

Site-Specific Environmental and Social Impact Assessment (ESIA)

SCATEC- SHADWAN 900MW at Gulf of Suez

Biodiversity Management Plan

July 2026

FINAL

REV-2



Client:



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Abbreviations

AOI	Area of Influence
ATMP	Active Turbine Management Plan
BMP	Biodiversity Management Plan
CHA	Critical Habitat Assessment
EBRD ESR6	European Bank for Reconstruction and Development Environmental and Social Requirement 6
EEAA	Egyptian Environmental Affairs Agency
EPC	Engineering, Procurement, and Construction
ESIA	Environmental and Social Impact Assessment
HSSE	Health, Safety, Security and Environment
IBA	Important Bird Area
IFC PS6	International Finance Corporation Performance Standard 6
IUCN	International Union for the Conservation of Nature
KBA	Key Biodiversity Area
NCE	Nature Conservation Egypt
RCREEE	Regional Centre for Renewable Energies and Energy Efficiency

1 INTRODUCTION

1.1 The Report

This document details a Biodiversity Management Plan (BMP) for the SCATEC- SHADWAN 900MW Wind Power Project, Gulf of Suez, Egypt. This BMP details the procedure for the implementation of the Project's biodiversity mitigation and management measures during the pre-construction (pre-clearance) and construction phases that will be followed by the Project Company and the EPC Contractor. It also includes outline details of the mitigation, monitoring and management measures for the operational phase of the Project that will be fully detailed in an updated BMP, when all project details are known.

1.2 Purpose and Scope

This BMP details the Project's biodiversity management initiatives, commitments, and obligations to safeguard and promote the viability of priority species and habitats associated with the Project.

Implementation of this BMP will ensure the Project's alignment with best practice, legislative requirements and the Project's commitments to biodiversity. It is a dynamic document that will be adapted and updated as and when new information becomes available throughout the lifespan of the Project to ensure its relevancy.

The purpose of this document is to:

- Set out the Project commitments and obligations related to biodiversity, and ensure compliance with relevant legislation, and the overarching requirements of the Project.
- Provide a summary of the baseline biodiversity conditions within the Project site.
- Identify activities that may have an impact on fauna and flora, highlighting the major biodiversity threats.
- Specify management, mitigation and enhancement measures / actions to be implemented for the Project to control impacts affecting the biodiversity within the project's area of influence.
- Identify roles and responsibilities for the implementation of identified actions.
- Outline training requirements, including awareness raising for workers.
- Specify monitoring and evaluation criteria, including KPIs to demonstrate no-net loss and net gains where applicable.
- Outline reporting requirements to Project stakeholders.

This document is considered part of the ESMS that will be implemented during the construction and operation of the Project.

The BMP is structured as follows:

- Section 1: Introduction
- Section 2: Provides an overview of the biodiversity elements within the Project Area
- Section 3: Presents the key impacts anticipated from each phase of the Project
- Section 4: Presents the mitigation requirements to be implemented
- Section 5: Roles and responsibilities related to the plan.

1.3 The Project Site and the Study Area

The SCATEC- SHADWAN 900MW Wind Power Project is located in the Ras Gharib Local Governmental Unit of the Red Sea Governorate of Egypt, approximately 270 km to the south-east of the capital city of Cairo. The nearest town is Ras Gharib, which is located 25 km to the north-east of the Project area. The Project is proposed to occupy approximately 90 km² (shown in *Figure 1*).

The Project site has an area of 90 km² and includes the following components:

- Wind turbines: The Project will be composed by 83 turbines (11 MW), each with a rotor diameter of 210 m and tip height of 220 m;
- Medium Voltage (MV) Cables: The wind turbines will be connected through underground transmission cables medium voltage cables (33kV or 35kV) to an onsite substation;
- Communications Network: The Project will have a Supervisory Control and Data Acquisition (SCADA) system for the remote operation of the facilities. A communication network will be installed in the same trenches as the MV cables which will consist of fiber optic cables connecting the turbines together to the SCADA system at the substation;
- Substation: This infrastructure collects and converts the output from the turbines to a higher voltage;
- Building Infrastructure: Onsite building infrastructure could include an administrative building (offices) used for normal daily operational related work, control room, workshop and a warehouse for storage of equipment and machinery;
- Road network: An internal road network will be required within the Project site for installation of the turbines during the construction process and for ease of access to the turbines for maintenance purposes during operation;
- Other Temporary Components: Temporary components include temporary offices, laydown areas, batching plant, borrow pits, generators
- Overhead Transmission Line (OHTL): A 220 or 500 kV s line that will connect the Project to the national grid. At this stage there are no details on the OHTL specifications (route, height, number of electrical towers, etc.) and therefore this infrastructure is outside the scope of this CHA.

Being located by the western coastline of the Gulf of Suez, the project site and the general study area are located along the Red Sea/Rift Valley flyway. This is one of the most important migration flyways or migratory soaring birds in the world with over 1.5 million soaring birds migrating through it twice a year (Birdlife, 2023)¹. The flyway links the European breeding grounds with the African wintering areas for at least 37 migratory soaring bird species. Regular migration monitoring along the western coast of the Gulf of Suez where the project is located has shown that there is a significant difference in the level of use of the area during migration seasons. Research has shown that this part of the flyway is used by much larger numbers of birds during spring migration in comparison with autumn migration seasons.

Approximately 5 km east of the site is the Gebel El Zeit Important Bird area (IBA) which is a narrow, 100-km-long strip of land extending along the Gulf of Suez/Red Sea coast, from Ras Gharib in the north to the bay of Ghubbet El Gemsa in the south. This contains several pools of hyper-saline water and large patches of saltmarsh as well as two large shallow bays with extensive intertidal mud and sandflats (Birdlife, 2026)². The IBA and surrounding area is known to be used by over 250,000 migratory soaring birds each year, with many of these birds crossing between the western shore of the Gulf of Suez and the Sinai Peninsula on their spring and autumn migrations. A map of the concentrated Rift Valley/Red Sea flyway elements is shown in *Figure 2* (N.B. birds migrate across the general area in Spring and Autumn, however concentrated crossing points have been identified at several

¹ Birdlife International 2023. <https://www.birdlife.org/news/2023/08/01/fostering-partnerships-for-bird-safe-energy-in-ethiopia/>

² BirdLife International (2026) Site factsheet: Gebel El Zeit. Downloaded from <https://datazone.birdlife.org/site/factsheet/6217-gebel-el-zeit> on 16/07/2026

locations along the coastal areas of Egypt).

As part of the Environmental and Social Impact Assessment (ESIA) for the project, in-flight monitoring assessments were undertaken at the project site during the spring and autumn seasons 2025. Additionally, a comprehensive literature review was completed.

A Critical Habitat Assessment has also been completed for the Project. This found that the site is Critical Habitat for two species, on account of birds in significant number and/or of higher conservation concern flying through the Project Area and buffer. These are Steppe Eagle and White Stork.

Habitat on site appears to broadly be natural habitat, but it is highly disturbed and degraded. One reptile - the Egyptian Spiny-tailed lizard (IUCN VU), one mammal - the Dorkas Gazelle (both IUCN VU), 30 migratory bird and one resident bird species, are all considered to be Priority Biodiversity Features and will be the focus of this BMP document.



Figure 1: Project Site

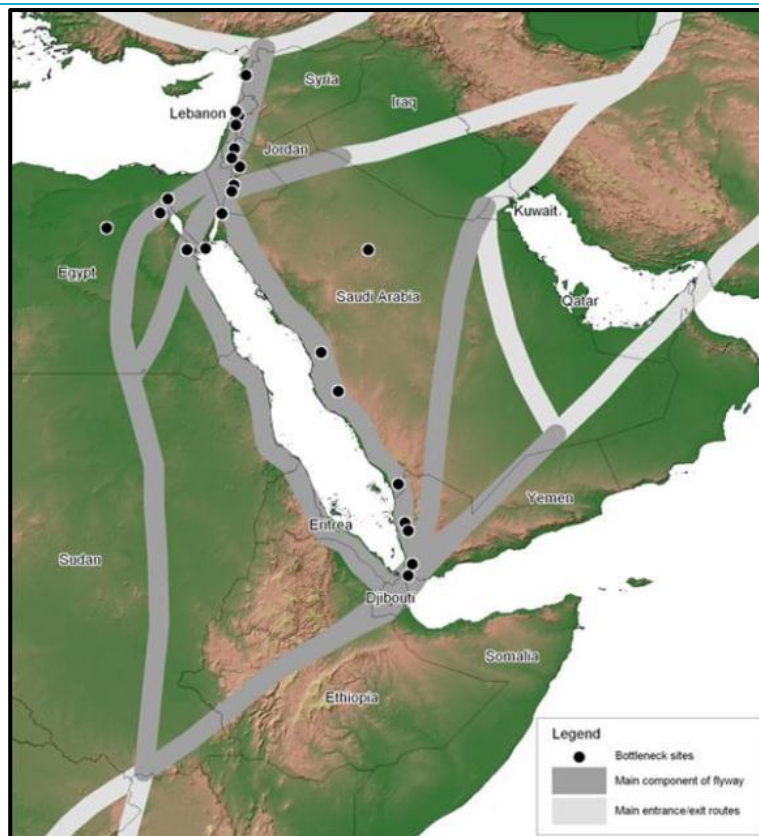


Figure 2: Map of the main elements of the Rift Valley/Red Sea flyway showing key bottleneck sites (Source: BirdLife International)

1.4 Lenders Standards

Standards for the IFC and EBRD performance standards/requirements are detailed below.

The Lender requirements indicate that protecting and conserving biodiversity, and its ability to change and evolve, is fundamental to sustainable development. The requirements set out in the standards/requirements have been guided by the Convention on Biological Diversity, which defines biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems.” The three principal objectives are:

- a) to protect and conserve biodiversity,
- b) to maintain the benefits from ecosystem services, and
- c) to promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.

The overall objective of the Project is to ensure:

- Ecological processes are maintained and are not disrupted.
- Impacts on fauna and flora species as a result of construction and O&M activities are minimized.
- “No net loss” for any Priority Biodiversity Features / Feature of Significant Biodiversity Value.
- Net Gains for Critical Habitat qualifying species; and
- Ensure no net negative residual impact on other ecological receptors.

Achieving these objectives requires that the mitigation hierarchy is exercised to manage project related impacts by taking appropriate avoidance, minimization and restoration measures before biodiversity offsets are considered to compensate for significant residual impacts.

2 OVERVIEW OF BIODIVERSITY

2.1 Designated Areas

2.1.1 Legally Protected Areas

No national or international designations were identified within the site boundary for SCATEC- SHADWAN 900MW Wind Power Project.

The Project location is not located within any existing or planned natural protectorates, where the closest is around 10km away - Malahet Ras Shukeir.

2.1.2 Internationally Recognized Areas

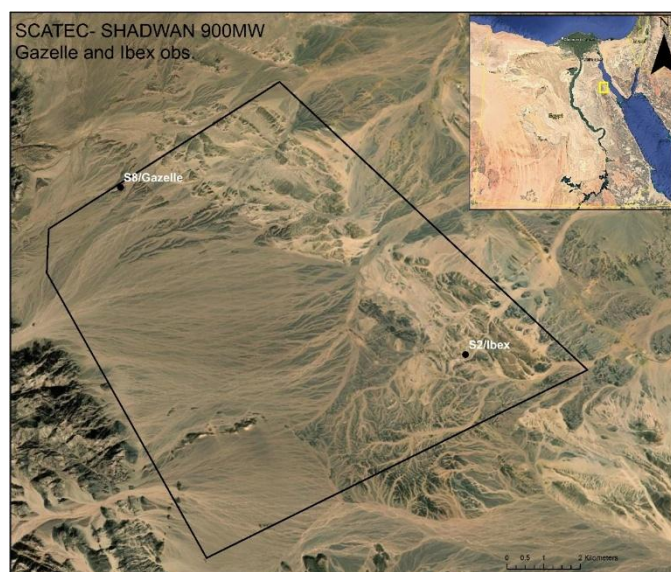
The nearest designated internationally recognised area is the Gebal El Zeit IBA which is located approximately 5km east of SCATEC- SHADWAN 900MW Wind Power Project. This is designated as an important migration corridor for soaring migrants, particularly birds of prey and White Storks (*Ciconia ciconia*).

2.2 Habitats, Flora and Terrestrial Fauna

The field survey for baseline biodiversity data was undertaken at the Project site during April-May 2025. The focus of the field survey was mainly to identify key habitats and identify any outstanding biodiversity taxa and/or elements that could require specific focus.

The initial field survey mainly included field observations, where the site was examined carefully for the presence of active animals, animal signs and tracks, active burrows, remains or any other vital signs that indicate the activity of animals. Sampling was undertaken over a varying number of points for different sampling methods. Points were distributed randomly to cover the whole area of the study, bearing in mind a minimum influence area of 1km to avoid double sampling. Stratification was not applied, as the area was considered homogeneous on both ecological and topological scales. The observed plant species were recorded over a circular area of 100m in diameter, using the quadrat method, whereas small mammals were recorded using the live-trap approach.

No rare or threatened habitats were identified during the surveys, although the Project Area is considered largely natural habitat, being primarily coastal plains habitat and the wadis. No endemic or higher conservation status plant species were identified in the surveyed area, similarly no endemic fauna species were identified in that area either. Nubian Ibex (*Capra nubiana*) (IUCN VU) and Dorcas Gazelle (*Gazella dorcas*) (IUCN VU) have been identified as present on the site. Wide ranging Striped Hyena (*Hyaena hyaena*) (IUCN NT) was identified as having ranges which overlap with the Project Area, however no evidence was found during the surveys.



	Stand ID	Latitude	Longitude	
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24-5-2025	2	28.065875	33.047423	Capra Nubiana (Ibex)
24-5-2025	8	28.106885	32.962807	Gazella dorcas (Gazelle)

Figure 3 and Table 1 observed Gazelle and Ibex records on the site and coordinates

One globally threatened IUCN Vulnerable reptile species, the Egyptian Spiny-tailed Lizard, was found in the Project Area during the surveys. The species was recorded along with its burrows as noted below. In total 89 individual and further signs/burrows were identified during the surveys, both active at the time of survey (defined by having footprints, drag marks or signs of fresh digging at the entrance) and not active. Observations were at a density of 1.077 per km². The spatial distribution of these observations in the project site shows a noticeable concentration of the species on the western side of the study site and towards the higher grounds, as shown in Figure 4.

