unpublished data) and bamboo stands (Streicher pers. comm). It can live in heavily disturbed agricultural areas if suitable foods are available. Confirmed in the Project area during biodiversity baseline field surveys.
2	Pygmy Slow Loris	*Nycticebus pygmaeus*	EN	-	-	Criterion 1	Confirmed	Montane Forest, Wet Evergreen Forest (including secondary and degraded habitat)	This species is found east of the Mekong River in eastern Cambodia, southernmost China (southeastern Yunnan), Lao PDR, and Viet Nam (Streicher 2004). The western limit of distribution in Lao PDR and Cambodia is uncertain, but it appears to be

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									absent or at least naturally very scarce in the extreme west of the Mekong plain. Sighted in a wide variety of habitats, including primary evergreen and semi-evergreen forest, forest on limestone, secondary and highly degraded habitats, and bamboo thickets (Ratajszczak 1998, Streicher 2005). It is found up to 1,500 m (MacKinnon and MacKinnon 1987). Confirmed in the Project area during biodiversity baseline field surveys.
3	Northern Buff-cheeked gibbon	*Nomascus annamensis*	EN	-	-	Criterion 1	Confirmed	Montane Forest, Wet Evergreen Forest	In Lao PDR, Nomascus annamensis is distributed in the south of the country (16°00'-16°03' N), East of Mekong River up to the Banhiang River in Savannakhet Province. N. annamensis occurs in the central and southern provinces of Attapu, Champasak, Salavan, Savannakhet and Xekong (Thinh et al. 2010, Chuong et al. 2018). Lao PDR may support the largest global populations of N. annamensis, although there is little population data for the country (Duckworth 2008), although the largest known population is in Cambodia. inhabits broadleaf evergreen and semi-evergreen forests, at elevations of between 100-1,200 m asl. The species is frugivorous but also consumes significant proportions of leaves, young shoots and flowers. They are also known to feed on Finlayson's Squirrel (single record by an adult female) and lizards. Food sharing has been observed (Geissmann 1995, Duc et al. 2016). This species is diurnal and arboreal. Confirmed in the Project area during biodiversity baseline field surveys.

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
4	Red-shanked Douc Langur	*Pygathrix nemaeus*	CR	-	Yes	Criterion 1	Confirmed	Montane Forest, Wet Evergreen Forest (including secondary habitat)	This species is associated with primary and secondary evergreen and semi-evergreen forests in both broadleaf and mixed broadleaf-coniferous forest, from lowland to montane habitats (recorded up to 1600 m amsl in Lao PDR) and also associated with forests on limestone (e.g., in Hin Namno NPA and Phong Nha Ke Bang NP) (Nadler *et al*., 2003; Coudrat *et al.,* 2012). The world's largest remaining population of Red-shanked Douc Langur is in Lao PDR, particularly in the near-contiguous Nakai-Nam Theun and Hin Namno NPA, which are likely to represent the largest contiguous suitable habitat for the species (Coudrat *et al*., 2012, 2013). These NPAs are located outside the EAAAs. Based on the commentary received from Timmins & Duckworth (2022), presence of this species is almost certain in forest strips on the northern edge of the project area contiguous with the forested Phou Ajol massif to the north, and densities here might be the highest in the project area. Presence is also likely in the forest to the west with relatively large patches of relatively mature closed canopy tall forest. The species was confirmed in the Project area during biodiversity baseline field surveys.
5	Chinese Pangolin	*Manis pentadactyla*	CR	-	-	Criterion 1	Confirmed	Wet Evergreen Forest, Shrubland, Grassland (including secondary and degraded habitat)	This species occurs in the Himalayan foothills of Nepal, southern Bhutan, north and northeastern India, northeast, northwest and southeastern Bangladesh, northern and western Myanmar, to northern and Annamite regions of Lao PDR and northern Viet Nam, part of northwestern Thailand, and across southern China. In Lao PDR, the species has been recorded in the north and central parts, but there are too few locality records

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									to determine the geographic and altitudinal range of the species in the country with any accuracy (Timmins and Evans 1996; Duckworth et al. 1999). Found in a wide range of habitats, including primary and secondary tropical forests, limestone, bamboo, broad-leaf and coniferous forests, grasslands and agricultural fields (Chao 1989, Gurung 1996). Confirmed in the Project area during biodiversity baseline field surveys.
6	Sunda Pangolin	*Manis javanica*	CR	-	-	Criterion 1	Confirmed	Wet Evergreen Forest, Shrubland, Grassland (including secondary and degraded habitat)	The Sunda Pangolin is widely distributed geographically, occurring across mainland and island Southeast Asia, from central Myanmar south through western, southeasterrn and southern Thailand, lowland Lao People's Democratic Republic (PDR), central and southern Viet Nam, Cambodia, Peninsular Malaysia and Singapore. It then occurs on Sumatra, Java and adjacent islands (Indonesia), and Borneo (Malaysia, Indonesia and Brunei Darussalam) and surrounding islands. Altitudinal limits are not well understood, but in the northern part of its range the species probably does not widely occur above 600 m asl (J.W. Duckworth pers. comm. 2006) Found in primary and secondary forest, including lowland dipterocarp forest, and cultivated areas – including oil palm and rubber plantations – including and near human settlements (e.g., in gardens; Nowak 1999, Azhar et al. 2013, Chong et al. 2016, Nash et al. 2019). The species is also a capable swimmer, like other pangolin species, and appears well adapted to wetland ecosystems. Confirmed in the Project area during biodiversity baseline field surveys.

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
7	Owston's Civet	*Chrotogale owstoni*	EN	-	-	Criterion 1	Confirmed	Montane Forest, Wet Evergreen Forest	This species is known to occur across eastern Laos, Viet Nam, and a small area of southernmost China. This species occurs in a variety of habitats, all within evergreen biomes that have a non-harsh dry season. This species is likely to occur mostly in hill and montane altitudes, and reportedly as low as 550 m asl (Gray *et al.*, 2014). Commentary received from Timmins & Duckworth (2022) suggests the species' tolerance of degraded and fragmented habitats is not well known, although the single project record suggests a significant level of resilience to these factors, consistent with inconclusive indications from northern Lao PDR and northern Vietnam. This species is mainly restricted to areas in eastern Laos that have similarities in climate to Viet Nam. Unlike in Viet Nam, wet evergreen forests in Laos are expected to still retain at least one-several large populations due to the presence of larger areas of forest with less road intrusion, and a lower human population (Gray *et al.*, 2014). Commentary received from Timmins & Duckworth (2022) suggests that the documented presence towards the centre of the project area indicates a greater range extent, possibly similar to the maximal extent postulated for Annamite Striped Rabbit. Village interviews during the wet season suggest that this species, although rare, has been sighted at study block 2. Confirmed in the Project area during biodiversity baseline field surveys.
8	Large-antlered Muntjac	*Muntiacus vuquangensis*	CR	-	Yes	Criterion 1 Criterion 2	Highly likely	Montane Forest, Wet Evergreen Forest	The species is known only from the Annamite mountain chain and associated hill ranges of Lao PDR, Viet Nam and, marginally, eastern Cambodia.

