



PREPARED FOR



ខេមបូឌា អ៊ែរវេត អ៊ិនវេសម៉ិន ឯ.ក
柬埔寨機場投資有限公司
Cambodia Airport Investment Co., Ltd

Cambodia Airport Investment Co.,
Ltd.

DATE

08 November 2024

REFERENCE

0730380

ESIA Addendum

Biodiversity Impact Assessment



DOCUMENT DETAILS

DOCUMENT TITLE	ESIA Addendum
DOCUMENT SUBTITLE	Biodiversity Impact Assessment
PROJECT NUMBER	0730380
Date	08 November 2024
Version	02
Author	Var.
Client name	Cambodia Airport Investment Co., Ltd.

DOCUMENT HISTORY

				ERM APPROVAL TO ISSUE		
VERSION	REVISION	AUTHOR	REVIEWED BY	NAME	DATE	COMMENTS
Draft 01	00	As above	David Blaha	Kamonthip Ma-oon	12.07.2024	Issued to Client
Draft 02	01	As above	David Blaha	Kamonthip Ma-oon	08.11.2024	Issued to Lender

SIGNATURE PAGE

ESIA Addendum

Biodiversity Impact Assessment

0730380



Kamonthip Ma-oon

Partner

ERM-Siam Co., Ltd.
179 Bangkok City Tower 24th Floor,
South Sathorn Road, Thungmahamek,
Sathorn, Bangkok 10120, Thailand

© Copyright 2025 by The ERM International Group Limited and/or its affiliates ('ERM'). All Rights Reserved.
No part of this work may be reproduced or transmitted in any form or by any means, without prior written permission of ERM.

CONTENTS

1.	IMPACT ASSESSMENT	1
1.1	BIODIVERSITY IMPACT ASSESSMENT	1
1.1.1	Impact Assessment Criteria	1
1.1.2	Impact Assessment in Construction Phase	5
1.1.3	Impact Assessment in Operation Phase	14

LIST OF TABLES

TABLE 1.1	CRITERIA FOR IMPACT MAGNITUDE FOR ASSESSMENT OF IMPACT TO BIODIVERSITY 1	
TABLE 1.2	CRITERIA FOR BIODIVERSITY RECEPTOR SENSITIVITY	2
TABLE 1.3	THE BIODIVERSITY-IMPACT ASSESSMENT CRITERIA	4
TABLE 1.4	IMPACT ASSESSMENT FOR HABITAT LOSS AND DEGRADATION: CONSTRUCTION PHASE	7
TABLE 1.5	IMPACT ASSESSMENT FOR CRITICAL HABITAT TRIGGERED SPECIES DISTURBANCE: CONSTRUCTION PHASE	8
TABLE 1.6	IMPACT ASSESSMENT FOR SPECIES DISTURBANCE AND DISPLACEMENT: CONSTRUCTION PHASE	11
TABLE 1.7	IMPACT ASSESSMENT FOR DIRECT MORTALITY CAUSED BY VEHICLE STRIKE, HUNTING AND POACHING: CONSTRUCTION PHASE	12
TABLE 1.8	IMPACT ASSESSMENT FOR SPECIES MORTALITY AVIFAUNA DUE TO AIRCRAFT STRIKE: OPERATION PHASE	15
TABLE 1.9	IMPACT ASSESSMENT FOR TERRESTRIAL SPECIES MORTALITY BY VEHICLE STRIKE DURING OPERATION PHASE	17
TABLE 1.10	IMPACT ASSESSMENT FOR FAUNA DISTURBANCE DURING OPERATION PHASE	19

ACRONYMS AND ABBREVIATIONS

Acronyms	Description
BAP	Biodiversity Action Plan
EAAA	Ecologically Appropriate Area of Analyses
ESIA	Environmental and Social Impact Assessment
IBA	Important Bird Area
IBAT	Integrated Biodiversity Assessment Tool
IFC	The International Finance Corporation
IUCN	The International Union for Conservation of Nature
KBA	Key Biodiversity Area
LC	Least Concern
NNL	No Net Loss
NT	Near Threatened

1. IMPACT ASSESSMENT

1.1 BIODIVERSITY IMPACT ASSESSMENT

The Biodiversity Impact Assessment section evaluates the potential impacts of the proposed project on biodiversity, drawing on a comprehensive set of baseline data and secondary information. The baseline data collection process includes field surveys and interview to establish the status of biodiversity within the Project area. In addition, secondary information, such as data from the Integrated Biodiversity Assessment Tool (IBAT), has been used to supplement the baseline findings, providing a broader context for the project's potential effects on local biodiversity.

