Environmental and Social Impact Assessment (ESIA)

Amunet Wind Farm 500 MW at Gulf of Suez

Final Report

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Table of Contents

List of Figures

List of Tables

List of Abbreviations

AC	Alternating Current
AWPC	Amunet Wind Power Company
BOO	Build, Own and Operate
CAAs	Competent Administrative Authorities
CAPMAS	Central Agency for Public Mobilization and Statistics
CBO	Community Based Organization
CRM	Collision Risk Modelling
DC	Direct Current
DEM	Digital Elevation Model
E&S	Environmental and Social
EBRD	European Bank for Reconstruction and Development
EEAA	Egyptian Environmental Affairs Agency
EETC	Egyptian Electricity Transmission Company
EHS	Environment, Health, and safety
EHSS	Environmental, Health, Safety and Social
EIA	Environmental Impact Assessment
EMU	Environmental Management Unit
EPC	Engineering, Procurement, and Construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GDP	Gross Domestic Product
GOE	Government of Egypt
GoS	Gulf of Suez
IBA	Important Bird Area
IEA	International Energy Agency
IFC	International Finance Corporation
IFIs	International Financial Institutions
IRENA	International Renewable Energy Agency
ISES	Integrated Sustainable Energy Strategy
ISO	International Organization for Standardization
kWh	Kilowatt Hour
LoS	Line of Sight

MS	Management System
MSB	Migratory Soaring Birds
MV	Medium Voltage
MW	Megawatt
NREA	New and Renewable Energy Authority
NGO	Non-Governmental Organization
NTS	Non-Technical Summary
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
OHTP	Occupational Health and Safety Plan
OHTL	Overhead Transmission Line
PPA	Power Purchase Agreement
PPS22	Planning Policy Statement 22
PR	Performance Requirement
PSs	Performance Standards
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
SCA	Supreme Council of Antiquities
SCADA	Supervisory Control and Data Acquisition
SEP	Stakeholder Engagement Plan
SESA	Strategic and Cumulative Environmental and Social Assessment
ToR	Terms of Reference
TSP	Total Suspended Particulate
VP	Vantage Points
WGS	World Geodetic System
WTG	Wind Turbine Generator
WWTP	Wastewater Treatment Plant

1. Introduction

1.1 Background

The energy sector is a key driver for the socio-economic development of Egypt, representing around 13% of current GDP and thus making economic growth in the country contingent upon the security and stability of energy supply.

Since 2007, Egypt has experienced an energy supply deficit due to the rapid increase in energy consumption and the depletion of domestic oil and gas resources, shifting its position as a net hydrocarbon exporter for the last three decades to that of a net importer.

This has brought a set of challenges to the energy sector, including electricity shortages, caused in part by the decline of domestic gas production, as natural gas is the main source of electricity, accompanied by highly subsidized energy prices, with negative financial implications for already dwindling government revenues.

In response, the Government of Egypt (GoE) has taken bold steps to adopt an energy diversification strategy with increased development of renewable energy and implementation of energy efficiency, including assertive rehabilitation and maintenance programs in the power sector (IRENA, 2018).

To this extent, in 2013, the Arab Republic of Egypt (through the Ministry of Electricity and Renewable Energy) had developed and adopted the Integrated Sustainable Energy Strategy (ISES) 2015 – 2035, which provides an ambitious plan to increase the contribution of renewable energy to 20% of the electricity generated by the year 2020, of which 12% of wind power plants is foreseen, mostly in the Gulf of Suez (GoS) due to the wind characteristics in the area.

In that respect, the GoE issued the Renewable Energy Law (Decree Law 203/2014) to support the creation of a favourable economic environment for a significant increase in renewable energy investment in the country. The law sets the legal basis for the Build, Own and Operate (BOO) scheme to be implemented. Through the BOO mechanism, the Egyptian Electricity Transmission Company (EETC) invites private investors to submit their offers for solar and wind development projects, for specific capacities and the award will be made to that bidder with the lowest Kilowatt Hour (kWh) price. In addition, the GoE (through the New and Renewable Energy Authority (NREA)) provides the land for the investors.

Through the BOO mechanism, a direct proposal was submitted by AMEA Power Ltd. to EETC for the development of a 500-Megawatt (MW) Wind Power Project in Red Sea Governorate (hereafter referred to as 'the Project'). The direct proposal was accepted pursuant to the Council of Ministers approval in the Cabinet meeting number 120, held on 2 December 2020, and a Power Purchase Agreement (PPA) was signed on 13 December 2020.

AMEA Power Ltd. established the Amunet Wind Power Co. (AWPC) (hereafter referred to as 'the Developer' or 'Project Company'), a wholly owned AMEA Power Ltd., responsible for the development, execution, and ownership of the Project.

1.2 Project Location and Components

The Project is located in the Red Sea Governorate of Egypt, around 230km 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 District of the Red Sea Governorate, where the closest residential areas include Ras Ghareb city (located 9km to the southeast) and Zaafarana village (65km to the north) – refer to figure below.

The Project is located within a 284km^2 area that has been allocated by the GoE to NREA for development of wind farms (presented in green in the figure below). Within this, a land area of 69.4km^2 (presented in blue in the figure below) has been allocated to the Developer by NREA for the development of this Project.

Figure 1: Project Site in Relation to the Capital City of Egypt

Figure 2: Project Site and Closest Villages

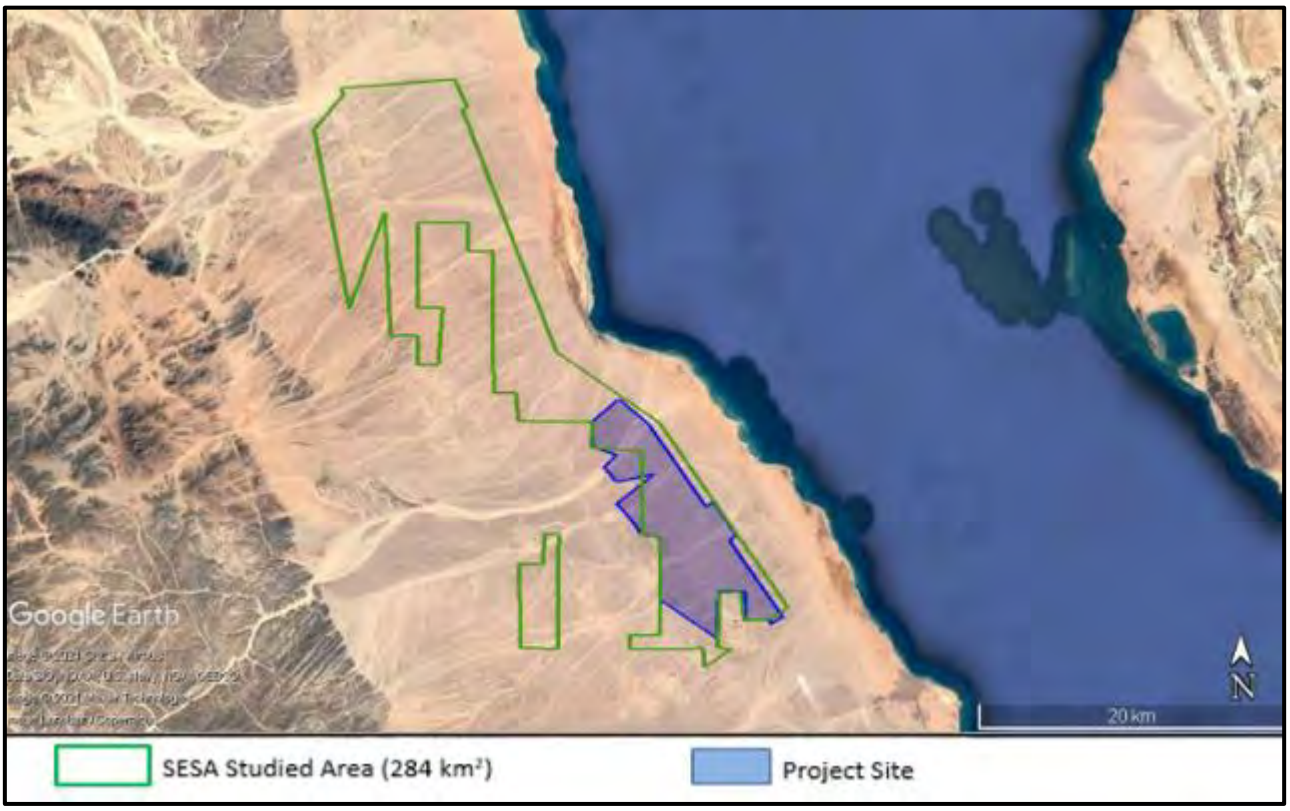


Figure 3: Project Site as Part of the 284km2 Area Allocated for Wind Farm Developments

1.3 Environmental and Social Impact Assessment Report

The environmental clearance for this Project is governed by the Egyptian Environmental Affairs Agency (EEAA) as stipulated by the Law No. 4 of 1994 (Law on Protection of the Environment). Executive Regulations 1995 (Prime Ministers Decree 338) issued in accordance with the Law, classifies a wind farm development of such nature and capacity (i.e. this Project) as "Category C", requiring a comprehensive Environmental and Social Impact Assessment (ESIA) in order to obtain the environmental clearance and permit, in order to commence with construction and operational activities.

The Project will be seeking financing from International Financing Institutions (IFIs) and therefore the Developer wishes to design and manage the Project in accordance with good international industry practice – for the purpose of the ESIA, it will be based on the following:

- International Finance Corporation (IFC) Policy on Environment and Social (E&S) Sustainability (2012), IFC Performance Standards (2012), and IFC Environment, Health and Safety (EHS) Guidelines; and
- European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy (2019) and associated Performance Requirements (PR).

ECO Consult & Green Plus were commissioned to prepare the Environmental and Social Impact Assessment (ESIA) for the Project in order to apply for the necessary environmental permit. This report is the ESIA that has been prepared in accordance with "Law No. 4 of 1994" and IFI requirements specified above.

1.4 Document Structure

The following table provides an overview of the Chapters within this ESIA document. The ESIA includes a standalone Non-Technical Summary (NTS) a Stakeholder Engagement Plan (SEP).

Table 1: ESIA Document Structure

Chapter	Description of Content
Chapter 2 – Project Description	Provides a detailed description of the Project in relation to its location, the key Project components and an overview of the proposed activities that are to take place during the various Project phases.
Chapter 3 – ESIA Approach and Methodology	Presents the methodology and approach that was adopted for the ESIA study.
Chapter 4 – Project Stakeholders and Consultations	Discusses in details the stakeholder consultation and engagement plans which were undertaken as part of the ESIA process for the Project and provides an overview of the findings. In addition, this Chapter also discusses the future stakeholder engagement and consultation plans which are to take place at a later stage.
Chapter 5 – Policy, Legal, and Administrative Framework	Provides an overview of the environmental and social regulatory and policy framework applicable to the Project.
Chapter 6 – Analysis of Alternatives	This chapter investigates several alternatives to the Project development and the reasons for the preferred choice. This includes alternatives in relation to the Project site, selected technology, Project design, and finally investigates the 'no action alternative' – which assumes that the Project development does not take place.
Chapter 7 – Existing Physical, Biological, and Social Environment	This Chapter presents the baseline conditions within the Project site and surroundings. This includes the following: Landscape and Visual (section 7.1), Land Use (section 7.2), Geology/Hydrology/Hydrogeology (section 7.3), Biodiversity (section 7.4), Birds (section 7.5), Bats (section 7.6), Archaeology and Cultural Heritage (section 7.7), Air Quality and Noise (section 7.8), Infrastructure and Utilities (section 7.9), Occupational Health and Safety (section 7.10), Public Health and Safety (section 7.11), and Socio-economics (section 7.12).
Chapter 8 – Impact Assessment	This Chapter assesses the anticipated impacts from the Project throughout its various phases on such a receptor. For each identified impact a set of mitigation and monitoring requirements have been identified which aim to eliminate the impact and/or reduce it to acceptable levels. This includes the following: Overview of Strategic Environmental and Economic Impacts (section 8.1), Landscape and Visual (section 8.2), Land Use (section 8.3), Geology/Hydrology/Hydrogeology (section 8.4), Biodiversity (section 8.5), Birds (section 8.6), Bats (section 8.7), Archaeology and Cultural Heritage (section 8.8), Air Quality and Noise (section 8.9), Infrastructure and Utilities (section 8.10), Occupational Health and Safety (section 8.11), Public Health and Safety (section 8.12), Socio-economics (section 8.13), Summary of Anticipated Impacts (section 8.14), and Assessment of Cumulative Impacts (section 8.15).
Chapter 9 – Environmental and Social Management Plan (ESMP)	Presents the Environmental and Social Management Plan (ESMP) for the Project; which mainly summarizes the impacts identified as well as the mitigation measures and monitoring requirements to be implemented throughout the various Project phases. In addition, this Chapter describes the institutional framework and procedural arrangement for the ESMP implementation.

1.5 Project Setup and Responsibilities

Different entities are involved in the planning and implementation of the Project. Responsibilities of each entity are listed in the text below along with a general description of their roles.

- *Amunet Wind Power Co. (AWPC):* The owner and developer of the Project (hereafter referred to as 'the Developer');
- *Egyptian Environmental Affairs Agency (EEAA):* the official governmental entity responsible for protection of the environment in Egypt. The EEAA is responsible for approval of the Environmental and Social Impact Assessment (ESIA) and making sure it complies with the "Environmental Protection Law No. 4 of 1994" and granting the environmental clearance for the Project;

- *Engineering, Procurement, and Construction (EPC) Contractor:* will be responsible for preparing the detailed design and layout of the Project; supply of the material and equipment (e.g. wind turbines); construction of the Project and its various components (turbines, internal roads, building infrastructure, and, etc.). The EPC Contractor for this Project has not been officially assigned to date;
- *Project Operator:* responsible for Operation and Maintenance (O&M) of the Project. The Project Operator has not been assigned at this stage;
- *Egyptian Electricity Transmission Company (EETC):* will be the off taker of electricity and is the entity that signed the Power Purchase Agreement (PPA) with the Developer. In addition, they will also be responsible for designing, building and operating the associated interconnection facilities. This will include the Overhead Transmission Line (OHTL) that will connect from the Project site to the existing national grid.
- *National Renewable Energy Authority (NREA*): is entity responsible for allocation of the land for the development of the Project;
- *Regional Center for Renewable Energy and Energy Efficiency (RCREEE):* responsible for management of certain aspects on behalf of the Developer related to the Project to include the ESIA study in particular.
- *Consultant (ECO Consult and Green Plus):* hereafter referred to as the 'ESIA Team' who is the ESIA Practitioner and the consultant commissioned by the Developer to prepare the ESIA for the Project in accordance with the requirements of the "Law No. 4 of 1994" as well as international best practice Environmental and Social (E&S) requirements.

2. Project Description

This chapter provides a detailed description of the Project in relation to its location, the key project components and an overview of the proposed activities that are to take place during the construction, operation, and decommissioning phase.

2.1 Administrative Set-up and Project Location

Egypt is divided into 27 Governorates. The Project site is located within the Red Sea Governorate that is bordered by the Red Sea Cost to the east and Beni Suef, Minya, Assyut, Sohag, Qena, Luxor and Aswan Governorates to the west, Suez Governorate to the North, and North Sudan to the south (refer to figure below). Red Sea Governorate's total area is around 120,000 km^2, forming 11.9% of the country's total area.

Administratively, the Red Sea Governorate is divided into 7 Cities (also known as Districts), each headed by a Local City Council. The capital of the Governorate is Hurghada that is located around 150km south of the Project site.

The Project site is located within the Ras Ghareb City (or District) and therefore administratively is under the Ras Ghareb City Council. The Ras Ghareb District is further divided into Ras Ghareb town as well as 2 rural (village) local units (Zaafarana and Wadi Dara). The closest community settlements to the Project site include Ras Ghareb city (located 9km to the southeast) and Zaafarana village (65km to the north).

Ras Gharib City is the second-largest city in the Red Sea Governorate, and the most important Egyptian city in terms of oil production.

As discussed earlier, the Project is located within a 284km^2 area that has been allocated by the GoE to NREA for development of wind farms. Within this, a land area of 69.4km^2 has been allocated to the Developer by NREA for the development of this Project. The coordinates of the Project area are presented in the table that follows.