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									The habitat preferences of the Large-antlered Muntjac remain unclear, although it is suggested that its presence is tied to the evergreen and semi-evergreen forests characteristic of the Annamites, and cannot use the climatically drier hill semi-evergreen forests further north and west (IUCN). The EAAA contains suitable habitat for this species and overlaps with the species geographic range. Of note, findings from the village interviews conducted during the Rapid Ecological Assessment (REA), and the wet season surveys suggests that there is a high likelihood that this species, although rare, could be present in the eastern section of the Dakchung Plateau KBA. With more than 0.5% of this species' distribution (c.2.2%) overlapping with the EAAA, and its presence being reported during the REA and wet season surveys, it is likely that significant concentrations of this species could be present. Commentary received from Timmins & Duckworth (2022) suggests that this species was probably at one time distributed across most if not all of the project area, but is now likely to be very localised and possibly extirpated. Whilst a localised presence in or very closely adjacent to the project area is likely, any remnant population is likely to be small. Elevations much above 1000 m, especially steep terrain, are likely to be naturally unsuitable.
9	Annamite Striped Rabbit	*Nesolagus timminsi*	EN	-	-	Criterion 1	Possible	Wet Evergreen Forest	The species occurs at low and medium altitudes (approximately 50-1,300m amsl) in the northern and central Annamite Mountains along the Viet Nam and Lao PDR border. In Lao PDR it is believed to occur also in six provinces (from north to south):

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									Xiangkhouang (unconfirmed), Bolikhamxai, Khammouan, Savannakhet, Salavan and Xekong. There are no records from the southern parts of the central Annamites or from the southern Annamites but these regions are not obviously ecologically unsuitable. It has been previously confirmed in Laos only in areas close to the border with Viet Nam: a pattern shown by various other wet evergreen forest indicator species. The Annamite ridge forms most of the international border between the two countries and places most of Laos in the rain-shadow of moisture-laden air masses from Viet Nam in the Lao dry season. The vast majority of habitat suitable for this species is therefore in Viet Nam. It is clear that it occurs predominantly in wet evergreen forest, which has little to no dry season (probably no month with rainfall below 40 mm (Rundel, 1999). Most records come from low- to mid-elevation broadleaved forests. Although population size and density have not been established anywhere in its range, Annamite Striped Rabbit appears to be noticeably less abundant in heavily hunted areas than in areas perceived on the basis of other evidence to have had lower hunting intensity. Nevertheless, interviews with villagers during the REA, and wet season surveys revealed that species has been reportedly sighted along the proposed TL section, close to the Vietnam border. Hunting of this species has also occurred as recently as last year. With more than 0.5% of this species' distribution (c.0.6%) overlapping with the EAAA, and its presence being reported during the REA and wet season surveys, it

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									is possible that this species could be present. Commentary received from Timmons & Duckworth (2022) suggests that the WEF 'corridor' along the eastern edge of the project area provides ecological continuity with adjacent sites known to have this species present. Also, the fact that Owston's Civet, a species with strong WEF associations, was verified towards the centre of the project area, gives support to a potentially more extensive distribution of the rabbit across the northeastern half of the project area, but presumably now very patchily.
10	Indochinese Silvered Langur	*Trachypithecus germaini*	EN	-	-	Criterion 1	Possible	Wet Evergreen Forest	This species is found across Cambodia, Lao PDR, Myanmar, Thailand, and Vietnam. In Vietnam, it occurs in a range of lowland habitats (up to 600 m amsl), from semi-evergreen and evergreen forests on Phu Quoc Island, and forest on karst areas, mangrove forest and inundated Melaleuca forest on the mainland (Hoang Minh Duc *et al.,* 2012, Hoang Minh Duc pers. obs.). In Cambodia, it is found in a wide variety of primarily lowland habitats, including evergreen and semi-evergreen forest patches within the extensive deciduous dipterocarp forests, mixed deciduous patches, riparian strips, gallery forest (Kong and Tan 2002; Moody et al. 2011), and the seasonally inundated forests of the Tonle Sap Lake and Mekong floodplains (Davidson, 2006). In Laos, this species is thought to be localized, and even common in areas where it is present; however, no large continuous area is known to support high populations (Duckworth *et al.,* 1999). This species is probably the rarest and most threatened monkey in Lao PDR (Timmins et al. 2011).

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									Findings from the REA suggests that this species could possibly be present in the northern section of the Project area, and within and in the vicinity of the transmission line alignment. Village interviews during the wet season survey suggest that this species was sighted at survey blocks 2, 3 and 4. Given the range overlap with the terrestrial EAAA (c.0.7%), and its presence being reported during the REA and wet season surveys, it is possible that significant concentrations of this species may be present. Based on the commentary received from Timmins & Duckworth (2022), there is slight possibility that a *T. cristatus sensu lato* taxon does occur, and that current understanding of the distribution and habitat use of silvered leaf monkeys in Indochina is incomplete.
11	Northern Yellow-cheeked Crested Gibbon	*Nomascus annamensis*	EN	-	-	Criterion 1	Highly likely	Montane Forest, Wet Evergreen Forest	The species inhabits broadleaf evergreen and semi-evergreen forests, at elevations of between 100-1,200 m amsl.. Suitable habitat therefore occurs in the EAAA for this species. In Laos, the species is distributed in the south of the country (16°00'-16°03' N), East of Mekong River up to the Banhiang River in Savannakhet Province. This species occurs in the central and southern provinces of Attapu, Champasak, Salavan, Savannakhet and Xekong (Thinh *et al.*, 2010, Chuong *et al.,* 2018). Although the largest known population is in Cambodia, Laos may support the largest global populations of this species, although little population data is available for the country (Duckworth, 2008). During the REA, interviews with villagers suggested the presence of gibbons near the village of Ban Prao (north of survey block SP4), and the areas within and in the vicinity

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									of survey points SP 9 and 10 being particularly suitable for this species. Wet season surveys confirmed the species' presence, and was estimated at 2 groups in study block 1, 2 groups in study block 2 and 1 group in study block 4 (Phiapalath, 2022). With more than 0.5% of this species' distribution (c.2.5%) overlapping with the EAAA, and its presence being reported during the REA and wet season surveys, it is likely that significant concentrations of this species may be present. Based on the commentary received from Timmins & Duckworth (2022), presence of this species is almost certain in forest strips on the northern edge of the project area contiguous with the forested Phou Ajol massif to the north, and densities here might be the highest in the project area. Presence is also likely in the forest to the west with relatively large patches of relatively mature closed canopy tall forest.
12	Saola	*Pseudoryx nghetinhensis*	CR	-	Yes	Criterion 1 Criterion 2	Unlikely	Wet Evergreen Forest	It is a restricted range species, with an EOO of less than 50,000 km^2 (<10,000 km^2). This species occurs only in the Annamite Mountains region of Laos and Vietnam. In Laos, there is evidence of its occurrence in Xieng Khouang, Bolikhamxay, Khammouan, Savannakhet and Xekong Provinces. Records come from as far west as central Bolikhamxay Province, but occurrence in Laos away from the main spine of the Annamite Mountains is likely always patchy because of generally unfavourable climatic conditions. This hunting-sensitive species is probably absent from small forest fragments in the order of 100 km^2 or less, and is likely to be largely restricted to larger forest blocks with relatively low hunting pressure.

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									Knowledge of this species' historical and current range suggests that it has a highly specific habitat association with wet evergreen forest. This is a forest type with little to no dry season (rainfall never falling on average below about 40 mm per month), which occupies a restricted geographic range mainly on the eastern (Vietnamese) slopes of the Annamite Mountains (Duckworth *et al.*, 1999, Lunde *et al.*, 2004). The number of Saola subpopulations—defined as those in non-contiguous blocks of habitat—probably numbers 6 to 15, and none likely holds more than 50 animals. Consequently, the total population is undoubtedly less than 750, and likely much less. Commentary received from Timmins & Duckworth (2022) suggests that it is likely that the species would have historically occurred within the WEF corridor, especially the northern two-thirds of it, given its ecological continuity with the species' confirmed range just to the north, however the species has declined catastrophically since its discovery in 1992 due to hunting pressures. This species' global range does not overlap with the EAAA, and there have been no reported sightings of this species from village interviews undertaken during the REA. Nevertheless, expert consultation confirms that it has yet been detected from, but could possibly be present in, the EAAA. If present, it will likely be restricted to 1-5 km from the Laos-Viet Nam border (A. Tilker, pers. comm, September 27 2021). If present, the species would likely be restricted to the eastern section of the EAAA, at the Laos-Vietnam border where wet evergreen forest mainly occurs. Given that very limited suitable habitat is present in the EAAA for this rare species, and the area

