Red Sea Wind Energy (RSWE) 500MW Power Plant
At the Gulf of Suez

Cumulative Effects Analysis

6 January, 2021

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Executive Summary

This report presents the findings of a rapid analysis of the potential cumulative effects on biodiversity of wind farms in development by Red Sea Wind Energy Project on the Gulf of Suez, Egypt. The report builds on the findings of the Cumulative Effects Analysis that was undertaken for the Lekela Wind Farm, which is located in the vicinity of the RSWE project to the south. The analysis identifies priority bird Valued Environmental Components (VECs) (IFC 2013) and a preliminary list of other VECs. High-level mitigation and monitoring actions that will be adopted by RSWE are presented.

Additional actions that RSWE and other developers in the study area will undertake or support to address their contribution to the cumulative effects of their developments together with others in the region are also presented.

To determine priority bird VECs for the Projects, the approach that was followed was originally modelled on the Tafila Region Wind Power Projects Cumulative Impact Assessment (IFC 2017), and has been modified to the local conditions and data available through a previous Cumulative Effects Analysis that was undertaken for the Lekela 250 MW wind project (TBC, 2018). Similar to the Lekela approach, a staged screening of the list of preliminary bird species was undertaken, to develop a final list of priority bird VECs that were likely to be at greatest overall risk from the Projects. The data used in the process included all the data that was originally available for the Lekela CEA in addition to all recent data collected in the study area including RSWE's on-site assessments that were carried out in autumn 2019 and spring 2020.

The process has identified 14 species, which had an Overall Risk of Major or Moderate, are considered priority bird VECs for the Projects. 13 of these species were already identified by the Lekela CEA while the current analysis has produced a modified overall risk status for some of them. **An additional species was identified to have a moderate overall risk and therefore was added into the list, namely Lesser Spotted Eagle *Clanga pomarina*.**

Step 4 of the Tafila approach, identifying fatality thresholds for priority bird VECs, has resulted in identifying a zero-fatality threshold for ten of the priority species identified, whereas the remaining four had a threshold ranging from 10 to 100. In step 5, mitigation measures and monitoring actions are proposed, to be adopted by RSWE project, and others that are proposed to be undertaken collectively and collaboratively by all wind energy developers across the study area. These mitigation and monitoring actions focus on the potential impacts to the 14 priority VECs are based on industry good practice while building on the already existing experience of adaptive management at operational wind farms along the Gulf of Suez.

1 INTRODUCTION

1.1 Scope and objectives

A Cumulative Effects Analysis (CEA) is a multi-layered analysis approach that aims at identifying and analysing the impacts of a set of projects on a pre-defined set of ecological elements; habitats and species. The CEA comes into context for the RSWE project since it is located in an area that includes multiple wind farms while being also located along a major bird migratory flyway, namely the Rift Valley Red Sea flyway. Although the impact of wind power project infrastructure on Migratory Soaring Birds (MSBs) is well documented, it should be highlighted that the CEA will not be limited to this context and will also take into consideration other ecological elements, including habitats and volant mammals (bats).

The CEA follows a series of multi-layered steps that would eventually identify the potential cumulative impacts of the projects of concern in order to eventually provide monitoring and mitigation measures that would be applied through an adaptive management approach. These steps would follow the approach that was developed under the Cumulative Effects Assessment for the Tafila Region Wind Power Projects in Jordan (IFC, 2017).

This analysis represents the initial steps in understanding potential cumulative effects to biodiversity of wind farm developments by RSWE S.A.E. and other operations in the Gulf of Suez, Egypt. It aims to identify priority Valued Environmental Components (VECs) which are most at risk from the combined impacts of all the existing and potential wind developments identified within the study area, building on the CEA that was undertaken by Lekela Power Ltd. For Lekela 250MW Wind Farm, which is located to the south of RSWE Project. Most importantly, this CEA integrates the avifaunal in-flight monitoring assessments that were undertaken at RSWE 500MW project during autumn 2019 and spring 2020 migration seasons. This analysis also proposes mitigation, monitoring and other management actions for projects operating within the study area to address potential impacts to the identified priority VECs.

1.2 The Geographic Boundaries

The Project is located in the Red Sea Governorate of Egypt, around 200km to the southeast of the capital city of Cairo. More specifically, the Project is located near the Red Sea shoreline and within the Ras Ghareb Local Governmental Unit of the Red Sea Governorate, where the closest residential areas include Ras Ghareb city (located 40km to the southeast) and Zaafarana village (45km to the north). The Project is located within a 1,200km^2 area that has been allocated by the Government of Egypt to NREA for development of wind farms, (presented in red in Figure 1 below), which is the area for assessing potential cumulative effects on biodiversity covers the area targeted for potential wind farm development in the Ras Gharib – Gebel El Zeit area, Red Sea Governorate, Egypt. Within this, a land area of approximately 70km^2 (presented in blue in Figure 1 below) has been allocated to the Developer by NREA for the development of this Project.

Being located by the western coastline of the Gulf of Suez, the project site is located along the Red Sea/Rift Valley flyway, which is one of the most important migration flyways for migratory soaring birds in the world with over 1.5 million soaring birds migrating through it twice a year (Birdlife, 2020). The flyway links the European breeding grounds with the African wintering areas of for a total of 37 migratory soaring birds. 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.

Figure 1: Project Site (Red) as Part of the National-Decree Area Allocated for Wind Farm Developments (Consultant, 2019)

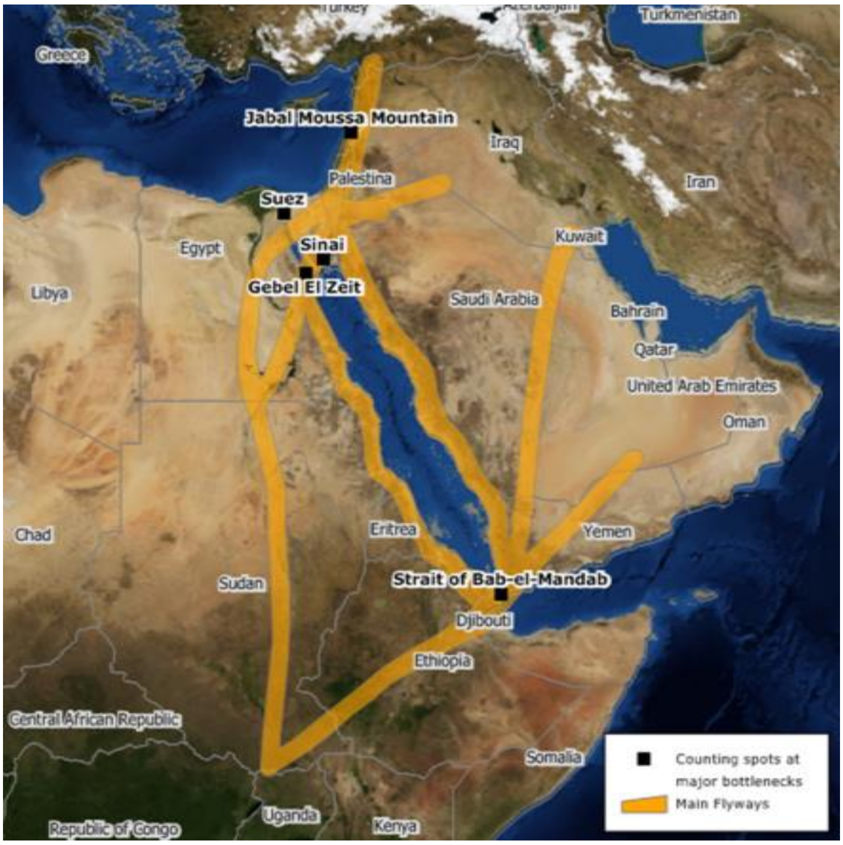

Figure 2. Main routes used by migratory soaring birds as part of the Red Sea/Rift Valley Flyway (BirdLife, 2020)

1.3 The Temporal Scope

The different wind farms in the study area are in varying stages of development. Some have been operational for a few years while others have started operating less than a year while others are in the pre-construction preparation phase. The temporal boundaries will be determined on the basis of monitoring, to take place during the first three years of RSWE project operations.

2 IDENTIFICATION AND SCREENING OF VECS

VECs are defined as attributes, both environmental and social, that are considered important in assessing the risks that a project, or suite of projects poses to the environment. Identification of VECs was restricted to flora and fauna species (biodiversity), physical features and habitat via a desk-based exercise using published and grey literature.