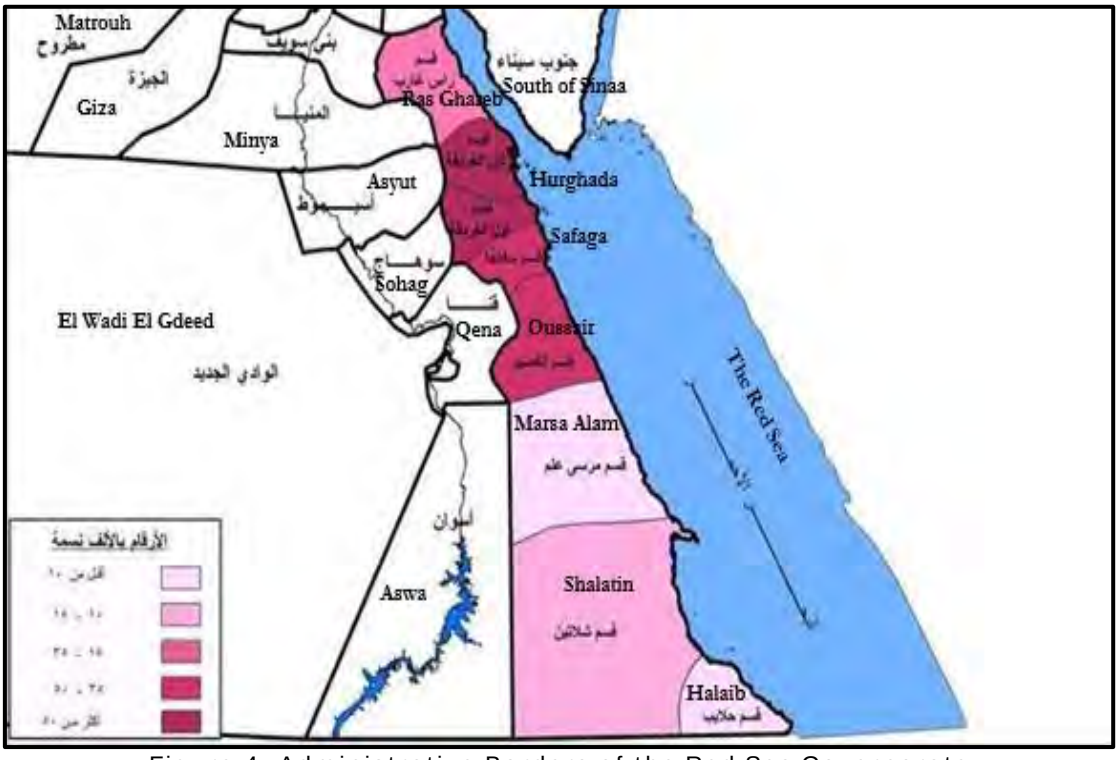


Figure 4: Administrative Borders of the Red Sea Governorate

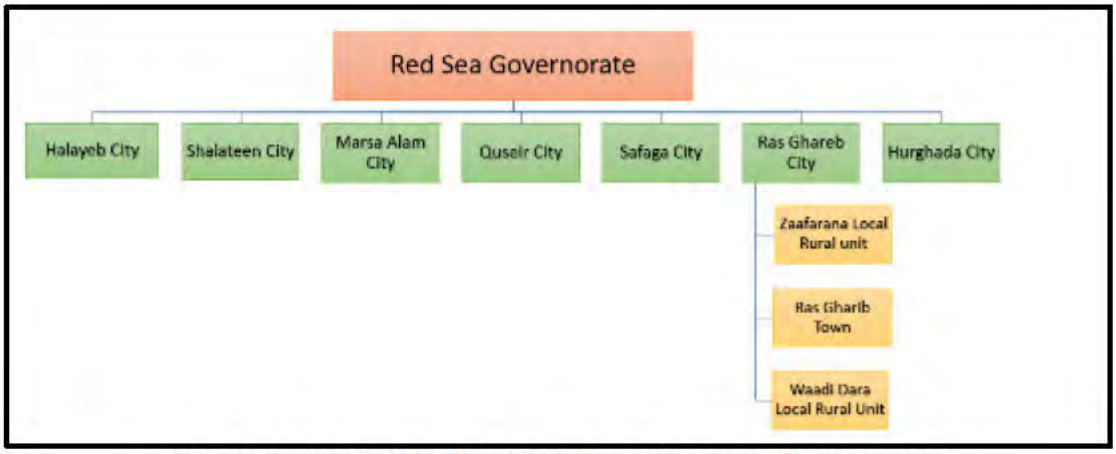


Figure 5: Administrative Division of Red Sea Governorate

Figure 6: Project Site and Closest Villages

Table 2: Project Site Coordinates

Point	WGS Coordinates		Point	WGS Coordinates	
	Latitude	Longitude		Latitude	Longitude
1	28° 31' 48.6100" N	32° 53' 03.1800" E	14	28° 25' 02.8200" N	32° 57' 01.8600" E
2	28° 30' 54.6500" N	32° 54' 14.9200" E	15	28° 23' 21.1400" N	32° 56' 59.0400" E
3	28° 27' 59.6000" N	32° 56' 33.0900" E	16	28° 24' 43.0100" N	32° 54' 42.2100" E
4	28° 28' 12.3300" N	32° 56' 49.3100" E	17	28° 26' 55.2500" N	32° 54' 39.8200" E
5	28° 27' 01.3800" N	32° 57' 44.0100" E	18	28° 27' 01.6600" N	32° 53' 56.5200" E
6	28° 26' 48.0300" N	32° 57' 29.6300" E	19	28° 27' 19.8900" N	32° 53' 44.0000" E
7	28° 24' 07.0700" N	32° 59' 36.5600" E	20	28° 28' 06.9800" N	32° 52' 58.4200" E
8	28° 23' 52.1700" N	32° 59' 06.0400" E	21	28° 29' 07.8800" N	32° 54' 26.1300" E
9	28° 24' 00.3900" N	32° 59' 06.0400" E	22	28° 28' 52.2800" N	32° 52' 56.7800" E
10	28° 24' 00.3900" N	32° 58' 34.1100" E	23	28° 29' 23.8500" N	32° 52' 27.6900" E
11	28° 24' 00.3900" N	32° 58' 06.0400" E	24	28° 29' 49.8700" N	32° 52' 57.6400" E
12	28° 24' 22.0900" N	32° 58' 06.0400" E	25	28° 30' 04.9600" N	32° 51' 58.7000" E
13	28° 25' 00.4000" N	32° 58' 06.0400" E	26	28° 31' 00.5000" N	32° 51' 59.3700" E

2.2 Outline of Wind Turbine Technology

Wind turbine technology relies on harvesting the kinetic energy in wind (i.e. movement of wind) and turning it into mechanical energy which in turn is used for electricity generation. To capture wind, turbines consist of rotor blades which are elevated from the ground using towers to take advantage of faster and less turbulent wind. As wind speed increases, the rotor blades begin to rotate which then spins a shaft that is connected to a generator thereby converting wind energy to electricity.

Wind turbines produce electricity at a certain voltage which must be matched to the grid it connects to. Therefore, transformers are used to convert the output from the wind turbines to a higher voltage that matches the grid.

2.3 Project Components

The table below provides a summary of the key Project components, along with a detailed description of each of those components to follow.

Table 3: Summary of Key Project Components

Component	Description
Project Generation Capacity (MW)	500.5
Number of Wind Turbines	77
Rated Power per Turbine (MW)	6.5
Rotor Diameter (m)	171
Hub Height (m)	94.5
Tip height (m)	180
Project area to be covered	69.4 km^2
Infrastructure and Utilities	This includes: (i) internal road network; (ii) underground MV cables; (iii) warehouse and offices; (iii) substation; and (iv) associated facilities such as the high voltage overhead transmission line.

2.3.1 Wind Turbines

Generally, a wind turbine consists of a foundation, tower, nacelle, rotor blades, a rotor hub, gearbox, generator and a transformer (refer to Figure 8 below). The foundation is used to bolt the tower in place. The tower contains the electrical conduits, supports the nacelle, and provides access to the nacelle for maintenance. Typically, three (3) blades are connected to the hub which then connects with the nacelle; the box-like component that sits atop the tower and which most importantly contains the gearbox (which steps up the revolutions per minute to a speed suitable for the electrical generator) and the generator (which converts the kinetic energy into electricity).

Foundations will be constructed to bolt the tower of the turbine in place (one for each turbine); where in general each foundation will consist of a circular footing of around 20m diameter and a depth of around 3m. The foundation will be built with concrete reinforced with structural corrugated steel. In addition, each turbine is equipped with a transformer that converts/steps up the output from the turbine to a higher voltage (from 11kV to 33kV) to meet a specific utility voltage distribution level that is appropriate for connection with a substation (explained in details below).

In addition, next to each turbine will be a crane pad to accommodate cranes for the installation of the wind turbines and for maintenance activities during operation. The crane pads will be suitable to support loads required for the erection, assembly an operation and maintenance of the turbines. Generally, crane pads have an area of around 1,500m^2.

The figure below presents the turbine layout for the Project that has been based on technical criteria as well E&S constraints or considerations identified to date (based on the outcomes of the ESIA study as per the methodology identified throughout this document).

Figure 7: Project Layout

2.3.2 Infrastructure and Utilities

The following highlights the infrastructure and utilities requirements of the Project.

- Medium Voltage (MV) Cables: The wind turbines will be connected through medium voltage cables (33kV) to an onsite substation (discussed below). The connection between the turbines and the substation will be made using underground transmission cables buried in the ground inside trenches.
- 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 which will consist of fibre optic cables connecting the turbines together to the SCADA system at substation. The communication system will be installed in the same trenches as the MV cables discussed above.
- Substation: The substation includes several high voltage transformer units that collect and convert the output from the turbines to a higher voltage (from 33 kV to 220 kV) that is appropriate for connection with the High Voltage National Grid (220 kV). The substation also includes all the control and protection equipment, like circuit breakers, relays, disconnectors, VTs, CTs, surge arrestors.
- Building Infrastructure: Onsite building infrastructure will be required for the daily operation of the Project. Such buildings 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 such as spare parts, oil cartridges, fuel, lubricants, etc.;
- Road network: A road network will be required for installation of the turbines during the construction process and for ease of access to the turbines for maintenance purposes during operation.

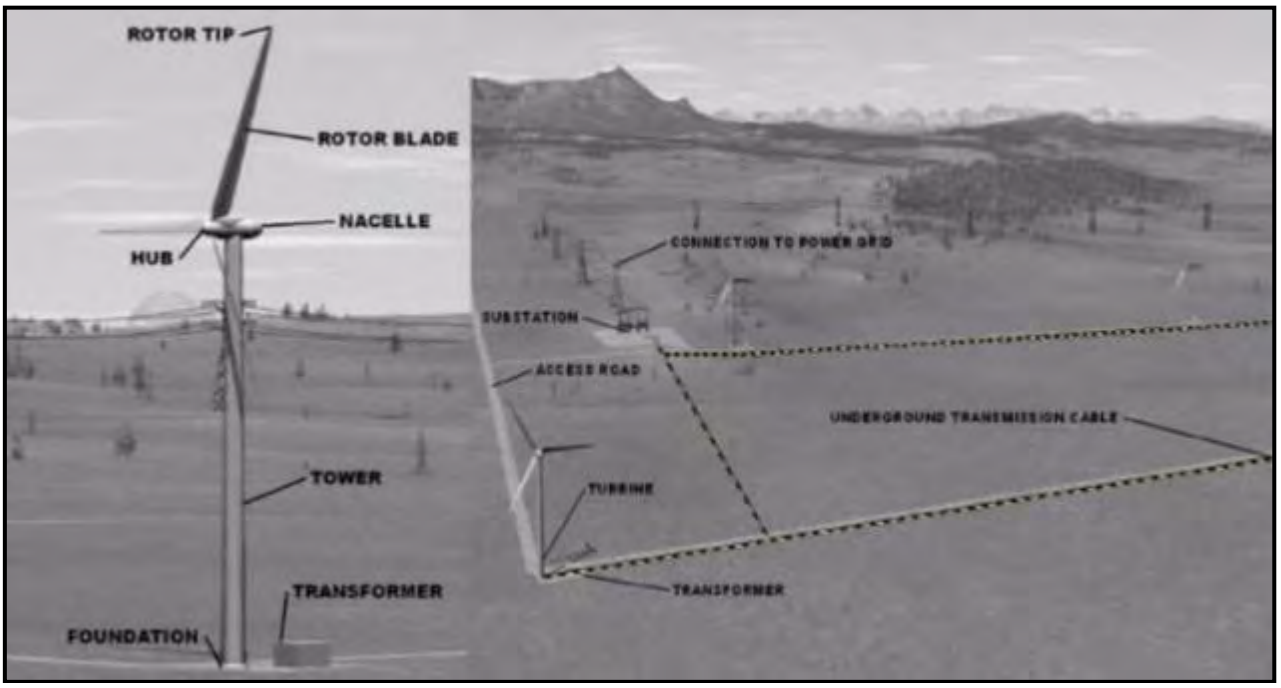


Figure 8: (a) Typical Structural Components of a Wind Turbine, (b) Typical Components of a Wind Farm (Source: EHS Guidelines for Wind Energy, IFC)


Figure 9: Typical 33/220kV Substation

2.3.3 Associated Facilities

As discussed earlier, the EETC will be responsible for offsite connection works from the onsite substation to the National Grid. EETC will be responsible for preparing the detailed design (including identification of the OHTL route), construction activities as well operation and maintenance activities of the OHTL.

It is important to note that a standalone ESIA has been undertaken for the OHTL that provides details on its route, height, number of towers, etc.

2.4 Footprint of the Project Components

This section provides an estimate on the footprint of the Project taking into account the components discussed in the previous section and based on assumptions made by the ESIA team to determine footprint values. As noted in the table below, the total area of disturbance for the

Project is significantly small, calculated at around 1% of the total boundary of the Project area (which is 69.4km^2).

Table 4: Footprint of the Project Components

Component	Footprint	Description
Turbines	0.14km^2	This includes the footprint for the foundation and the crane pad area for each turbine. Typically, each crane pad is around 1,500m^2 in area, whereas each foundation typically consists of a circular footing of 20m diameter.
Substation and Warehouse and Storage facilities	0.02 km^2	Typically, footprint for substation and building facilities is around 0.02km^2.
Trenches for MV cables and communication cables	0.06 km^2	This includes trenches with a calculated length of around 60km and a width of 1m.
Road networks	0.4 km^2	This includes the road network with a total length of 60km and a width of 6m.
Total Project Footprint	0.62 km^2	
Total Project site Boundary Area	69.4km^2	Project footprint is around 1% of the total boundary of the Project area.

2.5 Overview of Project Phases

This section presents the likely activities to take place during the Project development and which will include three distinct phases: (i) planning and construction, (ii) operation and (iii) decommissioning each of which is summarized below.

(i) Planning and Construction Phase

The typical activities that will take place during the planning and construction phase for wind farms include the following:

- Preparation of the detailed design and layout of wind turbines within the Project site in addition to the various other infrastructure/utility elements (buildings, roads, substation, etc.);
- Transportation of wind turbine components to the Project site. The components are expected to be transported to the closest marine port and then transported by road to the Project site;
- Site preparation of the turbine foundation. Such activities are limited to relatively small individual footprints of the foundations and will include excavations and land clearing activities for building the foundations;
- Installation of turbine components to include tower assembly, hub, rotor, blades and nacelle lift and rotor assembly which most likely will occur through onsite mobile cranes; and
- Additional construction work (which could include excavations, land clearing activities, etc.) and installation work that must be conducted to connect each turbine to the power grid. This will include installation and laying of distribution and communication cables, installation of substation, road networks, building infrastructure, etc.
- Commissioning tests of the wind farm which usually involves standard electrical tests for the electrical infrastructure as well as the turbine, and inspection of routine civil engineering quality records. Careful testing at this stage is vital if a good quality wind farm is to be delivered and maintained. Commissioning of an individual turbine can take little more than two days with experienced staff;

(ii) Operation Phase

Wind turbines generally require limited operational activities as this mainly includes the following:

- Normal daily operation of the wind farm. The long-term availability of a commercial wind turbine is usually in excess of 97 percent (i.e. 97% of the time, the turbine will be available to work); and
- Maintenance will also take place through a dedicated team. Typical routine maintenance time for a modern wind turbine is 40 hours per year. Non-routine maintenance may be of a similar order. Although minimal, maintenance activities may include turbine and rotor maintenance, lubrication of parts, washing of blades, maintenance of electrical components, full generator overhaul, etc.

(iii) Decommissioning Phase

According to the PPA agreement, the Project is expected to be operational for 20 years. In the case of complete decommissioning of a wind turbine, the tower and blades of the removed wind turbine will be taken down by crane, disassembled into components, and then the turbine will be refurbished at source and used elsewhere for another Project. The base will typically be left in place and covered by gravel and peat or loam. Tracks used for maintenance vehicles will be restored and can be kept as agricultural routes. Gates and fences will be removed.

(iv) Project Schedule

According to the current timeline information available by the Developer, construction of the Project is anticipated to commence around by November 2021, and will require approximately 30 months for construction and commissioning (i.e. till May 2024). Operation of the Project is therefore anticipated to commence in May 2024 for a period of 20 years based on the PPA signed.

2.6 Workforce Requirements

According to information provided by the Developer, the Project will require the following workforce throughout the construction and operation phase:

- Around 1,500 job opportunities at peak during the construction phase for a duration of approximately 30 months. This will mainly include skilled job opportunities (to include engineers, technicians, consultants, surveyors, etc.) and unskilled job opportunities (mainly labourers but will also include a number of security personnel).
- Around 60 job opportunities during the operation phase for a duration of 20 years. This will include skilled job opportunities (such as engineers, technicians, administrative employees, etc.) and unskilled job opportunities (such as security personnel, drivers, etc.).

Taking the above into account, the Developer is aiming to hire local community members to the greatest extent possible throughout the construction and operation phase for skilled and unskilled jobs. The Developer is committed to adhering to transparent recruitment procedures which includes local community members as discussed in further details in "Section 8.13".

3. ESIA Approach and Methodology

This chapter of describes the approach and methodology that was adopted for the ESIA study including the following:

- Approach for the analysis of alternatives;
- Approach to stakeholder engagement;
- Approach to determining the spatial and temporal study area;
- Methodology for assessment of the baseline environmental and social conditions;
- Methodology used to assess the potential environmental and social impacts of the Project - including the approach to determining significance, development of mitigation measures and the assessment of residual effects;
- Approach used for the assessment of cumulative effects; and
- Approach for development of an ESMP.

3.1 Analysis of Alternatives

The Egyptian Regulations to include the "Guidelines of Principles and Procedures for Environmental Impact Assessment" (EEAA, 2009) requires that the ESIA identify and analyse alternatives and present the main reason for the preferred choice. The examination of alternatives is also considered to be a key element of the ESIA process under good international practice, to include but not limited to the: (i) IFC Performance Standard 1 (IFC, 2012) and the associated "IFC Guidance Note 1" (IFC, 2012); and (ii) EBRD Performance Requirement 1.

The analysis of alternatives is presented in "Chapter 6". The chapter discusses and compared several alternatives to the Project development in relation to: (i) the Project site, (ii) the chosen technology, (iii) the Project design, and finally investigated the 'no action alternative' - which assumes that the Project development does not take place.

3.2 Stakeholder Engagement

Stakeholder consultation and engagement is an essential part of the ESIA process, and has been carried out in accordance with the regulatory requirements in Egypt and the requirements of IFC and EBRD. The previous and future stakeholder consultation and engagement for the Project are summarized below and discussed in detail in "Chapter 4".

The Project to date has included extensive stakeholder consultation and engagement with various stakeholder groups such as national governmental entities, local governmental entities, non-governmental organizations, and other as appropriate. This has been undertaken through bi-lateral meetings, e-mail communication, phone communication, formal letters, and other. In addition, a public disclosure session was undertaken with stakeholders.

"Chapter 4" also discusses future stakeholder engagement and consultations which are to take place at a later stage. This mainly includes the implementation of the Stakeholder Engagement Plan (SEP) by the Developer which describes the planned stakeholder consultation activities and engagement process' to take place after the ESIA approval.

3.3 Delineation of Study Boundaries and Scope of Assessment

3.3.1 Definition of Spatial Study Area

The overall Study Area for the ESIA represents the potential area of influence of the Project. This is 'the area over which significant effects of the Project could reasonably occur, either on their own, or in combination with those of other developments and projects'.

In general terms, the study area for the Project ESIA includes the footprint of Project disturbance as demarcated in the figure below. This includes the Wind Farm Project Site with a total area of 69.4 km^2.