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									is subject to heavy hunting pressures as assessed from villager interviews during the REA and wet season surveys, it is unlikely that significant concentrations of this species would occur in the EAAA.
Herpetofauna: Reptiles & Amphibians									
1	Red River Krait	*Bungarus slowinskii*	VU	-	Yes	Criterion 2	Confirmed	Wet Evergreen Forest (natural and modified)	It is a restricted range species with an EOO of 18,000 km^2. This snake is known only from Viet Nam, where it has been recorded from Yen Bai, Lao Cai, Quang Tri and Quang Nam Provinces (Nguyen et al., 2009), from 400 - 700 m asl. It has yet to be recorded in Laos (Nguyen, pers. comms., September 21, 2021). This species occurs in mountain regions, in or near streams in secondary or primary evergreen forest. It is also known to occur in heavily modified areas across its range. There is therefore suitable habitat for this species in the EAAA. Wet season surveys have further confirmed the presence of this species in survey block 2, presenting one of the first official records for Laos, while village interviews revealed that this species is likely to be present in all survey blocks. Even if the EAAA was found to support this species, it is unlikely that the loss of the entire area (2,670 km^2), would result in the reduction of this species' range by as much as approximately 72%, from 18,000km^2 to 5,000 km^2, thereby up listing this species' IUCN Red List status from VU to EN.
2	Impressed Tortoise	*Manouria impressa*	EN	-	-	Criterion 1	Confirmed	Montane Forest	Resident species of Cambodia; China (Hainan, Yunnan); Lao People's Democratic

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									Republic; Malaysia (Peninsular Malaysia); Myanmar; Thailand; Viet Nam. Inhabits upper evergreen montane forests between 900 and 1,600 m of elevation (above 1,200 m asl in China). It does not tolerate degraded forests. Manouria impressa shelters beneath logs, and is inactive for long periods of the year (aestivate). Confirmed during the baseline biodiversity surveys.
3	Bourret's Box Turtle	*Cuora bourreti*	CR	-	Yes	Criterion 1 Criterion 2	Unlikely	Wet Evergreen Forest, Waterbodies (streams)	It is a restricted range species, with an EOO of less than 50,000 km^2. The species is found from central Viet Nam (Nghe An, Ha Tinh, Quang Binh, Thua Thien-Hue, Da Nang, Quang Nam, and Kon Tum provinces), as well as from adjoining Savannakhet Province in Lao PDR (Obst and Reimann 1994, Nguyen et al., 2009, Stuart et al., 2011). The species inhabits upland, moist, closed-canopy evergreen forest, usually between 300 and 700 m altitude. This species inhabits terrestrial areas, and is not specifically associated with forest streams (Stuart and Platt 2004, Stuart et al. 2011, T. McCormack unpubl. data). Suitable habitat occurs in the EAAA for this species. No population numbers or estimates are known for this species, which is unsurprising due to their cryptic nature (extensive surveys are required to detect this species). Wet season surveys did not confirm the species' presence in the EAAA, but village interviews suggest its potential presence within study block 2. However, this species is thought to be very rare in the area, as locals have not recently come across this species while out hunting.

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
4	Black-breasted Leaf Turtle	*Geoemyda spengleri*	EN	-	-	Criterion 1	Unlikely	Montane Forest, Wet Evergreen Forest	The species is found across southern China, northern Viet Nam, and adjoining areas of Laos. The extent of its southern range remains unclear. The species is primarily terrestrial but occasionally uses streams (Fang, 1930). It inhabits closed-canopy forest at mid to high elevations (from 500 to over 1,000 m asl). Suitable habitat therefore occurs in the EAAA for this species. Very few field encounters of this species during biological surveys have been reported despite extensive survey efforts in suitable habitat. Wet season surveys did not detect the presence of this species, but village interviews suggest that it has been known to occur in study block 2 and 3. Given the difficulties of detecting this species in the field, and their reported presence in the area, the lack of records of this species to date is likely a result of the area being poorly surveyed. With a range overlap with the EAAA of <0.5% (c.0.06%), this species is unlikely to occur in the EAAA.
5	Annam Keelback	*Hebius annamensis*	DD	-	Yes	Criterion 2	Possible	Montane Forest, Wet Evergreen Forest, Waterbodies (streams)	It is a restricted range species with an EOO of approximately 23,000 km^2. This species is only known from Da Nang and Kon Tum Provinces in central Viet Nam, and Sekong Province in south eastern Laos (Stuart 2006, Nguyen et al. 2009). It occurs in rocky streams on steep terrain, in wet evergreen forest between elevations of 1,280–1,500 m (Stuart 2006). No population data is available as this species is only known from fewer than six specimens to date (Nguyen and Stuart, 2020). Baseline surveys to date have not observed or recorded this species. Nevertheless, the expert consulted considers this species as likely to be present within the EAAA, and

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									more widespread than currently known (Nguyen, pers. comms., September 21, 2021). Given the extent of range overlap with the EAAA (c.1.1%), and that this species is expected to have a larger range then currently known, it is unlikely that the EAAA will support significant concentrations of this species (i.e. at least 10% of the global population and 10 reproductive units).
6	-	*Quasipaa sp.*	NE	Unknown: potentially 'new to science'	Unknown: potentially 'new to science'	Criterion 2 possibly	Confirmed: potentially 'new to science'	Unknown: potentially 'new to science'	This amphibian species is a potential new species to science, and therefore has yet to be formally evaluated under the IUCN Red List. This species was detected close to transmission line route, near the Laos – Viet Nam border, north of study block 1 during the wet season field surveys. Given that limited global/regional/national evidence is available on the presence and extent of this species in Laos, this species is considered as restricted-range as anywhere from 1 - 95 percent of the (known) global population could be present in the EAAA. It is therefore possible that this species could trigger Criterion 2. In accordance with the precautionary principle, this species could possibly qualify the Project as being located in Critical Habitat.
7	-Maoson Horned Toad	*Xenophrys cf maosonensis*	NE	Unknown: potentially 'new to science'	Unknown: potentially 'new to science'	Criterion 2 possibly	Confirmed: potentially 'new to science'	Unknown: potentially 'new to science'	This amphibian species is a potential new species to science, and therefore has yet to be formally evaluated under the IUCN Red List. There is some evidence however that the species may have been previously described from Viet Nam. This species was detected in the concession area at both study block 4, and close to the transmission line route, near the Laos – Viet Nam border at study block 2, during wet season field surveys.

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									Given that limited global/regional/national evidence is available on the presence and extent of this species in Laos, this species is considered as restricted-range as anywhere from 1 - 95 percent of the (known) global population could be present in the EAAA. It is therefore possible that this species could trigger Criterion 2. In accordance with the precautionary principle, this species could possibly qualify the Project as being located in Critical Habitat.
8	-	*Rhacophorus sp nov*	NE	Unknown: potentially 'new to science'	Unknown: potentially 'new to science'	Criterion 2 possibly	Confirmed: potentially 'new to science'	Unknown: potentially 'new to science'	This amphibian species is a potential new species to science, and therefore has yet to be formally evaluated under the IUCN Red List. This species was detected in an open area close to transmission line route, near the Laos – Viet Nam border at study block 2, during wet season field surveys. Given that limited global/regional/national evidence is available on the presence and extent of this species in Laos, this species is considered as restricted-range as anywhere from 1 - 95 percent of the (known) global population could be present in the EAAA. It is therefore possible that this species could trigger criterion 2. In accordance with the precautionary principle, this species could possibly qualify the Project as being located in critical habitat.
Avifauna: Birds									
1	Vietnamese Crested Argus	*Rheinardia ocellata*	EN	-	-	Criterion 1	Confirmed	Montane Forest (natural and modified)	This species is endemic to South-East Asia, found across Laos, Malaysia, and Vietnam, with an EOO of 591,000 km^2. The nominate subspecies *R. o. ocellata* occurs along the Annamite mountain chain in central and southern Vietnam and neighbouring eastern Laos, between the Nghe An province and the Da Lat Plateau in southern Vietnam.