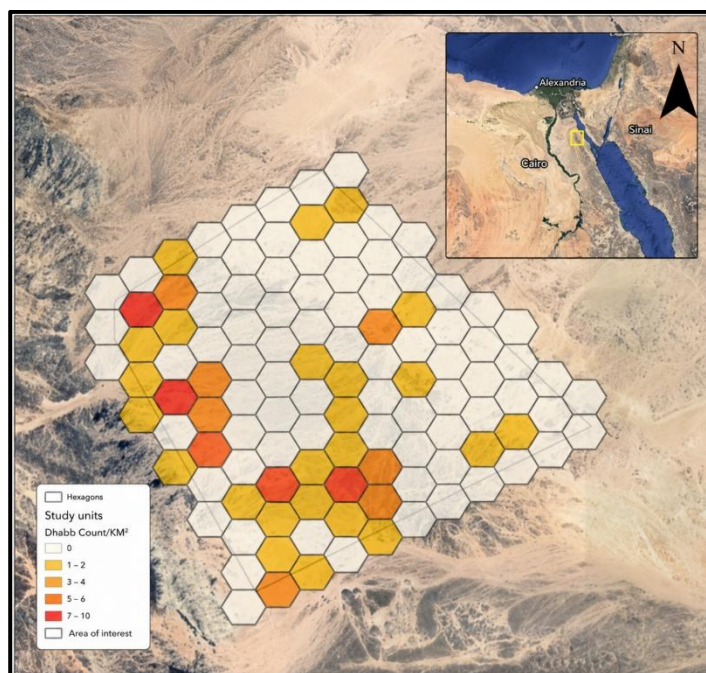


Figure 4 spatial distribution of presence marks of spiny-tailed lizard (*Uromastix aegyptia*) on the site

2.3 Bats

Automated detector surveys were undertaken during May to October 2025 at two locations on site. The detectors were on site for a total of 106 nights (combined total of 212 nights) and recorded from 30 minutes before sunset until 30 minutes after sunrise. All recorded audio files were checked and any bat calls analysed with “Anabat Insight” using Auto ID.

There are no natural or man-made structures on site suitable for use by roosting bats.

Only 75 bat calls/passes were recorded from one recording location. Two species were recorded; *Taphozous perforates* and *Pipistrellus kuhlii*, both of which are listed as Least Concern on the IUCN Red List.

2.4 Birds

Vantage point surveys were undertaken at the site in spring and autumn 2025, with eight vantage points selected to cover the entire Project Area. These were surveyed by experienced surveyors, with all flight times, direction and heights recorded on standardized forms. In total the site received over 2,861 hours of survey in spring and 2,975 hours in autumn to cover the major periods of migration in the region.

Spring recorded a total of 121,372 birds of 31 species. 72.93% of the birds involved only three (3) species; the White Stork *Ciconia ciconia*, Steppe Buzzard *Buteo buteo vulpinus*, and the Honey Buzzard *Pernis apivorus*.

Autumn recorded a total of 58,713 birds of 24 species. 99.01% of the birds recorded involving the White Stork, Honey Buzzard, and the Great White Pelican.

Five of these species are globally threatened, including two (2) Endangered-EN (Steppe Eagle and the Egyptian Vulture), and three (3) Vulnerable-VU species (Eastern Imperial Eagle, Greater Spotted Eagle and Sooty Falcon). In addition, one (1) species are Near Threatened-NT (Pallid Harrier). All the remaining species observed are classified as Least Concern-LC.

2.5 Assessment of Ecological Receptors

2.5.1 Modified and Natural Habitats

The Project Area contains largely natural habitat, being primarily coastal plains habitat and the wadis. No endemic or higher conservation status plant species were identified in the surveyed area. Approximately 2km² of natural habitat will be impacted during the proposed works. The Project has a No Net Loss target for priority Natural Habitat.

2.5.2 Critical Habitat

The site has been assessed as Critical Habitat for two species, on account of birds in significant number and/or of higher conservation concern flying through the Project Area and buffer. These are Steppe Eagle and White Stork, as shown in table 2. The Project has a Net Gain target for CH-qualifying features.

2.5.3 Priority Biodiversity Species

Thirty (29) migratory birds, one reptile and one mammal species have been assessed as being Priority Biodiversity Features (PBFs) for the project as shown in table 2. The Project has a No Net Loss target for priority PBFs.

However, only one individual of the Dorcas Gazelle was recorded in the Project area, where no suitable grazing habitats for the species were identified (Safe Soar 2025). This record appears to be far from any other recent known population of the species, so it should be treated as a newly discovered population and handled with caution.

Table 2: Summary of Sensitive Receptors and Species ³

Receptor	Conservation Status IUCN	Justification	CH or PBF
Habitat	-	Site habitats are common for the wider region in Egypt, and is considered to have no specific importance, vulnerability or potential for consideration as a critical habitat.	No – but no net loss is required for natural habitat
Egyptian Spiny-tailed Lizard	VU	89 Spiny-tailed Lizard were recorded during line transects and further inactive burrows/field signs. This is a high population of a IUCN Vulnerable species.	PBF
Dorcas Gazelle	VU	One Dorcas Gazelle was recorded during line transects. This is an IUCN Vulnerable species and is rarely recorded.	PBF
Steppe Eagle	EN	Surveys within the Project area recorded a maximum number of 1,465 individuals flying within the AoA. This constitutes 1.9% of the global population, therefore exceeding the threshold for qualification under Criteria PS6 3a/ESR6 4a/ESS4 2a.	CH
White Stork	LC	The number of White Storks that were recorded flying within the AoA (14,357) constitutes 1.8% of the global population. This exceeds the threshold for qualification under Criteria PS6 3a/ESR6 4a/ESS4 2a.	CH
Egyptian	EN	Surveys within the Project area recorded a seasonal	PBF

³ For all bird species. See the CHA (TBC 2026) for a full list of bird PBFs.

Vulture		maximum number of individuals flying through the AoA at low height of 45 individuals. This represents 0.2 % of the species' minimum global population. Therefore, the area does not qualify as CH for this species under Criteria PS6 3a/ESR6 2c, 4a/ESS4 2a, 4a.	
Saker Falcon	EN	The species has not been recorded during spring and autumn surveys within the Project area. It is generally rare in the region, and it is not detected every year. it is unlikely that the species occurs in sufficient numbers to qualify the Migratory Bird EAAA as CH.	PBF
Greater Spotted Eagle	VU	Although the Greater Spotted Eagle was recorded during the surveys (11 individuals), no individuals were detected within the AoA airspace.	PBF
Eastern Imperial Eagle	VU	The percentage of the global population of the Eastern Imperial Eagle that was recorded within the AoA was only 0.025% of the global population (six individuals).	PBF
Red-footed Falcon	VU	The Red-footed Falcon is an uncommon migrant in the region. Despite the fact that it is usually detected during baseline or monitoring surveys (in low numbers) it was not detected in the AoA.	PBF
Sooty Falcon	VU	Only nine Sooty Falcons were recorded within the AoA. This represents 0.2% of the global population.	PBF
Turtle Dove	VU	Regularly occurring IUCN VU species	PBF
Golden Eagle	LC	Considered a PBF on the basis of stakeholder concern. The species is very rare in Egypt and the wider region, and survey evidence suggests the presence of a breeding pair in the vicinity of the Project, in an area where the species had not previously been known to occur.	PBF
Other migratory birds	Various (below VU)	See below*	PBF

* All migratory species regularly occurring in the Project area of impact that are not CH-qualifying or globally Endangered or Vulnerable should be considered as PBFs under EBRD ESR6 Criterion 4a. These include migratory soaring birds such as the European Honey Buzzard (*Pernis apivorus*), Black Stork (*Ciconia nigra*), Great White Pelican (*Pelecanus onocrotalus*), Pallid Harrier (*Circus macrourus*), Black Kite (*Milvus migrans*), Eurasian Sparrowhawk (*Accipiter nisus*), Long-legged Buzzard (*Buteo rufinus*), Short-toed Eagle (*Circus gallicus*), Western Marsh Harrier (*Circus aeruginosus*), Montagu's Harrier (*Circus pygargus*), Lanner Falcon (*Falco biarmicus*), Eleonora's Falcon (*Falco eleonora*), Lesser Kestrel (*Falco naumanni*), Peregrine Falcon (*Falco peregrinus*), Eurasian Hobby (*Falco subbuteo*), Common Kestrel (*Falco tinnunculus*), Griffon Vulture (*Gyps fulvus*), Booted Eagle (*Hieraetus pennatus*), Osprey (*Pandion haliaetus*), Common Crane (*Grus grus*), Eurasian (Steppe) Buzzard (*Buteo buteo vulpinus*), Lesser Spotted Eagle (*Clanga pomarina*), Levant Sparrowhawk (*Accipiter brevipes*), and Oriental Honey Buzzard (*Pernis ptilorhynchus*).

3 IMPACT ASSESSMENT

This section presents the key anticipated impacts of the Project.

3.1 Priority Biodiversity and Critical Habitat Impacts

3.1.1 Ornithology

The construction phase of the project is expected to include clearance/levelling of land, excavation of turbine foundations, crane pads and building footprints, cable route trenching and the construction of internal roads.

Surveys on site did not identify any important feeding or nesting areas within the survey area and as such impacts during construction of the Project are predicted to be of minor/negligible significance at a local level, since no important feeding or nesting areas are being directly impacted but changes on site are considered to be permanent. It is worth noting that whilst the ESIA ruled out the proven presence of breeding Golden Eagle and Sooty Falcon these species were noted within the area should be considered as a potential risk going forward as part of adaptive management should they be recorded nesting during construction or operation in the future.

Impacts during the operation of the wind farm are also possible as a result of collision with the operational turbines, displacement and disturbance impacts and collision with the OHTL. Some of the mitigation will be installed during construction (e.g. Bird Flight Diverters (BFDs) on the OHTL).

3.1.2 Terrestrial

Direct impacts to Spiny-tailed Lizard are possible as a result of construction (habitat clearance, levelling or any other works) activities including killing or injuring, disturbance, direct habitat loss from construction of site roads, WTGs, substations, site compound area, workers' accommodation, if any, and access roads and habitat loss through fragmentation/barrier effect, poaching and collection, and indirect impacts from noise, pollution, non-native invasive species. Habitat loss along the OHTL Area of Influence (Aoi) is also likely. Impacts are likely to be medium-term and irreversible.

Impacts to Dorcas Gazelle during the construction phase (habitat clearance, levelling or any other works) of the WF (and OHTL) are direct mortality and injury from vehicles and other plant machinery, displacement and disturbance impacts, as well as loss of habitat, poaching and collection and indirect impacts from noise, pollution and non-native invasive species. Impacts are likely to be medium-term and irreversible.

Significant operational impacts on reptiles and mammals are not predicted. Impacts associated with vehicle collisions are, however, possible as well as impact associated with maintenance activities, especially where ground-breaking activities are required. Impacts associated with disruption to migration corridors through the WF site are however possible although currently the WF is not regularly used by significant numbers of large ungulates. The OHTL is unlikely to result in a barrier to movement of large mammals across its Aoi.

3.2 Habitats and Flora

Habitats present on the Project site are considered to be largely natural habitat but no endemic plant species, species of conservation importance or threatened habitats have been identified during the studies. In total the Project footprint will result in the permanent loss of an estimated 2 km². Losses of desert habitat are due to the construction of turbine bases, crane pads, building infrastructure, cable trenching and internal road networks and are considered to be of minor significance at a local level.

4 MITIGATION AND MANAGEMENT

4.1 Overall Approach to Biodiversity

The Project will seek to proactively address impacts and proposes to use an adaptive management approach (plan-do-check-act-replan) to reduce their potential severity.

The Project will follow the principles of the “mitigation hierarchy” as defined under IFC and EBRD E&S requirements. Those require that measures are taken to avoid creating E&S impacts from the outset of development activities, and where this is not possible, to implement additional measures that would minimize, mitigate, and as a last resort, offset and/or compensate any potential residual adverse impacts.

Management is defined as any actions that correspond to the four elements of the mitigation hierarchy, as described below.

- **Avoidance:** actions taken to fully prevent impacts to biodiversity values, such as changing the spatial design of a project to prevent impacts in specific locations
- **Minimization:** actions taken to reduce the duration, intensity and/or extent of impacts that cannot be completely avoided
- **Rehabilitation/Restoration:** actions taken to return areas to beneficial use and, if possible, assist in the recovery of the ecosystem that has been degraded, damaged, or destroyed
- **Biodiversity Offset:** measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people’s use and cultural values associated with biodiversity.

The measures detailed in this chapter of the BMP deals with the first three steps in the mitigation hierarchy and any actions are based on impacts identified in the Project’s ESIA.

4.2 General – Biodiversity

The measures detailed in this section are designed to avoid or minimize general impacts on the environment and biodiversity. Specific actions in relation to Priority Biodiversity Features are also included which will ensure that there are no-net losses for the qualifying species.

Biodiversity Manager

The Developer (or Engineering, Procurement, and Construction (EPC) Contractor) is responsible for the appointment of an in-county E&S Manager who will oversee all construction mitigation and monitoring that is detailed in the following sections.

Induction and Training

As required within the **ESMS Manual**, the EPC Contractor will design and deliver to all Project Employees, including subcontractors, mandatory E&S training covering all aspects of this BMP.

Training will be provided through an induction program, toolbox talks, ongoing job specific training, refreshers, and exercise/drills. A copy of the induction-training program shall be submitted to Developer Health, Safety, Security and Environment (HSSE) Manager for comment within 7 days of Notice to Proceed. The EPC Contractor shall provide training and attendance records to the Developer HSSE Manager, upon request. Only specific topics relevant to biodiversity are included in this document.

All personnel and visitors shall have completed the Project’s induction before having access to the Project Site and/or commencement of a task or any other works on the Project Site.

Training and inductions will include a specific section in relation to biodiversity and the measures that have been put in place to avoid and / or minimize impacts to biodiversity as well as mitigation measures and habitat re-instatement and enhancements. A summary of the controls relating to biodiversity is included below and these measures are in place in order to avoid and minimize direct impacts within the project site as well as indirect impacts to the wider landscape and Protected Areas (e.g., IBA/KBA).

Pollution Control

The **Waste Management Plan** must identify pollution control measures to be applied across the whole of the site and for the off-site disposal of wastes. These measures will avoid or minimize impacts on habitats and biodiversity.