However, for certain environmental and social parameters (such as landscape and visual, noise and shadow flicker, infrastructure and utilities, socio-economics, etc.), the study area goes beyond the actual footprint of the Project site, and therefore an appropriate thematic study area is determined for each theme on a case-by-case basis. Such a thematic study area is clearly identified within the relevant chapter it relates to throughout this ESIA.

In identifying these thematic study areas, the type and degree of the potential direct and indirect effects were taken into consideration. The core area where direct effects are likely to occur was determined, as well as the wider area of influence where indirect, combined and cumulative effects are likely to occur on the surrounding areas and communities.

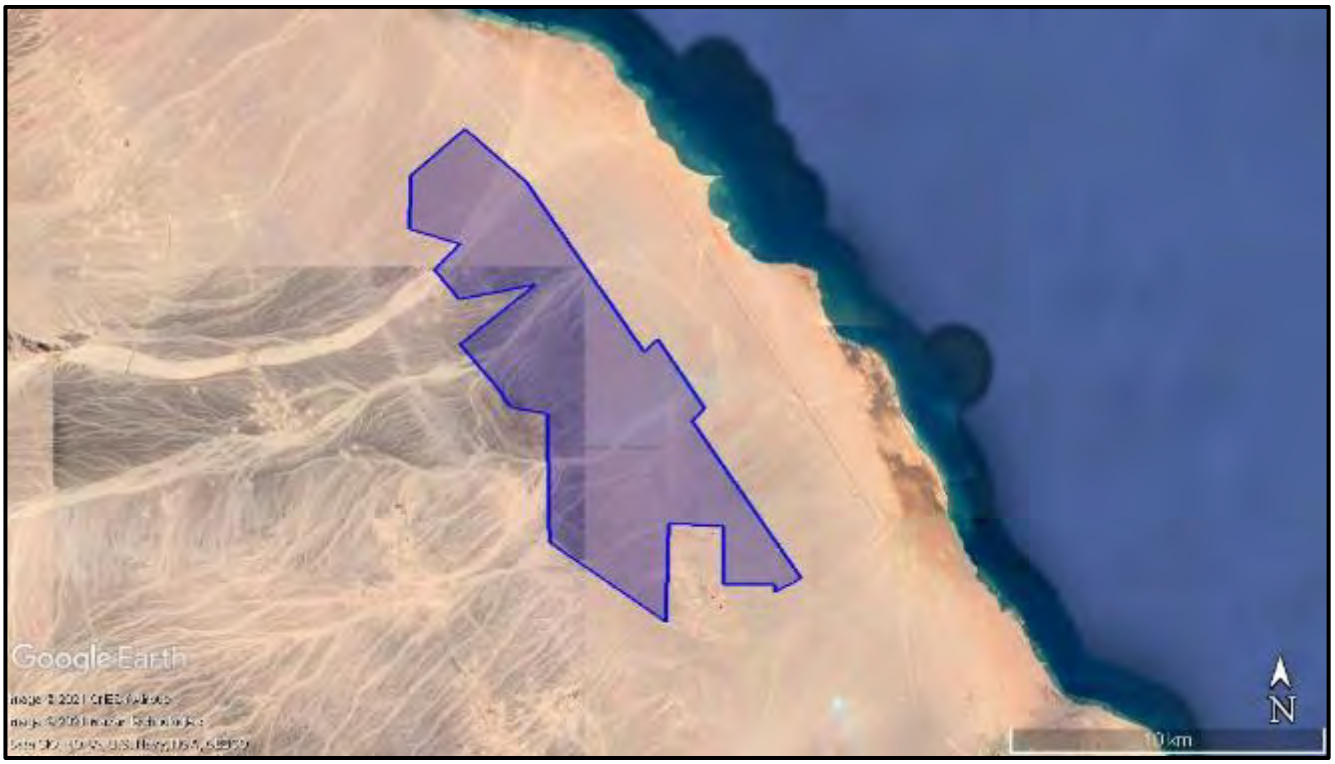


Figure 10: Study Area

3.3.2 Temporal Scope of the Assessment

The Project will be developed in a three-phase sequence as follows. The potential impacts are assessed throughout the various Project phases.

- Planning and Construction Phase;
- Operation Phase; and
- Decommissioning Phase.

(i) *Planning and Construction Phase*

This includes onsite construction activities which will be undertaken by the EPC Contractors under the guidance of the Developer. This mainly includes preparing the detailed design and layout of the turbines, transportation of Project components onsite, construction of the substation, as well as onsite site preparation and construction activities for installation of wind turbines.

(ii) *Operation Phase*

This includes activities to be undertaken by the Project Operator. Activities expected to take place mainly include the normal daily operation of the Project and the routine maintenance activities.

(iii) *Decommissioning Phase*

Generally, the anticipated impacts throughout the decommissioning phase are similar in nature to impacts assessed during the construction phase – and specifically in impacts related to soil and groundwater (from improper management of waste streams), air quality and noise, and occupational health and safety. Therefore, the assessment of impacts for those receptors and mitigation identified during the construction phase is assumed to apply to this phase in particular without the need to reiterate or emphasize this throughout subsequent chapters.

3.4 Environmental and Social Baseline Conditions

As part of the ESIA process, the baseline environmental and social conditions of the study area were established. Describing the baseline includes identifying and defining the importance and sensitivity of the various environmental and social resources and receptors likely to be impacted, i.e. within the study area. Understanding the value or sensitivity of the resources and receptors to impacts and changes is an important consideration when determining the significance of effects, and allows for better identification of the most appropriate measures that could be employed to avoid impacts, and to mitigate any adverse impacts.

The description of environmental and social baseline conditions has considered a wide range of data and information gathered from various sources, including:

- Desk-based studies and literature reviews;
- Data from statutory and non-statutory stakeholders; and
- Field surveys and site investigations.

These studies have covered all the environmental and social aspects related to the Project. The baseline conditions are treated as those conditions which would prevail in the absence of the Project.

Studies of the environment and social baseline are described in "Chapter 7" to include the following: landscape and visual; land use; geology/hydrology/hydrogeology; biodiversity; birds (avi-fauna); bats; archaeology and cultural heritage; air quality and noise; infrastructure and utilities; and socio-economic conditions. Within each chapter, the methodology which was undertaken for assessment of the each of those baseline conditions is described in detail.

3.5 Impact Assessment Methodology

Given the scale and type of the Project, the ESIA commences with an assessment of the positive environmental and economic impacts on the strategic and national level given the current challenges the energy sector in Egypt faces – as highlighted in "Section 8.1".

It then moves forward into the main body of the ESIA undertaking the assessment of impacts on environmental and social parameters for each receptor under the relevant chapter, from "Section 8.2" to "Section 8.13". The following section provides a description of the approach, methodology and process adopted for the impact assessment presented within this ESIA.

3.5.1 Approach to Assessment of Impacts

The adverse and beneficial environmental and social impacts of the Project have been identified and assessed against the established baseline. A consistent approach to the assessment of impacts was followed to enable environmental and social impacts to be broadly compared across the ESIA. A set of generic criteria were used to determine significance (see below) which were applied across the various environmental social and environmental parameters.

As far as possible, environmental and social impacts were quantified. Where it was not possible to quantify impacts, a qualitative assessment was conducted using professional experience, judgment and available knowledge, and including the consideration of stakeholder views. Where there were limitations to the data, and/or uncertainties, these have been recorded in the relevant chapters, along with any assumptions that were taken during the assessment.

In order to determine the significance of each impact, two overall factors are considered:

- The importance and/or sensitivity of the environmental and social receiving parameter, as determined during the assessment of baseline conditions; and
- Magnitude and Nature of the impact.

3.5.2 Sensitivity of the Receiving Parameter:

Receiving parameter sensitivity was determined using information taken from the baseline description on the importance, significance or value of the social or environmental component under examination. It is important to understand the sensitivity of the receiving parameter, as this is a measure of the adaptability and resilience of an E&S parameter to an identified impact. The following categories of sensitivity were applied to the assessment:

- *High*: The E&S parameter/receptor is fragile and an impact is likely to leave it in an altered state from which recovery would be difficult or impossible.
- *Medium*: The parameter/receptor has a degree of adaptability and resilience and is likely to cope with the changes caused by an impact, although there may be some residual modification as a result; and
- *Low*: The parameter/receptor is adaptable and is resilient to change.

3.5.3 Magnitude and Nature of the Impact:

The magnitude of the impact is the scale of change which the impact may cause compared to the baseline and how this change relates to accepted thresholds and standards. The following categories were applied to the assessment:

- *High*: a large change compared to variations in the baseline. Potentially a clear breach of accepted limits;
- *Medium*: change which may be noticeable and may breach accepted limits; and
- *Low*: when compared with the baseline, change which may only just be noticeable. Existing thresholds would not be exceeded.

Furthermore, in determining the magnitude of the impact it is important to take into account and consider several other factors which define the nature of the impact. This includes the following:

Type of Impact

- *Positive*: applies to impacts that have a beneficial E&S result, such as enhancement of conditions; and
- *Negative*: applies to impacts that have a harmful aspect associated with them such as loss or degradation of environmental resources.

Type of Effect

- *Direct*: applies to impacts which can be clearly and directly attributed to a particular E&S parameter (e.g. generation of dust directly impacts air quality); and
- *Indirect*: applies to impacts which may be associated with or are subsequent to a particular impact on a certain E&S parameter (e.g. high levels of dust could affect occupational health and safety).

Duration (how long the stressor or its effect last)

- *Short Term*: applies to impacts whose effects on the environment will disappear within a 1-year period, or once construction activities are completed;
- *Medium Term*: applies to impacts whose effects on the environment will disappear within a 5-year period; and
- *Long Term*: applies to impacts whose effects on the environment will disappear in a period greater than 5 years.

Reversibility

- *Reversible*: applies to impacts whose significance will be reduced and disappeared over time (either naturally or artificially), once the impacting activity ceases; and
- *Irreversible*: applies to impacts whose significance will not be reduced nor disappeared over time (either naturally or artificially), once the impacting activity ceases.

3.5.4 Assessing the Significance of the Impacts

The concept of 'significance' is central to the ESIA process and aids the identification and categorization of E&S effects. As noted, in order to determine impact significance, the sensitivity of each E&S parameter/receptor is considered in combination with the magnitude of the impact. The table below demonstrates how these parameters are considered in the assessment of significance.

Table 5: Determination of Significance

Magnitude of Impact / Sensitivity of Receiving Parameter/Receptor	**Low**	**Medium**	**High**
Low	Not significant	Minor	Minor
Medium	Minor	Minor	Moderate
High	Minor	Moderate	Major

While the above matrix provides a framework for the determination of significance, and enables comparison across E&S parameters, a degree of professional judgement must be used and some parameter-specific factors to be considered in making the determination of significance. Below provides additional guidance to the degrees of significance used in this ESIA. Note that positive impacts are defined, but are not rated for significance.

- *Major significance*: requires thorough investigation in the ESIA. These impacts have been studied and assessed extensively to design needed mitigation and environmental management measures.
- *Moderate significance*: requires reasonable investigation in the ESIA. These impacts have been studied to design needed mitigation and environmental management measures.
- *Minor significance*: must be listed, and addressed in some way, but which did not require detailed assessment in the ESIA.
- *Not significant*: for completeness, impacts which have been included in the assessment but determined not to be significant, are rated formally as 'not significant'.

3.5.5 Management Measures

Based on the impact assessment undertaken a set of management measures are identified for each impact which aims to address it. Management measures include the following:

- Additional Requirements: those are generally regulatory requirements which have been identified and which must be taken into account at a later stage.
- Additional Studies: for certain E&S receptors additional studies must be undertaken at a later stage. Such studies and their scope, timing, etc. have been highlighted were relevant.
- Mitigation Measures: a vital step in the ESIA process is the identification of measures that can be taken to ensure that impacts are mitigated or reduced to acceptable levels. The ESIA will firstly consider the significance of any impacts caused by the Project and then assigned mitigation options through applying the following hierarchy:
  - Avoiding or 'designing out' impacts wherever possible;
  - Considering alternatives or modifications to the design to reduce the impacts wherever possible;
  - Applying measures to minimize and manage impacts on the receptor; *then*
  - As a last resort, identifying fair compensation, remediation and offsetting measures to address any potentially significant residual effects.

  Some negative impacts can be easily mitigated, whilst others cannot or are too difficult and costly to mitigate. The various potential impacts are described in this ESIA, along with the provision of 'feasible mitigation measures' that can be implemented.
- Recommendations: for positive impacts it is not possible to identify mitigation measures, but rather recommendations have been identified which aim to enhance the positive impact.

3.5.6 Assessment of Residual Significance

If there are mitigation measures it is then necessary to make an assessment of the 'residual significance' after mitigation has been taken account. A re-assessment of Project impacts is then made, taking into account the effect of the proposed mitigation measures in order to determine the significance of the *residual effects*. Residual effects are discussed for each E&S theme in the ESIA chapters, and their significance determined and summarized in an Impact Assessment Table in "Section 8.14"

3.5.7 Assessment of Cumulative Impacts

For each of the impacts assessed, the ESIA investigates the cumulative impacts which could result from incremental impacts from other known existing and/or planned developments in the area, and based on currently available information on such existing/planned developments. Assessment of cumulative impacts is presented in "Section 8.15".

3.5.8 Development of Environmental and Social Management Plan (ESMP)

Based on the results of the impact assessment, development of management measures, and development of monitoring plan, an ESMP was compiled into a single table that details all of the above. The ESMP will be a key document and will list the environmental/social requirements and detail the procedures necessary for managing the significant environmental/social issues connected to proposed Project activities. The ESMP will be developed specifically to provide flexibility in the nature and exact location of operations, while ensuring all potential impacts are identified and properly mitigated and monitored throughout the later stages of the Project. This ESMP can be used as a stand-alone document during the different phases of the Project by Developer, EPC Contractors, EEAA, and other responsible parties.

3.5.9 Assessment of Associated Facilities

The key component related to the associated facilities would be the Overhead Transmission Line (OHTL) which will run from the Project site (from substation area) to the connection point with the National Grid. As discussed earlier, the design, construction and operation of the OHTL will be responsibility of EETC.

However, at this stage no details were provided on the OHTL to include its route, number of pylons and their location, height, etc. Therefore, the methodology and approach for this ESIA does not take into account the baseline conditions and impacts associated with the OHTL.

4. Stakeholder Consultation and Engagement

This Chapter discusses in details the stakeholder consultation and engagement plans which were undertaken as part of the ESIA process for the Project and provides an overview of the findings. In addition, this Chapter also discusses the future stakeholder consultation and engagement plans which are to take place at a later stage of the ESIA process as well the Project development.

4.1 Introduction

Stakeholder engagement is an integral part of ESIA good practice and is a statutory requirement of the national EIA legal framework in Egypt and within under good international practice, to include IFC and EBRD requirements. The Developer is committed to a technically and culturally-appropriate approach to consultation and engagement with all stakeholders affected either directly or indirectly by the Project. The consultation program for the Project is based on informed consultation and participation in line with good international practice requirements with affected people, and is designed to be both fair and inclusive. Consultation activities have been an ongoing process since the commencement of the ESIA study in January 2020.

Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively.

Stakeholders may include: 1. locally affected communities or individuals and their formal and informal representatives, 2. national or local government authorities, politicians, religious leaders, civil society organisations and groups with special interests, 3. the academic community, or other businesses.

Stakeholder consultation is an inclusive process for sharing information that enables stakeholders to understand the risks, impacts, and opportunities of a development or project, allowing them to express their views and articulate their perceptions towards it.

4.2 Objectives

The objective of stakeholder consultation is to ensure that a participatory approach takes place, which in turn documents concerns of all stakeholder groups and makes sure that such concerns are considered, responded to, and incorporated into the decision-making process of the development. Stakeholder consultation needs to be a two-way communication process that imparts information to stakeholders, but also obtains additional and on-the-ground information from them. Stakeholder consultation and engagement must take place at the inception phase of the ESIA process and implemented all through the study period.

The specific objectives of this chapter are to:

- Summarise national and international legal & policy requirements for stakeholder engagement;
- Describe and identify the stakeholders affected and/or with an interest in the Project;
- Summarise stakeholder engagement and consultation conducted to date. In addition, describe how the views and issues raised have informed and influenced the development of the Project; and
- Outline the future plans and approach to stakeholder engagement.

4.3 Requirements for Stakeholder Engagement

Egyptian Legislation Requirements

Egyptian legislative requirements for stakeholder engagement are mainly included within the undertaking of the ESIA. The "Environment Law No. 4 of 1994 and subsequent amendments" require that an ESIA study shall be undertaken for projects with significance impacts, including two phases of stakeholder consultation: scoping and public consultation.

The scoping should include targeted stakeholder consultations with key stakeholders as applicable (refer to "Section 4.5" below for additional details). In addition, the public consultation is required to include the following entities (refer to "Section 4.6" below for additional details):

- Representatives of the EEAA
- Related government authorities
- Representatives of the Governorate and local units where the project is located
- Affected local communities including local businesses
- NGOs and civil society groups

The articles covering the guidelines on conducting public consultations as part of the ESIA study are as follows:

- Paragraph 6.4.3.1 Scope of Public Consultation
- Paragraph 6.4.3.2 Methodology of Public Consultation
- Paragraph 6.4.3.3 Documentation of the Consultation Results
- Paragraph 7 Requirement and Scope of the Public Disclosure

Financing Requirements

Stakeholder engagement activities undertaken as part of the ESIA meets international best practice requirements to include the relevant environmental and social requirements of IFIs to include IFC and EBRD as identified below.

the IFC Performance Standard (PS) 1 "*Assessment and Management of Environmental and Social Risks and Impacts*" addresses Stakeholder Engagement and sets out the following requirements:

- Stakeholder Engagement is an on-going process that may involve: stakeholder analysis & planning, disclosure & dissemination of information, consultation & participation, grievance mechanism, and ongoing reporting to Affected Communities.
- A Stakeholder Engagement Plan (SEP) must be developed and implemented that is scaled to the project risks and impacts and development stage, and be tailored to the characteristics and interests of the Affected Communities.
- Affected Communities will be provided with access to relevant information on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such communities and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.
- When Affected Communities are subject to identified risks and adverse impacts from a project, a process of consultation will be undertaken in a manner that provides the Affected Communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them.
- The extent and degree of engagement should be commensurate with the project's risks and adverse impacts and concerns raised by Affected Communities.

- The consultation process will be tailored to language preferences of Affected Communities, their decision-making process, and the needs of disadvantaged or vulnerable groups.
- For projects with potentially significant adverse impacts, the client will conduct an informed consultation and participation.
- A grievance mechanism will be established to receive and facilitate resolution of Affected Communities' concerns and grievances about the client's environmental and social performance.