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									The species is known to occur in primary and secondary evergreen forest, and degraded forest habitat, including active logging concessions, at elevation limits of 1,700-1,900 m asl based on surveys on the Da Lat Plateau. It has also been recorded from degraded forest habitats. Highest densities have been recorded in moist primary forest in lowlands up to c.900 m. The population size is preliminarily estimated to fall into the band 10,000-19,999 individuals. Commentary received from Timmins & Duckworth (2022) suggests that the mountains (Phou Ajol) directly on the northern edge of the Dakchung Plateau, together with Xe Sap NPA are likely to be a particularly significant global stronghold for the species, contiguous with the Saola Nature Reserves in Vietnam. Considering that: (i) this species has been detected at the northern section of Project site and along the transmission line during the wet season surveys; (ii) the EAAA comprises more than 0.5% of this species' range (c.1.8%); and (iii) the presence of a fairly small number of individuals (50-100 individuals, i.e. 0.5% of the global species population) would trigger criterion 1, this species is considered as qualifying the Project as critical habitat.
2	Black-crowned Barwing	*Actinodura sodangorum*	NT	Yes	Yes	Criterion 2	Confirmed	Montane Forest, Wet Evergreen Forest (natural and modified), shifting cultivation and scrub	This species is known from c.10 locations, seven localities are in Vietnam, and three localities in Laos, of which one locality, Dakchung Plateau KBA is found within the Project site. It occurs mainly in secondary growth and evergreen forest at c.1,000-2,400 m, including small forest fragments with banana

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									groves amid shifting cultivation and scrub on steeply sloping hillsides. Recent observations in Laos suggest that it favours disturbed and secondary habitats, with no obvious reliance on the presence of nearby mature forest remnants (R. J. Timmins in litt. 2013). However, there are also recent records from hill evergreen and Ericaceous cloud-forest (T. Gray in litt. 2013), as well as tall, damp grassland and scrub adjacent to evergreen forest and open pine woodland. It appears to be genuinely localised to mature forest (R. J. Timmins in litt. 2013). Suitable habitat therefore occurs in the EAAA for this species. It is likely this species qualifies under criterion 2 given the relatively large range overlap with the terrestrial EAAA (c.15.1%), and confirmation of presence during transect surveys of this species, close to vantage point 4 and 6. Significant concentrations of this species (i.e. at least 1,000 individuals) out of a global population of 10,000 individuals) are likely to occur within the EAAA. Based on the commentary received from Timmins & Duckworth (2022), this species has been recorded from the Dakchung Plateau within the project area, with many observations of the species coming from secondary mosaic habitats at elevations similar to the north-eastern parts of the project area and therefore the species is likely to be widespread if not relatively common within this area. Bird surveys detected this species in the Project area.
3	Chestnut-eared Laughing thrush	*Garrulax konkakinhensis*	VU	-	Yes	Criterion 2	Likely	Montane Forest	This is a restricted range species with an EOO of 19,400 km2. This species is known from only two locations in Vietnam and one

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									location, Xe Xap National Park (c.50km from the EAAA), in Laos. It occurs in the undergrowth of primary upper montane evergreen forest between elevations of 1,200-1,750 m asl, and is also found to tolerate disturbed forest habitat (e.g. logged forest). The population is estimated at 1,000-2,499 mature individuals, which equates to c.1, 500-4,000 individuals. This species qualified under the IUCN RL category and criteria VU D2. To be up listed to EN status under criteria D would require this species' estimated population size to be fewer than 250 mature individuals. It is however unlikely that more than 80% (2249 mature individuals) of its current estimated global population of max. 2499 mature individuals is present in the EAAA and that the loss of individuals present in the EAAA would lead to this species' IUCN Red List status being up listed from VU (D2) to EN. To meet the threshold for Criterion 2, the EAAA will need to regularly hold 150-400 individuals (10% of the global population). As the EAAA comprises c. 10% of this species' range, and this species' presence is not well known in the project area and the wider region, it is possible that 10% of the global population is present in the EAAA. Based on the commentary received from Timmins & Duckworth (2022), the species is very likely to occur in the WEF corridor, primarily in the highest elevation areas, and in the tongues of forest on the northern edge of the project area, contiguous with the forested Phou Ajol massif to the north, and possibly in the isolated tall forest fragments towards the centre of the project area. Presence more widely in the project area is hard to assess, but not impossible in

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									secondary forest patches in the north-eastern quarter of the project area.
4	Golden-winged Laughingthrush	*Garrulax ngoclinhensis*	EN	Yes	Yes	Criterion 1 Criterion 2	Unlikely	Montane Forest	This restricted range and endemic species is currently only known from Mt Ngoc Linh and Mt Ngoc Boc on the Kon Tum plateau of central Vietnam, southeast, outside of the EAAA. This species has been recorded from upper montane, evergreen forest, between elevations of 1480-2200m amsl. Suitable forest habitat has been recognized as present in Attapu and Se Kong provinces of Laos, where the EAAA is located. From consultation with a regional expert (W. Duckworth pers. comm., April 6, 2021), the area is likely of particular importance to endemic bird species. Given that suitable habitat is present in the EAAA for this species, and it has a very small extent of occurrence (590 km^2), an extension of this species' range to encompass the entire EAAA will still result in this species being categorized as a restricted range species (EOO<50,000 km^2). Nevertheless, this species has remained undetected during the monthly bird transect surveys. Given that fairly extensive surveys have been conducted to date in the EAAA, it is unlikely that this species could be present at significant concentrations to qualify the Project as being in critical habitat under criterion 1 and 2. Based on the commentary received from Timmins & Duckworth (2022), this species appears to be a high elevation, high montane specialist and is unlikely to occur in the project area.
Flora (Plants)									

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
1	-	*Zingiber mellis*	EN	-	Unknown	Criterion 1	Confirmed	Montane Forest	A rhizomatous herb found growing in broadleaved evergreen montane forest at altitude 1,150 to 1,500 m. Confirmed during botanical field surveys in the Project area.
2	-	*Camellia sp.*	NE	Unknown: potentially 'new to science'	Unknown: potentially 'new to science'	Criterion 2 possibly	Confirmed	Unknown: potentially 'new to science'	These plant species were all detected during wet season surveys across various survey blocks. Following identification by regional and national experts from the Faculty of Forestry Science at the National University of Laos, these species have been considered as potential new species to science, and therefore have yet to be formally evaluated under the IUCN Red List. Given that limited global/regional/national evidence is available on the presence and extent of this species in Laos, these species are considered as restricted-range as anywhere from 1 - 95 percent of the (known) global population could be present in the EAAA, although survey results suggest that they could be more widely distributed in the area then currently known. It is therefore possible that these species could trigger criterion 2. In accordance with the precautionary principle, these species could possibly qualify the Project as being located in critical habitat.
3	-	*Garcinia sp.*							
4	-	*Lasianthus sp. 1*							
5	-	*Lasianthus sp. 2*							
6	-	*Machilus sp.*							
7	-	*Melastoma sp.*							
8	-	*Neolitsea sp.*							
9	-	*Polyosma sp.1*							
10	-	*Polyosma sp.2*							
11	-	*Smilax sp.*							
Fish									
1	-	*Poropuntius bolovenensis*	EN	Yes	Yes	Criterion 1 Criterion 2	Unlikely	Waterbodies (rivers & stream)	This species is an upland species found only on the Boloven Plateau, Paksong District, Champasak Province, southern Lao PDR. The distance between occupied locations furthest apart is smaller than 500km (i.e. 245km), therefore the species is a restricted-range freshwater species. Found in clear rocky streams at c. 800–1,200 m asl, it feeds mainly on insects. The species exhibits local