To avoid contamination, hydrocarbons will be stored in a secured bunds to be located on impermeable surfaces with controlled drainage away from natural water courses. Bunds will be sufficient to contain 110% of the volume of liquids to be stored within. They will also be fully contained to stop contamination of rainwater run-off. In addition, refuelling of vehicles and machinery will only occur in designated areas.

All hazardous materials must be correctly stored to limit chances of contamination of the area. Generally, it would be advisable to use biodegradable hydraulic oils, where possible.

Speed Limits and Driving Limits within the Project Site

The **Traffic and Transport Management Plan** must require that all driving be permitted on formal site roads and off-road driving is prohibited, unless it is driving within a works area (e.g. moving equipment or infrastructure around the site or for maintenance operations). Site wide speed limits and limits of driving are to be strictly enforced by the EPC Contractor in order to avoid / minimize the impacts of driving and vehicles on biodiversity. Speed limits should be set to 20 kmph on on-site roads / tracks. Enforcement of speed limits and limits of driving will minimize impacts on habitats, flora, birds, mammals, reptiles on site through the prevention of killing and injuring and reducing the likelihood of erosion and degradation of the habitats.

All site workers should adhere to national speed limits when driving to and from site.

Hunting / Collection of Animals and Plants

The worker code of conduct within the **Labor and Working Conditions Management Plan** must include the ban on hunting and or collection of animals and plants from the Project Area to be strictly enforced and this will avoid and minimize any construction related impacts on biodiversity features within the Project Area, especially Egyptian Spiny-tailed Lizards since hunting/collection are considered some of the major threats to this species. All contractors and site staff will be reminded that this ban is also effective within areas outside of the Project Area (e.g. within the wider landscape and nearby Protected Areas) and any training should also include details of any relevant national legislation protecting rare and endangered species as well as any national schemes (e.g. to reduce impact of trade in species).

Invasive Species

Measures regarding the control of invasive species will be fully implemented to avoid the introduction and spread of invasive species within the Project Area *or the wider landscape and nearby Protected Areas*. In order to control / limit the spread or introduction of invasive species the following will be completed:

- Any material that is imported into the site will be sourced responsibly by the contractor
- Continual survey of the site and any laydown areas, including soil storage areas, for the presence of non-native or invasive species and recording and reporting if any are observed
- Training of contractors / site staff as part of the induction process
- Production of an Invasive Species Management Plan. This will include:
 - Identification non-native or invasive species within the site boundary. This will be done by reporting any species thought to be non-native or invasive to the site manager

- Details of mechanical removal (e.g. cutting, pulling) and disposal to a safe location off site (invasive species should not be composted or simply cut and left as these methods can contribute to their proliferation)
- Details of chemical removal (e.g. blanket application of pesticides, spot treatments) will be avoided however if necessary, will be used but in accordance with national and international guidelines as well as those applied by the Lenders (e.g. specific risk assessment and Lender agreement prior to use).

Site Cleanliness and Control of Pest Species (e.g. Rats)

The **Waste Management Plan** must state that the site, including all offices and workers buildings are to be kept free of rubbish and litter, including food waste, as these might attract pest species and/or scavenging birds. All waste will be placed into appropriate bins and containers which will be appropriately sealed (e.g. lids or covers) to prevent pest species entering. In all cases priority will be for the use of mechanical control measures for pest species such as setting of live traps. Passive methods of control, such as chemical poisoning with baits or glue traps will only be used if there are no other feasible alternatives due to the potential to harm non-target species found within, and outside of, the Project Area. Finally, if pest species are caught, they will be humanely killed and if any non-target species are caught will be released, unharmed, away from site buildings.

4.3 Pre and During Construction Phases

4.3.1 Habitats and Flora

No sensitive habitats or species of plant were identified during the surveys but the site is situated within largely natural habitat and therefore habitat loss for Project infrastructure will be kept to a minimum. All areas of natural habitat being removed will be measured and recorded prior to work taking place so that a quantitative assessment of habitat loss can be completed.

Following construction, an area of 2 km² will be enhanced using appropriate, native planting in suitable parts of the Project Area, this will ensure that no net loss of habitat as a result of the works. This planting enhancement will be at in the western part of the project area, away from the main construction works, to benefit PBF species as much as possible. Any areas of additional planting will be monitored as part of the biodiversity monitoring program and any species which do not establish will be replaced.

All site workers will undertake a Project induction before working on site. The induction will include a comprehensive biodiversity element where the baseline ecological value and sensitivity of the site will be discussed. Prior to construction works, working areas will be subject to a botanical walkover survey to identify areas of non-native or invasive species. Any such specimens will be clearly marked, and the area avoided and if this is not possible the specimen will be removed and disposed of. Working areas will be clearly demarked using temporary fencing (e.g. orange netting attached to wooden posts), so that site workers fully understand the working area. Encroachment into areas outside of agreed working areas will be prohibited and working areas will be subject to regular check by the EPC E&S Manager to check enforcement of working areas.

On completion of phased construction works the EPC Contractor will be responsible for habitat restoration works in all areas that have been subject to temporary disturbance. A Habitat Restoration Plan including a habitat metric is described below.

Habitat condition assessment surveys will be carried out based on methodologies adapted from published methodologies (Sopotlieva et al 2018⁴). Broadly the aim is to:

- Survey the extent and condition of the habitats to be impacted at the outset of works;
- Assess the total habitat loss based on aggregating the scores/area for all different areas being impacted;
- Ensure during rehabilitation that the total habitat restoration effort meets an increased total habitat score.

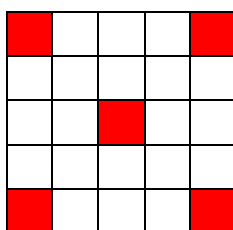
⁴ Sopotlieva et al 2018 Ecosystem condition assessment of semi-natural grasslands outside the Natura 2000 network in Bulgaria, using vegetation data. TUENIA 38:385-404

Habitat condition surveys must be undertaken by suitably qualified ecologists with experience of desert plant ecology.

Surveys will need to include control plots within parts of the project area that will not be impacted by the works. All of the pre-clearance habitat survey work will be undertaken within desert habitat, which is largely contiguous. However, there are some finer spatial habitat changes, for example within wadis. Plant species richness will be determined as a result of the detailed quadrat surveys and the final scoring within the metric may be updated to reflect this most representatively.

Surveys will include quadrat (2m x 2m) surveys across all areas and will be completed within the pre-commencement surveys. Exact locations for quadrat survey will be finalised during the survey to ensure representative locations are chosen. The quadrats will be oriented with their sides aligned north-south and a GPS location will be taken in the south-eastern corner of the quadrat to ensure repeatability. Photos of the quadrats will also be taken.

At each location for quadrat survey, five 2x2m quadrats will be undertaken in a grid pattern as shown below.



10x10m survey plots will be undertaken at each separate works location. Where habitats change at a survey location a plot will be required for each habitat (e.g. one in desert, one in wadi). Effort in each work location will include:

- WTG bases. One plot and one control plot adjacent in untouched land per base.
- Along roads (likely to be permanent habitat loss) and along tracks (temporary loss). One plot approximately every 1 km along the road. In addition a 'control' plot will be completed every third plot.
- Along the OHTL routes where there will be some permanent habitat loss at tower locations and temporary loss/damage along route. A quadrat location will be recorded approximately every 1 km.
- Substation and other permanent infrastructure within the windfarm work areas where there will be permanent habitat loss quadrats will be recorded at 4 per hectare with one control plot corresponding in adjacent untouched land.
- Within the windfarm work areas where there will be temporary habitat loss quadrats will be recorded at 4 per hectare with one control plot corresponding in adjacent untouched land.
- Other areas – sometimes areas outside of the above are impacted by contractors working outside of the correct proposed areas. If this occurs work should be conducted in these areas to ensure that the overall impact on habitat is kept up to date and restoration can be all encompassing going forward.

Table 3 shows what will be recorded during each quadrat survey and how each quadrat will be scored in order to determine the condition of the habitat area surveyed. The parameter scores for each of the five 2m x 2m quadrats will be averaged to give a final score for wider 10m x 10m quadrat.

Table 3. Metric for the Calculation of Habitat Condition (to be updated to reflect results of detailed quadrat surveys)

Parameter	Unit	Approach	Score 1 (Very Poor)	Score 2 (Poor)	Score 3 (Mode rate)	Score 4 (Good)	Score 5 (Very Good)
1. Plant Species Richness	Number of species per sample plot area	Observation	0-1	2-3	4-5	6-7	8+
2. Vegetation Cover	% (full number) per habitat type	Estimation based on	0-9	10-24	25-49	50-74	75-100

		Observation (quadrat)					
3. Abundance of native weeds and alien species	% of native weed/alien cover within the vegetation present (i.e. a % of plants coverage excluding bare ground)	Estimation based on Observation (quadrat)	26-100	11-25	6-10	1-5	0
4. Visible damage from human activities, as vehicles, geological exploration, fire, evidence of domestic livestock (grazing, paths, manure, clearings), etc.	% (full number)	Estimation based on Observation (quadrat)	26-100	11-25	6-10	1-5	0

For all parameters whole numbers will be used and will be rounded up, or down to the closest whole number.

Where vegetation cover is less than 10% a score of 0 will be applied to cover of Parameter 3. This is to avoid artificially inflating habitat condition scores for quadrats that are poorly vegetated.

The Metric maximum score is 20 (e.g. 4 x Score of 5). The Metric minimum score is 3.

Once the survey is completed the total score for each quadrat will be determined by adding up the scores for that quadrat (quadrat score). Once determined the Habitat Condition Score for that area is calculated by dividing the Quadrat Score by the Maximum Score (e.g. Quadrat Score of 20 = Habitat Condition Score of 1 (20 / 20), Quadrat Score of 15 = Habitat Condition Score of 0.75 (15 / 20)). Habitat Condition Rating and corresponding Habitat Condition Scores are shown in the table below.

Table 4. Habitat Condition Rating and corresponding Habitat Condition Scores

Habitat	Condition Rating	Condition Score
	Very Poor	0.15 - 0.2
	Poor	0.25 – 0.4
	Moderate	0.45 – 0.6
	Good	0.65 – 0.8
	Very good	0.85 - 1

Habitat Restoration

Habitat restoration will be completed in areas of the Project AoI that have been damaged by Project related construction activities and habitats will be restored to their former condition or better.

Additional habitat rehabilitation areas within the WF AoI (areas that are existing damaged/poor) will be identified during the pre-commencement survey, to be enhanced to ensure no net loss is achieved or an overall net gain. The area of land that will need to be restored will be determined following confirmation by the EPC Contractor of working areas for the WF and OHTL Projects (e.g. confirmation of area sizes of permanent lost habitat and temporary damaged habitat). Areas of habitat subject to restoration and rehabilitation will be improved through a process of re-grading earth, including filling in and re-profiling existing rutted tracks for example.

To utilise this metric in the field to provide information for habitat restoration / rehabilitation, habitat hectares (HH) would be calculated from the total amount of habitat loss (ha) multiplied by the condition of the habitat (e.g. 100ha of good condition habitat is 100 x 0.75 = 75HH).

Following the restoration work, in order to achieve no net loss of natural habitat it should be ensured that the calculated Habitat Hectares are greater than at the outset of the project. This can be achieved by rehabilitation of an area of the same size and same quality; a smaller area of higher quality; or a larger area of lower quality (with details to be decided using the above metric).

4.3.2 Mammals

Nubian Ibex (*Capra nubiana*) (IUCN VU) and Dorcas Gazelle (*Gazella dorcas*) (IUCN VU) have been identified as present on the site. However, these species are very rare in the area and are not expected to be regularly, if at all, in the proposed work area at other times. Wide ranging Striped Hyena (*Hyaena hyaena*) (IUCN NT) was identified as having ranges which overlap with the Project Area, however no evidence was found during the surveys.

If any large mammals are seen during the construction process, the construction manager will be informed, and photographs will be taken if possible for identification. This ongoing monitoring will be undertaken, and the results of the monitoring will be included in seasonal reporting. The following mitigation will ensure no direct impacts on these large mammals:

Surveys in areas of suitable habitat within 1km of working areas will be completed in April and May in each year throughout the construction period and If any large mammals are seen during the construction process, the construction manager will be informed, and photographs will be taken if possible, for identification. This ongoing monitoring will be undertaken, and the results of the monitoring will be included in seasonal reporting. All animals must be allowed to move freely away from construction areas to more suitable habitat (the hills to the west) and construction will only proceed when all animals have left the area naturally.

Site-wide lighting is not being implemented so any lighting impacts during operation will be very limited. Night-time working is not anticipated and will certainly not be a regular occurrence. Where lighting is required within worker compounds, site offices etc. ensure that any lighting is shielded and protected to reduce light-spill and glare. Low intensity lighting should also be used, where possible, to further reduce light spill. For external security lights PIR trigger units should be used and these should be timed to automatically switch off after five minutes. Turbines will not be lit and any aviation lights will be shielded to minimise visibility from ground level to reduce the attractiveness of lights to night flying insects which in turn could attract bats. Lighting above turbine doors will be PIR controlled and timed so that it switches off automatically after five minutes. Again this measure will be implemented to reduce night-flying invertebrates in proximity to turbines.

4.3.3 Birds

The site itself does not have any nests or bird activity for the species listed as Priority Biodiversity Features. None of the PBF species were recorded landing or utilizing the terrestrial habitat of the site; instead, the birds utilize the area's airspace. Therefore, the Project's impacts on birds during the construction phase are expected to be unlikely. However, there is the possibility of two PBF species nesting in the adjacent mountains and that the construction activities could impact these sensitive species. A Priority Birds Breeding Protection Plan will be included as an Annex in this BMP providing details of the required pre-construction and during construction surveys over slightly different nesting seasons. If nesting is confirmed the implementation of constraints on construction activity and monitoring during the breeding season. Constraints will likely include buffers around nest sites where no construction is permitted whilst the nest is active and there are dependable juveniles, with buffers in line with evidence based disturbance distances for these or comparable species (e.g. in Goodship and Furness 2022⁵).