Priority VECs were selected through an iterative process in consultation with the stakeholders. For each VEC group and/or potential impact, the following elements were discussed and were reviewed in the literature:

- Sensitivities
- Available data sources
- Activities and/or drivers other than wind projects
- Data ownership and access

3 THE APPROACH

The framework is based on internationally accepted approaches to risk assessment practices to identify priority VECs and aligns with IFC's GN6. This framework for birds has two objectives: to identify those species at highest risk from the potential impacts of developments in the study area, and to propose mitigation, monitoring and other management activities to address risks to those species. This framework follows a five-step process, as follows, see figure below.

- Step 1: develop a preliminary list of potential VECs, comprising species potentially at risk from developments in the study area, because they are either known or predicted to occur in the study area.
- Step 2: determine the relative 'Sensitivity' of the species, being a combination of the vulnerability of the species and Importance of the population recorded in the study area relative to the appropriate Unit of Analysis (UoA), i.e. the flyway population or global distribution. Species which were determined to have negligible sensitivity were dropped from analysis before proceeding to Step 3. Species where the flyway population comprised <1% of the global population, and for which any impact would be negligible for the species at a global level, were also dropped at this stage.
- Step 3: determine the Overall Risk to the species from the cumulative effects of wind farm developments within the study area, being a combination of the sensitivity, as identified in Step 2; and cumulative Likelihood of Effect (LoE) rating for each species. Those species with an Overall Risk of Major or Moderate are considered to be priority bird VECs for the project.
- Step 4: identify thresholds for fatalities for each priority bird VECs, by setting the point at which further loss is considered a risk to long-term viability of the population. Threshold setting takes into account species-specific biological and demographic parameters, the cumulative risk associated with WPPs, and the likely effects of external stressors on the population defined by the UoA.
- Step 5: proposes a range of mitigation, monitoring and management actions, to avoid fatalities of priority bird VECs, and to accurately estimate priority bird VEC fatalities to facilitate compliance with thresholds and inform adaptive management responses.

Data and Expert Review Panel (ERP) Inputs	CEA Bird Framework Steps	Scoped Out
➢Avifaunal assessments in the Study Area ➢Migratory Soaring Bird Database ➢BirdLife Soaring Birds Sensitivity Mapping Tool	**Step 1: Develop Species Population List and Identify Unit of Analysis** **Part 1: Develop Species Population List** ➢Determine a preliminary list of species populations.	
➢BirdLife flyway and global populations ➢ERP estimates of national population size ➢BirdLife global breeding distribution size	**Part 2: Determine Species Population Categories and Identify Unit of Analysis** ➢Assign each population on Species Population List to one of four categories: Category 1 MSBs Category 2 Breeding and resident raptors Category 3 Other migrants and wintering Category 4 Other residents and summer breeding ➢Identify unit of analysis (UoA) for each species population category. *Bird Populations Scoped in move to step 2*	
➢UoA from step 1 ➢Percentage of UoA overflying TRWPP sites and using TRWPP study area ➢BirdLife global breeding distribution size estimates	**Step 2: Identify Species Sensitivity** **Part 1: Score *Relative Importance*** ➢Score *relative importance* for each species population in relation to UoA as high, moderate, low, or negligible. ➢Consider biome-restricted species.	
➢Global IUCN Red List ➢Arabian Regional Red List –Breeding populations (Draft, 2013) ➢Conservation of Migratory Species – Category 2 List	**Part 2: Score *Vulnerability*** ➢Score *vulnerability* for each species population in relation to UoA. **Part 3: Assign Species Sensitivity** ➢Assign *sensitivity* (high, medium, low, or negligible) rating according to *relative importance* versus *vulnerability* matrix. *Bird Populations with High, Medium, and Low Sensitivity move to step 3*	*Bird populations with negligible sensitivity*
➢Bird baseline assessments in the study area	**Step 3: Create Ecological Risk Assessment Matrix and Identify Priority Bird VECs** **Part 1: Determine Likelihood of Effect** ➢ Determine likelihood of effect (LoE) by rating the overall score of each species; high, moderate, low and negligible. ➢ Component 1: score mean flock size and percentage of flights lowers than 120m for each species by combining them in matrix ➢ Component 2: score categories for the maximum seasonal counts for a species anywhere in the study area. ➢ Component 3: score records of a species on the ground in the study area **Part 2: Assign Risk Rating for Each Species Population** ➢ Assign risk rating (major, moderate, negligible, low) according to *sensitivity* versus *LoE* matrix. **Part 3: Identify Priority Bird VECs of highest risk of impact** ➢ Identify species with a **major or moderate** risk rating as **priority bird VECs.** *Priority Bird VECs move to Step 4*	*Species populations with negligible or low risk*

Step 4: Identify Thresholds for Fatalities for each Priority Bird VEC

To be developed in a later stage

Step 5: Identify Mitigation and Monitoring

Develop Joint MMP, including

- **On-site:** on-site mitigation and monitoring activities, including shutdown protocol
- **Joint Management and Action Plans:** focused on priority bird VECs

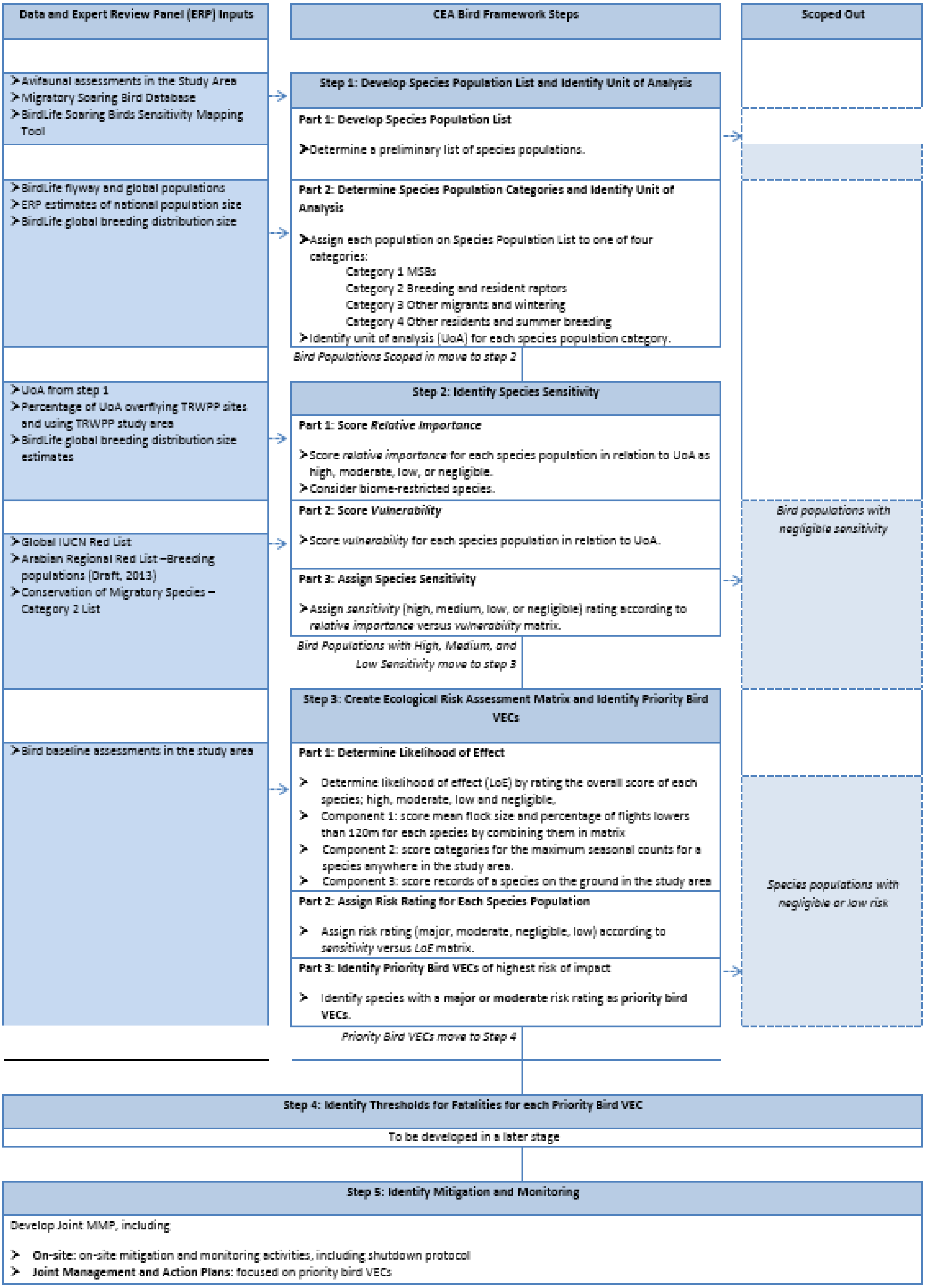

Figure 3. Process for identification of priority VECs

4 THE APPLICATION

4.1 Step1: Develop Species Population List and Identify Unit of Analysis

The purpose of step 1 is to identify all bird species or populations that could potentially be at risk from the cumulative effects within the study area and to determine a relevant UoA by which any effects on each species or population should be measured. A species population list of all bird species known or likely to be present in the study area was compiled from:

- RSWE 500 MW autumn 2019 and spring 2020 avifaunal and biodiversity assessments (ECOConsult, 2020);
- RSWE 500 MW Environmental and Social Impact Assessment (ESIA) (ECOConsult, 2020)
- Lekela North Ras Gharib 250 MW Environmental and Social Impact Assessment (ESIA) (Environics 2018);
- Lekela North Ras Gharib 250 MW baseline bird studies from autumn 2015, spring 2016, spring 2017 and autumn 2016 (Environics 2016b, 2016a, 2017a, 2017b);
- RCREEE Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez (RCREEE 2018);
- The ESIA of the area located to the west of Lekela North Ras Gharib 250 MW Project area (Ecoda 2013);
- The ESIA of Alfa Wind Project (EcoConServ 2016);
- Italgen Gabal El-Zeit 320 MW bird baseline studies in autumn 2008, spring 2009, autumn 2013, spring 2014 and autumn 2016 (Grontmij 2009; EcoConServ 2014, 2017);
- The ESIA of the area located north of Italgen Gabal El-Zeit 320 MW presenting bird baseline studies from spring and autumn 2010 (Ecoda 2011) and additional bird baseline studies from spring 2014 (El-Gebaly & Al-Hassani 2017);
- The Feasibility Study of NREA concession presenting bird baseline studies presented from autumn 2006 and spring 2007 (Decon 2007);
- A survey in autumn 2006 in Gebel El Zeit Important Bird Area (Hilgerloh et al. 2011);
- A survey in spring 2020 in AMUNET 500 MW Wind Farm (RCREEE, 2020)
- Species qualifying the listing of Gebel El Zeit as an Important Bird and Biodiversity Area (BirdLife International 2018a);
- The Migratory Soaring Bird Database (BirdLife International 2018b), filtered by species mapped as occurring in the project area; and,
- The lists of bird and bat species included in the assessment of global vulnerability to wind power development compiled by Thaxter et al. (2017), filtered by species mapped in IBAT as occurring in the project area as.

These species were then allocated to one of three categories, and an appropriate Unit of Analysis (UoA) determined for each category:

- Category 1: Migratory Soaring Birds (as per BirdLife International 2018b), with the UoA being the Rift Valley / Red Sea flyway population. Data on populations of these species were sourced from Grontmij (2009), supplemented with information from Porter (2005) as needed;
- Category 2: Breeding and resident raptors, including species that were recorded at the study area and are known from literature to be breeding in the study area and its vicinity;

- Category 3: Other migrants and wintering species, with the UoA being the global breeding range extent (taken from BirdLife International 2017) as no national, regional or flyway-level estimates were available to allow a definition of a smaller UoA;

- Category 4: Other resident species, with the UoA being the same as for Category 2 species

Step 1 produced a species population list of 194 bird species, see Table 1

Table 1. Species population list of potential bird VECs

Order	Number of Potential VECs
Accipitriformes (diurnal birds of prey)	31
Anseriformes (waterfowls)	8
Apodiformes (swifts, treeswifts and hummingbirds)	3
Bucerotiformes (hornbills, hoopoe, wood-hoopoe)	1
Charadriiformes (shorebirds)	43
Ciconiiformes (storks)	4
Columbiformes (pigeons and doves)	3
Coraciiformes (kingfishers and allies)	5
Falconiformes (falcons and caracaras)	10
Galliformes (ground-feeding birds)	2
Gruiformes (cranes, crakes and rails)	5
Passeriformes (perching birds)	60
Pelecaniformes (ibis, herons and pelicans)	14
Podicipediformes (grebes)	1
Pteroclidiformes (sandgrouses)	2
Strigiformes (nocturnal birds of prey)	1
Suliformes (cormorants, gannets and boobies)	1

4.2 Step 2 – Identify species sensitivity

The purpose of Step 2 is to determine the sensitivity of each species or population identified in Step 1 based on its vulnerability at a national, regional, or international scale, depending on the UoA, and the relative importance of the study area to the population. Sensitivity as considered here relates to the species population present in the study area, and combines two components:

- Relative Importance for each MSB species population was defined as an estimate of the proportion of the Rift Valley/Red Sea flyway population migrating through wind power projects within the study area. Owing to the practical difficulties of monitoring the entire flyway, the flyway population estimate for a species is given as the maximum seasonal count recorded at any of the Middle East bottleneck sites during the period of documented migration monitoring (Porter, 2005) recorded in the study area, and for other migrants and for resident species the global breeding range (sourced from Birdlife International species accounts), with ratings as per Table 2 and Table 3 respectively. For the population recorded in the study area, we have taken this number to be the maximum count recorded in any season for any survey.

- Vulnerability, for each species population, was scored using international and/or regional guidance on conservation status appropriate to its UoA and evidence of its vulnerability to wind farms. International guidance was applied to migrant and wintering species populations (categories 1 and 3) and regional guidance to the resident and summer breeding species populations (categories 2 and 4), see Table 4.

These two factors are combined in a matrix to determine to overall species sensitivity, see Table 5. Species with a negligible sensitivity were not progressed to Step 3. Additionally, we discounted species where the estimated flyway population was <1% of the total estimated global population to reflect the very low importance of the Rift Valley / Red Sea flyway population at a global level: this removed four additional species that were rated above a negligible sensitivity (White-tailed Sea Eagle *Haliaeetus albicilla*, Griffon Vulture *Gyps fulvus*, Hen Harrier *Circus cyaneus* and Red Kite *Milvus milvus*).

Table 2. Relative importance scoring for migratory soaring birds

Relative Importance	Maximum total count for a species within a single season from any one project in the study area as a percentage of flyway population
Negligible	≤ 1%
Low	>1% and ≤ 5%
Moderate	>5% and ≤10%
High	>10%

Table 3. Relative importance scoring for other migrants and resident species

Relative Importance	Global resident or breeding range (km²) – extent of occurrence
Negligible	> 10,000,000
Low	> 100,000 and < 10,000,000
Moderate	> 50,000 and < 100,000
High	< 50,000

Table 4. Vulnerability scoring criteria

Vulnerability rating	Migratory soaring birds (and other species where an SVI has been designated)	Other migrants and resident species
Negligible	LC on IUCN Global Red List, and SVI of 6 or below	LC on IUCN Global Red List
Low	VU or NT on IUCN Global Red List and SVI 6 or below; LC on IUCN Global Red List and SVI of 7 or 8; or CMS Category 2 Species and SVI of 6 or below	NT on IUCN Global Red List
Moderate	VU or NT on IUCN "Global" Red List and SVI of 7 or 8; LC on IUCN Global Red List and SVI of 9 or 10; or CMS Category 2 Species and SVI of 7 or 8	VU on IUCN Global Red List
High	CR or EN on IUCN Global Red List; VU or NT on the IUCN Global Red List and SVI of 9 or 10; or CMS Category 2 Species and SVI 9 or 10	CR or EN on IUCN Global Red List

Table 5. Sensitivity matrix

Sensitivity		Relative Importance			
		Negligible	Low	Moderate	High
Vulnerability	Negligible	Negligible	Negligible	Low	Low
	Low	Negligible	Low	Low	Medium
	Moderate	Low	Low	Medium	High
	High	Low	Medium	High	High

Step 2 produced a list of 35 avian species with their sensitivity being low or above, which means 159 species populations were scoped out as a result, see Table 6.