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									or short distance movements, therefore is probably not truly migratory. While thought to be restricted to the Boloven Plateau which is outside the boundaries of the EAAA, >0.5% of its distribution (c.5.7%) overlaps with the EAAA. Therefore, this species was initially considered as possibly triggering Criterion 1, but not Criterion 2 given this species' extent of range overlap being <10%. Consultations with a regional fish expert suggests that the Bolaven Plateau is unlikely to be hydrologically connected with the Dakchung Plateau and its surrounding area (M.Kottelat pers. comm., October 11, 2021). Given this species is known to only occur on the Bolaven Plateau and nowhere else, it is considered unlikely that this species would occur in the EAAA.
2	-	*Schistura bolavenensis*	EN	Yes	Yes	Criterion 1 Criterion 2	Unlikely	Waterbodies (rivers & stream)	This species is an upland species found only on the Boloven Plateau, Paksong District, Champasak Province, southern Laos PDR, is common on the plateau in the Xenamnoy sub-basin. The distance between occupied locations furthest apart is smaller than 500km (i.e. 194km), therefore the species is a restricted-range freshwater species. The species is found in clear rocky streams approximately 800–1,200 m asl. and feeds on insects. While thought to be restricted to the Boloven Plateau which is outside the boundaries of the EAAA, >0.5% of its distribution (c.5.7%) overlaps with the EAAA. Therefore, this species was initially considered as possibly triggering Criterion 1, but not Criterion 2 given this species' extent of range overlap being <10%. Consultations with a regional fish expert suggests that the Bolaven Plateau is unlikely to be hydrologically connected with the Dakchung Plateau and

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									its surrounding area (M.Kottelat pers. comm., October 11, 2021). Given this species is known to only occur on the Bolaven Plateau and nowhere else, it is unlikely that this species would occur in the EAAA.
3	-	*Poropuntius lobocheiloides*	EN		Unconfirmed	Criterion 1 Criterion 2		Waterbodies (rivers & stream)	*Poropuntius lobocheiloides* is a fish species listed as Endangered on the IUCN Red List. This species is only known from tributaries of the Xe Kong River on the eastern half of the Bolaven Plateau, Lao PDR, and has an EOO of 2,500 km^2. The distance between occupied locations furthest apart is smaller than 500km (i.e. 240km), therefore the species is a restricted-range freshwater species. The species is expected to occur in streams with clear, cool and fast water, over stones, rocks, rapids and waterfalls. While thought to be restricted to the Boloven Plateau which is outside the boundaries of the EAAA, >0.5% of its distribution (c.5.7%) overlaps with the EAAA. Therefore, this species was initially considered as possibly triggering Criterion 1, but not Criterion 2 given this species' extent of range overlap being <10%. Consultations with a regional fish expert suggests that the Bolaven Plateau is unlikely to be hydrologically connected with the Dakchung Plateau and it's surrounding area (M.Kottelat pers. comm., October 11, 2021). Given this species is known to only occur on the Bolaven Plateau and nowhere else, it is unlikely that this species would occur in the EAAA, thereby triggering the critical habitat criterion 1 and/or 2.
4	-	*Poropuntius solitus*	EN	Yes	Yes	Criterion 1 Criterion 2	Unlikely	Waterbodies (rivers & stream)	*Poropuntius solitus* is a fish species listed as Endangered on the IUCN Red List. This species is only known from tributaries of the Xe Kong River on the eastern half of the

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									Bolaven Plateau, Lao PDR, and has an EOO of 2,500 km^2. The distance between occupied locations furthest apart is smaller than 500km (i.e. 240km), therefore the species is a restricted-range freshwater species. The species is expected to occur in streams with clear, cool and fast water, over stones, rocks, rapids and waterfalls. While thought to be restricted to the Boloven Plateau which is outside the boundaries of the EAAA, >0.5% of its distribution (c.5.7%) overlaps with the EAAA. Therefore, this species was initially considered as possibly triggering Criterion 1, but not Criterion 2 given this species' extent of range overlap being <10%. Consultations with a regional fish expert suggests that the Bolaven Plateau is unlikely to be hydrologically connected with the Dakchung Plateau and it's surrounding area (M.Kottelat pers. comm., October 11, 2021). Given this species is known to only occur on the Bolaven Plateau and nowhere else, it is unlikely that this species would occur in the EAAA.
5	-	*Poropuntius consternans*	EN	Yes	Yes	Criterion 1 Criterion 2	Unlikely	Waterbodies (rivers & stream)	This EN species is only known from tributaries of the Xe Kong River on the eastern half of the Bolaven Plateau, Lao PDR, and has an EOO of 2,500 km^2. The distance between occupied locations furthest apart is smaller than 500km (i.e. 240km), therefore the species is a restricted-range freshwater species. The species is expected to occur in streams with clear, cool and fast water, over stones, rocks, rapids and waterfalls. While thought to be restricted to the Boloven Plateau which is outside the boundaries of the EAAA, >0.5% of its distribution (c.5.7%) overlaps with the EAAA. Therefore, this species was initially considered as possibly

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									triggering Criterion 1, but not Criterion 2 given this species' extent of range overlap being <10%. Consultations with a regional fish expert suggests that the Bolaven Plateau is unlikely to be hydrologically connected with the Dakchung Plateau and it's surrounding area (M.Kottelat pers. comm., October 11, 2021). Given this species is known to only occur on the Bolaven Plateau and nowhere else, it is unlikely that this species would occur in the EAAA.
6	-	*Devario salmonatus*	DD	Yes	Yes	Criterion 2	Unlikely	Waterbodies (rivers & stream)	This species is known from the Bolaven plateau, Xe Kong drainage, in Mekong basin, Lao PDR. The distance between occupied locations furthest apart is smaller than 500km (i.e. 192km), therefore the species is a restricted-range freshwater species. The species is expected to occur in streams under forest cover, with clear, moderate to fast flowing water. While thought to be restricted to the Boloven Plateau which is outside the boundaries of the EAAA, >0.5% of its distribution (c.5.7%) overlaps with the EAAA. Therefore, this species was initially considered as possibly triggering Criterion 1, but not Criterion 2 given this species' extent of range overlap being <10%. Consultations with a regional fish expert suggests that the Bolaven Plateau is unlikely to be hydrologically connected with the Dakchung Plateau and it's surrounding area (M.Kottelat pers. comm., October 11, 2021). Given this specie is known to only occur on the Bolaven Plateau and nowhere else, it is unlikely that this species would occur in the EAAA.
7	-	*Serpenticobitis octozona*	DD	Yes	Yes	Criterion 2	Unlikely	Waterbodies (rivers & stream)	This species is found in the Sekong drainage in Lao PDR, where the EAAA is located. The distance between occupied locations

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									furthest apart is smaller than 500km (i.e. 220km), therefore the species is a restricted-range freshwater species. The species is found in rapids and fast flowing waters in main rivers and larger tributaries, and stretches of river with large gravel. This species is uncommon, but this is possibly because its preferred habitat is not easily sampled. Consultation with a regional fish expert revealed that the most recent (and likely only) field survey of the area was briefly undertaken in 2011 (Kottelat, 2011. This species was not detected during surveys then. (M.Kottelat pers. comm., October 11, 2021). While endemic to the Sekong drainage, no other information reviewed suggests that suitable habitat does not occur across this species' range. Given that the EAAA comprises only c. 7.8% of this species' range, and assuming that there is suitable habitat for this species across most of it's range, it is unlikely that this species could be present in significant concentrations.
8	-	*Schistura imitator*	LC	Yes	Yes	Criterion 2	Possible	Waterbodies (rivers & stream)	This species has only been recorded from the Sekong basin, southern Lao PDR, where the EAAA is located. It has been assessed as Least Concern on the IUCN Red List due to the number of sites and lack of threats identified across its known range. The distance between occupied locations furthest apart is smaller than 500km (i.e. 195km), therefore the species is a restricted-range freshwater species. This species has only been collected from two surveys in the main Se Kong river, which does not overlap with the EAAA. Consultation with a regional fish expert revealed that the most recent (and likely