Immediately prior to construction, a walk-over survey will be undertaken of all working areas to check for the presence of ground nesting birds which would be at risk from construction related impacts. Whilst no significant use of the site by ground nesting birds was recorded it is best practice to ensure safe breeding of all bird species

⁵ Goodship, N.M. & Furness, R.W. (2022) *Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species*. NatureScot Research Report 1283

during construction. Surveys will be completed by an appropriately qualified ornithologist and surveys will be undertaken in the hours after sunrise (up to 10:00). The surveyors will aim to identify behavior indicative of breeding activity (e.g. carrying food / nesting material / fecal sacs, presence of nests, eggs or chicks (both nidifugous and nidicolous)).

Where nests are found during construction, they will be recorded in full and their locations mapped, with the data transferred to Excel master sheets and Google Earth. Mapping will then be circulated to the project team along with details of a works exclusion zone if needed. Exclusion zones will be established based on the survey results, species found and the expertise of the qualified Ornithologist and the Project Ecologist. All clearance work within this period will be done under the supervision of an on-site Ecologist.

4.3.4 Reptiles

A Spiny-tailed Lizard Translocation Plan will be developed for the project. The plan will be developed by Local experts that have been involved with other projects in the area and utilise the experience of successful programmes in the area. The plan will include pre-clearance burrow identification, capture, holding conditions, release site specs, release protocol and post release monitoring program. The Spiny-tailed Lizard program will be managed and overseen on the ground by a herpetological expert experienced in reptile relocation methods used for this species in Egypt. Relocation will be overseen by a vet.

Pre-construction surveys for sensitive species (i.e. those qualifying Priority Biodiversity Features) of herpetofauna will take place. The locations of known/active burrows used by Egyptian Spiny-tailed Lizard will be marked throughout the Project Area. Any newly found burrows noted during pre-construction walkovers will also be marked accordingly.

Prior to the start of construction suitable sites for the release of relocated Egyptian Spiny-tailed Lizards will be identified and mapped. Other windfarms within the area have had success with their translocation projects and therefore this is considered to be a suitable mitigation strategy. A suitable translocation receptor site must;

- Preferably be within the project wide boundary but certainly be within 10 km of the Project site.
- Contain appropriate vegetation (both for food and cover).
- Have suitable soil types to allow animals to dig and create new burrows.
- Not already be close to carrying capacity for this species.
- Not within another existing or proposed development site (or where there is likely to be a proposed site).

In order to ensure that the receptor area is suitable for Egyptian Spiny-tailed Lizards, a translocation plan will be produced prior to any work to more specifically detail the plan for lizard translocation on this project. This should include detail on the receptor site baseline as well as the practical steps to be followed to ensure safe capture and handling of lizards (including involvement of veterinary specialist on the site).

Capture and movement of Spiny-tailed Lizards will only be completed as a last resort. The 100 m and 200 m distances specified below have been agreed with the Egyptian Environmental Affairs Agency (EEAA), based on relevant experience and lessons learned from previous projects. All works will aim to be completed at least 100m from active burrows. Locations where burrows are present up to 200m of construction will be monitored throughout the construction period and if significant negative impacts (i.e., abandonment of burrows or increased mortality) are observed the remaining burrows in closest proximity will be excavated and the animals captured and translocated to holding areas in accordance with the below protocols for the duration of the construction window in that location.

Detailed design for the final layout will take into account the results of the pre-construction surveys and Project infrastructure will be sited to avoid the identified burrows to the greatest extent possible. Where this is not possible, or where fresh burrows are identified at the commencement of clearance works, these burrows will be excavated by hand and the animals captured and translocated, details of this are provided below.

Prior to work in an area containing Spiny-tailed Lizard burrows any remaining burrows within 100m of proposed works will be re-checked by the Ecologist using an endoscope and if empty dug out and destroyed. Works will be lead on site by suitably qualified ecologist with experience of carrying out translocation of this species. If any animal is found back in the working areas the burrow will be dug out carefully by hand by the ecologist and the animal captured and placed in a secure box before taking to a cool location ready for translocation to the receptor site. Once the lizard is removed from the burrow the hole will be collapsed and made unsuitable for future use.

If areas suitable for translocation exist within the Project Area these will be prioritized as this minimizes the impacts of transporting animals away from the Project site. Where possible animals will be moved to existing, but inactive, burrow sites – as long as the site is still suitable for use, with nearby food and cover plants etc.

Studies have shown that soft releasing Spiny-tailed Lizards leads to a better survival rate than simply releasing the animals into a new site⁶ so any animal which is translocated will be soft-released into an individual mesh enclosure within an area of suitable habitat. The pen will measure at least 2m x 2m and be covered to provide shade and prevent attack from above. A “starter hole” will be dug using a 20cm auger to a depth of approximately 30cm to provide some initial shelter. Supplementary feeding will also be given and after a period of seven days the enclosure will be removed to allow the lizards to move and forage naturally.

After the relocation period, a report will be prepared which will include the following information:

- Survey dates and timing of capture and release
- Weather conditions during survey and relocation effort
- Location of captured individuals
- Number of captured individuals during each relocation effort
- Number of juveniles, mature males and mature females
- Release sites used for relocation of each effort
- Number of males and females released at each site
- Number of mortalities during relocation effort

4.4 Operational Mitigation to be Installed During the Construction Phase

Mitigation is being installed to reduce the operational impact of the OHTL on migrating birds including birds of prey, waterbirds and other large soaring birds. Bird Flight Diverters (BFDs) are to be installed along the whole length of the OHTL. The BFDs installed are proposed to be ones that glow or light up at night and move with the wind to increase visibility for nocturnal migrants (e.g. Hawk Eye diverters) with Both type and configuration aligned with current recommendations from expert conservation stakeholders e.g. Birdlife and NCE. The EPC is committed to install diverters that meet the required long-term guarantee (e.g. of ten years or more) and specifications that are equal to or better than Hawk Eye diverters. Installation of earthing wire and attached BFDs will be completed at the time the lines are strung or at the very latest installed within 1 week of line stringing.

The installation of BFDs will need to be recorded by the Project Ecologist and these checks need to be included in the annual reports. BFDs should be checked every 6 months before the spring and autumn migration seasons so that they are in place and operational for higher risk periods. Any damaged or defective BFDs will need to be

⁶ Translocation trial of spiny-tailed lizard or dhub in Dubai, UAE. Soorae, P. S. (ed.) (2018). Global Reintroduction Perspectives: 2018. Case studies from around the globe. IUCN/SSC Reintroduction Specialist Group, Gland, Switzerland and Environment Agency, Abu Dhabi, UAE. xiv + 286pp https://iucn-ctsg.org/wp-content/uploads/publications/14_2018_Spiny-tailed_Lizard_UAE.pdf

replaced within 2 months of being reported as faulty.

4.5 Operational Phase

4.5.1 Operational Management Plan

The Operator will implement proper Mitigation, monitoring and management measures to prevent damage to the biodiversity of the site. This will include:

- establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping;
- Prohibit hunting of any wildlife at any time and under any condition by workers onsite;
- Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail above; and
- Restrict activities to allocated areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances.

4.5.2 On-Demand Turbine Shutdown

Shutdown during the operation of the wind farm will be undertaken with the primary objective of collision avoidance but also secondary for migration monitoring behaviour in order to inform the actual impact caused by the wind farm on resident and migratory birds. Note that this monitoring will be referred to as part of the shutdown process rather than a separate procedure. Shutdown protocols will be in line with the approved RCREEE methods used across the region.

Shutdown must take place during the spring migration season (from mid-February until mid-May) and autumn migration season (from mid-August till mid-November). Throughout these periods, shutdown must take place continuously on a daily basis with full site coverage using vantage points and experienced surveyors.

Shutdown will take place ensuring the following principles are followed:

- All of the turbines and a buffer area will be covered by constant observation.
- The buffer will ensure that enough time is available for WTG to be shutdown when birds approach.
- Should shutdown be observer led:
 - Observers will work in pairs and in shifts to ensure a vigilant effort from observers.
 - Observers will communicate both with shutdown operatives and other observers to ensure effective practices.
- Shutdown protocol process will undertake discussion with other operatives in the region to discuss best practice for the location
- The Project AoI is flat or gently undulating and as such turbines will be more obvious to birds migrating over the site than within hilly terrain.

4.5.3 Avi-Fauna and Bat Carcass Search during Operation

During the operation phase, Post Construction Fatality Monitoring (PCFM) will be undertaken, with carcass search surveys covering each turbine across the entire wind farm. The carcass search will demonstrate the effectiveness of mitigation measures such as turbine shut down and allow an estimation of the annual number of bird and bat deaths caused by the turbine.

Operational monitoring will be completed through the first 3 years of operation, with scope to continue depending upon results during the first three years, to monitor actual levels of mortality. Post construction fatality monitoring will be completed at all of the turbines, and the program of post construction monitoring will include carcass searching, searcher efficiency trials and carcass persistence trials. The results of the post-

construction fatality monitoring will be used to inform a GenEst Analysis. Such effort will be in line with the Post-construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries – Good Practice Handbook and Decision Support Tool (2023)⁷ or the most up to date version of this guidance as it is released.

An adaptive management strategy will be developed which will be based upon the thresholds presented within the CEA. Additional mitigation will be undertaken if the results of the post-construction fatality monitoring indicate higher than predicted mortality, especially in relation to species of elevated conservation concern. The Adaptive Management Plan will detail the threshold levels in line with the CEA along with required timings of reporting output to be provided, who it is to be provided to and a range of potential measure to be put in place.

A chance find procedure will be implemented and any carcasses seen by site workers will be reported to the Biodiversity Manager so that they can investigate. In addition, any prey species carcasses found on on-site (e.g. on roads) will be removed to reduce the likelihood of scavenging birds landing within the Project site.

4.5.4 Operational Management Plan - General

In addition to the above operational requirements, but the below must be adhered to during operation.

4.5.5 Invasive Species

Measures regarding the control of invasive species will be fully implemented to avoid the introduction and spread of invasive species within the project area or the wider landscape and nearby Protected Areas. EPC will provide a Biosecurity Plan. In order to control / limit the spread or introduction of invasive species the provided GIIP plan will include:

- Material imports to be taken from licensed local quarries or borrow pits to avoid importing non-native and invasive species.
- Surveys will be undertaken at the beginning and end of the growing season (e.g. two surveys per year) across the site for the presence of non-native or invasive species and recording and reporting if any are observed.
- If invasive species are recorded during surveys additional measure will be introduced including each and every vehicle, prior to coming to the site will be subject to a full clean down at a storage / plant yard so that is effectively clean. On arrival at the Project area vehicle will go into a wheel-cleaning facility that will be established before entry into the Project Area. The vehicle will then be subject to a visual inspection and if necessary, water or compressed air will be used to remove any other loose dirt debris.
- Measures to remove any identified non-native or invasive species within the site boundary if found. Measures will include:
 - Mechanical removal (e.g. cutting, pulling) and disposal to a safe location off site (invasive species should not be composted or simply cut and left as these methods can contribute to their proliferation)
 - Chemical removal (e.g. blanket application of pesticides, spot treatments) will only be used as a last resort and in line with Lender Safeguards and only once Lender approval for their use has been agreed.

4.5.6 Site Cleanliness and Control of Pest Species (e.g. Rats)

The site, including all offices and substation buildings, are to be kept free of rubbish and litter, including food waste, as these might attract pest species and/or scavenging birds. All waste will be placed into appropriate bins and containers which will be appropriately sealed (e.g. lids or covers) to prevent pest species entering. In all cases priority will be for the use of mechanical control measures for pest species such as setting of live traps. Passive methods of control, such as chemical poisoning with baits or glue traps will only be used if there are no other feasible alternatives due to the potential to harm non-target species found within, and outside of, the project

⁷ Post-Construction Bird And Bat Fatality Monitoring For Onshore Wind Energy Facilities In Emerging Market Countries. 2023 IFC, EBRD & KfW

area. Any chemical treatments will be used as a last resort and in line with Lender Safeguards and only once Lender approval for their use has been agreed. Finally, if pest species are caught, they will be humanely killed and if any non-target species are caught will be released, unharmed, away from site buildings.

4.5.7 Pest Species: Cats and Dogs

Where feral cats and dogs are identified the EPC Contractor / Ecologist must be notified and efforts made to catch these animals and transport them to appropriate animal shelters away from the site. Guard dogs for the works site (e.g. security for site offices, workers accommodation) must not be used. Pet cats and dogs are not allowed. These measures are in place to ensure no direct or indirect impacts to small mammals, reptiles and birds which are present within the site boundary.

4.5.8 Lighting

The following mitigation measures will be applied throughout the operational period to avoid/reduce the potential negative impact of lighting on valued ecological receptors:

- Night-time working will be limited and only completed when strictly necessary. Some emergency/unplanned night-time working may however be required (e.g. site shutdown at times when the panels are not generating power) but any such work would be limited and not permanent or regular (over extended periods). Any lighting required for such activities will be low intensity lighting and will be shielded to reduce light spill. Night-time working will be monitored to ensure minimal impacts (e.g. looking for grounded birds or bats) and if significant impacts are identified, night-time working will be ceased and alternative operational maintenance approaches explored.
- Where lighting is required within site offices etc. ensure that any lighting is of a warm hue (2700k or less), cowed and angled downwards to reduce light-spill and glare. Lights with a low component of UV will also be used, to further reduce impacts of lighting.
- For external security lights PIR trigger units will be used and these should be timed to automatically switch off after a maximum of five minutes.
- No lighting will be installed along site perimeter or along any sections of the OHTL.

4.5.9 Disturbance

Human disturbance at the site during the operational phase of the Project is expected to be minimal and limited to very occasional maintenance visits to limited areas of the site. No additional mitigation to reduce disturbance is considered necessary.

4.5.10 Poaching and Animal Collection

The following mitigation measures will be employed throughout the operational phase of the project to prevent (avoid) the potential negative impact of poaching and animal collection:

- The Project will enforce strict controls on hunting, gathering, poaching and otherwise disturbing flora and fauna within the Project AoI. Any breaches of this ban will be strictly enforced, and any workers found in breach of this control measure will be subject to disciplinary procedures which will entail instant dismissal where species of international conservation concern (IUCN CR/EN/VU) or high in-country conservation concern are affected. For more common species a formal warning will be issued, followed by dismissal if the offence is repeated.
- The ban on hunting etc. will be included in the site induction along with clear confirmation of the sanctions for breaches of this control measure.

4.5.11 Driving and Vehicle Collision

The following mitigation measures will be employed throughout the operational phase of the project to prevent (avoid) the potential negative impact of vehicle collisions:

- Appropriate speed limits will be enforced on internal road networks (40kmph).