In addition, the EBRD *"PR 1: Assessment and Management of Environmental and Social Impacts and Issues"* and EBRD *"PR 10: Information Disclosure and Stakeholder Engagement"* identify similar requirements to those of the IFC as identified above.

4.4 Stakeholder Identification and Analysis

The purpose of stakeholder identification is to identify and prioritise Project stakeholders for consultation. Stakeholder identification is an ongoing process, and thus key stakeholders will be identified during different stages of the Project. A systematic approach is used to map the stakeholders based on the Project zone of impacts. In this approach, by mapping the zone of social impacts, stakeholders are identified by the impact area.

As a result of the stakeholder mapping, Project stakeholders are categorised into two main categories:

- Primary stakeholders are the individuals and groups who are affected directly by the Project; and
- Secondary stakeholders are those parties who have influence on the Project and/or interested in the Project, but are not necessarily directly impacted by the Project.

The key stakeholders identified are presented in the following table.

Table 6: Stakeholder Identification

<table>
<tr><th colspan="2">Level of Stakeholder interest in/involvement to the Project</th></tr>
<tr><td colspan="2">1. Stakeholders who may be directly or indirectly affected by the Project</td></tr>
<tr><td colspan="2">▪ Nearby local community from Ras Ghareb and Zaafarana to include:
<table>
<tr><td>Community people</td><td>- Locals have a vested interest in the Project, as they might be able to land a job opportunity
- Locals will receive the impacts (positive/negative) as a result of the Project</td></tr>
<tr><td>Community Leaders</td><td>- They are socially active members and known figureheads for community members, who may or may not hold government positions. Community leaders involved in the Project are the heads of affected communities.</td></tr>
<tr><td>Business Community (Local Large-Scale Contractors)</td><td>- Could be involved in performing some contracting works on-site.</td></tr>
</table>
▪ Bedouin groups in the general area where the Project is located (named El-Ma'aza)
- Arab tribes will be helpful in providing security to the Project sites.
- Additionally, they might be able to provide supplies to the workers (water, food, etc.)
- Arab tribes include the group of people described as 'wise men' (El-Awaqel). They are responsible for Urfi juridical activities. All local communities abide by their judgments.
- Responsible for communication between the Project and their local communities.</td></tr>
<tr><td colspan="2">2. Secondary Interested Parties/Stakeholders</td></tr>
<tr><td colspan="2">Stakeholders who may participate in implementation of the Project</td></tr>
<tr><td colspan="2">▪ IFIs, and investors</td></tr>
<tr><td colspan="2">National Government & Permitting Authorities</td></tr>
<tr><td colspan="2">▪ Ministry of Environment –Egyptian Environmental Affairs Agency (EEAA): Responsible for reviewing and approving ESIAs, as well as for monitoring the implementation of the Environmental Management Plan.
▪ Environmental Office within the Governorate: Responsible for monitoring compliance to environmental requirements.</td></tr>
</table>

Entity	Scope
Egyptian Electricity Transmission Company (EETC)	Purchase of electrical energy produced from power plants, which authorizes local and foreign investors to create, and sell them on the ultra-effort networks. The implementation of projects for the electricity transmission.
New & Renewable Energy Authority (NREA)	NREA act as the national focal point for expanding efforts to develop and introduce renewable energy technologies to Egypt on a commercial scale together with implementation of related energy conservation programs. NREA is entrusted to plan and implement renewable energy programs in coordination with other concerned national and international institutions within the framework of its mandate. They were also responsible for providing the land required to the Developer for this Project in specific.
General Petroleum Company	A national State-owned company engaged in exploration, production and development of hydrocarbons, is responsible for the management of oil and gas exploration and production activities on behalf of the State. It is one of the subsidiary companies affiliated to the Ministry of Petroleum. It has the right of concession for petroleum exploration within the Project area in general and represents the main investment activity in the Project area.
Ministry of Defence: Army Intelligence force, Border guards	They also provide permissions to get into the desert area and responsible for providing security and support for the Project.
Red Sea Governorate	The main role of the governorate is supporting the Project by providing the various permissions and permits needed.
Ras Gharib City Council	Give permits for any construction projects (including this project). In addition, they are also responsible for providing supervision and follow-up from the Environmental Department in Ras Ghareb City Council during the construction phase. Finally, they are also the official entity to coordinate with for solid waste disposal.
Media: Newspaper, Television, Internet	They disclose information about the Project.
Water and wastewater Company in Ras Ghareb	Provide the Project needs and requirements for water supply during construction and operation as well as wastewater disposal.
Civil Aviation	Issuing a permit for height requirements and warning signs
Public health: Directorate of Health in Red Sea Governorate, Ras Ghareb General Hospital	They provide the health services and facilities to the local districts
Education providers (in particular technical / vocational training institutes)	Provides knowledge and skills required in for various occupations, including renewables and wind power in specific that is delivered through formal, non-formal and informal learning processes. The education curriculum in undergraduate, postgraduate, or Technical and Vocational Education and Training (TVET) could be reviewed and revised to match the market and workforce requirements.
Manpower Directorate:	Data of the labour force in Suez Governorate and monitor labour recruitment

Labour Office in Red Sea Governorate	standards.
Roads Directorate in Red Sea Governorate	Services and development of external roads in the Governorate and issue permits for any construction work on the external roads
Ministry of Interior	Responsible for national and local security, as well as approving emergency response and firefighting plans for establishments/projects.

Non-governmental Organisations (NGOs) and Community Based Organisations (CBOs)

- Organizations with direct interest in the Project, and which may have useful data or insight into local issues of relevance to the Project. These organizations can also influence the views of others regarding the Project, both nationally and internationally.
- NGOs are responsible for sharing information with the community.

NGOs/ CBOs	Scope
Association for the Conservation of the Environment in Red Sea (HEPCA)	Environment protection
Red Sea Ecotourism	Social and cultural services
Environmental protection in the Red Sea	Environment protection
Ababdeh Sons Association in Ras Ghareb	Community Development
Resala Association	Social and family services
Firdous Association	Social and family services
Egyptian Red Crescent	Community Development
Orban El-Saharaa	Community Development

4.5 Targeted Consultations

As part of the scoping process of the Project, targeted consultations were undertaken with key stakeholders that are relevant to the Project to include but not limited to: (i) central governmental entities; (ii) local governmental entities; (iii) key Non-Governmental Organizations (NGOs); and other.

The objective of such consultations was to:

- Introduce project (rationale, objective, location, key components, etc.)
- Explain and discuss overall methodology for ESIA study
- Explain and discuss key anticipated impacts as relevant
- Identify and determine additional requirements or key issues of concern to be taken into account for the ESIA study

Throughout the consultations a handout was prepared and distributed to such stakeholder groups with key information to include but not limited to rationale for Project, Project location and setting, key components and activities of the Project and other as applicable.

The table below presents summary for the outcomes of the stakeholder consultations undertaken, while the figure that follows presents sample photos.

Table 7: Outcomes of Stakeholder Consultations

Entity	Key Outcome
Central Governmental Entities	
EEAA, EIA Central Department,	- Stated support for such a Project as clean energy developments are considered environmentally friendly developments that reduce greenhouse gases and pollutant emissions as compared to traditional fuel-fired power plants

Entity	Key Outcome
Cairo	- Key issues to be considered for the ESIA study should include: (i) flood risks as the area in general is known for such impacts and project must avoid siting of components within such areas (impacts were considered – refer to "Section 8.4.1"); (ii) impacts on migratory birds due to sensitivity of the site (impacts were considered – refer to "Section 8.6"); and (iii) other potential impacts from construction activities such as dust and noise generation (impacts were considered – refer to "Section 8.9"). - Key requirements to be considered for the ESIA study include: (i) compliance with the wind energy guidelines issued in 2013 (ESIA has taken such requirements into account); and (iii) public consultation session which is to be undertaken as part of the disclosure phase must be undertaken in presence of all relevant stakeholders and beneficiaries, in a suitable venue, with key presentations in Arabic language, and ensuring that invitations are prepared and sent 15 days before target date of the session (refer to "Section 4.6" below).
EETC, Main Office, Cairo,	- Stated support for the Project as it is in line with Egypt's Strategy for development of clean and renewable energy. In addition, Project is considered an environmentally friendly development that would reduce emissions - Key advantage of the Project would be providing job opportunities which needs to be addressed in ESIA study (impacts were considered – refer to "Section 8.13").
NREA	- Stressed on the positive impacts of the Project in providing electricity for all development works in Egypt - Key impacts to be considered during construction and operation are on migratory birds and their migration routes and detailed studies should be undertaken in ESIA to investigate such impacts (impacts were considered – refer to "Section 8.6"). - Project will also entail key positive socio-economic impacts for local communities that should be addressed in ESIA. Such impacts are related to job and employment opportunities, local sub-contractors, as well as service facilities (accommodation, food, etc.) which will be required for Project workers (impacts were considered – refer to "Section 8.13").
Local Governmental Entities	
EEAA, Red Sea Regional Branch	- Emphasized that ESIA should take into account impacts during construction and operation; (i) relevant impacts during construction include impacts from noise and air quality (dust and emissions) from various construction works (impacts were considered – refer to "Section 8.9"); (ii) impacts from improper management of waste streams onsite (impacts were considered – refer to "Section 8.4.2"), (iii) impacts on biodiversity to include reptiles in specific (impacts were considered – refer to "Section 7.4"); (iv) effects on migratory birds in which a study must be undertaken identifying suitable mitigation measures to be implemented to avoid such impacts on migration routes and migratory birds to include for example appropriate siting of turbines (impacts were considered – refer to "Section 8.6").
Red Sea Governorate – Environmental Management Unit (EMU)	- Stressed on the necessity of conducting a biodiversity baseline that takes into account flora and fauna, including reptiles in specific and based on that appropriate mitigation measures should be identified for the construction phase (this has been taken into account – refer to "Section 7.4"). - Stated that there are extensive previous studies undertaken in the area and many of these reports are available on the NREA website. Such reports could be revised to provide additional information on the area in general.
Red Sea Water and Wastewater Company	- Stated that water requirements for wind Projects can be provided without affecting the services and facilities available in the Governorate as currently there are no problems or constraints in terms of water supply - Stated that supplying water to the Project through a pipeline would be unfeasible and difficult due to unavailability of water network in the area and long distance to the nearest connection point - Stated that all companies and developments operating in this area utilize water tankers from the nearest city, which are available by the Company and it also provides a designated place to pump water for these tankers
Non-Governmental Organizations	
Orban El-Saharaa NGO/ considered the most active within the Project area in	- Stated that the Project will produce clean energy that will have positive economical outcome that benefits society and the country. - Stated that the Project will have key positive impacts on local communities through providing job opportunities, local subcontracting works as well as service provisions for workers (such as housing requirements) - Stated that the Developer should also aim to implement a social responsibility program for local communities and one of the key needs is related to the health

Entity	Key Outcome
general in terms of social development	sector (impacts were considered – refer to "Section 8.13"). - Key negative impacts from the Project is related to impacts during operation on migratory birds and ESIA study should study such issue and determine appropriate mitigation measures (impacts were considered – refer to "Section 8.6"). Other impacts are considered minor given that the Project is located at a distance from any nearby communities. - Expressed their willingness to participate in any development work that could be required for the project
Other	
Petroleum Facilities and Companies in the Area	- In general, they stated that such renewable energy projects have significant positive impacts on the near and long-term levels - They do not see any conflict between oil companies (given that they have existing works and infrastructure elements within the NREA assigned plot for wind farm developments) and renewable energy companies as the two can work together through proper coordination, planning and work arrangements - Stated that such renewable energy developments in the region should also be a partner in local community socio-economic development through job opportunities, local subcontractor involvement, as well as service facilities (accommodation, food, etc.) which will be required for Project workers. - Key impacts to be considered is during operation on migratory birds and their migration routes. This should be investigated in the ESIA and mitigation measures should be taken into account to include radars to monitor bird migration and shutdown turbines to avoid collisions (impacts were considered – refer to "Section 8.6"). - There are other impacts which should be considered to include impacts on road networks from transportation activities of turbine (impacts were considered – refer to "Section 8.10.1", and potential impacts from noise (impacts were considered – refer to "Section 8.9").

Figure 11: Selected Photos of Targeted Consultations

4.6 Public Disclosure Session

Upon completion of the Draft ESIA study, a public consultation session was held on 6 April 2021 in Ras Gharib City at Red Sea Governorate. The session was undertaken at Orchida Hall. The objective of the session included the following:

- Introduce the Project to stakeholders;
- Present the methodology, results, outcomes and conclusions of the ESIA study
- Allow stakeholders to raise any comments or issues of concern in relation to ESIA study to include but not limited to the baseline results, impacts, mitigation, monitoring measures, etc.

The list of invitees was identified jointly between RCREEE in coordination with the 'ESIA Consultant' and included national/regional/local governmental entities (EEAA, NREA, EETC, etc.), Non-Governmental Organization (NGOs), local community members, private sectors representatives and companies in the area, and other.

In coordination with the 'ESIA Consultant', invitees were informed of the date and location of the Public Consultation. In addition, taking into account COVID-19 conditions, virtual online participation was enabled for participants through a direct URL link.

Participants were invited through the following:

- Invitations sent by fax
- Invitations sent via e-mails
- Telephone communication by the 'ESIA Consultant'
- Advertisement in an official daily newspaper as presented in the figure below (Gomhoryia Newspaper).
- Announcement through RCREEE social media pages (e.g. LinkedIn)

In total, sixty-nine (69) attendees were present as summarized in the table below. A Non-Technical Summary (NTS) of the ESIA was prepared and distributed to the attendees in Arabic language. Sample photos of the session are presented in the figure that follows.

Table 8: Distribution of Participants

Entity	No.	Percentage
EEAA	4	6
NREA	8	12
RCREEE	5	7
EETC	1	1
Other local government officials	8	12
Local community members	5	7
Journalists	2	3
Employees from Private Sector	9	13
Attendees via the online platform	27	39

Figure 12: Newspaper Advertisement

Figure 13: Selected Photos of the Session

The session was moderated by the following key entities: (i) Amunet Wind Power Company Representatives (as the Developer); (ii) RCREEE representatives; and (iii) ESIA consultants (ECO Consult and Green Plus). The session included the following;

- Welcoming remark by Mr. [redacted] (Green Plus representative) that aimed to welcome attendees to the session and outline it purpose
- Mr. [redacted] (RCREEE) presented the overall project and its economic and environmental importance
- Mr. [redacted] (Amunet representative) provided a brief on the company and its owner (AMEA Power) and its fields of expertise, especially in wind energy projects
- Mr. [redacted] (ECO Consult) provided a full and detailed presentation on the Project (to include location, components, phases, etc.) and the overall outcomes and conclusions of the ESIA to include the baseline, impacts and mitigation and monitoring measures.
- Dr. [redacted] presented in details the results of the migratory bird monitoring undertaken during spring and autumn as well outcomes of the impact assessment and recommendations and measures to be undertaken to reduce the impact.
- Mr. [redacted] (RCREEE representative) discussed mitigation measures and monitoring programs managed by RCREEE to avoid and prevent potential impacts from wind turbines on migratory birds in the GoS such as the Active Turbine Management Programs (ATMPs).

Finally, an open discussion took place where the attendees were given the chance to comment on the ESIA and its outcomes, results and conclusions. The table below, presents a summary of the key comments raised during the consultations as well as the responses provided on such comments.

Table 9: Key Outcomes and Responses of the Public Disclosure Session

Issue	Questions and comments	Responses
Birds (Avi-fauna)	[redacted] */Freelance Architect.* Suggested to coordinate with the Ministry of Education to provide curriculum related to students on importance of migratory birds.	It was stated that this can be implemented by adding an educational part to the children's curriculum on migratory birds and their global importance.
	[redacted] */ Project Manager – EEAA.* Stated that the Developer is required to contribute to support the bird monitoring training centre to increase the number of trainees in RCREEE	It was explained that this could be taken into account by the Developer throughout the upcoming phase.
	[redacted] */ EEAA.* Inquired whether there are specific corridors for bird migration routes within the project area.	It was explained that based on the bird studies undertaken during the last two (2) seasons no constraint areas for bird migration were identified which would require any specific buffer corridors.
	[redacted] */ EETC - General Management of the Environmental and Social Studies.* Inquired about the monitoring procedures during the various Project phases.	It was explained that the agency has departments for monitoring, inspection and follow-up from the main branch and regional branches. In addition, there is a protocol represented by EEAA and RCREEE, and one of the most important provisions of this protocol is the inspection and monitoring of wind farm projects during the studies, construction and operation phases. This is done through a specialized technical committee from EEAA and RCREEE which carries out continuous inspection and monitoring procedures.
	Inquiry via the Online Platform. Asked whether the shutdown-on-demand program be implemented when birds fly at low heights.	It was explained that there are several criteria regarding the shutdown-on-demand program that will be implemented during the operational phase of the Project that includes flying height of the birds and other considerations such as the number and type of birds, wind direction and other.
	[redacted] */ EEAA.* Inquired whether the turbine blades will be painted in accordance with the specifications identified by EEAA.	It was explained that any requirements identified by EEAA will be taken into account, including painting of blades if required to reduce bird collisions.
Infrastructure and Utilities	[redacted] */ Assistant Director-General - General Petroleum Company.* Stressed that there must be coordination between the project and the General Petroleum Company to manage all procedures in the construction phase.	It was stated that interviews and consultations were undertaken as part of the scoping phase of the ESIA with the General Petroleum Company. In addition, it was also explained that a later stage, the ESIA requires that further coordination is established with the oil companies as part of the design phase as well as the construction phase for management of onsite works. In addition, the ESIA also assessed all potential impacts on oil operations in the area.
Socio-economics	[redacted] */ General Manager of Energy Projects – EEAA.* Suggested to develop a community engagement Plan.	It was stated that as part of the ESIA a Stakeholder Engagement Plan (SEP) has been developed. In addition, the ESIA also provides recommendation for development of a local recruitment and procurements procedure as well as CSR program to be implemented by the Developer.
	[redacted] */ EETC - General Management of the Environmental and*	It was explained that at a later stage and as recommended in the ESIA, the Developer will be

	Social Studies. Inquired whether a direct contact with the residents of Ras Ghareb was undertaken to find out their needs to be included in CSR program by Developer.	implementing a CSR program in coordination with local entities as applicable and will be based on local community needs.
	[redacted] / *Freelance Architect.* Inquired about the requirements needed for hiring unskilled labour.	It was explained that at this stage, such information is not available given that the EPC Contractor has not been assigned yet. Once appointed a local recruitment procedure will be developed that will identify commitments and requirements to local hiring. This is expected to include job opportunities for skilled labour such as technicians and engineers which will require specific qualifications, as well as unskilled labour which will not, such as construction and excavation workers.
	[redacted] / *Egyptian Ministry of Education. S*uggested to coordinate with the Ministry of Education to make a technical semester for wind projects and also suggested Developer to contribute in improving Ras Garb Public Hospital.	It was explained that such suggestions can be taken into account and considered as part of the CSR activities that will be developed and undertaken by the Developer as explained earlier.
Analysis of Alternatives	*Eng.* [redacted] / *EEAA.* Stated that the presentation included alternatives for the turbine layouts and specifications and inquired if the impacts of such alternatives were studied in the ESIA.	It was explained that the ESIA took into account the impacts from the alternatives. All options were studied and assessed as part of the ESIA but the final ESIA will take into account a final layout only.
	[redacted] / *Project Manager – EEAA.* Recommended to consider the alternative which includes fewer number of turbines.	It was explained that the final selection of alternatives will be by the Developer and will depend on various factors such as technical consideration, economical and financial aspects and other.
	[redacted] /*General Manager of Energy Projects – EEAA.* Stressed that the study complies with the requirements of the EEAA. It is noted that the presentation included several alternatives in terms of the number and layout of wind turbines as well as specifications. The ESIA that is to be submitted should include only the final layout and turbine specifications for the project.	It was explained that the final ESIA that will be submitted will include a final layout and turbine specifications as required by EEAA.
	[redacted] / *Environmental researcher – EEAA.* Inquired about the reason behind choosing this site despite the presence of oil companies in the area. In addition, he also asked if there was coordination to avoid overlap with these companies and reduce cumulative impacts.	It was explained that the site has been allocated by NREA for wind power projects, and permits from different concerned authorities were obtained for the Project site. It was also explained that there was previous coordination with such oil companies and there is a requirement for further coordination during the planning phase of the Project as recommended in the ESIA.
Others	[redacted] / *Environmental management director – Ras Ghareb City Council.* Inquired on why the EPC Contractor was is not present to take into account the suggestions raised throughout the session.	It was explained that the EPC contractor has not been selected at this stage but will be completed by the Developer very soon. In addition, it was explained that the EPC Contractor will be required to adhere to all outcomes included within the ESIA and associated ESMP which would also take into account issues raised today as applicable.