S/N	Common Name	Scientific Name	IUCN Red List[a]	Endemic to Laos PDR?	Range-restricted Species?	ADB SPS critical habitat criteria[c]	Potential Occurrence in the EAAA[b]	Associated Habitat	Description & Rationale (IUCN)[d]
									only) field survey of the area was briefly undertaken in 2011 (Kottelat, 2011. This species was not detected during surveys then (M.Kottelat pers. comm., October 11, 2021). While endemic to the Sekong drainage, no other information reviewed suggests that suitable habitat does not occur across this species' range. In accordance with the precautionary principle, as the EAAA comprises more than 10% of the species' range (c.15.8%), and limited surveys have been located within the Se Kong basin, it is possible that this species could trigger Criterion 2.
9	-	*Schistura clatrata*	LC	Yes	Yes	Criterion 2	Possible	Waterbodies (rivers & stream)	This species has only been recorded from the Se Kong basin, southern Lao PDR, where the EAAA is located. It has been assessed as Least Concern on the IUCN Red List due to the number of sites and lack of threats identified across its known range. The distance between occupied locations furthest apart is smaller than 500km (i.e. 190km), therefore the species is a restricted-range freshwater species. This species has only been collected from two surveys in the main Se Kong river, which does not overlap with the EAAA. Consultation with a regional fish expert revealed that the most recent (and likely only) field survey of the area was briefly undertaken in 2011 (Kottelat, 2011. This species was not detected during surveys then (M.Kottelat pers. comm., October 11, 2021). While endemic to the Sekong drainage, no other information reviewed suggests that suitable habitat does not occur across this species' range. In accordance with the precautionary principle, as the EAAA

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									comprises more than 10% of the species' range (c.15.8%), and limited surveys have been located within the Se Kong basin, it is possible that this species could trigger Criterion 2.

Notes:

[a] **IUCN Global Red List status**: **CR** = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable; **NT** = Near Threatened; **LC** = Least Concern; **DD** = Data Deficient. *Note that there is no national Red List available for Laos.*

[b] **Potential occurrence in the EAAA**: **Confirmed** = presence confirmed through Project field surveys; **Highly likely**: habitat requirements fully met and EAAA within documented species geographical/altitudinal range; **Likely**: habitat requirements largely met and EAAA within the documented species geographical/altitudinal range; **Possible**: habitat requirements largely met and EAAA on the edge of the documented species geographical/altitudinal range; **Unlikely:** habitat requirements not met and/or EAAA outside of the documented species geographical/altitudinal range.

[c] **ASP SPS critical habitat criteria**: **Criterion 1 =** critically endangered or endangered species, **Criterion 2 =** endemic and/or restricted-range species.

[d] Note that in the absence of reliable population data, the proportion of a species' distribution in the area was used as a proxy for population size to inform critical habitat-determination. Species that did not meet the thresholds were screened out and have not been included in this list. Species that may not have met the thresholds but were identified as important by stakeholders were also retained.

APPENDIX B CANDIDATE SPECIES EXCLUDED FROM THE CHA.

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
MAMMALS					
Annamite Muntjac	*Muntiacus truongsonensis*	DD			
Long-toothed Pipistrelle	*Hypsugo dolichodon*	DD			
Walston's tube-nosed bat	*Murina walstoni*	DD			
Tibetan Tube-nosed Bat	*Murina aurata*	DD			
Burmese Long-talied Macaque	*Macaca fascicularis* ssp. *aureus*	DD			
Roosevelts' Muntjac	*Muntiacus rooseveltorum*	DD			
Indochinese Mountain Maxomys	*Maxomys moi*	LC	X		
BIRDS					
Pale-capped Pigeon	*Columba punicea*	VU	X		
Masked Finfoot	*Heliopais personatus*	EN	X		
Black-hooded Laughingthrush	*Garrulax milleti*	LC			
Indochinese Fulvetta	*Fulvetta danisi*	LC			
Necklaced Barbet	*Psilopogon auricularis*	LC		X	
Yellow-vented Green-pigeon	*Treron seimundi*	LC			X
White-spectacled Warbler	*Phylloscopus intermedius*	LC			X
Brown Prinia	*Prinia polychroa*	LC			X
White-faced Plover	*Charadrius dealbatus*	DD			X
Yellow-browed Tit	*Sylviparus modestus*	LC			X
Flavescent Bulbul	*Pycnonotus flavescens*	LC			X
White-gorgeted Flycatcher	*Anthipes monileger*	LC			X
Grey-cheeked Warbler	*Phylloscopus poliogenys*	LC			X
Ashy Bulbul	*Hemixos flavala*	LC			X
Alström's Warbler	*Phylloscopus soror*	LC			X
Slender-billed Oriole	*Oriolus tenuirostris*	LC			X
Yellow-cheeked Tit	*Machlolophus spilonotus*	LC			X
Kloss's Leaf-warbler	*Phylloscopus ogilviegranti*	LC			X
Malay Night-heron	*Gorsachius melanolophus*	LC			X

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
Mountain Tailorbird	*Phyllergates cucullatus*	LC			X
Japanese Thrush	*Turdus cardis*	LC			X
White-shouldered Starling	*Sturnia sinensis*	LC			X
Hill Prinia	*Prinia superciliaris*	LC			X
Wedge-tailed Green-pigeon	*Treron sphenurus*	LC			X
Maroon Oriole	*Oriolus traillii*	LC			X
Burmese Shrike	*Lanius collurioides*	LC			X
Grey-bellied Tesia	*Tesia cyaniventer*	LC			X
Yellow-bellied Warbler	*Abroscopus superciliaris*	LC			X
White-bellied Green-pigeon	*Treron sieboldii*	LC			X
Mountain Bulbul	*Ixos mcclellandii*	LC			X
Rufous-gorgeted Flycatcher	*Ficedula strophiata*	LC			X
Collared Owlet	*Glaucidium brodiei*	LC			X
Crow-billed Drongo	*Dicrurus annectens*	LC			X
Ferruginous Flycatcher	*Muscicapa ferruginea*	LC			X
Barred Cuckoo-dove	*Macropygia unchall*	LC			X
Slaty-legged Crake	*Rallina eurizonoides*	LC			X
Oriental Dwarf-kingfisher	*Ceyx erithaca*	LC			X
Blue-winged Minla	*Siva cyanouroptera*	LC			X
Blue-throated Bee-eater	*Merops viridis*	LC			X
Grey-chinned Minivet	*Pericrocotus solaris*	LC			X
Thick-billed Green-pigeon	*Treron curvirostra*	LC			X
Spot-billed Pelican	*Pelecanus philippensis*	NT			X
Sulphur-breasted Warbler	*Phylloscopus ricketti*	LC			X
Whistling Hawk-cuckoo	*Hierococcyx nisicolor*	LC			X
Blyth's Leaf-warbler	*Phylloscopus reguloides*	LC			X
Mountain Scops-owl	*Otus spilocephalus*	LC			X
Chestnut-crowned Warbler	*Phylloscopus castaniceps*	LC			X
Rosy Minivet	*Pericrocotus roseus*	LC			X
Asian Stubtail	*Urosphena squameiceps*	LC			X