- Speed limits will be enforced by regular speed checks to be undertaken by the site security staff and workers/contractors in breach of these will be fined. The results of monitoring will be included in annual reports.
- Regular signage will be installed along the site internal roads informing all drivers of the speed limit.
- Regular checks of the internal roads for carcasses and if found these will be removed and included in fatality reporting.
- A chance find procedure will be implemented so that all workers report any road (or infrastructure) collisions so that any such incident can be investigated in full.

4.5.12 **Chance Find Procedure**

The Project Biodiversity Manager must develop a clear Chance Find procedure for relevant personnel e.g. team leaders, site maintenance and security staff (and sub-contractors) to be trained in its use. This document will establish the procedure for actions in case of discovering valued ecological receptors that would have value in being recorded when encountered. This includes the animals themselves, and signs of them, e.g. burrows or nests. Training to include what to do in the event of encountering different species groups e.g. live small mammals, live large mammals, tortoises and snakes. Such discoveries must be immediately reported to the Project HSSE Manager who must then undertake further investigation, record the finding in the site logs and implement any other actions which may be appropriate. All Chance Finds should be included in the Project monitoring reports and provided to Lenders.

In addition to reporting live animals, all site staff must report All incidents of dead animals within the Project AoI, including the access road, and all incidents should be investigated by the HSSE Manager or suitably qualified ecologist.

The initial actions and report to the HSSE manager must include, but not be limited to:

- If possible, photograph the sighting and surrounding habitat;
- Record the location, time and date of the sighting;
- A description of the sighting (if positive identification isn't known) and the context e.g. leaving a burrow

A chance find procedure will also be implemented should any site worker find a wild animal, especially one that has become a nuisance (e.g. scavenger in the works camp, presence of small mammals in worker accommodation, presence of snake or scorpion on the works site) and the O&M Contractor will arrange for an appropriately qualified person to capture and relocate. Where scavengers have been identified within the works site additional housekeeping measures may be required. Any additional actions will be recorded and documented.

5 ROLES AND RESPONSIBILITIES

5.1.1 *Developer*

Measures have been included in this BMP to ensure that the Project does not result in short, medium or long-term negative impacts on site wide ecological receptors, including those considered to be Priority Biodiversity Features.

The Developer is responsible for ensuring that the measures set out in this BMP are completed in full and this will be achieved by ensuring that the EPC Contractor discharges their responsibility to conserve and enhance the ecological receptors found on the site, including Priority Biodiversity Features. This will ultimately be under the responsibility of the Developer HSSE Manager.

5.1.2 *Biodiversity Manager*

The Biodiversity Expert will be engaged by shadwan, who will be responsible for ensuring the correct implementation of all biodiversity-related operation and site-related mitigation measures detailed in this BMP.

The Biodiversity or E&S Manager will be the custodian of this BMP, checking the Project performance against its requirements as well as triggers for additional actions. The BMP will be updated periodically as required depending on the results of the surveys and if necessary additional works may be required in line with the monitoring requirement / targets.

The Biodiversity Manager will be present on-site during periods when construction activities pose significant risk to priority species. The Biodiversity Manager should be granted the authority to issue permit to work and to stop works, if deemed necessary.

The Developer and EPC Contractor are required to support the Biodiversity Manager and provide them with the necessary resources, including personnel, in order that they can fulfil their responsibilities.

The Biodiversity or E&S Manager should be well trained in the practical elements of protected and sensitive species including handling of species that they may have to move and the recognition of sensitive habitats and plant species; he/she should also have a working understanding of wider environmental issues and the construction/engineering process. If these skills are difficult to obtain in country, then training exercises from international ecologists to 'upskill' the Biodiversity Manager may be required.

The key responsibilities of the Biodiversity Manager, include but are not limited to:

Document Management & Review

- Maintain the BMP and update as and when required.
- Draft biodiversity protocols and method statements.
- Review and approve Contractor method statements to ensure biodiversity risks have been appropriately considered and that adequate management measures are specified.
- Liaise with EPC Contractor to ensure biodiversity is considered within the 'permit to work' systems.

On-site Activity

- Conduct walkthrough (rapid assessment) surveys immediately prior to works commencing in an area to identify features such as sensitive locations and species including the presence of Egyptian Spiny-tailed Lizard burrows and bird nesting areas along with other sensitive ecological receptors.
- This is required for all construction activities that pose risk to local biodiversity, such as site clearance, trenching, piling etc.
- Supervise the site clearance works and provide advice to the workforce when required. If clearance work is taking place in multiple locations at any one time the Biodiversity Manager may require additional assistance, if this is the case additional field ecologists may be drafted in to help cover the sites fully.

Training and Worker Awareness

- Provide worker awareness and training sessions on the requirements of the BMP, the need for the protection of local fauna, and the code of conduct that forbids poaching or deliberate killing of animals.
- Contribute to the production of an ecology section for the site wide induction which all new staff will have to complete prior to completing works on the site. This information should include details on the ecology of the site as well as identification charts for species found on the site.
- Prepare and deliver biodiversity management and control measures as part of the Toolbox Talks (TBT), which should include protocols for recording of incidental sightings as well as any road casualties.
- Organize and train personnel on animal rescue and relocation protocol.

Checking and Reporting

- Monitor and report on compliance against the BMP through the production of bi-annual ecology reports. These reports should contain the following:
 - Results of Pre-works surveys
 - Results of bi-monthly checks of the construction works
 - Details of chance-find events reported by onsite staff
 - Presence of any newly identified Priority Biodiversity Features or Valued Ecological Receptors.
- Conduct daily checks of the site during construction, such as working areas for cleaning operations and ensuring the requirements of the BMP are followed and prepare daily field notes.
- Monitor works and ensure that any species discovered are moved away from the work areas.
- Maintain a species database and update weekly based on site observations.
- Undertake biodiversity monitoring, data analysis and reporting throughout construction and operation phase of the project.
- Submit all data and related assessments in a timely manner and ensure that findings from the field are reported back to relevant stakeholders at regular intervals (full reports to be provided at least every quarter, carcass monitoring reports for example will be provided on a more regular basis e.g. monthly).
- Report any issues of non-compliance or incidents that require immediate action to the Developer HSSE Manager.
- Prepare and publish an annual ecology report to include the results of all of the on-site surveys completed. An annual ecology report should be produced after each of the annual monitoring programs.
- Submit all data to the Global Biodiversity Information Facility (GBIF).
- Regarding SDOD (see Shutdown on Demand Protocols), the Field Observers are responsible for conducting visual monitoring for target birds, assessing collision risk and communicating recommendations to the Field Coordinator. The Field Coordinator verifies SDOD criteria, issues shutdown/restart requests for target turbines, and conducts after-event evaluations. The SCADA Operator is the engineer responsible for executing shutdown and restart requests as directed by the Field Coordinator and is responsible for real-time tracking, recording and reporting all shutdown events
- Regarding PCFM (see Post-Construction Fatality Monitoring Protocols), PCFM will be conducted at the turbines and along the transmission line to assess the success of mitigation measures and contribute to the adaptive management process. The PCFM will be supervised by a wildlife expert with an appropriate background in data collection and statistical analysis, and the PCFM and SDOD monitoring teams will maintain regular communication to improve monitoring results and facilitate the adoption of additional mitigation measures,

where required.

5.1.3 Site Workers

All site workers should be made aware of the ecological receptors present in the Project Area and all measures contained within this document will be included in the site induction. All workers are to be informed of their responsibility to the environment including but not limited to:

- Protection of all ecological receptors. Staff to be informed of discipline procedures for failure to comply to this.
- Adherence to site wide speed limits and informed that they will be enforced by site security staff.
- Reporting any spills of fuel, lubricants or other potentially polluting materials.
- Good housekeeping and disposal of all waste in accordance with site-wide policies, which should include recycling as much waste material as possible.
- Chance find reporting

6 APPENDIX 1 – BMP TABLES

The appended BMP table provides a comprehensive tabular format including breakdown by receptors/ receptor groups, showcasing how monitoring and evaluation will be done to ensure that ESIA, BAP and BMP requirements are carried out in accordance with the associated plan(s).

Receptors / Receptor Grouping	Required Mitigation Measures (Management / Monitoring Activity)	Phase	Responsible Person for Ensuring Action Implementation	Means of Verification that Commitment has been Met	Timing and Frequency of Monitoring	Parameters	Locations	Reporting Requirements	KPIs
Birds and bats	Minimize attractiveness to birds and bats to prevent, nesting, roosting and feeding on and near turbines	Design	EPC Contractor	Review of WTG detailed design	When design is provided	No bat/bird attracting elements such as such as inappropriate lighting measure, lattice towers and crevices	N/A	N/A	N/A
Birds and bats	Micro-siting of turbines	Design	EPC Contractor	Review of WTG detailed design	When design is provided	Turbines locations to adhere to approved project footprint as provided in the ESIA	N/A	N/A	N/A
Reptiles (Egyptian Spiny-tailed Lizard)	Release Site Identification of areas suitable for release of relocated reptiles	Pre-construction / Construction	Local Expert, subcontracted by EPC Contractor	Record of release site identification survey	N/A	N/A	N/A	Release Site Identification Report	Identification of suitable release sites
Reptiles (Egyptian Spiny-tailed Lizard)	Relocation of Spiny-Tailed Lizard if necessary from construction footprint prior to any ground clearance works	Pre-construction / Construction	Local Expert, subcontracted by EPC Contractor	Records of relocation efforts to be kept on the implementation of the Reptile Relocation Plan	Where necessary	N/A	N/A	Reptile Relocation Report	No Egyptian Spiny-tailed Lizard loss in the construction footprint
Reptiles (Egyptian Spiny-tailed Lizard)	Population monitoring surveys of relocated Egyptian Spiny-tailed Lizard at release sites during the appropriate seasons following the first release effort and continued for a minimum period of 3 years following the final release effort.	Construction / Post-construction	Local Expert, subcontracted by EPC Contractor / O&M Contractor	Records of post-release monitoring efforts to be kept and regularly reviewed	Monthly	Population monitoring	Construction footprint	Post-release monitoring report	Population numbers to be constant or increasing
Mammals (Nubian Ibex)	Monitoring surveys for birthing females /	Pre-construction	Local Expert, subcontracted	Records to be kept of surveys	Daily – April and May (yearly)	Presence or absence	Within 1 km of construction	Mammal Survey	Confirmation of daily surveys at correct time of

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Receptors / Receptor Grouping	Required Mitigation Measures (Management / Monitoring Activity)	Phase	Responsible Person for Ensuring Action Implementation	Means of Verification that Commitment has been Met	Timing and Frequency of Monitoring	Parameters	Locations	Reporting Requirements	KPIs
and Dorcas Gazelle)	females with calves	/ Construction	by EPC Contractor				footprint	Report	year
Mammals (Nubian Ibex and Dorcas Gazelle)	If large mammals observed, the following measures should be implemented: controlled working practices, noise and lighting management, ecological monitoring, and workforce awareness, to minimize disturbance to wildlife - Avoiding unnecessary off-road movement of vehicles and machinery	Pre-construction / Construction	EPC Contractor, HSSE Manager	Records to be kept of construction activity within 1 km of birthing animals / females with young calves	Daily – April and May (yearly)	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Mammal Survey Report	No incidences of disturbance, animals have left the area naturally
Mammals (Nubian Ibex and Dorcas Gazelle)	Population / Habitat suitability monitoring	Construction / Post-construction	EPC and O&M Contractors, HSSE Manager	Records of post-construction habitat restoration monitoring to be kept and reviewed regularly	The Spring, Summer and Autumn seasons during first year post restoration	Monitoring the effectiveness of the restoration effort (has natural ecosystem succession occurred?)	Sampling to be done throughout restored areas	Post-restoration Monitoring Report(s)	No net loss of the habitat availability/suitability for use by these species
All Sensitive Ecological Receptors Native Flora and Fauna	Implementation of vehicular speed limits within the project site. Enforcement of ban against driving outside the delineated access roads	Construction	EPC Contractors HSSE Manager	Zero incident logs of over speeding in the project site and driving outside of the delineated access roads	Daily, Weekly Site Inspections throughout construction phase	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No speeding within the project site
Scavenging Raptors	Removal of any carcasses on roads immediately upon observation to at least 50m away from the roads	Construction	EPC Contractors HSSE Manager	Zero observations of animal carcasses remaining within 50m of roads within the project footprint	Daily, Weekly Site Inspections throughout construction phase	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No carcasses observed remaining on the roads within the project footprint
All Sensitive Ecological Receptors	Implementation of controls prohibiting gathering, poaching or	Construction	EPC Contractor to appoint on-site Ecologist,	Zero incident logs of take in the form of gathering,	Daily, Weekly Site Inspections throughout	Monitoring to ensure controls are being implemented and	Construction footprint	Incident logs, Monthly reports,	No take of flora/fauna on site

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Receptors / Receptor Grouping	Required Mitigation Measures (Management / Monitoring Activity)	Phase	Responsible Person for Ensuring Action Implementation	Means of Verification that Commitment has been Met	Timing and Frequency of Monitoring	Parameters	Locations	Reporting Requirements	KPIs
	otherwise disturbance of flora or fauna on site		under supervision of the HSSE Manager	poaching/hunting or other disturbance to flora or fauna	construction phase	enforce		Quarterly audits	
All Sensitive Ecological Receptors	Induction training and regular toolbox talks on sensitive flora and fauna species and overall importance of ecosystem integrity	Construction	EPC Contractor to appoint on-site Ecologist, under supervision of the HSSE Manager	Records are to be kept and regularly reviewed for the implementation of personnel training on sensitive flora and fauna species awareness	Daily, Weekly as required for new starters or actions throughout construction phase	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No Non-compliances with BMP and associated plans
All Sensitive Ecological Receptors	Regular training on appropriate waste management practices and ban on provision of food to feral domestics	Construction	EPC Contractor to appoint on-site Ecologist, under supervision of the HSSE Manager	Records are to be kept and regularly reviewed for the implementation of personnel training waste management protocol	Daily, Weekly as required for new starters or as required throughout construction phase	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No Non-compliances with Waste Management Plan
All Sensitive Ecological Receptors	Enforcement of ban on littering	Construction	EPC Contractor to appoint on-site Ecologist, under supervision of the HSSE Manager	Zero incident logs of littering on site	Daily, Weekly Site Inspections throughout construction phase	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No Non-compliances with Waste Management Plan
All Sensitive Ecological Receptors	Minimize or maintain: 5m construction buffer on either side of access roads; 10 m construction buffer around the permanent built-up area of the substation; And 30 m construction buffer around OHTL tower base	Construction	EPC Contractor to appoint on-site Ecologist, under supervision of the HSSE Manager	Regular checks to ensure compliance with construction buffers	Daily, Weekly Site Inspections throughout construction phase	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No Non-compliances with BMP and associated plans
All Sensitive Ecological Receptors	Implementation of light pollution control measures such as: Minimise external	Construction	EPC Contractor to appoint on-site Ecologist, under	Records of implementation of light pollution mitigation as per	Daily, Weekly Site Inspections throughout construction	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly	No non-compliances of CESMP