Table 6. Scoring at step 2 for species sensitivity rates as Low, Moderate and High

Species	Vulnerability	Relative Importance	Sensitivity
European Turtle-dove *Streptopelia turtur*	Negligible	Moderate	Low
Bar-tailed Godwit *Limoa lapponica*	Low	Low	Low
Curlew Sandpiper *Calidris ferruginea*	Low	Low	Low
Great Snipe *Gallinago media*	Low	Low	Low
Yellow-billed Stork *Mycteria ibis*	Moderate	Negligible	Low
White-eyed Gul *Larus leucophthalmus*	Low	Low	Low
Black-winged Pratincole *Glareola nordmanni*	Low	Low	Low
Black Stork *Ciconia nigra*	Moderate	High	High
White Stork *Ciconia ciconia*	Moderate	High	High
Common Crane *Grus grus*	Moderate	High	High
Dalmatian Pelican *Pelecanus crispus*	High	Negligible	Low
Great White Pelican *Pelecanus onocrotalus*	Moderate	High	High
European Honey-buzzard *Pernis apivorus*	Moderate	Low	Low

Species	Vulnerability	Relative Importance	Sensitivity
Bateleur *Terathopius ecaudatus*	Moderate	Negligible	Low
Egyptian Vulture *Neophron percnopterus*	High	Low	Moderate
Cinereous Vulture *Aegypius monachus*	High	Negligible	Low
Lappet-faced Vulture *Torgos tracheliotos*	High	Negligible	Low
Black Kite *Milvus migrans*	Low	Moderate	Low
Bonelli's Eagle *Aquila fasciata*	Moderate	Negligible	Low
Tawny Eagle *Aquila rapax*	High	Negligible	Low
Steppe Eagle *Aquila nipalensis*	High	High	High
Eastern Imperial Eagle *Aquila heliaca*	High	Low	Moderate
Golden Eagle *Aquila chrysaetos*	Moderate	Negligible	Low
Verreaux's Eagle *Aquila verreauxii*	Moderate	Negligible	Low
Greater Spotted Eagle *Clanga clanga*	High	High	High
Lesser Spotted Eagle *Clanga pomarina*	Moderate	Moderate	Moderate
Booted Eagle *Hieraaetus pennatus*	Moderate	High	High
Short-toed Snake-eagle *Circaetus gallicus*	Low	Moderate	Low
Eurasian Buzzard *Buteo buteo*	Low	Moderate	Low
Long-legged Buzzard *Buteo rufinus*	Low	Moderate	Low
Levant Sparrowhawk *Accipiter brevipes*	Negligible	High	Low
Montagu's Harrier *Circus pygargus*	Moderate	Negligible	Low
Pallid Harrier *Circus macrourus*	Moderate	Moderate	Moderate
Saker Falcon *Falco cherrug*	High	Negligible	Low
Cyprus Warbler *Sylvia melanothorax*	Negligible	High	Low

4.3 Step 3 – Ecological risk assessment and identification of priority bird VECs

Step 3 aims to identify priority bird VECs from the 35 sensitive species remaining from Step 2. This is done by combining each species' sensitivity rating with an estimated of site-specific risk (the Likelihood of effect: LoE) to identify the species which are most at risk of significant impacts from wind farm developments in the study area. Based on the baseline bird data available, Likelihood of Effect comprised of three components:

- Component 1. A score for the combined effect of the percent of individuals recorded flying below 200 m and mean flock size, see Table 7. These are birds which are potentially at risk of collision with turbines or could collide with transmission lines. We took the weighted mean percent of individuals recorded flying below 200 m (i.e. sum total of individuals <200 m divided by the sum total individuals for all seasons) for all seasons where this value was reported. For species with no data for the percent of records <200 m, we scored these as having 50% of records <200 m. Mean flock size was derived from the average flock sizes reported during each survey period: no weighting was applied as not all surveys covered the full migration period for all species, and flocking behaviour might vary throughout this period. Larger flocks were considered to be at greater risk of multiple fatalities due to the higher numbers present and the reduced ability for individuals in the flock to see and avoid turbines or power lines. For species with no data on mean flock size, we conservatively scored these as having a maximum flock size equal to the maximum count recorded in a season (as per Component 2, below: i.e. equivalent to all individuals passing in a single flock). For species with values for both variables, the resulting matrix score was increased by one if the variability (taken as the standard deviation of all reported values for that species) of the percentage of flights <200 m was in the top two quartiles (i.e. the top 50% of values). We added this additional step to account for situations where flight height behaviour was very variable and the average value was less valid as a risk predictor;
- Component 2. The maximum total count for a species within a single season from any one project in the study area to reflect the fact that species with higher counts in the study area are more likely to be affected by wind developments, see ; and,
- Component 3. Whether or not that species had been recorded on the ground within the study area, irrespective of the numbers of individuals involved (species with records of landing scored 1, those without 0). Those species recorded on the ground must pass through the collision risk zone, and hence are at greater risk of collision than those species for which landing on the ground has not been recorded.

These three components were summed to arrive at a final LoE score for each species (theoretical range 2-10), which was separated into quartiles to derive a LoE rating for that species, see Table 9. This LoE rating was then combined with the Sensitivity rating from Step 3 to derive an Overall Risk rating from the project, see Table 10. Species which had an Overall Risk of Major or Moderate were considered Priority bird VECs for the study area

Table 7. Matrix for scoring mean flock size and percentage of flights less than 200m for each species

Mean flock size	Percentage of flights < 200m			
	0-25	26-50	51-75	76-100
< 10	1	1	2	2
10–50	1	2	2	3
51-100	2	2	3	4
> 100	2	3	4	4

Table 8. Score categories for the maximum seasonal counts for a species in the study area

Maximum season count	
Range	**Score**
0-10	1
11-1,000	2
1,001-10,000	3
> 10,000	4

Table 9. Likelihood of Effect rating based on overall score for each species evaluated at Step 3

Likelihood of Effect (LoE)	
Overall Score (based on quartiles)	**Level of Effect**
≤2	Negligible
>2 and ≤3	Low
>3 and ≤6	Medium
>6	High

Table 10. Overall risk matrix

Overall risk		Likelihood of Effect (LoE)			
		Negligible	**Low**	**Medium**	**High**
Sensitivity	**Low**	Negligible	Minor	Minor	Moderate
	Medium	Minor	Minor	Moderate	Major
	High	Minor	Moderate	Major	Major

Step 3 identified 14 species with an Overall Risk of Major or Moderate from the project, and these species considered priority VECs for this analysis, see Table 11.

Table 11. Scoring and rating details for the 14 species identified as priority VECs

Species	IUCN Red List Status	SVI	Vulnerability	Highest Count	Flyway Population	% of UoA	Relative Importance	Sensitivity	% flights <200m	Mean flock size	Landing in Area	LoE	Overall Risk
Black Stork *Ciconia nigra*	LC	10	Moderate	6,738	19,500	34.6	High	High	36	12	Yes	High	Major
White Stork *Ciconia ciconia*	LC	10	Moderate	212,030	450,000	47.1	High	High	35	653	Yes	High	Major
Common Crane *Grus grus*	LC	10	Moderate	12,004	35,000	34.3	High	High	19	100	Yes	High	Major
Great White Pelican *Pelecanus onocrotalus*	LC	10	Moderate	31,001	70,000	44.3	High	High	40	222	Yes	High	Major
European Honey-buzzard *Pernis apivorus*	LC	7	Moderate	35,423	1,000,000	3.5	Low	Low	38	42	Yes	High	Moderate
Egyptian Vulture *Neophron percnopterus*	EN	10	High	395	4,335	8.7	Low	Moderate	41	1	No	Medium	Moderate
Black Kite *Milvus migrans*	LC	8	Low	16,229	132,700	12.2	Moderate	Low	52	5	Yes	High	Moderate
Steppe Eagle *Aquila nipalensis*	EN	9	High	17,152	37,500	45.7	High	High	32	5	Yes	Medium	Major
Greater Spotted Eagle *Clanga clanga*	VU	9	High	341	2,180	15.6	High	High	23	2	No	Medium	Major
Lesser Spotted Eagle *Clanga pomarina*	LC	9	Moderate	1,705	59,700	2.9	Moderate	Moderate	14	5	No	Medium	Moderate
Booted Eagle *Hieraaetus pennatus*	LC	9	Moderate	858	3,169	27.1	High	High	26	1	No	Medium	High
Eurasian Buzzard *Buteo buteo*	LC	7	Low	86,740	1,250,000	6.9	Moderate	Low	36	24	Yes	High	Moderate
Levant Sparrowhawk *Accipiter brevipes*	LC	6	Negligible	30,134	75,000	40.2	High	Low	40	110	No	High	Moderate
Pallid Harrier *Circus macrourus*	NT	8	Moderate	100	1,505	6.6	Moderate	Moderate	85	1	No	Medium	Moderate

4.4 Step 4 – Identification of thresholds for fatalities for each priority bird VECs

Step 4 aims to identify thresholds for fatalities for each priority bird VECs for the study area, by setting the point at which further loss is considered a risk to long-term viability of the population. Threshold setting takes into account species-specific biological and demographic parameters, the cumulative risk associated with WPPs, and the likely effects of external stressors on the population defined by the UoA.