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
White-browed Shrike-babbler	*Pteruthius aeralatus*	LC			X
Oriental Paradise-flycatcher	*Terpsiphone affinis*	LC			X
Brown-rumped Minivet	*Pericrocotus cantonensis*	LC			X
Little Pratincole	*Glareola lactea*	LC			X
Indian Thick-knee	*Burhinus indicus*	LC			X
Blue-and-white Flycatcher	*Cyanoptila cyanomelana*	LC			X
Asian Plain Martin	*Riparia chinensis*	LC			X
Pygmy Cupwing	*Pnoepyga pusilla*	LC			X
Oriental Hobby	*Falco severus*	LC			X
Collared Scops-owl	*Otus lettia*	LC			X
Large Woodshrike	*Tephrodornis virgatus*	LC			X
Orange-headed Thrush	*Geokichla citrina*	LC			X
Besra	*Accipiter virgatus*	LC			X
Black Baza	*Aviceda leuphotes*	LC			X
Ashy Woodswallow	*Artamus fuscus*	LC			X
Grey-breasted Prinia	*Prinia hodgsonii*	LC			X
White-throated Fantail	*Rhipidura albicollis*	LC			X
Asian Barred Owlet	*Glaucidium cuculoides*	LC			X
Red-billed Blue Magpie	*Urocissa erythroryncha*	LC			X
Black Bulbul	*Hypsipetes leucocephalus*	LC			X
Indian Spot-billed Duck	*Anas poecilorhyncha*	LC			X
Fork-tailed Drongo-cuckoo	*Surniculus dicruroides*	LC			X
Asian Green Bee-eater	*Merops orientalis*	LC			X
White-throated Rock-thrush	*Monticola gularis*	LC			X
Pale-legged Leaf-warbler	*Phylloscopus tenellipes*	LC			X
Grey-headed Lapwing	*Vanellus cinereus*	LC			X
Black-naped Monarch	*Hypothymis azurea*	LC			X
Verditer Flycatcher	*Eumyias thalassinus*	LC			X
Ashy Minivet	*Pericrocotus divaricatus*	LC			X
Chinese Paradise-flycatcher	*Terpsiphone incei*	LC			X

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
Black-winged Cuckooshrike	*Lalage melaschistos*	LC			X
Large Hawk-cuckoo	*Hierococcyx sparverioides*	LC			X
Plain Prinia	*Prinia inornata*	LC			X
Ruddy-breasted Crake	*Zapornia fusca*	LC			X
Hair-crested Drongo	*Dicrurus hottentottus*	LC			X
Black Bittern	*Ixobrychus flavicollis*	LC			X
Grey-faced Buzzard	*Butastur indicus*	LC			X
Blue Whistling-thrush	*Myophonus caeruleus*	LC			X
Eastern Crowned Warbler	*Phylloscopus coronatus*	LC			X
Cinnamon Bittern	*Ixobrychus cinnamomeus*	LC			X
Eastern Spotted Dove	*Spilopelia chinensis*	LC			X
Forest Wagtail	*Dendronanthus indicus*	LC			X
Intermediate Egret	*Ardea intermedia*	LC			X
Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	LC			X
Black-browed Reed-warbler	*Acrocephalus bistrigiceps*	LC			X
Chinese Pond-heron	*Ardeola bacchus*	LC			X
Black-naped Oriole	*Oriolus chinensis*	LC			X
Pied Harrier	*Circus melanoleucos*	LC			X
Oriental Scops-owl	*Otus sunia*	LC			X
Ashy Drongo	*Dicrurus leucophaeus*	LC			X
White-breasted Waterhen	*Amaurornis phoenicurus*	LC			X
Yellow Bittern	*Ixobrychus sinensis*	LC			X
Red Turtle-dove	*Streptopelia tranquebarica*	LC			X
Black Drongo	*Dicrurus macrocercus*	LC			X
Pied Bushchat	*Saxicola caprata*	LC			X
Purple-backed Starling	*Agropsar sturninus*	LC			X
Schrenck's Bittern	*Ixobrychus eurhythmus*	LC			X
Watercock	*Gallicrex cinerea*	LC			X
Long-tailed Shrike	*Lanius schach*	LC			X
Oriental Reed-warbler	*Acrocephalus orientalis*	LC			X

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
Chinese Grasshopper-warbler	*Locustella tacsanowskia*	LC			X
Chestnut-eared Bunting	*Emberiza fucata*	LC			X
Two-barred Warbler	*Phylloscopus plumbeitarsus*	LC			X
Radde's Warbler	*Phylloscopus schwarzi*	LC			X
Asian House Martin	*Delichon dasypus*	LC			X
Oriental Skylark	*Alauda gulgula*	LC			X
Chestnut Bunting	*Emberiza rutila*	LC			X
Wire-tailed Swallow	*Hirundo smithii*	LC			X
Grey Nightjar	*Caprimulgus jotaka*	LC			X
Japanese Sparrowhawk	*Accipiter gularis*	LC			X
Mugimaki Flycatcher	*Ficedula mugimaki*	LC			X
Oriental Pratincole	*Glareola maldivarum*	LC			X
Siberian Blue Robin	*Larvivora cyane*	LC			X
Oriental Honey-buzzard	*Pernis ptilorhynchus*	LC			X
Red-necked Stint	*Calidris ruficollis*	NT			X
Shikra	*Accipiter badius*	LC			X
Pacific Golden Plover	*Pluvialis fulva*	LC			X
Thick-billed Warbler	*Arundinax aedon*	LC			X
Blue Rock-thrush	*Monticola solitarius*	LC			X
Red-rumped Swallow	*Cecropis daurica*	LC			X
Asian Brown Flycatcher	*Muscicapa dauurica*	LC			X
Eyebrowed Thrush	*Turdus obscurus*	LC			X
Dark-sided Flycatcher	*Muscicapa sibirica*	LC			X
Siberian Thrush	*Geokichla sibirica*	LC			X
Kentish Plover	*Charadrius alexandrinus*	LC			X
Whiskered Tern	*Chlidonias hybrida*	LC			X
Red-throated Pipit	*Anthus cervinus*	LC			X
Temminck's Stint	*Calidris temminckii*	LC			X
Eastern House Martin	*Delichon lagopodum*	LC			X
Lanceolated Warbler	*Locustella lanceolata*	LC			X

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
Richard's Pipit	*Anthus richardi*	LC			X
Dusky Warbler	*Phylloscopus fuscatus*	LC			X
Olive-backed Pipit	*Anthus hodgsoni*	LC			X
Little Egret	*Egretta garzetta*	LC			X
Pintail Snipe	*Gallinago stenura*	LC			X
Great Cormorant	*Phalacrocorax carbo*	LC			X
Eastern Yellow Wagtail	*Motacilla tschutschensis*	LC			X
Little Grebe	*Tachybaptus ruficollis*	LC			X
Grey Plover	*Pluvialis squatarola*	LC			X
Purple Heron	*Ardea purpurea*	LC			X
Greater Spotted Eagle	*Clanga clanga*	VU			X
Eurasian Woodcock	*Scolopax rusticola*	LC			X
Brown Shrike	*Lanius cristatus*	LC			X
Siberian Rubythroat	*Calliope calliope*	LC			X
White-winged Tern	*Chlidonias leucopterus*	LC			X
Yellow-breasted Bunting	*Emberiza aureola*	CR			X
Common Moorhen	*Gallinula chloropus*	LC			X
Green-backed Heron	*Butorides striata*	LC			X
Oriental Cuckoo	*Cuculus saturatus*	LC			X
Baillon's Crake	*Zapornia pusilla*	LC			X
Yellow-browed Warbler	*Phylloscopus inornatus*	LC			X
Black-crowned Night-heron	*Nycticorax nycticorax*	LC			X
Red-throated Flycatcher	*Ficedula albicilla*	LC			X
Grey Wagtail	*Motacilla cinerea*	LC			X
Cattle Egret	*Bubulcus ibis*	LC			X
Common Coot	*Fulica atra*	LC			X
Common Rosefinch	*Carpodacus erythrinus*	LC			X
Common Redshank	*Tringa totanus*	LC			X
Eurasian Curlew	*Numenius arquata*	NT			X
Grey Heron	*Ardea cinerea*	LC			X