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Receptors / Receptor Grouping	Required Mitigation Measures (Management / Monitoring Activity)	Phase	Responsible Person for Ensuring Action Implementation	Means of Verification that Commitment has been Met	Timing and Frequency of Monitoring	Parameters	Locations	Reporting Requirements	KPIs
	lighting as much as possible. Ensure lighting is fit for purpose Duration of lighting to be controlled and minimized as much as possible Lights will be shielded to prevent skyglow, spill and glare		supervision of the HSSE Manager	light control section of the CESMP. Regular monitoring of use of artificial light within the project site	phase			audits	
All Sensitive Ecological Receptors	Prevention and control of contamination through development and implementation of hazardous material control measures, emergency action plan, spill prevention and control measures	Construction	EPC Contractor to appoint on-site Ecologist, under supervision of the HSSE Manager	Records of site inspections, audits and incident logs to be kept to ensure implementation of the spill prevention and control measures, waste management protocols, handling of hazardous materials, emergency action plans	Daily, Weekly Site Inspections throughout construction phase	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No non-compliances of CESMP
All Ecological Receptors	Minimize construction footprint and strict controls to prevent driving out of designated corridors to control impacts to soil	Construction	EPC Contractor to appoint on-site Ecologist, under supervision of the HSSE Manager	Regular checks to ensure compliance with construction buffers. Zero incident logs of driving outside access roads	Throughout construction - Daily checklist, Weekly inspections, Monthly reporting	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No Non-compliances with Control Plan
Native flora and fauna	Biosecurity control through import of soil from local quarries or borrow pits as close to the site as reasonably practical to avoid the risk of foreign seeds and invasive species	Construction	EPC Contractors' HSSE Manager	Regular checks and inspections to ensure compliance with Biosecurity Control Plan. Zero incident logs of non-native and/or invasive species	Throughout construction - Daily checklist, Weekly inspections, Monthly reporting	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No Non-compliances with Control Plan

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Receptors / Receptor Grouping	Required Mitigation Measures (Management / Monitoring Activity)	Phase	Responsible Person for Ensuring Action Implementation	Means of Verification that Commitment has been Met	Timing and Frequency of Monitoring	Parameters	Locations	Reporting Requirements	KPIs
Native flora and fauna	Biosecurity control through checks on soil imports from outside of the area prevent the accidental introduction of exotic species/pathogens	Construction	EPC Contractors' HSSE Manager	Regular checks and inspections to ensure compliance with Biosecurity Control Plan. Zero incident logs of non-native and/or invasive species	Throughout construction - Daily checklist, Weekly inspections, Monthly reporting	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audit	No Non-compliances with Control Plan
Native flora and fauna	Plant and machinery will require an HSE certificate of inspection, issued by the EPC, before coming onto the site and this will include necessary cleaning /pressure washing to reduce risks of importing invasive species	Construction	EPC Contractors' HSSE Manager	Regular checks and inspections to ensure compliance with Biosecurity Control Plan. Zero incident logs of non-native and/or invasive species	Throughout construction - Daily checklist, Weekly inspections, Monthly reporting	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No Non-compliances with Control Plan
Native flora and fauna	Designation of appropriate cleaning stations inside and outside the project boundary. Run-off from washdown will be captured and treated to remove/kill pests prior to appropriate discharge	Construction	EPC Contractors' HSSE Manager	Regular checks and inspections to ensure compliance with Biosecurity Control Plan. Zero incident logs of non-native and/or invasive species	Throughout construction - Daily checklist, Weekly inspections, Monthly reporting	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No Non-compliances with Control Plan
Native flora and fauna	Staff training on the potential sources of biosecurity breaches, impacts, control measures, required actions and roles and responsibilities	Construction	EPC Contractors' HSSE Manager	Records are to be kept and regularly reviewed for the implementation of personnel training on biosecurity risks and control measures	Throughout construction - Daily checklist, Weekly inspections, Monthly reporting	Monitoring to ensure controls are being implemented and enforced	Construction footprint	Incident logs, Monthly reports, Quarterly audits	No Non-compliances with Control Plan
All Ecological Receptors	Post-construction Habitat Restoration of areas temporarily disturbed during	Post-construction	Local Expert, subcontracted by EPC Contractor	Records of post-construction habitat restoration efforts	N/A	N/A	N/A	Restoration Completion Report(s)	N/A

BMP for SCATEC- SHADWAN 900MW Wind Power Project

Receptors / Receptor Grouping	Required Mitigation Measures (Management / Monitoring Activity)	Phase	Responsible Person for Ensuring Action Implementation	Means of Verification that Commitment has been Met	Timing and Frequency of Monitoring	Parameters	Locations	Reporting Requirements	KPIs
	construction								
Flora / All Ecological Receptors	Post-restoration Habitat Restoration Monitoring for determination of success rate	Post-construction	Local Expert, subcontracted by EPC Contractor	Records of post-construction habitat restoration monitoring to be kept and reviewed regularly	The Spring, Summer and Autumn seasons during first year post restoration	Monitoring the effectiveness of the restoration effort (has natural ecosystem succession occurred?)	Sampling to be done throughout restored areas	Post-restoration Monitoring Report(s)	Successful, healthy habitats in restored areas showcasing vegetation coverage and biodiversity indices aligned with or approaching similar undisturbed habitat in the area
Birds and bats	Monitoring fatality of birds and bats from collision and electrocution fatality of birds from OHTL	Operation	PCFM team (see appendix 3), subcontracted by Project Company	Records and findings of carcass searches and trials to be kept to ensure implementation of the PCFM	Monthly during all seasons for birds and bat active period (May through November) for bats from the timing of installation of OHTL	Fatality should not exceed thresholds calculated using PBR analysis	Fatality should not exceed thresholds calculated using PBR analysis	Monthly Carcass Search Report	Fatality not to exceed thresholds
Birds and bats	Calculating assumed fatality rate per species based on carcass counts and corrections	Operation	PCFM team, subcontracted by Project Company	Records of the fatality assessments to be kept and reviewed by the lenders	Semi-annual from timing of Installation of OHTL	Fatality should not exceed thresholds calculated using PBR analysis	Construction footprint	Semi-Annual Fatality Monitoring Report	Fatality not to exceed thresholds
Birds	BFDs to be installed at least every 10m along the entire length of the OHTLs	Construction	EPC Contractors' HSSE Manager	Regular checks to ensure they are installed and continuing to function	To be checked every six months, prior to Spring and Autumn migration periods	N/A	Construction footprint	Semi-annual report	All damaged or missing BFDs replaced within two months of being reported
Scavenging Raptors	Livestock Carcass Removal/Disposal to reduce attractiveness to vultures and carrion-eating birds	Operation	Local Expert Team, subcontracted by Project Company	Records of livestock carcasses in the project footprint and timely disposal of these carcasses	Throughout operation	Zero fatalities due to scavenging opportunities	N/A	Carcass Removal Report	Zero fatalities due to scavenging opportunities

7 APPENDIX 2 - SCOPE OF SHUTDOWN ON DEMAND PROTOCOL

The Avifauna monitoring and SDOD Protocol will be undertaken in line with RCREEEs ATMP protocol. The RCREEE protocol uses experience of this work in the region to refine its practices and provide the most relevant and up to date methods which include:

- Defining/delimiting key flight activity periods at the project site prior to commencement;
- Reviewing use of Radar and other high-tech monitoring technology if available;
- Identifying high-risk areas and times; defining the groups of WTGs by zones for the SDOD Protocol;
- Adopting a reactive/responsive approach to mitigation but which will be informed and refined through a predictive approach;
- Determining strategically located vantage points for facilitating effective turbine shutdown; and
- Improving effective communication networks between bird observers as well as between bird observers and project wind turbine operators.

Shutdown on Demand Criteria

- *Threatened species*: wind turbines should be shut down whenever a bird or birds of a threatened species (according to the last updated IUCN Red List of Threatened Species) are detected migrating through the wind farm area or heading towards it at collision risk flight altitudes (i.e. within the rotor-swept area).
- *Flocks with 10 or more large soaring birds (target species)*: wind turbines should be shut down whenever flocks with 10 or more large soaring birds are detected migrating through the wind farm area or heading towards it at collision risk flight altitudes.
- *Imminent high risk of collision*: A single wind turbine or turbines should be shut down whenever there is an imminent high risk of collision of a large soaring bird (e.g. a bird approaching a turbine at a close distance).
- *Sand storms*: Wind turbines should be shut down during sand storms whenever criteria 1 and/or 2 have been verified in the two hours that preceded the sand storm.
- *Roosting/resting inside or near wind farm*: Whenever bird(s) of a threatened species or flocks with 10 or more soaring birds is detected roosting or attempting to roost inside or near the windfarm area (≤ 2000 m); risky turbines should be shut down until the bird(s) depart the risk zone, or until the risk is assessed as low by the SDOD field coordinator.

Responsibilities

– On site personnel

The project O&M Team will have overall responsibility and will need to appoint appropriate personnel (Team Leader/Lead Ecologist) to oversee the avifauna monitoring and SDOD. All proposed personnel will have expertise in Bird Migration Patterns, Shutdown On Demand Programs and Predictive Fixed Shutdown Programs for Wind Farms in Gulf of Suez. The key roles and responsibilities will include the following:

- Overall quality assurance/control on observer and observations undertaken
- Developing schedule for observers/VP
- Overall management of observers to include but not limited to assignment, daily checks on VP to ensure they are onsite, ensure observations are done and completed properly, etc .

- Collection of data from observers and undertake quality control review
- Respond/resolve any issues within the site /observers

The Main Team Leader will be supported by one Supportive Team Leader, who will be onsite at all times. The Supportive Team Leader will be assigned VP areas and observer teams as applicable, in addition to undertaking VP survey responsibilities.

– Consultant(s) / Observer(s)

Selected consultants for this project and will be responsible for the overall execution of the SDOD-Program, mainly including coordination and communication between all involved parties, execution of meetings and workshops, organization and execution of the fieldwork, data analysis and preparation of reports, compilation of databases and capacity building. They will be responsible for implementing the optimized SDOD in the GoS by assigning experienced surveyors and technical coordination with other Responsible Entities.

– Sponsors/Operators of the wind farm, lenders, and/or other organizations

Sponsors/Operators of the wind farm, Lenders, and/or other Organizations will be informed on the current status and the progress of the SDOD protocol, the main conclusions, and any recommended adjustments regularly. They will provide final reports prepared by the consultant(s) in due time. In addition, Sponsors/Operators, Lenders, and other Organizations will be invited to participate in regular meetings and will get the opportunity to ask for clarifications, raise concerns, and propose adjustments.

Data Collection Methodology

The absolute main aim of the Shutdown surveyor work is to safeguard the safe movement of priority bird species through the site and avoid any collision impacts. Alongside this additional aims are present however it is important to note that should any of these aims have the impact to reduce the safety of bird movement during implementation in the field the monitoring will take a back seat to the main shutdown aim. An example of this is collection of details such as exact flight height during the duration of the flight where it is more important to confirm the shutdown protocol. It is worth noting that any such data collected is not entirely comparable to pre-construction data due to ensuring a safety first approach as noted above as well as impacts associated with turbine presence and the and any reporting of such monitoring will have this as an acceptable caveat.

Bird Monitoring (Migrating, Resting, and Local Birds) and Key MSB Species

Bird Monitoring will be conducted in accordance with the EIA guidelines and monitoring protocols for wind energy developments in Egypt as well as recommended bird survey methods to inform impact assessment of onshore wind farms. The bird monitoring aims to:

- Collect baseline data on migrating, resting and local birds;
- Describe migration patterns and altitudes of concerned MSBs within the Project Site in a quantitative way;
- Identify and assess likely impacts caused by the project; and
- Recommend mitigation measures to minimize impacts.

Migratory soaring birds (MSBs) are divided into the following:

- Globally threatened species, mainly (but not limited to): Egyptian Vulture, Steppe Eagle, Eastern Imperial Eagle, Greater Spotted Eagle, Sooty Falcon, and Pallid Harrier

- Species known to occur in high numbers, mainly (but not limited to): Great White Pelican, White Stork, European Honey Buzzard, Black Kite, Levant Sparrowhawk, Steppe Buzzard, Steppe Eagle, Common Crane
- Species known to occur in notable numbers and other (threatened) species: Black Stork, Short-toed Eagle, Harriers, Lesser Spotted Eagle, Booted Eagle, Lesser Kestrel, Saker Falcon.

The 29 Priority MSB Species for the wind farm based on cumulative effects analysis are as follows: Levant Sparrowhawk, Eurasian Sparrowhawk, Golden Eagle, Eastern Imperial Eagle, Steppe Eagle, Eurasian (Steppe) Buzzard, Long-legged Buzzard, White Stork, Black Stork, Short-toed Eagle, Western Marsh Harrier, Pallid Harrier, Montagu's Harrier, Greater Spotted Eagle, Lesser Spotted Eagle, Lanner Falcon, Sooty Falcon, Eleonora's Falcon, Lesser Kestrel, Peregrine Falcon, Eurasian Hobby, Common Kestrel, Red-footed Falcon, Common Crane, Griffon Vulture, Booted Eagle, Black Kite, Egyptian Vulture, Osprey, Great White Pelican, European Honey-buzzard, and Crested Honey Buzzard.

General

Bird observation will be undertaken daily between 1 hour after sunrise to 1 hour before sunset and will be 10-12 hours at chosen VP locations. All public holidays will be accounted for and undertaken regardless. Rotational breaks of 30-60 minutes will ensure that no viewshed is missed throughout the monitoring period.