Step 4 has two parts: Part 1 identifies, for each priority bird VEC, a threshold number of fatalities appropriate in the study area for maintaining or attaining the long-term viability of the population. Part 2 explains the threshold system and the actions triggered as a consequence of passing thresholds. These actions are summarized as a decision tree in Figure 4. The decision tree forms the basis of the adaptive management framework, described in detail in step 5.

4.4.1 Part 1: Threshold-Setting Process

The Tafila approach was followed in the threshold-setting process, which was originally guided by related concepts within European and U.S. legal frameworks, specifically criteria underpinning "Favourable Conservation Status" (EC Habitats Directive, Council Directive 92/43/EEC) and "Optimal Sustainable Population" (pursuant to 16 USCS § 1362). Thresholds were assessed for each priority bird VEC relative to the population size determined by their UoA.

For each priority bird VEC, the annual number of fatalities that could be sustained without compromising long-term viability was determined using a simple "potential biological removal" (PBR) analysis, see below. This annual fatality estimate was then compared with the annual number of fatalities predicted from the effects of principal external stressors on the population, in particular illegal killing, power-line electrocution, and the taking of live birds.[1] When this fatality estimate exceeded the PBR level, an annual threshold of zero fatality threshold target was applied. When the PBR level was not exceeded, the expertise of the authors of the conservation status of the population was used to assess whether the results was (a) sufficiently close to the PBR to imply no WPP-related mortality was possible without an adverse effect on the population or (b) sufficiently below the PBR level to indicate that some WPP-related mortality was possible without an effect on population viability. When the results of this effort were best described by (a), a *zero fatality threshold target* was applied to the species. When it was best described by (b), a more complex population viability analysis (PVA) was conducted to inform the setting of an appropriate *annual fatality threshold target*.

Potential Biological Removal analysis is a simple, robust, and precautionary test developed for situations in which information on species population biology is limited (see Wade, 1998; Neil and Lebreton, 2005; Dillingham and Fletcher, 2011). It uses species-specific biological and demographic parameters, specifically adult survival rate and year of first breeding, to calculate an annual rate of human-caused mortality that if realized would likely result in a non-viable population in the long term. It should be highlighted that no cumulative collision risk estimate could be obtained since not all wind farm projects in the study area have undertaken a Collision Risk Modelling and the SESA has indicated that such modelling is difficult to provide valid estimates in the geographical area of the Gulf of Suez.

Primary Threshold Targets

<u>Zero Fatality Threshold Targets</u>

Priority bird VEC populations that were assigned a zero fatality threshold target are subject to monitoring, mitigation plans and adaptive management designed to minimize the contact of these species with WPPs in the study area, and conservation actions designed to reduce the number of fatalities from other stressors. For these priority bird VECs, an adaptive management response is triggered when there is an elevated-risk situation or a near-miss incident or if a fatality occurs.

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[1] Information on the number of fatalities from external stressors is scarce for both the study area and Egypt as a whole, and typically relates to "incidental" reports of fatalities and their apparent causes. To address this information gap and make it possible to incorporate external stressors into an assessment of the viability of each population, the ERP identified principal stressors for the priority bird VECs and then gave approximate range estimates of the annual number of fatalities attributable to each stressor individually and all external stressors combined. Range estimates for annual fatalities were < 1, ≥ 1 and < 5, ≥ 5 and < 10, > 10 < 100, > 100 < 1000, > 1000 < 10000.

Annual Fatality Threshold Targets

Priority bird VECS assigned to an annual fatality threshold target are subject to the same monitoring and mitigation plans and adaptive management as zero fatality threshold populations. For these priority bird VECs, an adaptive management response is triggered when periodic review of the results of postconstruction carcass searches shows that the annual fatality threshold target has been exceeded.

Other Threshold Targets

Extreme Events Threshold Targets

In addition to thresholds set for priority bird VECs, thresholds are required to alleviate the risk of multi-fatality events to a small number of populations that are not priority bird VECs. This is particularly relevant to WPPs in the study area because of the potential for flocks of specific nonpriority MSBs to occur in the area. For practical reasons, such as the need for a quick decision in the field to avoid this type of extreme event, thresholds should be set to a standard flock size (regardless of species) and should be broadly informed by PBR levels of flocking species and estimates of external stressor fatality rates.

Adaptive Management

Adaptive management is triggered when target thresholds are exceeded and when new evidence acquired over time shows an increased or decreased risk to a priority bird VEC or an increased risk to a non-priority population. Increased risk to priority birds requires that mitigation and management measures be revised to uphold thresholds and promote the long-term viability of the population. For priority bird VECs that exhibit a decreased risk over time, their primary threshold target may be reassessed, and revised or reassigned to reflect the reduced risk to their long-term population viability. Non-priority populations that exhibit evidence of increased risk may be assigned as priority bird VECs, may have an appropriate threshold determined and may be subject to associated adaptive management response strategies. Adaptive management is a key component of threshold setting within the CEA as it provides a mechanism for dealing with the uncertainty associated with determining priority bird populations and with predicting thresholds for priority bird VECs.

This process is iterative, and the breaching of successive thresholds should be matched by an increase in the measures to protect and promote the viability of priority bird VEC populations.

Adaptive management responses are not limited to exceeded thresholds. Adaptive management may also be triggered in response to other events:

- Evidence of an increased risk to a population from other unrelated sources that indirectly affects the threshold for fatalities related to the study area. For example, evidence of increased persecution during the operational phase of the WPPs may lead to re-assigning a priority bird VEC with an *annual fatality threshold target* to a *zero fatality threshold target.*
- An elevated risk situation, in which a temporary increase in the level of risk to priority birds in the vicinity of turbines occurs as a consequence of changes in human behaviour or environmental conditions. For example, increased activity of sheep grazing around turbines may result in an observed increase in vultures in the area triggering an increase in monitoring effort and engagement with livestock owners.
- A near-miss incident, in which no fatality occurred but monitoring and mitigation protocols failed to alleviate the risk of collision; for example, where a request to shut down a turbine in response to an approaching priority bird was not completed before the bird flew through the rotor-swept area, leading to a review and revision of monitoring and mitigation protocols.

4.4.2 Decision Tree for Thresholds

The decision tree explains the threshold system and actions triggered because of passing a threshold, see Figure 4. In addition, the decision tree and proposed thresholds from step 4 provide the basis for developing mitigation and monitoring protocols, the adaptive management framework, and joint management and action plans for developers and other stakeholders (see step 5).