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
Green Sandpiper	*Tringa ochropus*	LC			X
Common Greenshank	*Tringa nebularia*	LC			X
Little Ringed Plover	*Charadrius dubius*	LC			X
Black-winged Stilt	*Himantopus himantopus*	LC			X
Wood Sandpiper	*Tringa glareola*	LC			X
Great White Egret	*Ardea alba*	LC			X
Common Snipe	*Gallinago gallinago*	LC			X
Common Kestrel	*Falco tinnunculus*	LC			X
Black-headed Gull	*Larus ridibundus*	LC			X
Common Stonechat	*Saxicola torquatus*	LC			X
Black Kite	*Milvus migrans*	LC			X
Common Sandpiper	*Actitis hypoleucos*	LC			X
Bluethroat	*Cyanecula svecica*	LC			X
White Wagtail	*Motacilla alba*	LC			X
Osprey	*Pandion haliaetus*	LC			X
Barn Swallow	*Hirundo rustica*	LC			X
Peregrine Falcon	*Falco peregrinus*	LC			X
REPTILES					
Elongated Tortoise	*Indotestudo elongata*	CR	X		
Three Horned-scaled Pitviper	*Protobothrops sieversorum*	EN	X		
-	*Sphenomorphus buenloicus*	LC		X	
-	*Acanthosaura nataliae*	LC		X	
South-east Asian Green Grass Lizard	*Takydromus hani*	LC		X	
Saltwater Crocodile	*Crocodylus porosus*	LR/lc			X
FISH					
Yellow Tail Brook Barb	*Poropuntius deauratus*	EN	X		X
-	*Hypsibarbus lagleri*	VU	X		X
Thicklipped Barb	*Probarbus labeamajor*	EN	X		X
-	*Labeo pierrei*	VU	X		X
-	*Bangana behri*	VU	X		X

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
Elephant Ear Gourami	*Osphronemus exodon*	VU	X		X
Red Mahseer	*Tor sinensis*	VU	X		X
Giant Pangasius	*Pangasius sanitwongsei*	CR	X		X
-	*Schistura kontumensis*	VU	X		
Black-Lined Loach	*Yasuhikotakia nigrolineata*	VU	X		
Red Fin Shark	*Epalzeorhynchos munense*	VU	X		
-	*Pseudecheneis maurus*	DD		X	
-	*Sewellia elongata*	NT		X	
-	*Poropuntius aluoiensis*	DD		X	
-	*Schistura fusinotata*	LC		X	
-	*Glyptothorax filicatus*	DD		X	
-	*Schistura carbonaria*	LC		X	
Black Paradise Fish	*Macropodus spechti*	DD		X	
-	*Hemimyzon ecdyonuroides*	DD		X	
-	*Devario gibber*	LC		X	
-	*Rhinogobius taenigena*	LC		X	
-	*Schistura khamtanhi*	DD			X
-	*Sikukia gudgeri*	DD			X
-	*Mekongina erythrospila*	NT			X
-	*Cyclocheilichthys lagleri*	LC			X
Royal Featherback	*Chitala blanci*	NT			X
-	*Yasuhikotakia longidorsalis*	DD			X
Redtail Barb	*Discherodontus ashmeadi*	LC			X
-	*Tor laterivittatus*	DD			X
-	*Mystacoleucus atridorsalis*	LC			X
Mekong catfish	*Pangasius mekongensis*	LC			X
-	*Garra fasciacauda*	LC			X
Harmand's Sole	*Brachirus harmandi*	LC			X
-	*Cosmochilus harmandi*	LC			X
-	*Mystus multiradiatus*	LC			X

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
-	*Puntigrus partipentazona*	LC			X
-	*Ompok urbaini*	LC			X
-	*Wallago micropogon*	DD			X
-	*Cyclocheilichthys enoplos*	LC			X
-	*Belodontichthys truncatus*	LC			X
Swamp Barb	*Puntius brevis*	LC			X
-	*Amblyrhynchichthys truncatus*	LC			X
Crocodile catfish	*Bagarius suchus*	NT			X
-	*Bangana yunnanensis*	DD			X
Dwarf Horseface Loach	*Aperioptus delphax*	LC			X
-	*Laides longibarbis*	LC			X
Mud Carp	*Cirrhinus molitorella*	NT			X
-	*Pangasius macronema*	LC			X
Mekong bachcha	*Clupisoma sinense*	LC			X
Red-tail Tinfoil Barb	*Barbonymus altus*	LC			X
Bumble bee catfish	*Pseudomystus siamensis*	LC			X
Hard-lipped Barb	*Osteochilus vittatus*	LC			X
Waandersii's Hard-lipped Barb	*Osteochilus waandersii*	LC			X
-	*Labiobarbus leptocheilus*	LC			X
Tiny scale barb	*Thynnichthys thynnoides*	LC			X
Marbled Goby	*Oxyeleotris marmorata*	LC			X
Black Sharkminnow	*Labeo chrysophekadion*	LC			X
Horse face loach	*Acantopsis choirorhynchos*	LC			X
-	*Cyclocheilichthys repasson*	LC			X
Indochinese Needlefish	*Xenentodon canciloides*	LC			X
Tinfoil Barb	*Barbonymus schwanefeldii*	LC			X
-	*Cyclocheilichthys armatus*	LC			X
Sucker Barb	*Barbichthys laevis*	LC			X
-	*Crossocheilus cobitis*	LC			X
Forest Snakehead	*Channa lucius*	LC			X

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
Long Pectoral-fin Minnow	*Macrochirichthys macrochirus*	LC			X
Scaleless Worm Goby	*Caragobius urolepis*	LC			X
-	*Tor tambroides*	DD			X
-	*Tor tambra*	DD			X
-	*Wallago attu*	VU			X
-	*Bagarius yarrelli*	VU			X
Climbing Perch	*Anabas testudineus*	LC			X
Slender Barb	*Rasbora daniconius*	LC			X
Marbled Eel	*Anguilla marmorata*	LC			X
Dwarf Snakehead	*Channa gachua*	LC			X
Shortfin Eel	*Anguilla bicolor*	NT			X
-	*Pseudapocryptes elongatus*	LC			X
Striped Bass	*Morone saxatilis*	LC			X
-	*Leptobrachium banae*	LC		X	
-	*Odorrana absita*	LC		X	
-	*Amolops spinapectoralis*	LC		X	
-	*Gracixalus supercornutus*	NT		X	
AMPHIBIANS					
Striped Oriental Frog	*Occidozyga vittata*	LC			
-	*Odorrana khalam*	LC			
-	*Leptobrachella tuberosa*	LC			
Annam Spadefoot Toad	*Megophrys intermedia*	LC			
-	*Amolops compotrix*	LC		X	
-	*Odorrana orba*	LC		X	
Spinybottom Tree Frog	*Rhacophorus exechopygus*	LC		X	
-	*Microhyla marmorata*	LC		X	
INVERTEBRATES					
-	*Sulcospira tourannensis*	LC		X	
-	*Protosticta robusta*	DD		X	
-	*Amphithemis kerri*	DD		X	

Common name	Scientific name	IUCN RL status[1]	ADB SPS Critical Habitat criteria[2]		
			Criterion 1	Criterion 2	Criterion 3
-	*Coeliccia scutellum*	LC		X	
Red Glider Dragonfly	*Tramea transmarina*	LC			X
Gossamer Damselfly	*Ischnura aurora*	LC			X
Keyhole Glider	*Tramea basilaris*	LC			X
Old World Twister	*Tholymis tillarga*	LC			X
Painted Lady	*Vanessa cardui*	LC			X
Wandering Glider	*Pantala flavescens*	LC			X
-	*Vietopotamon aluoiense*	DD		X	
-	*Caridina lanceifrons*	LC			X

Notes:

[1] **IUCN Global Red List (RL) status**: **CR** = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable; **NT** = Near Threatened; **LC** = Least Concern; **DD** = Data Deficient. *Note that there is no national Red List available for Laos.*

[2] **ASP SPS critical habitat criteria**: **Criterion 1 =** critically endangered or endangered species, **Criterion 2 =** endemic and/or restricted-range species, **Criterion 3/4 =** Key migratory/congregatory species.

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