Based on the survey, 44 species of flora and 132 species of terrestrial and aquatic fauna. From IBAT 1,086 species have been flagged including one (1) fungus, three (3) annelids, 242 fishes, 112 Arthropod, 283 birds, 89 reptiles, 74 mollusks, 157 plants, 31 amphibians, 44 volant mammals (bat) and 26 non-volant mammals.

The Critical Habitat Assessment has been done and only one (1) species of bird, Cambodian Tailorbird is triggering Critical Habitat Criteria.

1.1.1 IMPACT ASSESSMENT CRITERIA

The criteria for assessing both impact magnitude and receptor sensitivity for biodiversity are categorized and described in **Table 1.1** and **Table 1.2**, respectively.

TABLE 1.1 CRITERIA FOR IMPACT MAGNITUDE FOR ASSESSMENT OF IMPACT TO BIODIVERSITY

Magnitude	Extent/ Duration/ Scale/ Frequency	
	Habitats	Species
Negligible	Immeasurable, undetectable or within the range of normal natural variation.	Immeasurable, undetectable or within the range of normal natural variation.
Small	May cause some minor impacts of limited extent, or to some elements of the area, are evident but easy to recover through natural regeneration.	May affect specific group of localized individuals within a population over a short time period (one generation or less) but does not affect other trophic levels or the population itself.
Medium	May affect some, if not all, of the area's ecological features, structures and functions in the short or medium term. The area or region may be able	May affect a portion of a population and may bring about a change in abundance and/ or distribution over one or more generations but does not threaten the integrity of that

Magnitude	Extent/ Duration/ Scale/ Frequency	
	Habitats	Species
	to recover through natural regeneration and restoration.	population or any population dependent on it.
Large	May affect the integrity of an area or region, by substantially changing, in the long term, its ecological features, structures and functions, across its whole area, that enable it to sustain the habitat, complex of habitats and/or population levels of species that makes it important.	May affect an entire population or species in sufficient magnitude to cause a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.

TABLE 1.2 CRITERIA FOR BIODIVERSITY RECEPTOR SENSITIVITY

Sensitivity	Designation / Importance / Vulnerability	
	Habitats	Species
Low	<p>A habitat not protected by law nor has a national or international designated conservation status.</p> <p>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.</p>	<p>A species not protected by law and/or not considered threatened by the IUCN red list (i.e., not designated as VU, EN, or CR)</p> <p>Not critical to other ecosystem functions (e.g. as prey to other species or as predator to potential pest species) or common / abundant locally.</p>
Medium	<p>A habitat that has designated conservation status at a national or regional scale.</p> <p>Areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary</p>	<p>A species population that has designated conservation status at a national or regional scale.</p> <p>A species common globally but rare locally. Important to ecosystem functions or under threat or population in decline.</p>

Sensitivity	Designation / Importance / Vulnerability	
	Habitats	Species
	ecological functions and species composition.	
High	A habitat that has designated conservation status at an international scale (e.g. IUCN). Areas of particular biodiversity importance that may support populations of restricted range, endemic or endangered species, or is in itself unique or threatened.	A species population that has designated conservation status at an international scale (e.g. IUCN). A species that is globally rare. A keystone species fundamental to the functioning of the ecosystem.

The biodiversity impact assessment criteria have been provided in **Table 1.3** below.

TABLE 1.3 THE BIODIVERSITY-IMPACT ASSESSMENT CRITERIA

Sensitivity/ Value	Magnitude of Effect on Biodiversity			
	Negligible	Small	Medium	Large
Negligible	Negligible	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Critical

1.1.2 IMPACT ASSESSMENT IN CONSTRUCTION PHASE

1.1.2.1 POTENTIAL IMPACTS

The following activities can have impacts to terrestrial flora and fauna during the Construction Phase of the Project.

- Site preparation;
- Construction of the airport, other infrastructure and runway extension
- Materials and wastes transportation

The impacts to biodiversity consist of physical disturbance or damage to a habitat or species. Examples include, but are not limited to:

- Impacts on legally protected areas and internationally recognized areas;
- Disturbance or loss of habitat;
- Disturbance of Critical Habitat
- Species disturbance and displacement;
- Direct Mortality or injury to individuals (particularly species of conservation significance);
- Temporary and permanent barrier creation, edge effects and fragmentation;

1.1.2.2 EMBEDDED CONTROL

The embedded controls to help avoid or minimize impacts to water, soil, air, and noise (as assessed in **ESIA Addendum – Physical Environmental Impact Assessment**) can have indirect beneficial effects to biodiversity. The controls proposed under these sections are also applicable here.