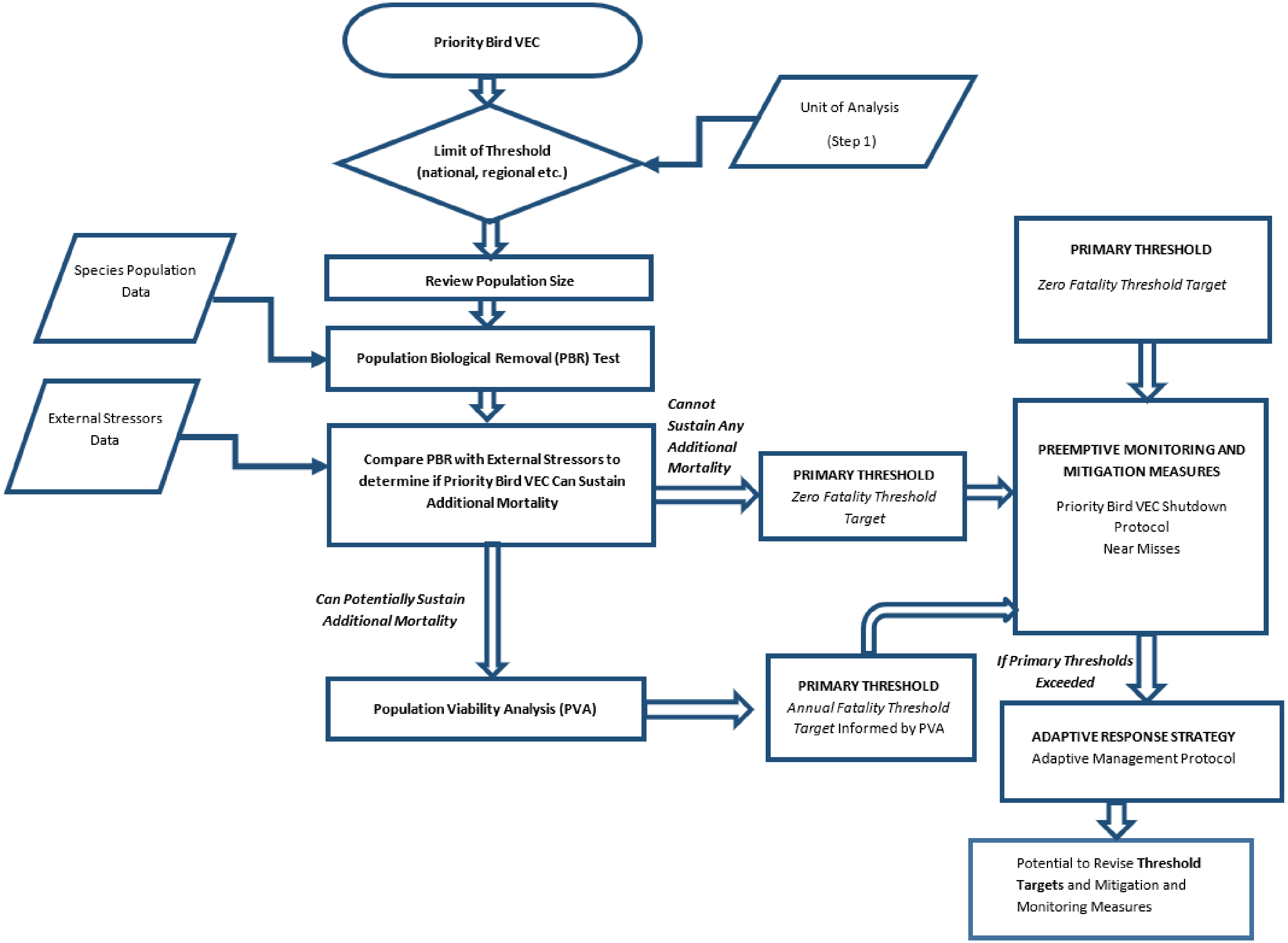

Figure 4. Decision Tree for Priority Bird VECs

Out of the 14 species, ten species were assigned to a zero fatality threshold target as a result of applying the threshold-setting protocol in step 4, while the other four species were given a threshold ranging from 1 to 10 individuals per species, see Table 12 Table 13.

Biological and demographic parameters required to conduct threshold-setting analyses were taken from existing species-specific studies for each priority bird VEC. Parameters derived from studies of populations within the Middle East region were used where they existed; otherwise the results of studies from the most appropriate population outside the region were used. Using surrogate parameters from different populations of the same species should provide reasonably similar parameter values, as was the case here. The two populations are similar in other aspects of their biology, e.g., migratory, nonmigratory populations. For some of the species were no species-specific parameters were available, typical values for raptors of similar mass were used to give an indication of a likely threshold. Adult survival and age of first breeding, are related to body mass in raptors (Newton, 1979; Newton, McGrady, and Oli, 2016); therefore, using surrogate species with similar mass should allow approximate predictions about the amount of mortality these priority bird VEC populations can sustain.

Table 12. Potential Biological Removal Analysis Input Data and Results for Priority VECs

Species	IUCN Red List Status	Unit of Analysis	Flyway Population	Demographic Parameters			
				Age at First Breeding	Annual Adult Survival (%)	Recovery Factor Used in PBR	PBR Level Estimate, Annual No. of Fatalities
Black Stork *Ciconia nigra*	LC	Flyway Population	19,500	3	80%	0.1	102
White Stork *Ciconia ciconia*	LC	Flyway Population	450,000	3	78%	0.1	2353
Common Crane *Grus grus*	LC	Flyway Population	35,000	4	89%	0.1	183
Great White Pelican *Pelecanus onocrotalus*[1]	LC	Flyway Population	70,000	3	80%	0.1	366
European Honey-buzzard *Pernis apivorus*[2]	LC	Flyway Population	1,000,000	3	90%	1	70000
Egyptian Vulture *Neophron percnopterus*	EN	Flyway Population	4,335	5	93%	0.1	9.6
Black Kite *Milvus migran*[3]	LC	Flyway Population	132,700	4	96%	1	5242
Steppe Eagle *Aquila nipalensis*[4]	EN	Flyway Population	37,500	4	92%	0.1	197
Greater Spotted Eagle *Clanga clanga*[4]	VU	Flyway Population	2,180	4	92%	0.1	11.4
Lesser Spotted Eagle *Clanga pomarina*[4]	LC	Flyway Population	59,700	4	92%	0.1	313.6
Booted Eagle *Hieraaetus pennatus*[3]	LC	Flyway Population	3,169	4	96%	1	125.2
Eurasian Buzzard *Buteo buteo*[4]	LC	Flyway Population	1,250,000	3	90%	1	87500
Levant Sparrowhawk *Accipiter brevipes*[5]	LC	Flyway Population	75,000	1	90	1	5250
Pallid Harrier *Circus macrourus*	NT	Flyway Population	1,505	3	74%	1	59.4

1. No species-specific biological or demographic parameters available. Analysis uses an estimate of adult survival rate and age of first breeding for the American White Pelican (Johnson and Sloan, 1978).
2. No species-specific biological or demographic parameters available. Analysis uses an estimate of adult survival rate and age of first breeding for Eurasian Buzzard Buteo buteo (Kenward et al., 2000)
3. No species-specific biological or demographic parameters available. Analysis uses an estimate of adult survival rate and age of first breeding for the red kite Milvus milvus) (Newton, Davis, and Davis, 1989)
4. No species-specific biological or demographic parameters available. Analysis uses an estimate of adult survival rate and age of first breeding for the Eastern imperial eagle *Aquila heliacal* (Katzner et al., 2006)
5. No species-specific biological or demographic parameters available. Analysis uses an estimate of adult survival rate and age of first breeding for the Eurasian Sparrowhawk *Accipiter nisus* (Newton, 1975).

Table 13. Priority VECs – Review of Steps 1-3 and Results of Step 4 Identifying thresholds

Species	IUCN Red List Status	SVI	Vulnerability	Relative Importance	Sensitivity	LoE	Overall Risk	PBR Level (annual fatality estimate)	Non-wind farm fatality estimate			Primary Threshold Target
									Electrocution	Illegal killing	Collection of live birds	
Black Stork *Ciconia nigra*	LC	10	Moderate	High	High	High	Major	102	≥1 and <5	≥1 and <5	≥1 and <5	Zero fatality
White Stork *Ciconia ciconia*	LC	10	Moderate	High	High	High	Major	2353	> 10 < 100	> 100 < 1000	> 10 < 100	7
Common Crane *Grus grus*	LC	10	Moderate	High	High	High	Major	183	> 10 < 100	> 10 < 100	> 10 < 100	Zero fatality
Great White Pelican *Pelecanus onocrotalus*	LC	10	Moderate	High	High	High	Major	366	> 10 < 100	> 10 < 100	> 10 < 100	Zero fatality
European Honey-buzzard *Pernis apivorus*	LC	7	Moderate	Low	Low	High	Moderate	70000	≥1 and <5	> 100 < 1000	> 10 < 100	5
Egyptian Vulture *Neophron percnopterus*	EN	10	High	Low	Moderate	Medium	Moderate	9.6	≥1 and <5	≥1 and <5	≥1 and <5	Zero fatality
Black Kite *Milvus migrans*	LC	8	Low	Moderate	Low	High	Moderate	5242	> 10 < 100	> 10 < 100	> 10 < 100	1
Steppe Eagle *Aquila nipalensis*	EN	9	High	High	High	Medium	Major	197	> 10 < 100	> 10 < 100	> 10 < 100	Zero fatality
Greater Spotted Eagle *Clanga clanga*	VU	9	High	High	High	Medium	Major	11.4	> 10 < 100	≥1 and <5	≥1 and <5	Zero fatality
Lesser Spotted Eagle *Clanga pomarina*	LC	9	Moderate	Moderate	Moderate	Medium	Moderate	313.6	> 10 < 100	≥1 and <5	≥1 and <5	Zero fatality
Booted Eagle *Hieraaetus pennatus*	LC	9	Moderate	High	High	Medium	High	125.2	> 10 < 100	≥1 and <5	≥1 and <5	Zero fatality
Eurasian Buzzard *Buteo buteo*	LC	7	Low	Moderate	Low	High	Moderate	87500	≥1 and <5	> 100 < 1000	> 10 < 100	10
Levant Sparrowhawk *Accipiter brevipes*	LC	6	Negligible	High	Low	High	Moderate	5250	> 10 < 100	≥1 and <5	≥1 and <5	Zero fatality
Pallid Harrier *Circus macrourus*	NT	8	Moderate	Moderate	Moderate	Medium	Moderate	59.4	> 10 < 100	≥1 and <5	≥1 and <5	Zero fatality

4.5 Step 5 – Identify mitigation and monitoring

This section follows the broad mitigation and monitoring actions that were proposed by the Cumulative Effects Analysis that was undertaken for Lekela project. Following the same approach and building on the results of that analysis while adding to it more analysis by the more recent field assessments and literature, the actions follows the same approach and broad lines. These mitigation and monitoring actions focus on the 14 priority bird VECs, as identified in this document, but will, even if indirectly, will provide benefits for for other bird species passing through the area of all wind farms. In all cases, mitigation and monitoring actions are based on industry good practice, adapted to be locally-relevant. Mitigation and monitoring actions focus on two areas:

- On-site mitigation and monitoring methods, to minimise collision risk, validate the effectiveness of proposed mitigation methods, allow estimation of residual impacts and provide information to adapt monitoring and mitigation to prevailing conditions9; and,
- Collaborative efforts with other wind farm entities, to minimise the cumulative effects of all the proposed wind farm developments in the study area.