Flight heights will be recorded as follows:

- Band A: 0-15m is a ground clearance;
- Band B: 15-180m is a collision height;
- Band C: 180m-300m is a risk height;
- Band D: 300-500 m;
- and Band E above 500m.

Data Collection by Visual Observation

The focus of observation will be soaring and gliding birds as these birds have limited flight ability, are less manoeuvrable, have larger body sizes and spans, and therefore are significantly more vulnerable to wind farms than other bird species.

Vantage Points will be selected based on practical viewshed analysis during site visits.

To ensure a standardized recording and a safe identification of soaring and gliding birds, the main part of the analysis will be restricted to birds migrating at distances up to 2 km from each VP.

Data Collection

Data will be recorded on spreadsheets form. These spreadsheets will be filled on a daily basis by the Bird Observers.

- VPs. The recording of observations will follow the methods described by NatureScot (formally Scottish Natural Heritage), which are summarized below. Observers at VPs must position themselves to minimize their effects on bird behaviour. A complete circle of 360 degrees will be scanned using a combination of natural eyesight and use of 10x magnification binoculars. If a migratory species is detected, it will be followed until it ceases flying or is lost from view. For each observation of a target species, data collected will include the following:
 - The time the species was detected
 - The flight duration of the species to the nearest 15-second interval
 - Estimate of the bird's flight height above ground level at the point of first detection and thereafter at 15-second intervals, where flight heights to be classified based on turbine specifications

As a guidance to observers to define their area of survey before starting the observation, determining the cardinal directions (North, South, East and West), and also pre-defining several landmarks of reference in the field, if possible, is also recommended. Observers should constantly scan the whole covered buffer of 360 degrees around, from each VP until a species is detected.

Weather conditions (such as wind speed, wind direction, visibility, cloud cover and precipitation) will be recorded at start time of monitoring activities, then at every subsequent hour and at the end time of monitoring activities. This is particularly important in the case of soaring birds when wind direction and strength is likely to affect migration behaviour.

It is important to note that complete information on all records including the records detected outside the buffer radius around the VP have to be collected, this including number of birds and distance. Also, the distance between the detected record and the observer has to be collected and documented within datasheets. Flight direction as well as heights of all records are among the basic information to be collected.

Accounting for roosting and resting of birds

Many birds must utilise roosting and resting sites during migration to/from overwintering and breeding ranges, and identifying roost sites/habitat features is an important aspect of migratory bird studies for proposed wind energy projects within migratory flyways. MSB and other target species and groups exhibit different migratory strategies, and such strategies are also influenced by bottleneck sites, topography, weather, behaviour, and other factors which influence the location of roost and rest sites. Migration timing, coupled with the condition of individual location of roosting or resting sites along migratory routes, especially in cases where long-distance over-water crossings are involved, such as across the Red Sea between the Sinai Peninsula and the western GoS coast, where the proposed sites are located.

This can result in dynamic spatial use of an area for roosting/resting, even for the same species. For example: one flock of birds undertakes the over-water crossing at a similar time to another, but the first encounters more difficult conditions or requires rest earlier than the second. While the second group passes through an area during the daytime, the first group stops for rest and roosts overnight. Therefore, the study design will aim to document and characterise the extent to which migratory soaring birds rested or roosted in the proposed project areas and the immediate surrounding areas using the following approach:

- Recording resting/roosting birds during VP observations - visible ground will be scanned thoroughly for any birds, and any birds identified resting or roosting on the ground will be documented using the appropriate data sheet.
- Recording roosting/resting birds outside of VP surveys – During travel to/from VPs or between VPs and within 2-km of the sites, observers to record any resting or roosting migratory soaring birds. These observations will be recorded on a data sheet and roosting/resting sites were mapped .

Data evaluation on bird/wind turbine-interactions

Undertake general analysis (abundance and frequency of birds, average flight altitude, species-specific flock size, daily and seasonal migration patterns, spatial distribution of migration and high-risk areas) but also the data evaluation on bird/wind turbine-interactions (**Micro-avoidance** behavior of MSBs, flight periods when birds face collision risk, species-specific behaviour of MSBs when passing the Private Sector Wind Farm sites (**macro-** and **meso-avoidance**) and the assessment of magnitude of barrier effects (depending on other factors, e.g. flock size, flight altitude, operating/non-operating wind turbines, weather conditions, etc.), and (**Near Miss Incidents** are situations in which Priority Bird/s or flocks of non-priority MSBs are exposed to the risk of collision i.e. they fly through the rotor -swept zone of one or more turbines but are not struck. This may occur when field observers and/or turbine operator were not able to achieve shutdown before the bird/s flew through the collision risk zone).

Communication

All team members will be provided with a mobile phone including internet connection and messaging (e.g.

WhatsApp) phone application. The team in the field will be in contact during the monitoring period via mobile phones and a dedicated messaging group for immediate communication for any key issues to include for example: (i) follow up on the migrating flocks and individuals over the project area; (ii) avoid double count of same flocks/individuals and other as appropriate. It is highly recommended to use appropriate sets of Walkie-talkies and repeaters (subject to permits from Egyptian military) as reliable and efficient communication means for the long-term implementation of the BMP & SDOD to cover all VPs. This will resolve the most critical aspect in SDOD Program implementation and optimize the program efficiency. At least three sets of Walkie-talkies should be used in case of reliable mobile network in the coming seasons (one for field coordinator, one for SCADA operator, and one for RADAR operator). If the mobile network coverage is poor, additional units should be used for each monitoring VPs.

Communication Protocols and Channels

The SDOD protocol is part of an environmental management system that aims to avoid potential negative impacts on Migratory Soaring Birds (MSBs). Thus, one main objective is to test and increase the effectiveness of mitigation measures and to enable and support an active turbine management of multiple wind farms in the GoS. To achieve this objective, it is important to follow a technically sound approach that is coordinated among all involved parties. For that reason, a regular and open communication between all parties following a responsive and adaptive approach is crucial for a successful implementation. The main communication tools to be applied are:

- Technical workshops will be held involving all consultants of all operational wind farm projects along the Gulf of Suez (e.g. including Project O&M Team, Technical Committee, Lenders and/or other Organization (e.g. NGOs)). The main objective of these technical workshops is to discuss and agree on the approach of data collection and data analysis that is being implemented as part of the wider area turbine management. Conclusions from the workshops should be documented in order to be integrated into the wider area turbine management and to be shared with all involved parties.
- Technical meetings for the Project O&M Team, involving the Technical Committee, Lenders, the project's consultants will be held on annual basis to review the implementation of SDOD at the project level and provide amendments and adaptations on the wider level.
- Technical reports will be prepared seasonally by the consultant(s) and will be shared with all involved parties.
- Public meetings (if needed) to inform certain or all involved parties. The results of a public meeting should be recorded in an official protocol that should be submitted to all involved parties.

The SDOD program should follow the following procedures:

- The SDOD Field Coordinator will coordinate the SDOD work and be the first line of communication and reporting to/with the radar and SCADA operators.
- Once a potential collision risk event is identified, the field observers will have the flexibility to evaluate the collision risk taking into account the species, flight altitude, speed, likely flight path and behaviour, distance from the bird to the turbine and the time it takes to shut down turbines once the request is made. This information should be instantly communicated to the field coordinator.
- The SDOD Field Coordinator will be responsible for requesting the turbine(s) shutdown/restart after event evaluation and verification of the SDOD criteria. They will have the responsibility to decide whether some individual/ group or even all the turbines must be shut down and to decide when it is safe to turn them on again.
- The shutdown/restart requests will be either communicated to the SCADA operator by effective communication means (e.g. mobile phone or radios) or by direct access to the SCADA system if possible.
- To make the communication, coordination, and decision-making protocol easier, it is crucial to limit the shutdown/restart request and the event recording to the field coordinator. Communication between the

SDOD Consultant, and the Beneficiary will be handled in two levels: Operational level: involve direct verbal communication between the field coordinator and the SCADA operator to request the turbine(s) shutdown/restart. Management level: involve written communication from the SDOD Consultant and the Beneficiary/Project O&M Team on a pre-set interval (preferably weekly) reporting progress of the SDOD program, and a written confirmation's reply from the Beneficiary on the records match with the SCADA logs.

- Prepare a guidance on use of SDOD for Beneficiary team including SDOD's Criteria, Procedures, and Communication Protocols as well as and monthly SDOD event curtailment time duration during bird migration seasons.

Adaptive Management Process for the ATMP (Linkage between the ATMP components)

The SDOD-Program shall remain flexible and adopt an approach of adaptive management with a yearly reporting frequency, particularly with regards to shutdown criteria, options to forecast migratory activity (e.g. in relation to climatic conditions), observation periods and times, location and - maybe - number of observation site etc. The monitoring of collision victims is extremely important as an evaluation tool, i.e. to prove whether the proposed approach is working and whether the assumptions that form the basis of the approach are well-founded. The design and the scope of the post-construction SDOD protocol shall be updated and adjusted on a yearly basis.

It is crucial that cumulative impacts of multiple wind farms can be thoroughly considered during the operational phase of multiple wind farms in the GoS. The adaptive for the ATMP should aim to assess the impacts of the project during the operational phase, building on the findings of the project's ESIA. In order to achieve this, regular reporting should be maintained in order to ensure the quality of the implementation of the ATMP is being maintained. The Project's consultants implementing the SDOD should be committed to the following:

- Provide monthly reports to RCREEE and the Project O&M Team for review and documentation.
- Provide detailed seasonal reports to RCREEE, Project O&M Team and other relevant entities, including Technical Committee for review, these reports should include recommendations for amendments on ATMP if necessary.
- Provide annual summary report to all relevant entities, presenting recommendation for ATMP amendments if available.
- In case of documentation of any fatality of any priority species, either through SDOD monitoring or carcass search, a report should be provided during the same day of the event and to be submitted to RCREEE and Project O&M Team for follow-up and documentation.

Based on the above reporting requirements, ATMP amendments could be undertaken at seasonal or annual basis depending on the findings of the ATMP implementation and/or based on the recommendations from the relevant entities.

8 APPENDIX 3 – POST CONSTRUCTION FATALITY MONITORING (PCFM) PROGRAM

Systematic fatality surveys (i.e. carcass searches) by trained experts have become the primary means of monitoring collision victims and estimating collision rates at wind power plants worldwide. Applying the suitable survey design to be implemented at the project site, is the most reliable and accurate approach for determining the number of birds killed in a certain wind farm, monitoring bird fatalities over time, for analyzing the factors that cause variations in fatalities among turbines or analyzing the effectiveness of measures designed to reduce collision risk.

All works associated with PCFM will be fully aligned with IFC, EBRD & KfW (2023) *Post-construction bird and bat fatality monitoring for onshore wind energy facilities in emerging market countries. Good Practice Handbook and Decision Support Tool. International Finance Corporation (IFC). European Bank for Reconstruction and Development (EBRD). Kreditanstalt für Wiederaufbau (KfW).* A summary of the requirements of this document are provided below however for full, detailed methods the original document should be followed and adapted for use on site.

Scope of the monitoring program

Obtaining unbiased fatality rates requires the following field activities to be conducted at the wind farm and along the OHTL during autumn and spring bird migration seasons (from Spring 2025 and will cover from mid-February to late May each subsequent spring, and mid August to mid November each subsequent autumn) for the lifespan of the project:

- A schedule of systematic fatality search surveys conducted; at a specified number of turbines and powerline sections, within defined search area limits (the search plot), using defined transect spacing within the search area (20m apart), within the area defined as 'searchable' within the search plot;
- Searchable efficiency bias correction experiments to estimate the % of fatalities missed by searchers; and
- Carcass persistence bias correction experiments to estimate fatalities removed by scavengers between searches.

When conducting systematic carcass searches experts walk along pre-defined transects under each turbine. All found carcasses (in this case a bird/bat or parts of a bird/bat) are recorded and carefully examined (any evidence of fatality, carcass complete or dismembered, type of injuries evident, scavenging evident, distance and direction to turbine, etc.). Estimates of fatality rates are biased concerning searcher efficiency. Furthermore, other factors such as the proportion of searched areas and carcass persistence should be taken into consideration when estimating fatality rates. When carcasses are located, observers will record the species name, distance from the turbine tower, direction to the nearest turbine, and predation evidence or other observations. Carcasses will be then used in carcass persistence trials. Note should be made of any tags, rings, or transmitters that might be on such birds. Carcass search surveys will also be undertaken along the associated Overhead Transmission Line (OHTL) during bird migration seasons. In general, the same approach on standardized carcass searches can be applied.

PCFM Search Team – Roles and Responsibilities

The PCFM Search Team will consist of: Search Technicians, Lead Ecologist, Wind Wildlife Expert, and project O&M Team. The specific responsibilities of these roles is as detailed below.

Search Technicians (ST). The Search Technicians are the people who perform the carcass searches. They must be based close enough to the wind farm to allow for the performance of fieldwork at the site on a full-time, daily basis, ideally with less than one hour of travel time to and from the site each day. They will be hired, trained, resourced, and managed by the Lead Ecologist and must have the capacity to drive a field survey vehicle, and to perform rigorous fieldwork in extreme climatic conditions. ST must be able to follow all instructions/procedures related to the survey protocol, including data recording/documentation, and site safety requirements and personnel policies of the wind farm.

Lead Ecologist (LE). The Lead Ecologist will be an external, independent environmental consultant/consultancy, most likely based in Egypt, who must possess the capacity to perform the following functions that will be assigned as responsibilities of the LE: 1) recruit, hire, manage, resource, and supervise the ST staff required to perform the search effort, 2) perform taxonomic identification of bird and bat specimens discovered during the searches, either through the use of in-house or subcontracted national taxonomic experts, 3) liaise effectively with the Operator and the Internationally-recognized Wind Wildlife Expert (WWE), and 4) fulfil the monthly reporting requirement (see under “reporting”) beginning with the start of monitoring, 5) manage the data throughout the monitoring and reporting periods, and 6) with respect to the semi-annual reporting requirement (see under “reporting”), the LE will be expected to receive training from the WWE in year 1, so that the LE may assume responsibility for the semi-annual fatality rate analysis and reporting responsibilities in future years. Required qualifications include bachelor’s level or higher degree in ecology or a related scientific discipline from an accredited college or university; regional taxonomic expertise in birds and bats of Egypt, capacity to recruit, train, resource, and manage a staff of ST, capacity to perform quantitative and qualitative analysis and presentation of scientific data, including simple statistical analyses; and capacity to produce professional quality reports in English, including georeferenced map figures.