1.1.2.3 IMPACTS ON THE LEGALLY PROTECTED AREA AND INTERNATIONALLY RECOGNIZED AREAS

Impact Significance

The Project is located in Kandal province, Cambodia, it is not designed to be located in or overlap with any legally protected areas or internationally recognized areas such as KBAs. As a result, the Project will not affect any of these designated areas. Three (3) KBAs were identified within 50 km of the Project. The closest KBA is located 7 km to the east.

There is no both protected area and internationally recognized areas within the area of EAAA, the impacts outlined in this chapter are not anticipated to have any effect on the nearby KBAs. The assessment of the impacts on the legally protected areas and internationally recognized area is not required.

1.1.2.4 TERRESTRIAL AND AQUATIC HABITAT LOSS AND DEGRADATION

Impact Significance

The Project's EAAA (580.9 km²) consists mostly of modified habitat, which covers 91.9% of the total area. Only 8.1% of the total area is identified as natural habitat. Within the modified habitat, the main land use is cropland, covering 80% (465.19 km²) of the total EAAA in 2016. The Project area is surrounded by areas containing built-up areas, surface water, and wetlands.

The Project area of disturbance consists mostly modified habitat (66.54%, or 17.31 km² in 2016). The construction will disturb the natural habitat with area of 8.71 km² (33.46 % of total disturbance area), which is classified as wetland or flooded forest and surface water.

Groundwork and site preparation activities associated with clearing soil and backfilling it elsewhere can significantly impact wildlife habitat. The movement of heavy machinery during clearing and backfilling compacts the soil, and it will reduce its ability to absorb water and support plant life. Additionally, exposed soil is susceptible to erosion from wind and rain, which degrades the quality of both terrestrial and aquatic habitats.

The sensitivity of the habitat is considered to be **Low** because the area is not designated by law and/or IUCN as the area of conservation concern, Furthermore, the area primarily consists of modified habitat.

The magnitude of effect is likely to be **Medium** as all habitats within the Project boundary will be converted, but only 33.46 % of total is considered natural habitat. Some of the ecological features of the area will be lost in long term. The impact significance is therefore likely to be **Minor** for Natural Habitat before mitigation measures are implemented.

Additional Mitigation, Management, and Monitoring Measures

The following mitigation measures will be implemented in relation to habitat impacts during construction:

- Clearing vegetation outside of designated areas will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation outside designated areas.
- A Biodiversity Action Plan has been prepared to document the measures the Project has agreed to achieve no net loss of wetland habitat, which includes establishing protected areas program. As the construction will disturb the wetland habitat in 7.78 km² (778 ha), but the habitat itself has been partially degraded. In order to achieve NNL of wetland habitat, the target size of area required is calculated to be 622.4 ha based on the habitat hectare method (detailed in **ESIA addendum BAP**). The identified area within the Boeung Veal Samnap IBA and Tonle Bet will be raised to a conservation level covering a total area equal to the proposed target habitat size.

The following monitoring measures will be applied:

- Regular (weekly) checks during construction are to occur along all Project boundaries to ensure compliance with clearing within marked boundaries;
- Records are to be kept and regularly reviewed (quarterly) for implementation of the workforce training program for fauna/flora awareness;
- A monitoring plan should be carried out to identify and remove any invasive alien species within the Project area of disturbance. In addition, prompt revegetation (i.e., sowing of native herbaceous species and/or planting native shrubs/trees) on bare soil with natural or semi-natural vegetation will reduce the spread of alien species.
- Monitoring of rehabilitation success/failure is to occur on all replanting sites. Monitoring is to consist of regular inspections (3 monthly) to determine plant establishment. Where plant establishment is determined to have failed, reestablishment is to occur.

Residual Impact Significance

In view of the implementation of mitigation measures, the lost habitats will be compensated by establishing wetland preservation area of equal size to the NNL target within the identified areas of Tonle Bet and Boeung Veal Samnap IBA. As a result, to magnitude of the overall impact is reduced to **Small**, then the residual impact significance is reduced to be **Negligible** (**Table 1.4**).