	[redacted] / *Environmental researcher – EEAA.* Inquired on why turbine heights are specifically limited to 120m in height.	It was explained that such limitation on height was set for all wind farm projects in the region based on security issues due to location of Project within a military zone as well as other technical standards.
	Enquiry via the online platform. A question was raised on whether climate and temperature impacts have been studied on the turbines that will be selected and their performance.	It was explained that the technical study that is undertaken by the Developer takes into account climatic conditions within the Project area including temperature levels.

4.7 Future Stakeholder Engagement and Consultation

Future stakeholder engagement and consultations will mainly include the following, each of which is discussed in further details below: (i) disclosure of the E&S documents; and (ii) implementation of the Stakeholder Engagement Plan (SEP) by the Developer.

Disclosure of the ESIA document

The final ESIA, Non-Technical Summary (NTS) and the SEP will be disclosed on the Developer's website. Such documents will be disclosed for a minimum of 60 calendar days to allow any stakeholder to review the studies and comment on the scope of work undertaken, key issues identified and any other issues of concern they might have. At the end of the disclosure period, all received comments will be addressed and taken into account and an updated ESIA will be provided.

Stakeholder Engagement Plan

Stakeholder Engagement is an on-going process that involves: stakeholder analysis & planning, disclosure & dissemination of information, consultation & participation, grievance mechanism, and on-going reporting to Affected Communities. A Stakeholder Engagement Plan (SEP) is developed and implemented that is scaled to the Project risks and impacts and development stage, and be tailored to the characteristics and interests of the Affected Communities and key stakeholders.

The SEP for the Project describes the planned stakeholder consultation activities and engagement process and includes the following:

- Define the Project's approach to future stakeholder engagement;
- Identify stakeholders within the area influenced by the Project;
- Profile identified stakeholders to understand their priorities;
- Propose an action plan for future engagement with identified stakeholders; and
- Set out the grievance/project complaints mechanism.

The Developer is committed to implementing the requirements of the SEP throughout the lifetime of the Project. The SEP is provided as a standalone document.

5. Regulatory and Policy Framework

This chapter first provides an overview of the environmental clearance process for the Project. The Chapter then discusses the regulatory context which is directly related to environmental compliance which must be adhered to by all parties involved in the Project throughout the planning and construction, operation, and decommissioning. The Chapter goes on to summarise the relevant international agreements and conventions to which Egypt is a signatory.

Finally, as the Project is seeking financing from prospective lenders, this Chapter highlights the environmental and social policies and requirements of the potential lenders and IFIs which must be adhered to by the Developer.

5.1 Egyptian Environmental Institutional Framework

Egyptian Environmental Affairs Agency (EEAA)

The EEAA is an authorised state body regulating environmental management issues. Egyptian laws identify three main roles of EEAA:

- A regulatory and coordinating role in most activities, as well as an executive role restricted to the management of natural protectorates and pilot projects.
- The responsibility of formulating the Environmental Management (EM) policy framework, setting the required action plans to protect the environment and follow their execution in coordination with Competent Administrative Authorities (CAAs).
- The responsibility of EEAA in reviewing and approving the ESIA studies for new projects/expansions undertaken as well as monitoring the implementation of the ESMP.

Environmental Management Unit (EMU)

The Environmental Management Unit (EMU), at Governorate and district level, is responsible for the environmental performance of all projects/facilities within the Governorates premises. The Governorate has established EMUs at both Governorate and city/district levels. EMUs are responsible for the environmental protection within the Governorate boundaries. They are mandated to undertake both environmental planning and operation-oriented activities. EMU is mandated to:

- Follow-up the environmental performance of the projects within the Governorate during both construction and operations phases to ensure the project is in compliance with the laws and regulations as well as with the mitigation measures included in its ESIA approval.
- Investigate any environmental complaints filed against projects within the Governorate.
- EMUs are administratively affiliated to the Governorate, yet technically to EEAA. EMUs submit monthly reports to EEAA with their achievements and inspection results.
- The Governorate has a solid waste management unit at Governorate and district level. The units are responsible for the supervision of solid waste management contracts.

Competent Administrative Authorities (CAAs)

The Competent Administrative Authorities (CAAs) are the entities responsible for issuing licenses for project construction and operation. The ESIA is considered one of the requirements of licensing. The CAA for this project is NREA. NREA is thus responsible for receiving the ESIA studies, checking the information included in the documents concerning the location and for the suitability of the area to the project activity. It is also responsible for ensuring that the activity does not negatively impact the surrounding activities and that the location is in compliance with the ministerial decrees related to the activity. NREA forwards the documents to EEAA for review and to issue its response in 30 days period. They are the main interface with the project proponents in the ESIA system. The CAA is mandated to:

- Provide technical assistance to Project Proponents
- Ensure the approval of the Project Site
- Receive ESIA Documents and forward it to EEAA
- Follow-up the implementation of the ESIA requirements during post construction field investigation (before the operation license).

5.2 Egyptian Environmental Clearance Process

The ESIA is governed by the Law No. 4 of 1994 and its amendments, the Law on Protection of the Environment and its Executive Regulations 1995 and its amendments (Prime Ministers Decree 338). According to Law 4 of 1994, applications for a license from an individual, company, organization or authority, an assessment of the likely environmental impacts of development projects should be undertaken. An ESIA is required for all electricity generation projects including renewable energy projects.

Based on the categorisation of development projects included within the Guidelines for EIA issued by the EEAA in 2009, wind farm projects are considered under Category C projects (projects with high potential impacts) which require undertaking a full ESIA study.

The ESIA process is set according to the guidelines issued by the EEAA including: EIA Guidelines (2009), and the Environmental Impact Assessment Guidelines and Monitoring Protocols for Wind Energy Development Projects along the Rift Valley/Red Sea Flyway with a particular reference to wind energy in support of the conservation of Migratory Soaring Birds (MSB) (2013). The ESIA process is stipulated in the figure below.

The key requirements for a full ESIA as per the requirements above include the following:

- Environmental and Social (E&S) Regulatory and Legal Review
- Project Description
- Description of the Baseline Environment (physical, biological, social)
- Identification and Analysis of Impacts
- Analysis of Alternatives
- Public Consultation (on the draft ESIA)
- Environmental Management Plan (EMP) (mitigation measures, monitoring program, institutional arrangements)

Upon submission of the ESIA report by the ESIA Practitioner to the CAA in charge of issuing licences, sends the ESIA to EEAA for evaluation. The EEAA shall review the ESIA and provide comments or feedback within 30 days. The CAA in charge of issuing licences in case of wind power projects is the NREA.

After submission of an ESIA for review, EEAA may request revisions in the ESIA report within 30 days, including additional mitigation measures, before issuing the report approval.

5.3 Egyptian E&S Regulatory Context

This section lists those legislations that are directly related to environmental and social compliance that must be adhered to by all parties involved in the Project throughout the planning and construction, operation, and decommissioning phase. These legislations include: (i) those issued by EEAA (laws, regulations and instruction), and (ii) the relevant national legislations issued by other line ministries (laws, regulations, instructions, standards).

The table below lists the key relevant legislation and regulator/entity relevant to each of the environmental and social parameter being studied and assessed within this ESIA. Throughout the following Chapters, reference to the requirements set out within those legislations is provided under each relevant parameter.

Table 10: National Legislation and Guidelines Governing the E&S Compliance for the Project during all Phases

Legislation	Relevant Article	Requirements
Land Use		
Electricity Law 87/2015	Article 53	▪ Stipulates the right of proper compensation for the affected persons due to the establishment of Electricity projects
	Article 55	▪ Identifies the Right of Way that should be avoided for the OHTL and the underground cables: - 25 meters from the centre for extremely high voltage OHTL - 13 meters from the centre for the high voltages OHTL - 5 meters for the medium voltage OHTL - 5 meters for the high and extremely high voltage cables - 2 meters for low and medium voltage cables ▪ The Owner of the land should be compensated in case of land acquisition. The right of way stated in article 55 should be abided by
Law 10/1990	The project will not entail any land acquisition activities	▪ The main site is located on a state-owned land which does not trigger any expropriation activities, according to law no. 10/1990.
Law 577/1954	Law 577/54, later amended by Law 252/60 and Law 13/162	▪ Establishes the provisions pertaining to the expropriation of real estate property for public benefit and improvement. ▪ The project will not entail any land acquisition activities
Civil code 131/1948	Articles 802-805	▪ Recognises private ownership right. - Article 802 states that the owner, pursuant to the Law, has the sole right of using and/or disposing his property. - Article 803 defines what is meant by land property - Article 805 states that no one may be deprived of his property except in cases prescribed by Law and would take place with an equitable compensation. ▪ Land for the Project was allocated by NREA and was not previously owned and thus no compensation would be needed
Unified Building Law No. 119 of year 2008	Article 39	▪ Apply and a receive the construction permit before start of the implementation ▪ Ensure that all designs abide by the building codes of Egypt
Geology, hydrology, hydrogeology		
Law 4/1994	Article 33 of the Executive regulations of Law 4/1994	▪ The owner of the project is responsible to decontaminate the area/soil in case of relocation or decommissioning
Management of solid waste and hazardous waste generated from the facility during generation, handling, transportation and disposal		
Law 4/1994 amended by Law 9/2009 and ER 1095/2011 amended by Decree 710/2012)	Articles 28, 29, 33, 37, 39	▪ Identification: Using the HW lists issued by the competent authority. ▪ Minimization: strive to reduce quantitatively and qualitatively the generation of the HW ▪ Segregation: HW is to be separated from other types of non-hazardous waste. In addition, the different types of HW must not be mixed together. ▪ On site Storage: HW is to be stored in a designated area, and containers must be made of suitable materials and be properly sealed to avoid any leakages or spills into the surroundings. ▪ Off-site transportation: HW is to be submitted to authorized HW contractors. ▪ Obtaining a license from the competent authority to handle Hazardous waste
	Article 22 and Article 17 of the Executive	▪ The establishment should maintain an environmental register in accordance with Annex 3 of the Executive regulations

	Regulations	
	Article 39 and Article 41 of the Executive Regulations	▪ Article 39: The establishment should maintain the cleanliness of garbage bins and vehicles. Garbage collection bins shall be tightly covered and waste shall be transported at suitable intervals. ▪ Article 41: The establishment shall undertake necessary precautions to secure the safe storage and transportation of waste. These precautions include the following: - Construction waste storage is to be carried out at site such that it does not obstruct movement of vehicles and personnel. - waste subject to emission should be covered to avoid air pollution - waste is to be submitted to authorized waste contractors
	Articles 26, 28 and 29 of the Executive regulations	▪ The establishment should maintain a register for the hazardous waste should be maintained as well as record for the hazardous substances used
Control of the wastewater discharge into the sewage system and public network.		
Ministerial Decree 44/2000, Decree of Law 93/1962	Article 14	▪ The law prohibits the disposal of domestic, industrial and commercial wastewater, treated or untreated, in public drainage system without obtaining a prior approval. ▪ Article 14 of the executive regulations set the parameters required regarding the quality of the wastewater discharged to the public sewage network. ▪ The owner of the project should abide by the limits stated in article 14 of the Executive regulations of Law 93/1962
Biodiversity, Birds, and Bats		
Law 4 of 1994	Article 28, as amended by Law 9 of 2009. Annex 4 of the Executive Regulations of law 4/1994, amended by Prime Minister Decree 1095 of 2011	▪ Defines fauna and flora which are forbidden to be hunted or disturbed. ▪ Ensure that no species are being disturbed and implement all mitigation measures needed to reduce the impact on any fauna and flora in the vicinity of the project
Environmental Impact Assessment Guidelines and Monitoring Protocols for Wind Energy Development Projects along the Rift Valley/Red Sea Flyway with a particular reference to wind energy in support of	Section One Guidelines for Environmental Impact Assessment for Wind Energy Development in Egypt 1.5 Description of EIA Study Components for Wind Farm Projects – 0.7 Project Environmental Setting	▪ Defines the ecological components of plant, animals and their habitats, including threatened species and areas that have been identified as protected areas or IBAs and requests the review IUCN Red List of Threatened Species. ▪ Defines baseline information requirements for birds at Wind Farm Projects.
	Section Two Guidelines on Mitigation, Monitoring and Training 2.2 Monitoring Protocols	▪ Defines standard methods and models to predict risk for migratory birds. ▪ Define standard methods used in pre- and post-construction studies of Wind Energy Facilities are focused on assessing impacts on birds. ▪ Define standard protocol to be implemented building on results of species recorded and numbers of passage birds recorded during studies.

the conservation of Migratory Soaring Birds (MSB)		
Archaeology and cultural heritage		
Law 117/1983	Article 1	▪ Defines a monument as a building or movable property produced by different civilizations or by art, sciences, literature and religions from prehistoric era and during successive historical eras until a hundred years ago or historical buildings.
	Article 2	▪ States that any building or movable property that has an historical, scientific, religious, artistic or literary value could be considered as a monument whenever the national interest of the country imposes its conservation and maintenance without adherence to the time limit contained in the preceding Article no.1
	Article 5	▪ States that the Supreme Council of Antiquities (SCA) is the competent authority responsible for antiquities in Egypt.
	Article 20	▪ States that license of construction in archaeological sites or land is not permitted. It is prohibited to make any installation or landfill or digging channels, construct roads, agricultural land or for public benefits in the archaeological sites or land within its approved border lines. ▪ The Article additionally, states that a buffer zone around the monument or the site is defined as three kilometres in the uninhabited areas or any distance determined by the SCA to achieve environmental protection of the other parts of the monument in the surroundings (article 20-Ch.1). ▪ The provisions of this article (20) apply on land which appears to the SCA - based on conducted studies – that there is a probable existence of monuments in the subsoil. ▪ The provisions of this article are also applied to desert and areas where quarrying work is licensed.
	Article 22	▪ States that license of construction in the immediate vicinity of archaeological sites within populated areas could be delivered by the competent authority, after the approval of SCA. ▪ The competent authority must state in the license the conditions which the SCA emphasizes to guarantee that the building does not have a negative visual impact on the monument and its direct buffer zone protecting the archaeological and historical surroundings. ▪ The SCA has to pronounce its verdict on the license demand within 60 days of the date of submission. Otherwise, the elapsing of this period is regarded as a decision of refusal.
	Article 23	▪ States that the SCA should take the necessary steps to expropriate land that is found in or kept in place and registered according to the rules of this Law. (Article 23- Ch.1). [These rules are defined in the second chapter of the Law 117 – articles 26-30]. ▪ The Ministry of State for Antiquities must be notified in the event that an unrecorded ruin is found by any person (Article 23).
	Article 24	▪ States that everyone finding by chance part or parts of a monument in its place must promptly inform the nearest administrative authority within forty-eight hours. ▪ Although there are no cultural heritage areas in the site vicinity, the ESIA report will refer to relevant regulations for unexpected cases of chance finds.
Air quality and noise		
Law 4/1994 amended by Law 9/2009	Article 42 of Law 4/1994 amended by Law 9/2009 Article 44 of ER	▪ Maximum allowable limits for ambient noise intensity and maximum exposure duration