Internationally-recognized Wind-Wildlife Expert/Consultancy (WWE). The WWE will be an external, independent expert who possesses a master’s degree or higher in ecology or a related scientific field, and extensive experience (minimum 5 years) in the design and implementation of PCFM programs at wind energy facilities, following GIIP and the typical requirements of Development Finance Institutions. Responsibilities of the WWE will include 1) prepare all necessary protocols and data forms required to guide and document the effort, 2) conduct a two-week site visit to the wind farm to provide direct training and supervision to the rest of the Team at the initiation of PCFM, 3) liaise effectively with the LE and with the Operator, and 4) perform the semi-annual data analysis and reporting requirements in year 1, while providing training and direct guidance/capacity building to the TL in such aspects, so that the TL may successfully assume responsibility for semi-annual data analysis and reporting requirements in year 2 and beyond.

Methodology

Post Construction Fatality Monitoring will be undertaken during the operation phase, with carcass search surveys covering each turbine across the entire wind farm. The carcass search will demonstrate the effectiveness of mitigation measures such as turbine shutdown and allow an estimation of the annual number of bird and bat deaths caused by the turbines and OHTL.

General Estimator of Mortality (GenEst)

The suggested approach uses the GenEst program to calculate fatality rates. This free to use, state-of-the-art estimator software combines the expertise from teams that developed earlier fatality estimators and is demonstrated to provide unbiased fatality rate estimates, improving on, and replacing all previous estimators. The software has been designed to be used by ecological managers and features a user-friendly interface and comprehensive and practical user manual.

In the suggested approach these activities generate data which is transferred from field data sheets to five (5) input files for analysis in GenEst. These files are:

- Carcass observations (CO) – containing details of all found fatalities during search surveys,
- Search schedule (SS) – containing dates when each turbine/powerline was searched,
- Searcher efficiency (SE) – containing results of searcher attempts to find carcasses placed to test searcher efficiency,
- Carcass persistence (CP) – containing results of the times when carcasses placed to test carcass persistence were last recorded present and first recorded absent,
- Density weighted proportion (DWP) – containing turbine/powerline specific figures giving the % of the total carcasses available to be found accounting for those that were not ‘available’ because they landed in unsearched areas either within or beyond the search plot.

These files are uploaded to the GenEst program and allow the analysis of fatality rate estimates to be calculated.

GenEst is best suited for sites where >5 carcasses are found over each monitoring period. Where fewer carcasses are found during monitoring the Evidence of Absence estimator tool is likely to provide a more appropriate statistical model. This requires the same information as GenEst (as detailed above) .

Technical Approach

The PCFM protocols will be implemented by a team of observers (Search Team) who will be led by the Lead Ecologist. The search team will require adequate numbers of staff to perform all searches required, allowing for working hour restrictions, breaks, holidays/illness, etc. The Lead Ecologist will be responsible for the final, on site design and implementation of the PCFM program and will train the Search Technicians (including searcher efficiency (SP) and carcass persistence trials (CP)), schedule and coordinate fieldwork, manage bias correction trials, manage data and reporting. The Search Technicians will be responsible for the day to day searches, the completion of trials, accurate data recording and inputting raw data.

During the testing and commissioning phase when the PCFM protocol is first implemented, the following steps will be taken:

- During the first 5 days, the WWE/ Lead Ecologist and the Search Technicians will inspect all turbines and mark out the search plots for each WTG.
- The WWE/ Lead Ecologist will review all search plots of the WTGs to identify searchable and unsearchable areas, which will be crucial for estimating mortality using the GenEst model.
- Additionally, the WWE/ Lead Ecologist will guide the Search Technicians to test the feasibility of the proposed methodology on the ground, assess if any further inputs are needed, and ensure that the methodology is standardized for the upcoming season.

Prior to the next season/year searches taking place the Lead Ecologist will re-visit all turbine locations to ensure the previously designated search plots are still applicable, if changes are required these will be completed and documented.

The Lead Ecologist and Search Technicians will also carry out a clearing search at all turbines to ensure only new carcasses are included in any statistical modelling. If carcasses are found during the clearing searches, these should be recorded separately and if required and appropriate, saved for use in searcher efficiency and carcass persistence trials.

Search Time and Routine

The daily field work will be performed according to the following methodology:

- All WTGs will be searched on a weekly basis, conducting a total of four search cycles throughout a month.
- The suggested search rate average will be (3 turbines/day/searcher), yielding an average of 21 turbines per day. The average time required to conduct the search procedure/protocol at a single turbine is anticipated to be approximately 80-90 minutes for one Search Technician.
- The Lead Ecologist will be following the implementation of the field work, data collection, daily follow-up routine for the team, collecting data revision and data storage into a database and testing the Search Efficiency.

Overhead Transmission line (OHTL) search

A systematic search transect by car will be conducted for the OHTL inside and outside the windfarm boundaries. The route will be divided into segments each measuring approximately 5 km. Within each 5 km segment at least 50% of the overall length will be searched – ideally using 500 m search lengths separated by an equal distance. The search will be done at intervals of between 7 and 14 days depending upon search results during the search period. The transects will be carried out by walked transects, or from a slow-moving vehicle along set routes covering a

plot measuring 50m either side of the OHTL centre line i.e., 100m total width. Search transects will be of 20 m width either side of the walked/driven line as per the turbine searches.

Search Plots and Visibility Classes

Due to rough terrain, hazardous slopes or construction remains, some of the plot's areas could be out of reach and therefore, the unsearchable area will be mapped and calculated to be omitted from the total searched area as well as determine the search accuracy. Therefore, determining visibility classes of all wind turbines and OHTL search plots for the wind farm will be conducted, the total search area will be classified according to search feasibility and land topographic nature into High, Medium or Low visibility, or whichever suits the site terrain nature.

Searcher Efficiency (SE)

Searcher efficiency is the probability that a searcher will spot a carcass in the searched area which is typically estimated through purposefully made-up field trials as a bias correction approach. Decoys of different size classes (Bats, large birds (>55cm body length), medium (30-55cm body length) and small (<30cm body length)) will be placed at different visibility classes (high, medium, low and very low) by the Lead Ecologist unwitnessed by the Search Technicians.

Good practice is to use a minimum of 10 decoys per covariate (i.e. size class x visibility class x season) meaning a minimum of 40 samples per season will be used (assuming high visibility throughout the search areas). In addition, decoys that were not found on the first search should be left in place to test whether searchers find them on the next scheduled search.

Undetected decoys will then be calculated to give an estimate on Search Technicians' efficiency at each month of the seasons (spring and autumn). The decoys will be placed in the search plots on different dates along the search period.

Carcass Persistence (CP)

Carcass persistence is the probability that a carcass spotted at time (0) will continue to persist for (t) days. During the trial, carcasses will be chosen to closely represent all targeted species of the wind farm. During the trial, the person in charge will record the exact time and location of placement and revisit each carcass periodically, recording the date and time of the visit and the presence or absence of the carcass.

Carcass persistence varies according to different characteristics such as carcass size, search season and nature of land cover. During the search, found carcasses will be marked and documented to be checked up periodically for removal rate.

Mortality Estimation

Estimated mortality is calculated through GenEst once searchers' efficiency and carcass persistence models are set for each size class.

Detection probability & Density-Weighted Proportion (DWP)

Detection probability varies with several factors including migratory bird species, carcass size class, searching season, topography (scale of seachable areas and visibility classes) and the search schedule since it tends to be higher in daily searches than weekly ones.

Furthermore, carcass arrival time can affect detection probability in that early spotted carcasses could be revisited frequently through the search period while those spotted near the end of the season won't be recorded as much. Therefore, to avoid misleading calculations, GenEst depends on complex models that yield carcass-specific detection probability for mortality estimation (Dalthorp et al 2018⁸).

To produce unbiased fatality estimates, **it is important to account for carcasses that land in these unsearched**

⁸ Dalthorp, D., Madsen, L., Huso, M., Rabie, P., Wolpert, R., Studyvin, J., Simonis, J., and Mintz, J. (2018). *GenEst statistical models—A generalized estimator of mortality*. U.S. Geological Survey Techniques and Methods, book 7

and unsearchable areas of the fall zone, especially if such areas cover a large proportion of the fall zone (e.g., in road and pad only search plots). Unsearched and unsearchable areas are accounted for by calculating the density weighted proportion (DWP; Huso and Dalthorp 2014⁹) of the fall zone that is searched. The DWP allows fatality estimates to be adjusted to account for carcasses falling in unsearched and unsearchable areas.

Field data collection

In order to standardise data collection and ensure all relevant information is recorded in the field the following forms will be completed during each period of carcass searching

Search schedule form:

One of these forms should be filled out by the Search Technician performing the searches for each day of carcass searching. The following information will be recorded;

- Date
- Turbine Searched
- Search Technician name
- Start and end time + total time spent searching
- Carcasses found (species, sex and age class if possible)
- Carcass ID numbers of each
- Data name and path (file) of track-log

Carcass Observation (CO) form:

One of these forms should be filled out by the Search Technician for each carcass discovered during the searches. This form will contain all the following information collected for each carcass;

- Turbine number
- Date
- Time
- Carcass ID (e.g. X001)
- Distance from wind turbine
- Bearing from centre of turbine mast (degrees)
- Species (or group if unidentifiable), sex and age class (e.g., juvenile, sub-adult, adult)
- Carcass condition and estimated carcass age (e.g., whether the carcass has been found by scavengers, what state of rigor mortis, and an estimate of the number of days it has been present)
- Notes – to include measurements of wing, body length, forearm where applicable

In addition to the above, photographs should be taken of all fatalities with an emphasis on taking high quality informative photographs adequate to identify a fatality. These should be taken; *a) as the carcass is found, taken directly from above, b) turned over to show ground-facing side, c) from all angles to show features which might help with identification (e.g., all sides of head, open wings, tail, feet), d) showing any injuries, e) showing area immediately surrounding the carcass. All photographs should have a size reference (e.g., ruler) in frame at the same elevation as the carcass.*

Searcher efficiency trial (SE) form:

One of these forms should be filled out by the Lead Ecologist for each day on which SE trials are performed. This form will contain the following information:

- Date of trial
- Turbine number
- Carcass types used (i.e., large bird, small bird, bat, or surrogates)
- Time carcass put out
- Placement of carcass (distance and bearing from centre of turbine mast)
- Name of Lead Ecologist placing carcass

⁹ Huso MMP, Dalthorp D (2014) Accounting for unsearched areas in estimating wind turbine-caused fatality. J Wildl Manag 78(2):347–358

- Name of Search Technician taking part in trial – N.B. the searchers should not be aware they are in the trial
- Result of trial (i.e. found by searcher, not found by searcher but relocated later by Lead Ecologist, not found by searcher and not relocated later by the Lead Ecologist)

Carcass persistence trial (CP) form: One of these forms should be filled out by the Search Technician for each round of CP trials. This form will contain the following information:

- Date and time of original carcass placement
- Turbine number
- Carcass type used (i.e., large bird, small bird, bat or surrogate)
- Placement of carcass (distance and bearing from centre of turbine mast)
- Date and time of each subsequent visit to relocate carcasses
- Result of subsequent searches to relocate carcass (present/not present/status of decay, scavenging e.g. by insects)
- Freezer log form: One of these forms will be required for each freezer dedicated to bird/bat specimen and/or test carcass storage located at the facility. Information on this form should be recorded by whomever removes or adds any carcasses to/from the freezer. The purpose of this log is to maintain an up-to-date inventory of the carcasses contained within the freezer, including both carcasses discovered and collected during carcass searches, and other carcasses obtained otherwise for the purpose of use in bias-correction experiments. The log will also be used to document when specimens are removed, i.e. for use in bias correction experiments.

Materials necessary for conducting the surveys include the following:

- Bite-proof gloves for specimen handling
- Personal protective equipment (including but not restricted to hard-hat, boots, appropriate clothing for seasonal weather conditions).
- On-site freezer for specimen storage.
- Field data forms.
- Camera, scale ruler and GPS unit - for photographing and georeferencing carcasses found during the searches. In addition a laser range finder will help obtain accurate measurements in the field.
- Plastic bags, labels, waterproof writing implements for specimen collection and labelling.
- Ruler and callipers for measuring specimens.
- Written field protocol.
- Safety supplies.

Weather data

Weather condition parameters will include wind speed, wind direction, visibility and any other notes or special weather conditions (like sand storms, heavy rains etc...), will be documented at the start time for each carcass search.

Wind speed will be measured using a basic anemometer, while wind direction will be estimated using a compass, and visibility will be visually determined with the aid of fixed reference land marks and structures, which includes four categories: 1) < 5 km, 2) 5-10 km, 3) 10-15 km and 4) > 15 km.

Data Management

Compiling, storing and data input in Genest

- Data storing system will be established between the Lead Ecologist and the Search Technicians for adequate daily data storage.
- The Search Technicians will report any drawbacks or encountered complications in data collection daily to the coordinate (Lead Ecologist).
- The Lead Ecologist will double check the received data organize it and transfer it into digital spread sheets weekly.

- Formats of dates and variables constituting GenEst data sheets will be exactly as mentioned in the GenEst guidelines.

Quality Assurance and Control

- At all stages of monitoring, including field data collection, data entry, data analysis, and report preparation, the Lead Ecologist must implement QA/QC measures.
- Each Search Technician will check their data forms for completeness, accuracy, and legibility at the end of each survey day.
- The Lead Ecologist will verify data forms on a regular basis to ensure completeness and legibility, and any errors will be remedied.
- The individual making the modification will initial and date any changes to the data forms.
- Data will be extensively reviewed for issues.
- Any inaccuracies will be addressed by referring to the raw data forms and/or checking with the data collector(s).
- Any unusual data discovered, as well as any data suspected of being problematic, will be discussed with the Search Technicians and Lead Ecologists.
- Any modifications to the raw data will be documented.

Reporting

Reporting will be supplied to the Project team on a regular basis, with biannual reports distributed to summarise the previous seasons findings, results of mortality monitoring aligned to PBR thresholds and recommendations for any adaption to methodology or existing impact assessments and mitigation (Adaptive Management).

In addition to the formal reporting above, monthly email reports will be sent detailing recent findings and to give regular updates to findings, schedules and address any changes in methodology that may be required to complete the relevant tasks. The emails are expected to contain updates on all current ongoing site activities relating to biodiversity studies and enhancements.