TABLE 1.4 IMPACT ASSESSMENT FOR HABITAT LOSS AND DEGRADATION: CONSTRUCTION PHASE

Impact Significance					
Impact Nature	Negative		Positive		Neutral
	Loss of natural habitat for the area of construction.				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	The scale of the impact is likely to be local within the construction site boundary.				
Frequency	Impacts will arise from land conversion for construction of the airport and other infrastructure.				
Pre-mitigation Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Pre-mitigation Impact Significance	Negligible	Minor		Moderate	Major
Residual Impact Magnitude	Negligible	Small		Medium	Large
Residual Impact significance	Negligible	Minor		Moderate	Major

1.1.2.5 CRITICAL HABITAT TRIGGERED SPECIES DISTURBANCE

Impact Significance

The Critical Habitat Assessment, based on a review of the Integrated Biodiversity Assessment Tool (IBAT) data and the field survey findings, indicates that the area qualifies as critical habitat for the Cambodian Tailorbird (*Orthotomus chaktomuk*, NT). This is because the area meets IFC Performance Standard 6 Criterion 2 (i.e. Habitat of significant importance to endemic and/or

restricted range species) for this species. The Critical Habitat Assessment is included as part of the ESIA addendum.

The triggered species will lose habitat due to the disturbance by the Project. Individuals of this species present within the area of disturbance would then be forced to relocate to other areas.

The sensitivity of the critical habitat is considered to be **High** because the critical habitat assessment identified the area contain critical habitat for restricted-range or endemic species. While the magnitude of the impacts is considered **Small** as the affected habitat is relatively small and isolated (i.e., surrounded by modified habitat). The pre-mitigation impact significance is therefore considered **Moderate** for critical habitat.

Additional Mitigation, Management, and Monitoring Measures

The following mitigation measures will be implemented in relation to habitat impacts during construction:

- Clearing vegetation outside of designated areas will be prohibited for Project staff, workers, all contractors and personnel engaged in or associated with the Project, with penalties levied, including fines and dismissal, and prosecution under the relevant laws for clearing vegetation outside designated areas.
- The Project aims to achieve a net gain for the target species by establishing a protected area of equal size to the NNL target within the identified areas of Tonle Bet and Boeung Veal Samnap IBA as detailed in the Biodiversity Action Plan (**ESIA addendum BAP**).

Residual Impact Significance

In view of the implementation of mitigation measures, the lost habitats will be compensated by establishing wetland preservation areas of equal size to the NNL target within the identified areas of Tonle Sap and Boeung Veal Samnap IBA. The preserved wetland area will provide benefits to Cambodian Tailorbird in long term, as long as the area has the protection from the habitat loss. The residual impact magnitude remains **Small**, and the residual impact significance remains **Moderate**. (**Table 1.5**).

TABLE 1.5 IMPACT ASSESSMENT FOR CRITICAL HABITAT TRIGGERED SPECIES
DISTURBANCE: CONSTRUCTION PHASE

Impact Significance				
Impact Nature	Negative		Positive	Neutral
	Potential disturbance to the rare and restricted range species.			
Impact Type	Direct		Indirect	Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local		Regional	International

Impact Significance					
Impact Scale	The scale of the impact is likely to be local				
Frequency	Impacts will arise from land conversion for construction of the airport and other infrastructure.				
Pre-mitigation impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Pre-mitigation impact Significance	Negligible	Minor	Moderate		Major
Residual Magnitude	Negligible	Small	Medium	Large	
Residual Impact significance	Negligible	Minor	Moderate		Major

1.1.2.6 TERRESTRIAL AND AQUATIC SPECIES DISTURBANCE AND DISPLACEMENT

Impact Significance

The disturbance and displacement of resident fauna species within the footprint will primarily be caused by light, noise and vibration impacts during construction. These impacts are considered to be indirect impacts caused by the use of Project machinery and equipment.

Noise, light and vibration disturbances have the potential to influence breeding, roosting or foraging behaviors of fauna.¹ During construction phase, temporary impacts from the Project are expected. Noise will be the primary disturbance of this nature due to vegetation clearing, soils levelling, movement of materials and construction activities for airport and other facilities. These activities will introduce noise sources to areas not currently exposed to these disturbances. In addition, there may be vibration associated with the movement of any heavy vehicles/machinery.

The consequences of these influences are dependent on the extent of disturbance but in extreme cases these factors can influence local populations. For example, if breeding and communication is influencing lifecycle, or, if individuals are displaced from noisy areas and home ranges are reduced. Excessive noise can impede fauna communication and deter the use of habitats nearby. Similarly, introducing light sources has the potential to deter foraging and dispersal activities of nocturnal species.

The duration of construction activities it is expected to be temporary (36 months). Similarly, it should be noted that the noise, light and vibration disturbances will not be continuous for the construction period or focused on any one specific location for the total time. Noise, light and vibration disturbances will occur should not extend more than 1 km beyond the Project's area

¹ van der Ree, R., Smith, D.J. and Grilo, C., 2015. *Handbook of road ecology*. John Wiley & Sons.

of disturbance. Construction works that produce high noise and vibration level will be limited to daytime hours (Between 7 am to 6 pm, see more detail in **EIA Chapter 7**).