and ER 710/2012	710/2012	
	Article 38 of ER	▪ Open burning of garbage and non-hazardous solid waste is strictly prohibited, and garbage and solid waste shall only be dumped or treated in designated areas away from residential, industrial, agricultural and waterways.
		▪ Dumping areas should be bound by a wall, away from obstruction, traffic and pedestrians and take into account the coverage of volatile soil so as not to cause air pollution. ▪ Transporting waste and dust resulting from excavation, demolition and construction in special containers or using transport vehicles prepared and licensed for this purpose. ▪ (A) The vehicle shall be equipped with a special box or a tight cover that prevents the spread of dust and debris to the air or falling on the road. ▪ (B) The vehicle shall be equipped with special equipment for loading and unloading. ▪ (C) The car should be in good condition according to the rules of safety, durability and lights and equipped with all safety devices. ▪ Ensure that the places to which this type waste transported so that a distance of not less than 1.5 km from the residential areas and be of a low contour level and settled after filling and filling.
ERs (amended by Decree 1095/2011 amended by Decree 710/2012)	Annex 5	▪ Maximum limits of ambient air pollutants
	Annex 6	▪ Permissible limits of air pollutants in emissions
	Annex 8 and Annex 9	▪ Maximum allowable limits for air emissions, heat stress, ventilation rates within the work environment
Modified ERs (710/2012) of Law 4/1994	Article 37	▪ Maximum allowable limits for exhaust gases from machines, engines and vehicles.
Law 4/1994	Article 36	▪ It is prohibited to use machines, engines or vehicles whose exhaust emissions exceed the limits set by the executive regulations of this Law.
Law 4/1994 and its modified ERs	Article 35 of Law 4/1994 and article 34 of its modified ERs	▪ Maximum allowable limits for ambient air pollutants stated should be met by the contractors and operator throughout the lifetime of the plant.
Infrastructure and utilities		
Petroleum pipelines Law 4/1988	Decree 292/1988	▪ The owner of a property should allow the passing of pipelines transporting liquid or gaseous hydrocarbons beneath the ground surface in accordance with the procedure mentioned in the executive regulations
	Article 2	▪ Specifies that no buildings or trees, other than agricultural land trees, should be constructed or planted at a distance less than 2 m on each side of the pipeline inside urban and 6 m on each side of the pipeline outside the urban areas. ▪ If it is necessary to place the pipelines at a closer distance than what is specified in the law, it is allowed through a decision from the chairman of Egyptian General Petroleum Corporation (EGPC); taking into consideration the necessary safety precautions. ▪ also specifies that if the activities done in accordance to the law will result in damage to the property, the owner has the right to a fair compensation to be decided by a committee formed by a decision from the Minister of Petroleum, and the executive regulations include the guidelines for compensation estimation.
Occupational health and safety		
Law 4/1994	Articles 43 – 45 of Law 4/1994, which address	▪ The owner of the project should abide by the limits stated in Annex 7 of the Executive regulations ▪ In case the limits are exceeded, special protective equipment should be made available (earmuffs, masks…) (Annex 9)

	air quality, noise, heat stress, and the provision of protective measures to workers.	▪ In case the limits are exceeded, the workers should have rests as specified by the limits (especially for noise and vibration from electric jack hammers or any other ramming equipment) ▪ Conduct regular medical check-ups for workers that are facing noise, vibration or heat stress exceeding the limits
Law 12/2003 on Labour and Workforce Safety	Articles 80-87	▪ Regulates working hours and rest times for workers ▪ The working hours shall include a period of one or more meals and rest not less than one hour in total and the period shall not exceed five consecutive hours. The competent minister may, by a decision, determine the cases or works which are imperative for technical reasons or operating conditions. ▪ Work hours and rest periods should be organized so that the period between the beginning and the end of working hours does not exceed ten hours per day. ▪ Work shall be organized at the facility so that each worker shall receive a weekly rest of not less than 24 hours after six working days at most. In all cases, weekly rest shall be paid. ▪ The employer shall put on the main doors used by the workers for entry, as well as in a visible place in the establishment a schedule showing the weekly rest day, working hours and rest periods for each worker and the amendment to this schedule.
	Book 3 - Single worker contract: Article 32	The employer shall be obliged to issue the contract in writing in Arabic in three copies. The employer shall keep one and deliver a copy to the worker. In particular, the contract shall include the following data: ▪ Name of employer and place of work. ▪ The name of the worker, ▪ his qualification, ▪ his profession or craft, ▪ his insurance number, ▪ his place of residence and what is necessary to prove his identity. The nature and type of work being contracted. ▪ If there is no written contract for the worker, the unit to prove his rights, all methods of proof. The employer shall be given a receipt for the papers and certificates he has deposited with him.
Law 12/2003 on Labour and Workforce Safety and Book V on Occupational Safety and Health (OSH) and assurance of the adequacy of the working environment	Minister of Labour Decree 48/1967. Minister of Labour Decree 55/1983. Minister of Industry Decree 91/1985 Minister of Labour Decree 116/1991.	▪ The owner of the project is bound with the provision of protective equipment to workers and fire-fighting/emergency response plans. Moreover, the following laws and decrees should be considered: ▪ The contractors should have appropriate number of first aid kits in relation to the size of the site and the number of workers on site
	Article 211 and article 34 of the Decree of the Minister of Labour and Manpower no. 211/2003	▪ The establishment should prepare records/reports/register for chemical safety
Law 137/1981	Article 117	▪ The employer should inform his workers of the hazards associated with non-compliance with safety measures
Decree 458/2007		▪ Egyptian Drinking Water Quality Standards should be met for all water bought and stored on site for the workers' use.
Socio-economics		
Law 94/2003		▪ The Law on Establishing the National Council for Human Rights (NCHR) aims to ensure respect, set values, raise

		awareness and grant observance of human rights. ▪ At the forefront of these rights and freedoms are the right to life and security of individuals, freedom of belief and expression, the right to private property, the right to resort to courts of law, and the right to fair investigation and trial when charged with an offence. ▪ This Constitution came into force after a public referendum on 11th September 1971 and was amended on 22nd May 1980 to introduce the Shoura Council and the press.
EEAA EIA guidelines	▪ Paragraph 6.4.3.1 Scope of Public Consultation ▪ Paragraph 6.4.3.2 Methodology of Public Consultation ▪ Paragraph 6.4.3.3 Documentation of the Consultation Results ▪ Paragraph 7 Requirement and Scope of the Public Disclosure	▪ Conduct a public consultation as part of the ESIA study according to the EEAA guidelines methodology. The involvement of the public and concerned entities in the EIA planning and implementation phases is mandatory for Category C projects through the public consultation process with concerned parties. ▪ Preparation of the Public Consultation Plan before starting the consultation activities in the EIA scoping phase, the project proponent prepares a plan indicating the methodology of the public consultation to be adopted in the two public consultation phases (EIA scoping phase and consultation on the draft EIA). The plan should indicate the concerned parties that will be consulted, method of consultation and other points. ▪ An individual chapter in the EIA will be prepared for public consultation ▪ Disclosure of relevant material is an important process and should be undertaken in a timely manner for all Category C projects. This process permits meaningful consultations between the project proponent and project-affected groups and local NGOs is required to take place. Before the public consultation on the draft EIA, the draft technical summary in Arabic should be disclosed to all concerned parties.

5.4 International Agreements

Egypt has signed and ratified a number of international conventions committing the country to the conservation of environmental resources and protection of workers' health & safety and labour rights. The following Table lists the key conventions:

Table 11: Relevant Egyptian International Conventions and Agreements

Name of Multilateral Environmental Agreement	Date
Biodiversity and Natural Resources	
International Plant Protection Convention	1951
Agreement for the Establishment of a Commission for Controlling the Desert Locust in the Near East	1965
Convention on Wetlands of International Importance Especially as Water Fowl Habitat (RAMSAR)	1971
Convention Concerning the Protection of the World Cultural and Natural Heritage	1972
Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)	1973
Convention on the Conservation of Migratory Species of Wild Animals	1979
Protocol to Amend the Convention on Wetlands of International Importance Especially as Water Fowl Habitat	1982
Convention on Biological Diversity (CBD)	1992
Agreement for the Establishment of the Near East Plant Protection Organization	1993
United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa	1994
Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean	1995
African Convention on the Conservation of Nature and Natural Resources (revised)	2003
International Tropical Timber Agreement	2006
Hazardous Materials and Chemicals	
Convention Concerning Prevention and Control of Occupational Hazards Caused by Carcinogenic Substances and Agents	1974
Convention on the Prohibition of the Development, Production and Stock-Piling of Bacteriological (Biological) and Toxin Weapons, and on their Destruction	1972
Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal	1976
Convention on the Prohibition of Military or any other Hostile Use of Environmental Modification Techniques	1976
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	1989
Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa	1991
Amendment to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	1995
Stockholm Convention on Persistent Organic Pollutants (POPs)	2002
Atmosphere, Air Pollution and Climate Change	
Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space Including the Moon and Other Celestial Bodies	1967
Vienna Convention for the Protection of the Ozone Layer	1985
Montreal Protocol on Substances that Deplete the Ozone Layer	1987
(London) Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer	1990
United Nations Framework Convention on Climate Change	1992
(Copenhagen) Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer	1992
Kyoto Protocol	1997
Paris Agreement under the United Nations Framework Convention on Climate Change	2015
Health and Worker Safety	
International Labour Organization Core Labour Standards	1936
Convention Concerning the Protection of Workers Against Ionizing Radiation	1960
Convention Concerning the Protection of Workers Against Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration	1977
Occupational Safety and Health Convention	1979

5.5 Requirements for Project Financing – IFC Requirements

The Project will be seeking financing from International Financing Institutions (IFI). Therefore, the E&S requirements of such IFI's must be considered throughout the Project development,

which require the Project development to adhere to specific E&S requirements which reflect international best practice.

For the purpose of the ESIA, it will be based on the International Finance Corporation (IFC) E&S requirements as well as the European Bank for Reconstruction and Development (EBRD) E&S requirements, both of which are discussed below.

IFC E&S Requirements

The IFC E&S requirements are considered the most comprehensive. The IFC of the World Bank provides a range of guidance documents related to the assessment and management of E&S issues in project development. Not only does IFC guidance provide a generally accepted basis for good practice, but it also provides the technical cornerstone for the Equator Principles which set out the E&S requirements of banks for project finance. The IFC requirements have become the *de facto* international E&S performance benchmark for project financing.

Summarized below are the requirements for the International Finance Corporation (IFC).

IFC Policy on E&S Sustainability (2012)

The IFC policy on E&S Sustainability puts into practice IFC's overall commitments to E&S sustainability. The policy seeks to: (i) enhance the predictability, transparency, and accountability of IFC's actions and decision making; (ii) help clients manage their environmental and social risks and impacts and improve their performance; and (iii) enhance positive development outcomes on the ground. In addition, the Policy identifies IFC's commitments, its roles and responsibilities and other as applicable.

One of the key outputs of the Policy, is the E&S Categorization of projects, which are summarized as follows:

- Category A: Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.
- Category B: Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
- Category C: Business activities with minimal or no adverse environmental or social risks and/or impacts.

The IFC does not provide specific details on what wind farm projects should be classified.

IFC Performance Standards (2012)

The IFC Performance Standards (PS) on Social and Environmental Sustainability set out a framework for managing and improving project performance from planning and assessment, through construction and operations to closure. The Performance Standards requirements are summarized in the table below.

Table 12: IFC Performance Standard Requirements

IFC PS	Key Points
PS1: Assessment and Management of Environmental and Social Risks and Impacts	PS1 underscores the importance of managing social and environmental performance throughout the life of a project by using a dynamic social and environmental management system. Specific objectives of this Performance Standard are: ▪ To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence; ▪ To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment; ▪ To ensure that affected communities are appropriately engaged on issues that could potentially affect them; and ▪ To promote improved social and environment performance of companies

IFC PS	Key Points
	through the effective use of management systems.
PS2: Labour and Working Conditions	The requirements set out in this PS have been in part guided by a number of international conventions negotiated through the International Labour Organization (ILO) and the United Nations (UN). Specific objectives of this Performance Standard are: ▪ To establish, maintain and improve the worker-management relationship; ▪ To promote the fair treatment, non-discrimination and equal opportunity of workers and compliance with national labour and employment laws; ▪ To protect the workforce by addressing child labour and forced labour; and ▪ To promote safe and healthy working conditions, and to protect and promote the health of workers.
PS 3: Resource Efficiency and Pollution Prevention	This Performance Standard outlines a project approach to pollution prevention and abatement in line with international available technologies and practices. It promotes the private sector's ability to integrate such technologies and practices as far as their use is technically and financially feasible and cost-effective in the context of a project that relies on commercially available skills and resources. Specific objectives of this Performance Standard are: ▪ To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; and ▪ To promote the reduction of emissions that contribute to climate change.
PS 4: Community Health, Safety and Security	This PS recognizes that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development. However, projects can also increase risks arising from accidents, releases of hazardous materials, exposure to diseases, and the use of security personnel. While acknowledging the public authorities' role in promoting the health, safety and security of the public, this PS addresses the project sponsor's responsibility in respect of community health, safety and security.
PS 5: Land Acquisition and Involuntary Resettlement	Involuntary resettlement refers both to physical and economic displacement as a result of project-related land acquisition. Where involuntary resettlement is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	This Performance Standard reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote the use of renewable natural resources in a sustainable manner. This Performance Standard addresses how project sponsors can avoid or mitigate threats to biodiversity arising from their operations as well as sustainably manage renewable natural resources. Specific objectives of this Performance Standard are: ▪ To protect and conserve biodiversity; and ▪ To promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.
PS 8: Cultural Heritage	Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to protect irreplaceable cultural heritage and to guide project sponsors on protecting cultural heritage in the course of their business operations.

Note: PS 7 (Indigenous Peoples) is not considered to be applicable to this Project. The Indigenous World 2018 Report (IWGIA, 2018) states that Egypt is not classified as a country with indigenous people. In addition, this was confirmed based on previous experiences on E&S assessments with IFIs in Egypt where such standard was not triggered.

IFC EHS Guidelines

In addition, to the Performance Standards, the IFC have sector-specific EHS guideline documents. With regards to the project the following are applicable:

- IFC General EHS Guidelines (2007): identifies detailed EHS management and technical recommendations which are applicable for all development projects
- IFC EHS Guidelines for Wind Energy (2015): identifies they key E&S impacts that should be investigated and provides detailed management and technical recommendations with regards to Industry-Best Practice. The IFC EHS Guidelines identifies the following key issues:
  - Landscape and visual
  - Noise
  - Biodiversity (to include birds and bats)
  - Shadow flicker
  - Water quality
  - Occupational health and safety
  - Blade and ice throws
  - Aviation
  - Electromagnetic interference
  - Public access
  - Abnormal load transportation
- IFC EHS Guidelines for Electric Power Transmission and Distribution (2007): this in particular could be applicable for the associated facilities of the Project (i.e. transmission line for connection with the grid). The Guideline identifies they key E&S impacts that should be investigated and provides detailed management and technical recommendations with regards to Industry-Best Practice. The IFC EHS Guidelines identifies the following key issues:
  - Biodiversity (to include birds and bats)
  - Electric and magnetic fields
  - Hazardous materials
  - Occupational health and safety
  - Community health and safety

EBRD Requirements

EBRD's 2019 Environmental and Social Policy seeks to ensure, through its environmental and social appraisal and monitoring processes, that the projects it finances:

- Are socially and environmentally sustainable;
- Respect the rights of affected workers and communities; and
- Are designed and operated in compliance with applicable regulatory requirements and good international practice.

In addition, EBRD's E&S policy identifies large scale wind power projects as 'Category A' which are projects that could result in potentially significant environmental and/or social impacts that require an environmental and social impact assessment

To translate this objective into successful practical outcomes, EBRD has adopted a comprehensive set of Performance Requirements (PRs) covering key areas of environmental and social impacts and issues.

EBRD is committed to promoting European Union (EU) environmental standards as well as the European Principles for the Environment, to which it is a signatory, and which are also reflected in the PRs. EBRD expects clients to assess and manage the environmental and social issues associated with their projects so that projects meet the PRs.

The EBRD Performance Requirements applicable to this project are summarised in the table below.

Table 13: Overview of Key Points of EBRD Performance Requirements of Relevance to the Project

EBRD PR	Key Points Relevant to the Project
PR 1: Assessment and Management of E&S Risks and Impacts	This PR outlines the process of appraising, managing and monitoring environmental and social issues associated with a project consistent with the European Union environmental impact assessment directive (85/337/EEC as amended).
PR 2: Labour and Working Conditions	This PR assures that human resources policies, procedures and standards will meet the following minimum requirements during the life of the Project with regards to labour and working conditions: ▪ Establish and maintain a sound worker-management relationship and promote the fair treatment, non-discrimination and equal opportunity of workers; ▪ Promote compliance with any collective agreements to which the client is a party, national labour and employment laws, and the fundamental principles and key regulatory standards embodied in the applicable ILO conventions; and ▪ Protect and promote the health of workers, especially by promoting safe and healthy working conditions. In addition, EBRD requires compliance with applicable EU Occupational Health and Safety requirements and, where such requirements do not exist, applicable IFC Occupational Health and Safety guidelines (IFC PS2).
PR 3: Resource Efficiency and Pollution Prevention and Control	Pollution prevention and abatement are key ingredients of a sustainable development agenda and EBRD - financed projects must meet good international practice in this regard. The impacts and issues associated with polluting activities need to be considered in all economic activities, and from effluents and emissions at the facility level, to impacts at a regional and global level where appropriate. This performance requirement assures that all aspects of the Project will meet the following objectives: ▪ To avoid or, where avoidance is not possible, to minimize adverse impacts on human health and the environment by avoiding or minimizing pollution directly arising from projects; ▪ To assist clients in identifying project-related opportunities for energy and resource efficiency improvements and waste reduction; and ▪ To promote the reduction of project-related greenhouse gas emissions.
PR 4: Health. Safety and Security	While bringing many positive benefits to local communities, projects can also increase the potential for community exposure to risks and impacts arising from temporary or permanent changes in population; transport of raw and finished materials; construction, operations and decommissioning; accidents, structural failures, and releases of hazardous materials. This performance requirement addresses the project proponent's responsibility to identify and to avoid or minimise the risks and adverse impacts to community health, safety and security.
PR 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Involuntary resettlement refers both to physical and economic displacement as a result of project-related land acquisition. Where involuntary resettlement is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.
PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	EBRD recognises the need for the protection and conservation of biodiversity in the context of projects in which it invests. In pursuing these aims, EBRD is guided by and supports the implementation of applicable international law and conventions and applicable EU Directives: ▪ To protect and conserve biodiversity; ▪ To avoid, minimize and mitigate impacts on biodiversity and offset significant residual impacts, where appropriate, with the aim of achieving no net loss or a net gain of biodiversity; ▪ To promote the sustainable management and use of natural resources; ▪ To provide for fair and equitable sharing of the benefits from project development and arising out of the utilization of genetic resources; ▪ To strengthen companies' license to operate, reputation and competitive advantage through best practice management of biodiversity as a business risk and opportunity; and ▪ To foster the development of pro-biodiversity business that offers alternative livelihoods in place of unsustainable exploitation of the natural environment.