Since these measures and actions have already been included in the project's ESIA, which has been submitted for approval and they have also been adopted by existing developers in the study area, such as Lekela (TBC, 2018), and now to be adopted by RSWE, this will ensure the conservation of the VECs all across the area and would consequently help in protecting the species across a critical part of the flyway. By adopting best-practice mitigation measures and monitoring actions, RSWE will be able to reduce its impact for the identified VECs, see Table 14.

Table 14. Proposed mitigation measures and monitoring actions for the project and the study area

Action	Measure	Description	Key objective	Responsible entity	Timeframe
		Site-specific mitigation actions			
1	Development of appropriate protocols	All actions require clear and detailed protocols that can be followed by all survey teams: this information should be included in the relevant Project documents. Protocols should align with industry good-practice guidelines, and be designed by an ornithologist experienced in assessing bird risk at wind farm developments. This can build on the already available protocols prepared for the implementation of the ATMP that is already being implemented at the operational wind farms along the Gulf of Suez	Ensure that all actions are undertaken in a consistent manner, and collect appropriate data to make decisions.	Consultant / RCREEE	Approved protocols at least three months prior to commencement of operation
2	Shutdown On-demand	Shutdown on-demand' is an established method to mitigate the risk to birds of colliding with wind turbine rotors. It involves a coordinated team of field observers identifying situations when birds are at risk of colliding with turbines as they move within the wind farm, and initiating a temporary shut-down of one or more turbines.	To minimize the number of collisions between priority bird VECs and wind turbines.	Consultant / RCREEE	Protocols and tested system in place prior to commencement of operation
3	Installation of bird flight diverters on Project power lines	Many bird species are known to collide with power lines (particularly high-voltage lines), and installing bird flight diverters has been shown to lessen this risk. The configuration (type and frequency) of bird flight diverters should be based on industry good-practice, relying on local examples of successful installation if available.	Minimisation of collisions to priority bird VECs with Project power lines	EETC	During power line erection
4	Monitoring of priority VECS in-flight monitoring	'In-flight monitoring' is a bird surveillance programme and method that is designed to monitor activity and track the flight paths of Priority Birds[2] and flocks of non-priority Migratory Soaring Birds (MSBs) relative to operational wind turbines. The principal aim of in-flight monitoring is to inform turbine shutdown decisions and to identify 'Elevated Risk Situations'. Similar to shutdown on-demand, in-flight monitoring of priority birds follows a protocol that can be developed following the protocols developed as part of the ATMP that is being implemented as part of the operational monitoring of wind farms along the Gulf of Suez	To ensure that shut-down on demand protocols can be initiated with sufficient time to minimize bird collisions	Consultant / RCREEE	Prior to commencement of operation
6	Carcass search surveys	This involves regular surveys of the area beneath turbines to detect carcasses from individual birds that have collided with turbine blades. Similar surveys are being already implemented, according to best-practice guidelines, in operational wind farms along the Gulf of Suez as part of the ATMP and can be applied similarly at the project site.	To determine the level of observed fatalities due to collisions with turbines and power lines at the wind farm site.	Consultant / RCREEE	On-going for at least the first three years of operation, then reassessment
7	Carcass bias-correction trials	Bias-correction trials aim to convert the observed carcasses to an actual estimate of mortalities, as some carcasses will be removed prior to carcass surveys occurring (carcass removal bias), and searchers will not detect all carcasses present (searcher efficiency bias). Such trials are being already implemented, according to best-practice guidelines, in operational wind farms along the Gulf of Suez as part of the ATMP and can be applied similarly at the project site.	To determine the correction factor to apply to detected carcasses to estimate true project-related mortality.	Consultant / RCREEE	Annually for three years, then reassessment. Can begin prior to commencement of operation.
8	Review to improve monitoring and	Periodic reviews of Actions 1, 2, and 4-8 will be undertaken to improve the effectiveness of monitoring and mitigation actions. This will include:	Adaptive management to reduce risk	RSWE	On-going from start of construction

[2] These are bird populations identified by the CEA as least able to tolerate adverse effects on their populations and remain viable in the long-term.

Action	Measure	Description	Key objective	Responsible entity	Timeframe
	mitigation effectiveness	Immediate review of process in the event of a recorded mortality for a priority bird VEC, to determine if additional actions could be implemented to further reduce collision risk.			
Actions to be implemented on the level of the study area					
9	Data sharing	All developers to make annual summaries of their respective monitoring and mitigation efforts publicly available to support baseline knowledge, increase transparency and understanding of the work being undertaken.	Maximise the knowledge base in the region.	All developers	Variable, depending on the data released
10	Joint training of observers	All developers to contribute to the joint training of a pool of skilled bird observers who are able to carry out baseline and monitoring surveys throughout the study area, and adjacent Important Bird Area	Ensure comparable observer standards are maintained across all project sites.	All developers	On-going, with establishment prior to commencement of operation
11	Coordination of observer networks	All developers to co-ordinate in the Project area to site observer networks where these can be of greatest benefit	Maximise the benefits from an extended observer network	All developers	On-going, with establishment prior to commencement of operation
12	Discussion forum	Facilitate / support an annual biodiversity workshop / conference for all wind farms in the Project area, to facilitate knowledge exchange, share experiences and plan cumulative actions….	Improve regional knowledge of priority avian VECs and improve wind farm operations	All developers	Annually

5 NEXT STEPS

The CEA has focused on identifying priority bird VECs and outlining appropriate mitigation and monitoring actions. In order to complete the cumulative effects analysis the following actions are required:

- Share the findings for review and input with stakeholders including (but not limited to): government agencies, RCREEE, wind farm developers, lenders, NGOs (e.g. Nature Conservation Egypt, BirdLife International), environmental impact experts, and ecologists with local expertise.
- It is well documented that avifauna and more specifically MSBs are potentially the taxa that are at the highest risk from the development of wind power projects, however it would be worth expanding the CEA to include taxa other than avifauna to ensure that any additional VECs identified can be included in the future mitigation and monitoring actions of the study area. Determination of non-bird biodiversity priority VECs through stakeholder/expert consultation and potentially additional field work and mapping.

6 OTHER BIODIVERSITY COMPONENTS

As part of the Lekela CEA an assessment was undertaken for other biodiversity components to include most importantly bats as well. This was mainly based on desktop and literature review.

The outcomes of the Lekela CEA is expected to be similar with the same findings in the context of this CEA given that they both investigate and study the exact same area utilizing similar secondary data and resources as well.

The Lekela CEA concludes that two bat species (Rueppell’s Pipistrell and Desert Pipistrelle), one reptile (Egyptian Spiny-tailed Lizard) and three ecosystems (Wadi, Saltmarsh and Rocky outcrops / caves ecosystems) are at potential risk from significant cumulative effects of wind farms in the area. The Lekela CEA recommends broad mitigation and monitoring actions that focus on the priority bird VEC but also aim to avoid impacts on the identified bats and reptile species as well as the ecosystems.

REFERENCES

Anna, T.E. 2012. Breeding and Migration of the Black Stork Ciconia nigra) with special regard to a Central European Population and the Impact of hydro-meteorological factors and wetland status. University of Debrecen, Hungary.

BirdLife International. 2020 Important Bird Areas factsheet: Gebel El Zeit. Downloaded from http://www.birdlife.org

BirdLife International. 2019a. *Aquila nipalensis* (amended version of 2017 assessment). The IUCN Red List of Threatened Species 2019: e.T22696038A155419092. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T22696038A155419092.en.

BirdLife International. 2019b. *Falco concolor* (amended version of 2017 assessment). The IUCN Red List of Threatened Species 2019: e.T22696446A155431439. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22696446A155431439.en.