Although the construction schedule is expected to span multiple breeding seasons, noise, light and vibration disturbance are unlikely to occur at the same time and will be localized. The area affected by this disturbance is predominantly classified as modified habitat. Therefore, the species potentially impacted by this construction are primarily those living within the already disturbed areas, such as small mammals, reptiles, and amphibians, which are already somewhat acclimated to these disturbances.

The biodiversity baseline study identified four (4) vulnerable terrestrial species found within these modified habitats according to the IUCN Red List, which are the Burmese Python, Indochinese Spitting Cobra, King Cobra, and Fishing Cat. Additionally, two (2) vulnerable fish species, *Hypsibarbus lagleri* and *Cirrhinus microlepis*, were confirmed through interviews with local stakeholders. These vulnerable terrestrial species can typically be found in modified habitats because their prey consists of small mammals or reptiles that can live in cropland and nearby built-up area.^{2 3 4 5} The vulnerable fish species *Cirrhinus microlepis* is also widespread in Thailand, particularly in Ubon Ratchathani, Mukdahan, and Chiang Rai provinces, while *Hypsibarbus lagleri* is endemic to the middle Mekong basin.

The sensitivity of these species is considered to be **Medium** due to the species having high IUCN conservation status. The magnitude of the effect on terrestrial and aquatic fauna due to disturbance and displacement is considered **Small**. This is because the impact will be limited to a small area, the species of concern are already acclimated to some level of disturbance and/or are not especially sensitive to these disturbances. The pre-mitigation impact significance is therefore **Minor**.

Additional Mitigation, Management, and Monitoring Measures

The following mitigation measures will be applied in relation to habitat impacts during construction:

- Use of signs and/or fences in access roads and construction sites, to avoid any impact to areas out of the Project footprint. Protective measures should be implemented especially on the locations of active construction works. Use of fences in the construction sites will also avoid the entrance of fauna and avoiding accidents.
- Whenever possible, night lighting should be minimized. If lighting is necessary, it should be directed inwards to the Project area.
- Outdoor light source should install shielded light fixture to minimize the light pollution.

² Smith, S. N., Jones, M. D., Marshall, B. M., Waengsothorn, S., Gale, G. A., & Strine, C. T. (2021). Native Burmese pythons exhibit site fidelity and preference for aquatic habitats in an agricultural mosaic. *Scientific reports*, 11(1), 7014.

³ Wüster, W., Warrell, D. A., Cox, M. J., Jintakune, P., & Nabhitabhata, J. (1997). Redescription of *Naja siamensis* (Serpentes: Elapidae), a widely overlooked spitting cobra from SE Asia: geographic variation, medical importance and designation of a neotype. *Journal of Zoology*, 243(4), 771-788.

⁴ Lim, K. K., Leong, T. M., & Lim, F. L. (2011). The king cobra, *Ophiophagus hannah* (cantor) in singapore (Reptilia: Squamata: Elapidae). *Nature in Singapore*, 4, 143-156.

⁵ Phosri, K., Tantipisanuh, N., Chutipong, W., Gore, M. L., Giordano, A. J., & Ngoprasert, D. (2021). Fishing cats in an anthropogenic landscape: A multi-method assessment of local population status and threats. *Global Ecology and Conservation*, 27, e01615.

- Native plant species shall be prioritized for the land rehabilitation program in order to create green vegetation cover in the Project Site after completion of construction works.
- If vulnerable species are encountered during Project activities, they will be relocated to other protected or designated conservation areas by qualified wildlife rescue personnel.

Residual Impact Significance

In view of the mitigation measures described above, whenever the vulnerable species are found during the construction, they will be relocated to suitable protected or designated areas to ensure no harm to biodiversity receptors. the residual impact magnitude is reduced to **Negligible** and, therefore, the residual impact significance is **Negligible** for terrestrial species (**Table 1.6**).