EBRD PR	Key Points Relevant to the Project
PR 8: Cultural Heritage	Cultural heritage is important as a source of valuable historical and scientific information, as an asset for economic and social development, and as an integral part of a people's cultural identity, practices, and continuity. EBRD requires the protection of cultural heritage from project activities.
PR 10: Information Disclosure and Stakeholder Engagement	EBRD considers stakeholder engagement as an essential part of good business practice and corporate citizenship. In particular, effective community engagement is central to the successful management of risks and impacts on communities, as well as central to achieving enhanced community benefits. The specific objectives of this PR are: ▪ To identify people or communities that are or could be affected by the Project, as well as other interested parties; ▪ To ensure that such stakeholders are appropriately engaged on environmental and social issues that could potentially affect them through a process of information disclosure and meaningful consultation; and ▪ To maintain a constructive relationship with stake holders on an ongoing basis through meaningful engagement during project implementation.

Note: PR 7 (Indigenous Peoples) is not considered to be applicable to this Project. The Indigenous World 2018 Report (IWGIA, 2018) states that Egypt is not classified as a country with indigenous people. In addition, this was confirmed based on previous experiences on E&S assessments with IFIs in Egypt where such standard was not triggered. In addition, PR 9 (Financial Intermediaries) is also not considered applicable.

6. Analysis of Alternatives

6.1 Site Selection Alternatives

The GoE has allocated to the NREA through Prime Ministerial Decree No. (37/4/15/14) of 2015 land for development of renewable energy projects through usufruct rights.

The area was proposed by the National Centre for Land-use Planning and was approved by the Council of Ministers. In line with the decree, the government assigned about 7,600km^2 in the GoS, east and west of the Nile, Benban and Kom Ombo regions, of which about 5,700km^2 are for wind projects (75% share) and about 1,900 km^2 for solar energy projects (25% share), This includes an area of 1,220 km^2 in the GoS with a total capacity of 3,550 MW for wind power projects (IRENA, 2018).

Of the 1,220 km^2 area in the GoS, currently an area of around 284km^2 is being developed for multiple wind farm projects as noted in the figure below. The key factors taken into account for selection of this area include the following:

- The land area is under governmental ownership and therefore does not require any land acquisition measures
- The area is mostly free from competing uses;
- The area is presumed to be one of the areas in Egypt with the highest wind power potential;
- The area mostly consists of vast desert grounds;
- The geomorphology of the area is favourable for wind power development requiring limited construction and landscape modification measures;
- The access to the area can be considered to be easy requiring only limited road construction measures

Based on the above, NREA has granted the Developer full access rights to the specific Project for the development of a 500MW Wind Farm Project. Therefore, taking the above into account, there are no site alternatives that were considered by the Developer in this case.

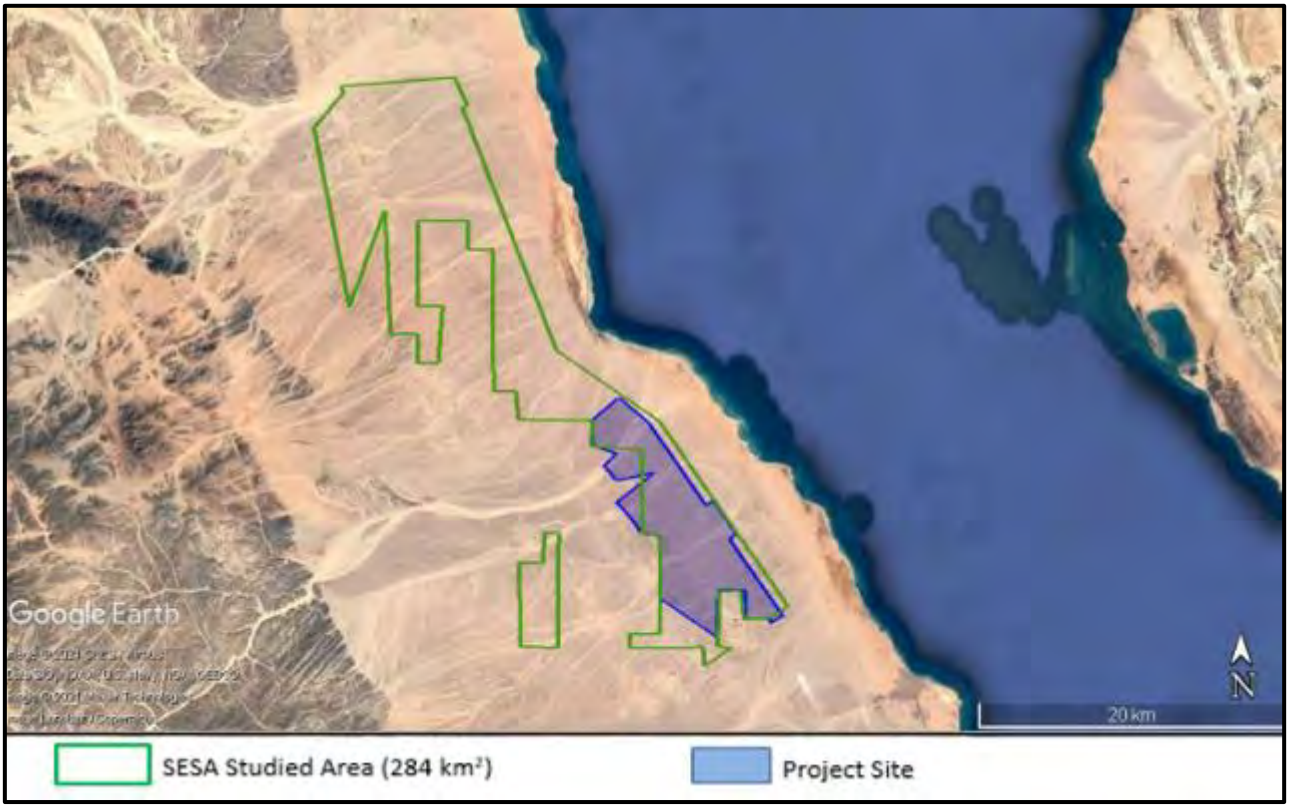


Figure 14: Project Site as Part of the 284km^2 Area Allocated for Wind Farm Developments

6.2 Technology Alternatives

This section discusses several alternatives besides the development of a wind farm project. This mainly includes other renewable energy alternatives suitable for Egypt, as well as other technological alternatives for power generation such conventional thermal power plants.

6.2.1 Renewable Energy Development Projects

As discussed earlier, the GoE has taken bold steps to adopt an energy diversification strategy with increased development of renewable energy and implementation of energy efficiency, including assertive rehabilitation and maintenance programs in the power sector (IRENA, 2018).

To this extent, in 2013, the Arab Republic of Egypt (through the Ministry of Electricity and Renewable Energy) had developed and adopted the ISES 2015 – 2035, which provides an ambitious plan to increase the contribution of renewable energy to 20% of the electricity generated by the year 2020, through hydro, wind, and solar.

Egypt enjoys favourable solar radiation intensity and it is considered one of the most appropriate regions for exploiting solar energy both for electricity generation and thermal heating applications. Similar to the wind power development process, the GoE is developing many solar development projects (to include solar Photovoltaic (PV) and concentrated solar power) through the BOO mechanism and other (such as the Feed-In Tariff mechanism). Such development projects have been identified within key areas that provide the most favourable potential and conditions for solar development – this includes but not limited to Kom Ombo, West Nile, Hurghada, Zaafarana, Benban and other.

With regards to hydropower, the main hydro resource in Egypt is the River Nile, with the highest potential in Aswan where a series of power stations are located. Within this context, several projects have been realised and several other hydroelectric plants are being developed.

Taking the above into account, with regards to the Project site in specific it is best utilised for wind power projects. According to Egypt's Wind Atlas (Wind Atlas for Egypt Measurement and Modelling 1991-2005), the country is endowed with abundant wind energy resources, particularly in the GoS area. This is one of the best locations in the world for harnessing wind energy due to its high stable wind speeds that reach on average between 8 and 10 m/s at a height of 100m, along with the availability of large uninhabited desert areas. Check figure below.

Therefore, as discussed earlier, the GoE has allocated to the NREA through Prime Ministerial Decree No. (37/4/15/14) of 2015 an area of 1,220km2 in the GoS for wind development projects.

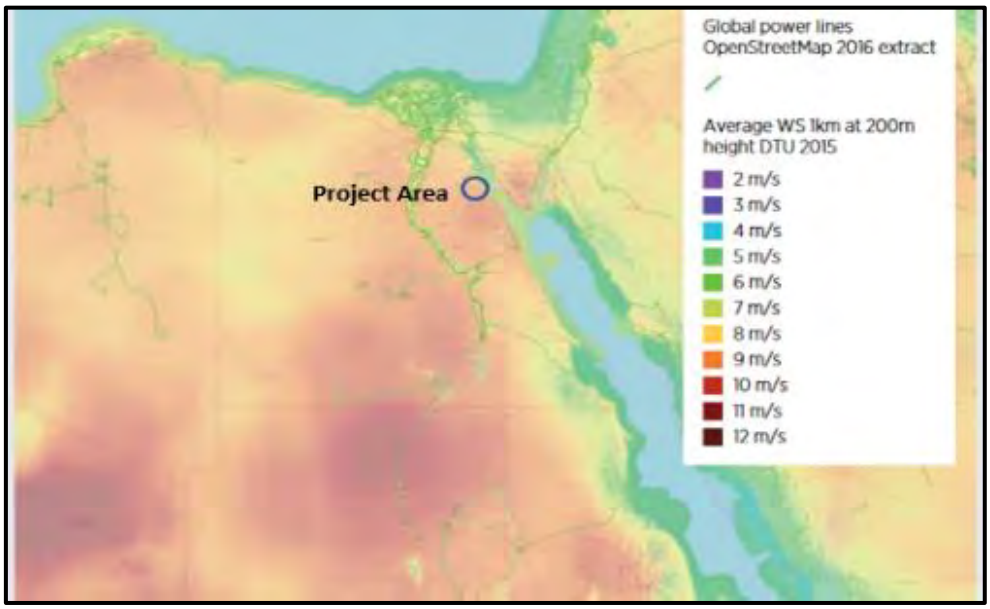


Figure 15: Egypt's Wind Atlas (Source: IRENA, 2018)

6.2.2 Thermal Power Plants

Other energy generation alternatives suitable to be built in Egypt include conventional thermal power plants, similar to others already existent in the country. Despite the advantages that a solution of this kind would entail - such as a potential bigger energy generation capacity or the creation of more jobs during both construction and operation - the disadvantages would be significant; especially those related to environmental impacts. Conventional thermal power plans are well known for their environmental impacts when compared to this Project and could include significantly higher water consumption, generation of air pollutants and greenhouse gas emissions, etc.

More importantly, as noted earlier such developments would not be in line with the Government's ISES 2015 – 2035" which in broad terms advocates for the diversification of energy resources and increasing the share of renewable energy to 20% in 2020.

6.3 Design Alternatives

As discussed earlier, currently an area of around 284km^2 in the GoS is being developed for multiple wind farm projects. NREA has granted the Developer full access rights to the specific Project for the development of a 500MW Wind Farm Project.

A Strategic and Cumulative Environmental and Social Assessment (SESA) was undertaken for the 284km^2 area (was carried out by the RCREEE on behalf of NREA) and the Wind Energy Developers approved by the EEAA in July 2018.

One of the objectives of the SESA was to investigate the cumulative impacts of the wind farm developments and identify constraints to be taken into account by the various developers.

The SESA investigated key E&S attributes to include biodiversity, birds, bats, land use, archaeology and cultural heritage, etc. In summary, the SESA does not identify any constraints for the Project area that should be taken into account. However, the approval requirements identified by EEAA on the SESA identified the following measures (discussed in further details in "Section 7.2") which have been taken into account by the Developer as part of the preliminary design process:

- Turbine should be sited in rows perpendicular to the main wind direction;
- A distance of 1km should be maintained between the rows;

- Avoid turbines with lattice towers;
- Paint turbine blades to increase blade visibility and, thus, decrease collision risk for migrating roosting and local birds;
- Restrict turbine height to a reasonable maximum total tip height, as collision risk for migrating birds is believed to increase with turbine height. A maximum total tip height of 120 m is recommended[1];
- Avoid lighting of wind turbines, as birds might be attracted to wind farm areas by lights leading to an increased collision risk;
- Build the grid within a wind farm area and the grid between different wind farm areas by underground cables. If the use of overhead lines cannot be avoided, such overhead lines should be designed according to available guidelines;
- It is important to note that the SESA identifies buffer areas of importance for migratory birds in which no turbines are allowed to be sited. No such areas are located within the Project site and therefore no specific measures should be undertaken; and
- Other operational mitigation measures to be considered which will be identified in the ESIA to include an Active Turbine Management Plan.

In addition, one of the objectives of this ESIA is to build on the outcomes of the SESA and investigate/identify any further site-specific E&S constraints to be taken into account by the Project developer throughout the planning and design phase of the Project. However, as presented throughout the ESIA, no further site-specific constraints have been identified in relation to the Project site. Therefore, there are no additional design alternatives to be considered in relation to E&S issues. However, the ESIA identifies additional E&S requirements which must be taken into account as presented throughout the document.

6.4 No-Project Alternative

The 'no project' alternative assumes that the 500MW Project will not be developed. Should this be the case, then the Project site area would remain the same. The land area would remain with its current characteristics – a vast desert grounds with sparse vegetation.

Should the Project not move forward, then the Project-related negative environmental impacts discussed throughout this ESIA would be averted. However, as noted throughout the ESIA, generally such impacts do not pose any key issues of concern and can be adequately controlled and mitigated through the implementation of the ESMP discussed in "Chapter 9". Nevertheless, should the Project not move forward; the significant and crucial positive economic and environmental benefits would not be realised. Such benefits include the following:

- This development allows for more sustainable development and shows the commitment of the GoE to realizing the energy strategy;
- Contribute to increasing energy security through development of local energy resources and reducing dependency on external energy sources;
- The clean energy produced from renewable energy resources is expected to reduce consumption of alternative fuels for electricity generation, and will thus help in reducing greenhouse gas emissions, as well as air pollutant emissions; and
- Project is expected during the construction and operation phase to generate local employment and commit to other social responsibilities. As such, this is expected, to a certain extent, to

[1] Note: in July 2022 new governmental approvals have been provided for an increase in tip height up until 220m. collision risk for migrating birds has been assessed for the tip height considered for this Project as discussed later in "Section 8.6".

subsequently enhance the socio-economic conditions and standards of living of the local communities.

In conclusion, an ESIA must investigate all potential positive and negative impacts from a project development. In the case of this Project, it is important to weigh the significant positive economic and environmental impacts incurred from the Project development, against the negative environment impacts anticipated at the site-specific level – in which generally this ESIA concludes to be minor in nature and can be adequately controlled. The comparison in this chapter clearly concludes that the 'no project' alternative is not a preferable option.

7. Existing Physical, Biological and Social Environment

7.1 Landscape and Visual

This section provides an assessment of baseline conditions within the Project site and surrounds in relation to landscape and visual.

7.1.1 Baseline Assessment Methodology

A site assessment was undertaken to characterise the general landscape and topography characteristics of the Project site.

Based on several European guidelines and regulations, four zones of potential visual impact are identified which can be distinguished as noted in the table below (SESA, 2018). At distances greater than 10km visibility impacts are not relevant and can only be seen as minor elements in the landscape (if seen at all).

Table 14: Classification of Different Zones of Potential Visual Impact

Distance	Perception of tall, man-made structures	Impact
Up to 2 km	perceptible, likely to be a prominent feature in the landscape	high impact
2 to 5 km	regularly perceptible, relatively prominent	moderate impact
5 to 10 km	only perceptible in clear visibility, seen as part of the wider landscape	low impact
> 10 km	only occasionally seen in very clear visibility, only minor element in the landscape (if at all)	no relevant impact

Therefore, taking the above into account, the site assessment focused on identifying any key critical visual receptors within the Project site and a 4-5km radius from the area. The ESIA Team also crosschecked Google Maps to identify locations that should be verified during the field surveys. Moreover, based on desktop review and consultations with relevant stakeholders (to include Ras Ghareb Local City Council and Red Sea Governorate), any current plans in the area as well as key visual receptors within a 15km radius from the Project site were identified.

7.1.2 Results

Based on the site survey, generally, the landscape characters of the area can be classified as a desert area with soil that is formed from sand, rocks, and gravel that is flat with very small elevation differences and without any specific features. Most of the area is covered with compact angular gravels and pebbles forming a so-called desert armour.

Hilly terrains can be found in its north-western part. The area is gently sloping from West to East without pronounced landscape features such as steep slopes or escarpments. This is illustrated in the following figures.

The figure below presents the general landscape character of the Project site.

Figure 16: View and Landscape of the Project Area

Critical visual receptors are identified as those normally seen as valuable by the human perception and include recreational activities, environmental reserves, local community settlements, remarkable historical or cultural sites, and other.

Based on the site visit undertaken for the Project area and the 4-5km radius, no critical visual receptors were identified. The general area around the Project has different petroleum activities but nothing major inside the Project site. The nearest neighbour to the Project area is a petroleum company.

In addition, based on the literature review and consultations, no critical visual receptors were identified within the 15km radius with the exception of Ras Ghareb city located at around 9km to the southeast. There are several receptors located within the 15km radius as identified in "Section 7.2" below, however those do not classify as key visual receptors. This includes an Air Force Defence Unit, several Petroleum facilities, other wind farm development projects, dams, and other.

Other key critical visual receptors are located at a distance from the Project area. This includes for example: (1) Zaafarana village located at more than 65 km to the north west; (2) closest key archaeology/cultural heritage site (harbour complex dating to the Old Kingdom located at more than 30 km away), (3) key biodiversity areas (Gabal El Zeit Important Bird Area located near the Project site – additional details on this is provided in "Section 7.2" below); (4) a touristic resort located 40 km to the north; (5) the nearest police mobile station is located about 5 km from the site on the Ras Ghareb – Sheikh Fadl Road.

7.2 Land Use

This section provides an assessment of baseline conditions within the Project site and surrounds in relation to land use.

7.2.1 Baseline Assessment Methodology

The baseline assessment of the 'formal' land use was based on collection of secondary data and plans available from the relevant governmental entities – this includes in particular as related to the ESIA (i) formal land use planning for Ras Ghareb; and (ii) area of critical environmental concern planning. In addition, the ESIA Team reviewed the different studies undertaken for the area.

Understanding and characterising the informal, customary, or actual land use of the Project site was mainly based on a detailed land use survey for the Project site and a 4-5km radius to document and understand any informal land use activities undertaken such as physical activities (houses, structures, etc.) or economical activities (such as grazing, agricultural, petroleum activities, etc.). The ESIA Team also checked the Project area on Google Earth prior to the site survey and identified buildings/facilities that should be verified during the site visit. In addition, consultations were undertaken with relevant stakeholders to further understand any informal, customary, or actual land use practices as identified throughout the text below.