BirdLife International. 2019c. *Neophron percnopterus*. The IUCN Red List of Threatened Species 2019: e.T22695180A154895845. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T22695180A154895845.en.

BirdLife International. 2018a. *Accipiter brevipes*. The IUCN Red List of Threatened Species 2018: e.T22695499A131936047. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22695499A131936047.en.

BirdLife International. 2018b. *Pelecanus onocrotalus*. The IUCN Red List of Threatened Species 2018: e.T22697590A132595920. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22697590A132595920.en.

BirdLife International. 2017a. *Buteo buteo* (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T61695117A119279994. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T61695117A119279994.en.

BirdLife International. 2017b. *Ciconia nigra* (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T22697669A111747857. https://dx.doi.org/10.2305/IUCN.UK.2017-1.RLTS.T22697669A111747857.en.

BirdLife International. 2017c. *Clanga clanga* (amended version of 2016 assessment). The IUCN Red List of Threatened Species 2017: e.T22696027A110443604. https://dx.doi.org/10.2305/IUCN.UK.2017-1.RLTS.T22696027A110443604.en.

BirdLife International. 2016a. *Ciconia ciconia*. The IUCN Red List of Threatened Species 2016: e.T22697691A86248677. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22697691A86248677.en.

BirdLife International. 2016b. *Clanga pomarina*. The IUCN Red List of Threatened Species 2016: e.T22696022A93539187. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22696022A93539187.en.

BirdLife International. 2016c. *Pernis apivorus*. The IUCN Red List of Threatened Species 2016: e.T22694989A93482980. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22694989A93482980.en.

Del Hoyo, J. & Collar, N.J. 2014. HBW and BirdLife International Illustrated CHecklisst of the Birds of the World. Volume 1: Non-passerines. Lynx Edicions, Barcelona.

Delic, A & Muzinic, J. 1995. Breeding of the Booted Eagle *Hieraaetus pennatus* in North-western Croatia. Orn. Verh. Vol. 25: 219-222.

Dillingham, P.W., Fletcher, D. 2011. Potential Biological Removal of Albatrosses and Petrels with Minimal Demographic Information. Biol. Conserv. doi:10.1016/j.biocon.2011.04.014

EcoConServ. 2016. Alfa Wind Project: Environmental and Social Impact Assessment 2nd draft report.

Ecoda. 2013. Environmental and Social Impact Assessment for an Area of 300 km2 at the GULF OF SUEZ.

El-Gebaly, O. & Al-Hasani, I. 2017. Gabel Al-Zayt 200 MW Wind farm Project: post-construction monitoring for non-operational wind farm spring Survey (April 4 – May 15, 2014) Migratory Soaring Birds Project - Egypt.

Environics. (2016a) Report on the Spring. 2016. Pre-construction Ornithological Monitoring at the Lekela Project Site, Ras Gharib, Gulf of Suez.

Environics. (2016b) Autumn. 2015. Pre-construction Ornithological Monitoring at the Lekela project site, Ras Gharib, Gulf of Suez Draft Report.

Environics. 2017a. Report on the autumn 2017 pre-construction ornithological monitoring at the Lekela wind energy development area, Ras Gharib, Gulf of Suez.

Environics. 2017b. Spring 2017 Ornithological Monitoring pre-construction at Wind Development Site Ras Gharib, Gulf of Suez Draft Report.

Environics. 2018. ESIA for Lekela BOO Wind Power Plant at Gulf of Suez (Draft Report).

European Bank for Reconstruction and Development. 2014a. EBRD Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. European Bank for Reconstruction and Development, London.

European Bank for Reconstruction and Development. 2014b. Guidance Note: EBRD Performance Requirement 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources. European Bank for Reconstruction and Development, London.

International Financing Corporation. 2017. Tafila Region Wind Power Projects Cumulative Effects Assessment. International Finance Corporation, Washington D.C.

Johson Jr., R.F. and Sloan, N.F. 1978. White Pelican Production and Survival of Young at Chase Lake National Wildlife Refuge, Norht Dakota. Wilson Bulletin, 90(3). Pp. 346-352. USA.

Hardey, J. Crick, H. Wernham, C. Riley, H. Etheridge, B. & Thompson, D. 2013. Raptors: A Field Guide to Surveys and Monitoring. Edition 3. The Stationery Office, UK.

Katzner, T. Bragin, E.A. & Milner-Gulland, E.J. 2006. Modelling Populations of Long-lived Birds of Prey for Conservation: a Study of Imperial Eagles (*Aquila heliaca*) in Kazakhstan. Biological Conservation 132 (3): 322-335. UK.

Kenward RE, Hall DG, Walls SS, Hodder KH, Pahkala M, Freeman SN, Simpson VR. 2000. The prevalence of non-breeders in raptor populations: evidence from rings, radio-tags and transect surveys. Oikos 91(2):271–279

Leito, A. Truu, J. Leivitis, A. & Ojaste, I. 2003. Changes in Distribution and Numbers of the Breeding Population of the Common Crane *Grus grus* in Estonia. Ornis Fennica. Vol. 80 (4): 159-171.

Meyburg, B.U. Belka, T., Danko, S., Wojciak, J., Heise, G., Blohm, T. & Matthes, H. 2005. Age at First Breeding, Philopatry, Longevity and Causes of Mortality in the Lesser Spotted Eagle *Aquila pomarina.* Limicola. Vol. 19 (3). pp. 153-179.

Newton, I. 1975. Movements and Mortality of British Sparrowhawks. Bird Study, 22:1, pp. 35-43. UK.

Newton, I. Davis, P.E. & Davis, J.E. 1987. Age of First Breeding, Dispersal and Survival of Red Kites *Milvus milvus* in Wales. Ibis 131:16-21.

Niel, C. & Lebreton, JD. 2005. Using Demographic Invariants to Detect Overharvested Bird Populations from Incomplete Data. Conservation Biology, Volume 19, No. 3, USA.

Regional Centre for Renewable Energy and Efficiency. 2018. Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez Final report (D-8) on the Strategic Environmental and Social Assessment for an Area of 284km2 at the Gulf of Suez.

Regional Centre for Renewable Energy and Efficiency. 2020. Environmental and Social Impact Assessment for Red Sea Wind Energy 500 MW project, Gulf of Suez, Egypt. Unpublished.

Sanz-Aguillar, A. Cortes-Avizanda, A. Serrano, D. Blanco, G., Ceballos, O. Grande, J.M., Tella, J.L. & Donazar, J.A. Sex- and Age-dependent Patterns of Survival and Breeding Success in a Long-lived Endangered Avian Scavenger. Sci. Rep. 7:40204.

Serckx, A., Wilson, D., Katariya, V. and Pollard, E. 2018. Lekela North Ras Gharib 250 MW: Analysis of cumulative effects to biodiversity. Unpublished report prepared on behalf of Lekela Power Ltd. The Biodiversity Consultancy Ltd, Cambridge, UK.

Sergio, F. 2003. From Individual Behaviour to Population Pattern: Weather-dependent Foraging and Breeding Performance in Black Kites. Animal Behaviour. 66 (6): 1109-1117.

Sundev, G., Yosef, R. Birazana, O. & Damdin, S. 2012. Breeding Ecology of the Steppe Eagle (*Aquila nipalensis*) in Mongolia. Ornis Mongolica. Vol. 1, pp. 13-19.

Terraube, J. Arroryo, B.E., Mougeot, F., Madders, M., Watson, J. & Bragin, E.A. 2009. Breeding Biology of the Pallid Harrier Circus macrourus in North-central Kazakhstan: Implications for the Conservation of a Near Threatened Species. Oryx, Vol. 43, Issue1, pp. 104-112. UK.

Vergara, P. Aguirre, J.I. & Fernandez-Cruz, M. 2007. Arrival Date, Age and Breeding Success in White Stork *Ciconia ciconia*. Journal of Avian Biology. Vol. 38, No. 5, pp 573-579.

Wade, P.R. 1998. Calculating Limits of the Allowable Human-caused Mortality of Cetaceans and Pinnipeds. Marine Mammal Science. The Society for Marine Biology. USA.

Wilms, T., Eid, E.K.A., Al Johany, A.M.H., Amr, Z.S.S., Els, J., Baha El Din, S., Disi, A.M., Sharifi, M., Papenfuss, T., Shafiei Bafti, S. & Werner, Y.L. 2012. Uromastyx aegyptia (errata version published in 2017). The IUCN Red List of Threatened Species 2012: e.T164729A115304711. https://dx.doi.org/10.2305/IUCN.UK.2012.RLTS.T164729A1071308.en.