TABLE 1.6 IMPACT ASSESSMENT FOR SPECIES DISTURBANCE AND DISPLACEMENT: CONSTRUCTION PHASE

Impact Significance						
Impact Nature	Negative		Positive		Neutral	
	Potential disturbance to the rare and restricted range species.					
Impact Type	Direct		Indirect		Induced	
Impact Duration	Temporary	Short-term		Long-term	Permanent	
Impact Extent	Local		Regional		International	
Impact Scale	The scale of the impact is likely to be local					
Frequency	Impacts will arise intermittently from land preparation activities and construction of the airport and other infrastructure.					
Pre-mitigation impact Magnitude	Positive	Negligible	Small		Medium	Large
Resource Sensitivity	Low		Medium		High	
Pre-mitigation impact Significance	Negligible		Minor		Moderate	Major
Residual Magnitude	Negligible		Small		Medium	Large
Residual Impact significance	Negligible		Minor		Moderate	Major

1.1.2.7 TERRESTRIAL SPECIES DIRECT MORTALITY CAUSED BY VEHICLE STRIKE, HUNTING AND POACHING

Impact Significance

During construction, several factors may cause fauna mortality including vehicle or machinery strikes, mortality from construction activities especially for less mobile species, and increased hunting or poaching pressure as a result of workforce presence.

In this case, construction vehicles will primarily be transiting across modified habitat to reach the construction site, so the magnitude of potential vehicle strikes is considered low. However, some species which are present, such as snakes, are susceptible to vehicle strikes. The Project will involve significant earthmoving activities, which could result in mortality for less mobile species, but among the threatened species found in the areas, this is primarily limited to snakes. The presence of construction workers has resulted in increased hunting or poaching activities in many areas, but in this case there are few species present that are attractive targets for hunting or poaching.

The sensitivity of the species present is considered **Medium** because of the presence of several threatened species. The magnitude of effect due to the impacts is **Small** as the effect will not cause a substantial change to the species populations during constructions. The pre-mitigation impact significance of this impact is therefore **Minor**.

Additional Mitigation, Management, and Monitoring Measures

The following mitigation measures are to be applied in relation to habitat impacts during construction:

- To limit vehicle strikes, vehicle speeds will be limited and drivers will be familiarized with the sensitivity of local fauna and instructed to take appropriate evasive action when wildlife is seen along the road and to report all vehicle strikes.
- To limit mortality from construction activities, the Project will establish a Wildlife Shepherding Protocol involving the relocation by a trained specialist of any threatened wildlife species found during construction to a conservation area.
- To limit poaching and hunting, a worker code of conduct will be established that prohibits these activities, including penalties up to and including dismissal.

Residual Impact Significance

In view of the implementation of mitigation measures, vehicles will be limited to slow speeds to reduce the chance of wildlife strikes. Additionally, workers will be prohibited from poaching and hunting any wildlife. the residual impact magnitude is reduced to **Negligible** and therefore, the residual impact significance is **Negligible** (**Table 1.7**).

TABLE 1.7 IMPACT ASSESSMENT FOR DIRECT MORTALITY CAUSED BY VEHICLE STRIKE, HUNTING AND POACHING: CONSTRUCTION PHASE

Impact Significance			
Impact Nature	Negative	Positive	Neutral

Impact Significance					
	Potential for mortality of rare or restricted-range species.				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	The scale of the impact is likely to be local				
Frequency	Impacts will arise intermittently from land preparation activities and construction of the airport and other infrastructure.				
Pre-mitigation impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Pre-mitigation impact Significance	Negligible	Minor		Moderate	Major
Residual Magnitude	Negligible	Small		Medium	Large
Residual Impact significance	Negligible	Minor		Moderate	Major

1.1.3 IMPACT ASSESSMENT IN OPERATION PHASE

1.1.3.1 POTENTIAL IMPACTS

Impacts to biological resources during the operation phase consist of physical disturbance or damage to a habitat or species as following:

- Mortality of avifauna due to aircraft strike
- Mortality of fauna due to car strike
- Fauna disturbance by noise and light from the airport

1.1.3.2 MORTALITY OF AVIFAUNA DUE TO AIRCRAFT STRIKE

Impact Significance

Bird strikes by aircraft can result in mortality and poses a significant risk to some avian species. Bird strikes can occur at any point during flight. However, the risk is highest during take-off, initial climb, approach, and landing because these phases involve more birds flying at lower altitudes where they intersect with aircraft flight paths. Additionally, as most birds are active during the day, the majority of bird strikes also occur during daylight hours. Bird strike records indicate that approximately 85% of incidents involve aircraft below 800 feet, 15% occur remotely from the airfield, and further analysis reveals that up to 40% happen beyond the airport perimeter.^{6 7} In addition to impacts to the individual avifauna, these bird strikes also poses safety risks to the aircraft.

Based on the biological baseline data, two locations have been identified as potential bird habitats. Boueng Rean, located northeast of the Project site, and Boueng Cheung Loung, situated southeast of the airport, are these potential habitats. The most abundant birds found during the study were Plain Prinia (*Prinia inornata*), Black-winged Stilt (*Himantopus himantopus*), and Little Egret (*Egretta garzetta*). The Critical Habitat Assessment also identified a small bird, the Cambodian Tailorbird (*Orthotomus chaktomuk*).

Records of bird species that form small or large flocks and may fly at high altitudes (possibly exceeding 150 meters) are listed below:

- Javan Pond Heron (*Ardeola speciosa*, LC)
- Chinese Pond Heron (*Ardeola bacchus*, LC)
- Cattle Egret (*Bubulcus ibis*, LC)
- Great Cormorant (*Phalacrocorax carbo*, LC)
- Spot-billed Pelican (*Pelecanus philippensis*, NT)
- Lesser Whistling Duck (*Dendrocygna javanica*, LC)

The Asian Openbill (*Anastomus oscitans*, LC) was not recorded during the bird survey, but its presence in the area is likely due to its documented distribution throughout agricultural landscapes.

⁶ Thorpe, J (1987), 'Civil Aviation Birds Record', Royal Aeronautical Society Bird Hazards in Aviation Conference, 14 October, London, p5.

⁷ Riddington, R (2000), 'The Large Flocking Bird Hazard', Flight Safety Foundation / International Federation of Airworthiness / International Air Transport Association, International Air Safety Seminar, New Orleans, November

The sensitivity of the avian species present in the Project area is considered **Low** as the biodiversity receptors are not designated by law and/or IUCN as high conservation species. Although the one critical habitat bird species found, the Cambodian Tailorbird, is not well studied, in general birds of this genus are not strong fliers and tend to remain close to its preferred wetland shrub habitat. Therefore, it is unlikely to be at risk from aircraft strikes. The magnitude of the impact regarding aircraft strike is considered **Small**. This is because the impact may affect specific bird groups, and the bird species identified during the study are unlikely to be affected by the impact. The pre-mitigation impact significance is **Negligible** before mitigation measures are implemented.

Additional Mitigation, Management, and Monitoring Measures

As the impact significance is assessed as Negligible, no additional mitigation measures are required. It is recommended that the airport keep a record of bird strikes to determine if additional mitigation measures may be needed from an aircraft safety perspective.

Residual Impact Significance

In view of the implementation of mitigation measures, the residual impact remains of **Negligible** significance (**Table 1.8**).

TABLE 1.8 IMPACT ASSESSMENT FOR SPECIES MORTALITY AVIFAUNA DUE TO AIRCRAFT STRIKE: OPERATION PHASE

Impact Significance					
Impact Nature	Negative		Positive		Neutral
	Potential impact to the restricted-range bird species.				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	The scale of the impact is likely to be local				
Frequency	Impacts will arise intermittently throughout the operation of the airport.				
Pre-mitigation impact Magnitude	Positive	Negligible		Small	Medium Large
Resource Sensitivity	Low		Medium		High
Pre-mitigation impact Significance	Negligible		Minor Moderate		Major

Impact Significance				
Residual Magnitude	Negligible	Small	Medium	Large
Residual Impact significance	Negligible	Minor	Moderate	Major

1.1.3.3 TERRESTRIAL SPECIES DIRECT MORTALITY BY VEHICLE STRIKE

Impact Significance

The operation phase of airports may lead to increased wildlife mortality due to vehicle strikes. Airports require extensive ground transportation infrastructure, including service roads and parking areas, which may intersect either natural habitat or modified habitat. Vehicles moving at high speeds pose a significant risk to animals crossing these roads, leading to frequent collisions. These vehicle strikes not only result in the immediate death of individual animals but can also have broader ecological impacts, such as reducing local wildlife populations, and disrupting breeding cycles.

However, terrestrial wildlife will be prevented from entering the airport during the operation phase due to the installation of the perimeter dike and security fence around the airport, which will be completed during the construction phase.

The sensitivity of the species is **Medium** because the threatened species found (i.e., several snake species and the fishing cat) are only classified as vulnerable and are already acclimated to risks associated with modified habitats. The magnitude of effect is considered **Negligible** given the predominance of modified habitat, the conversion of most of the habitat within the airports boundary to developed land uses, and the presence of a dike and security fence to further restrict wildlife access to areas where they could be susceptible to vehicular strikes. Therefore the overall impact significance is **Negligible**.

Additional Mitigation, Management, and Monitoring Measures

As the impact significance is assessed as Negligible, no additional mitigation measures are required.

Residual Impact Significance

In view of the implementation of mitigation measures, the residual impact remains of **Negligible** significance (**Table 1.9**).

TABLE 1.9 IMPACT ASSESSMENT FOR TERRESTRIAL SPECIES MORTALITY BY VEHICLE STRIKE DURING OPERATION PHASE

Impact Significance				
Impact Nature	Negative		Positive	Neutral
	Potential impact to the rare and restricted-range species.			
Impact Type	Direct		Indirect	Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local		Regional	International

Impact Significance					
Impact Scale	The scale of the impact is likely to be local				
Frequency	Impacts will arise intermittently from the transportation of the passengers, materials and waste during the operation phase.				
Pre-mitigation impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Pre-mitigation impact Significance	Negligible	Minor		Moderate	Major
Residual Magnitude	Negligible	Small		Medium	Large
Residual Impact significance	Negligible	Minor		Moderate	Major

1.1.3.4 FAUNA DISTURBANCE FROM NOISE AND LIGHT DURING OPERATION PHASE

Impact Significance

The operation phase of airports can significantly disturb wildlife due to increased noise and artificial lighting. Aircraft noise, both from takeoff and landing, can create a persistent and high-decibel environment that can disrupt animal communication, breeding, and feeding behaviors. Furthermore, safety management team of the airport may use noise cannon to keep air space clear for takeoff and landing, which also disrupt ecological functions.

For instance, birds may abandon nests, and mammals may avoid otherwise suitable habitats. Aircraft noise originates from both the engines and the airframe, with the most significant impact occurring during landing and takeoff, particularly along frequently used flight paths. Other activities within the airport such as the application of reverse-thrust (an optional braking aid on landing), engine tests and on-site vehicular traffic can also generate noise pollution to wildlife around the airport. The significance of noise impact is determined by factors such as volume, duration, location, time and frequency.

Nocturnal wildlife, species that rely on natural light cycles for navigation and foraging at night, are particularly susceptible to disruption by continuous artificial lighting from runways and terminals. Continuous lighting throughout the night can attract wildlife directly or indirectly. For example, light may attract insects, which in turn attract bats and birds to the area. Furthermore, light pollution can disrupt wildlife's natural rhythms, including sleep and hibernation.⁸ The impacts of artificial light are primarily limited to terrestrial biodiversity, unless the light is installed near water habitats. However, the species screening did not identify any species likely to be disturbed during the operation phase.

The sensitivity of the biodiversity receptors in the EAAA is considered **Medium** because of the presence of several threatened species (IUCN Vulnerable). However, the magnitude of these impacts is considered **Negligible** given that the species present are already acclimated to modified habitat, several of the threatened species are not especially sensitive to noise impacts (e.g., several species of snakes), and the fact that little to no natural habitat will remain within the airport boundary after construction where the greatest noise and light impacts will occur. The pre-mitigation impact significance is **Negligible**.

Additional Mitigation, Management, and Monitoring Measures

As the impact significance is assessed as Negligible, no additional mitigation measures are proposed.

Residual Impact Significance

The residual impact significance remains **Negligible** for fauna disturbance (**Table 1.10**).

TABLE 1.10 IMPACT ASSESSMENT FOR FAUNA DISTURBANCE DURING OPERATION PHASE

Impact Significance			
Impact Nature	Negative	Positive	Neutral

⁸ Rich, C. and T. Longcore, Ecological Consequences of Artificial Night Lighting, Island Press, Washington, DC.

Impact Significance					
	Potential disturbance to the rare and restricted range species.				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	The scale of the impact is likely to be local within the airport boundary.				
Frequency	Impacts will arise intermittently from the operation of artificial lights at the airport facilities.				
Pre-mitigation impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Pre-mitigation impact Significance	Negligible	Minor		Moderate	Major
Residual Magnitude	Negligible	Small		Medium	Large
Residual Impact significance	Negligible	Minor		Moderate	Major



ERM HAS OVER 160 OFFICES ACROSS THE FOLLOWING
COUNTRIES AND TERRITORIES WORLDWIDE

Argentina	The Netherlands
Australia	New Zealand
Belgium	Peru
Brazil	Poland
Canada	Portugal
China	Romania
Colombia	Senegal
France	Singapore
Germany	South Africa
Ghana	South Korea
Guyana	Spain
Hong Kong	Switzerland
India	Taiwan
Indonesia	Tanzania
Ireland	Thailand
Italy	UAE
Japan	UK
Kazakhstan	US
Kenya	Vietnam
Malaysia	
Mexico	
Mozambique	

ERM-Siam Co., Ltd.

179 Bangkok City Tower,
24th Floor,
South Sathorn Road,
Thungmahamek, Sathorn,
Bangkok, 10120, Thailand

T: (662) 074 3050

www.erm.com