7.2.2 Formal Land Use

Local Formal Land Use Plan

Consultations were undertaken with the Ras Ghareb City Council to understand the formal land use plan set for the Project area. According to such consultations, the specified area for the Project is not in the City's plan and based on the "Presidential Decree No. 116 of the year 2016", it has been allocated to NREA for the development of wind farm projects. These plots have been allocated to various developers by NREA.

As discussed earlier, NREA has allocated to the Developer the Project site area in specific for development of this Project.

General Petroleum Company

The area in general includes petroleum mining activities that are operated mostly by the General Petroleum Company. A Work Coordination Agreement has been signed between NREA and the General Petroleum Company in 2005 for an area of 700km^2 in which wind farm developments will take place. The Agreement includes several articles for the development projects to include for example:

- The General Petroleum Company has agreements for oil exploration and utilisation within concession areas located within the agreed 700km^2 area.
- Wind turbines will be allocated in rows with a distance of 1km between each row and the next
- A distance of 260m will be respected between each wind turbine
- The hub-height of the turbines should be around 65m above ground
- The dimensions of the concrete foundation should be around 20m×20m and depth of 4m below ground
- Cables should be laid out next to the rows of turbines at a depth ranging from 1.5-2m and enclosed within special pipes with a diameter of around 15cm that connects to a substation that will be constructed on an area of 500m×500m
- Within the same trench, communication cables will be included that will connect with a control room in the main administrative building
- The wind rows will be serviced with internal roads with a width of 6m located adjacent to each row and these roads should be designed without an asphalt layer and should be able to withstand a load of 15ton/axle
- Other requirements will include an administrative building, service buildings, accommodation facilities, etc.
- General Petroleum Company has the right to undertake surveys, measurements or any other exploration activities along with any other company associated with it. The agreement identifies several provisions that should be met for any well drilling or survey activities some

of which include: (i) ensure appropriate areas are available within the wind farms for installation of equipment and machinery to undertake required surveys; (ii) turn off turbines when required for security reasons or reduce noise impacts on survey results; (iii) provide the General Petroleum Company with final, detailed and accurate as built drawings for all infrastructure elements above and underground (e.g. cables, roads, etc.).

- Identifies areas where no wind farm development projects are allowed. No such areas are located within the Project site.
- NREA will inform the General Petroleum Company before commencement of any activity of any wind farm development in the area.

Areas of Critical Environmental Concern

Planning for areas of critical environmental concern is under the responsibility of the EEAA and this includes Important Bird Areas (IBAs) and natural protectorates. EEAA's nature protection team published in 2013 the locations for all current and future natural protectorates. The Project location is not located within any existing or planned natural protectorates, where the closest is 70km away to include the planned natural protectorate at Ras Shukeir.

In addition, Egypt has 34 IBAs and the closest IBA to the Project site is Gabal El Zeit, covering a 100-km strip along the shoreline starting 21 km north of Ras Ghareb reaching its end 50 km north of Hurghada. The Gabal El Zeit IBA is located on the borders of the Project site and in addition around 1km^2 of the IBA is located within the Project site as noted in the figure below.

Taking the above into account, it is important to note that there is no relevant Egyptian legislation which prevents development projects (including wind farms) within IBAs or legislations which identify any specific constraints to be taken into account.

According to the Strategic and Cumulative Environmental and Social Assessment (RCREEE, 2018), which covers the overall NREA wind farm project development area along the Gulf of Suez, including the Project site, this overlap has been identified, as noted in the figure below. Based on the expected impact of the wind farm developments and the mitigation measures particularly required to minimize any potential impact to an acceptable level, the SESA states "the ecological function of the IBA will not be decreased by operational wind farms, if appropriate mitigation measures will be considered and thoroughly implemented." The SESA also states "… development of wind turbines in the eastern part of the Wind project-plot 3-4, which overlaps with the Important Bird Area Gebel El Zeit, needs to be discussed amongst relevant stakeholders ensuring the preservation of the ecological function of the IBA Gebel El Zeit as a migration corridor for large soaring birds."

Taking the above into account, based on the approval requirements identified in the SESA and also based on RCREEE's experience with other wind farm developments in the area, the following measures are identified to be taken into account as discussed earlier in "Section 6.3":

- Turbine should be sited in rows perpendicular to the main wind direction;
- A distance of 1km should be maintained between the rows;
- Avoid turbines with lattice towers;
- Paint turbine blades to increase blade visibility and, thus, decrease collision risk for migrating roosting and local birds;
- Restrict turbine height to a reasonable maximum total tip height, as collision risk for migrating birds is believed to increase with turbine height. A maximum total tip height of 120 m is recommended; however, this should not be regarded as a strict limitation. According to the technical characteristics of modern turbines exceeding a height of 120 m might be acceptable to a certain degree. It is worth noting that in July 2022, the Government of Egypt has provided a permit to upgrade the turbine heights up until 220m, while the Developer have selected turbine specifications with a 180m tip height.

Impacts have been properly assessed for the increase in tip height accordingly as discussed later in "Section 7.58.6";

- Avoid lighting of wind turbines, as birds might be attracted to wind farm areas by lights leading to an increased collision risk;
- Build the grid within a wind farm area and the grid between different wind farm areas by underground cables. If the use of overhead lines cannot be avoided, such overhead lines should be designed according to available guidelines;
- It is important to note that the SESA identifies buffer areas of importance for migratory birds in which no turbines are allowed to be sited. No such areas are located within the Project site and therefore no specific measures should be undertaken; and
- Other operational mitigation measures to be considered which will be identified in the ESIA to include an Active Turbine Management Plan.

Figure 17: SESA Area Overlap with IBA

Land Ownership

The Government of Egypt (GoE) has allocated to the NREA through "Presidential Decree No. 116 of the year 2016", land for development of renewable energy projects through usufruct rights. The area was proposed by the National Centre for Land-use Planning and was approved by the Council of Ministers. In line with the decree, this includes an area of 1,220 km^2 in the Gulf of Suez (GoS) with a total capacity of 3,550 MW for wind power projects. Of the 1,220 km^2 area in the GoS, currently an area of around 284km^2 is being developed for multiple wind farm projects.

Based on the above, NREA has granted the Developer full access rights to the specific Project for the development of a 500MW Wind Farm Project. Therefore, the land is currently under the ownership of NREA.

7.2.3 Actual Land Use

As discussed earlier, a detailed land use survey was undertaken for the Project site and a 4-5km radius to document and understand any informal land use activities undertaken such as physical activities (houses, structures, etc.) or economical activities (such as grazing, agricultural, petroleum activities, etc.).

Based on the site survey it can be concluded that there are no housing structures, settlements or residential areas within the Project site. In addition, no economic activities or evidence of such activities were noted within the Project site to include grazing activities or agricultural activities. It was noted that one Bedouin working as a guard for a nearby wind farm project (Lekela project) lives in a temporary shed in the northern area, but outside the boundaries of the Project.

Based on the site surveys and assessment, the only land use activity noted within the Project site and 4-5km radius include mainly petroleum activities and operational petroleum companies the following which are also presented in the figure and table that follows.

The ESIA Team met with representatives from the petroleum companies to understand the nature of activities and use of these facilities. Generally, employees work during normal working hours and are on call in case of emergency. There are no lodging facilities in these facilities identified above. As a result, these are not considered as populated areas or sensitive receptor locations.

Apart from those receptors identified above, the area in general is uninhabited and vacant with no indication or evidence of any physical or economical land use activities throughout the Project site and its 4-5km radius.

Other notable land uses include: (i) the nearest police mobile station is located about 5 km from the site on the Ras Ghareb – Sheikh Fadl Road; and (ii) there is an Air Force Defence Unit located around 9km to the north. Based on available information this Air Force Defence Unit includes offices, training grounds, radar systems, mosque, and barracks for accommodation of soldiers that is likely on a rotational basis; (iii) there are other operational wind farms within the area – this is discussed in further details in "Section 8.15".

Table 15: The Main Key Activities/Facilities Identified in the Vicinity of the Project Site

#	Coordinates	Description and importance as visual receptor	Photo
1	28°32'46.33"N 32°55'30.84"E	**Gas plant– GAPCO** Located in the north eastern direction Distance from Project Centre is 7.5 km Distance from nearest project border is 3.8 km	
2	28°30'45.51"N 32°57'38.53"E	**Activities of one of the petroleum companies** Located in the eastern direction Distance from Project Centre is 7.5 km Distance from nearest project border is 4.6 km	
3	28°27'17.51"N 33° 0'59.23"E	**Activities of one of the petroleum companies** Located in the south eastern direction Distance from Project Centre is 8.5 km Distance from nearest project border is 5.0 km	

4	28°26'54.96"N 32°59'47.38"E	Dara Petroleum Co. Gate Located in the south eastern direction Distance from Project Centre is 7.0 km Distance from nearest project border is 2.9 km	
5	28°26'36.02"N 32°57'56.10"E	Sub Station location Located in the south eastern direction Distance from Project Centre is 4.0 km Distance from nearest project border is 380 m	
6	28°24'47.79"N 32°57'48.64"E	Dara Petroleum Co. Field Located in the southern direction Distance from Project Centre is 5.5 km Distance from nearest project border is 270 m	
7	28°23'52.67"N 32°57'48.00"E	West Ras Bakr Petroleum Co.- office building & parking Located in the southern direction Distance from Project Centre is 9.0 km Distance from nearest project border is 480 m	
8	28°25'18.11"N 32°51'48.87"E	Activities of one of the petroleum companies Located in the western direction Distance from Project Centre is 7.1 km Distance from nearest project border is 4.65 km	
9	28°24'9.67"N 32°55'12.02"E	West Ras Bakr Petroleum Co. Gate Located in the south eastern direction Distance from Project Centre is 7.0 km Distance from nearest project border is 430 m	
10	28°23'41.72"N 32°51'18.84"E	H Area -Dara Petroleum Co. Located in the south western direction Distance from Project Centre is 9.0 km Distance from nearest project border is 4.8 km	
11	28°21'51.20"N 32°53'33.54"E	K Area -Dara Petroleum Co. - far away about 11 km from project center at South west direction, and about 5.35 km from the nearest project border	

12	28°21'44.29"N 32°55'14.54"E	Activities of one of the petroleum companies Located in the south western direction Distance from Project Centre is 10.0 km Distance from nearest project border is 4.2 km	
13	28°24'4.49"N 32°55'49.45"E	An old site for a petroleum company located at the southern border includes unfixed caravans and some equipment.	

Figure 18: The Main Key Activities/Facilities Identified in the Vicinity of the Project Site

Old and Obsolete Land Use Locations

During the site surveying by the ESIA Team, some old and obsolete areas have been detected at the Project area especially at the northern part of the site. Mainly they are old and obsolete oil wells, with no ongoing activities onsite. The following are clarifying the coordinates of the main findings with some photos.

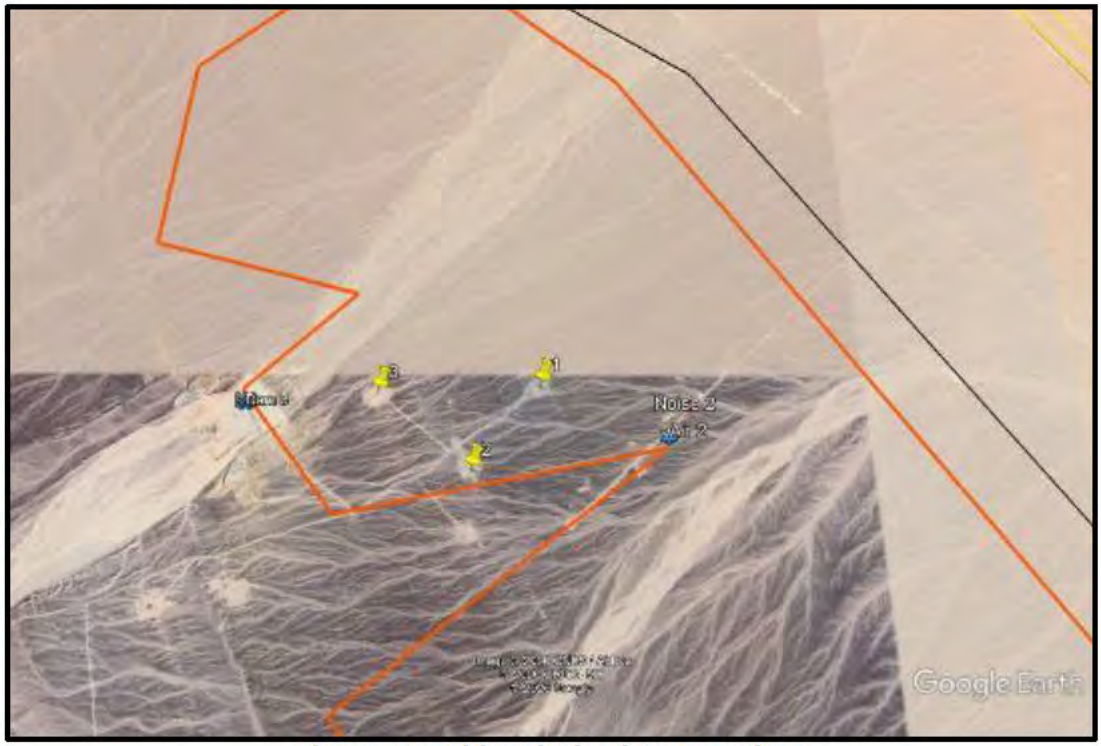
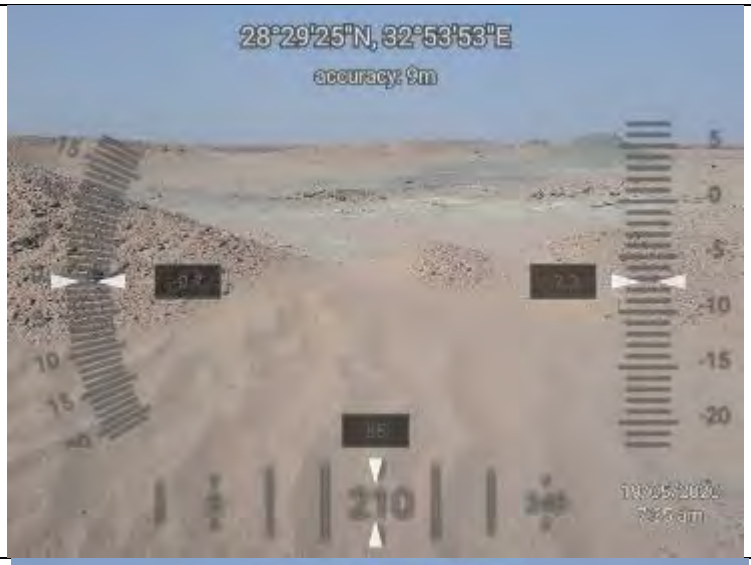
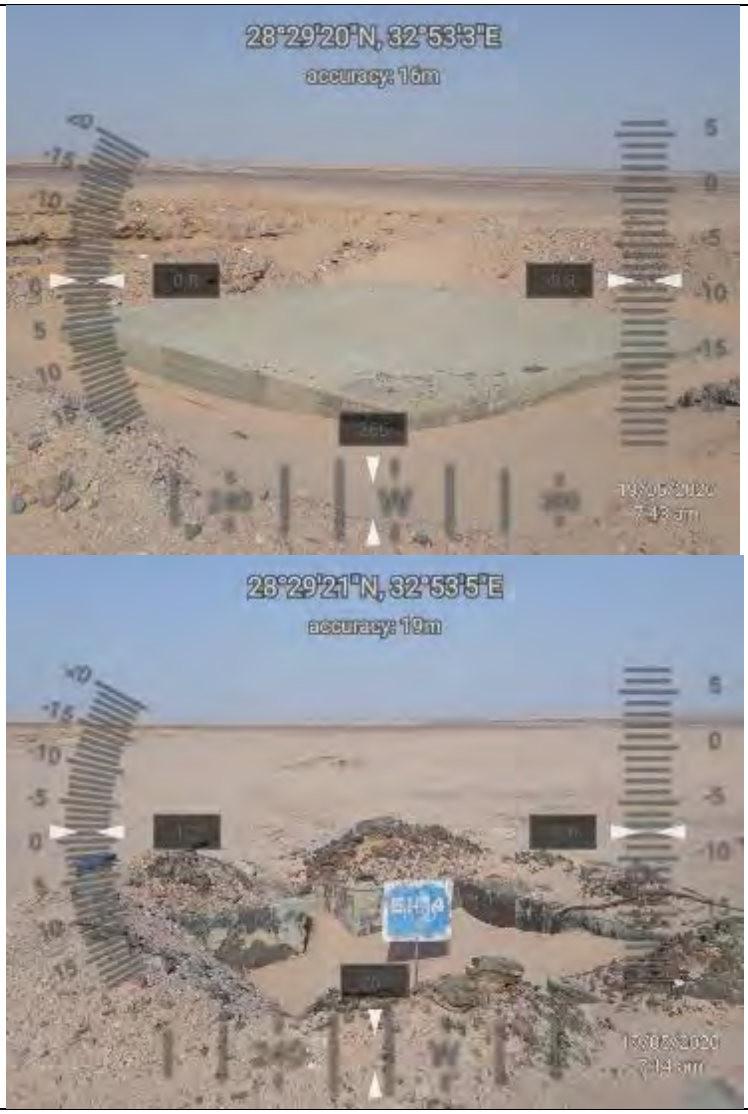


Figure 19: Old and Obsolete Locations

Table 16: Old and Obsolete Land Use Locations

Description	Coordinates	Photo
POINT 1	28°29'24.21"N 32°53'51.20"E	

		
POINT 2	28°29'2.33"N 32°53'32.14"E	 

POINT 3	28°29'22.16"N 32°53'5.45"E	

Bedouin Groups

The key Bedouin group known in the area is the Ma'aza tribe, a tribe of Arabs that used to live in the mountain range to the west of the site as well as within the local governmental unit in Ras Ghareb. Currently, the Ma'aza tribe settle permanently in Ras Gharib town, Zaafarana and Wadi Dara. Such Bedouin groups generally engage in traditional economic activities such as agriculture and animal husbandry and in addition, they are also employed in the Development projects in the area (mainly the petroleum companies) either as guides, security guards, or contractors.

In general, local Bedouin tribes (to include Ma'aza tribe) do not abide to the legal process required to own land. Therefore, Bedouins apply a type of customary ownership which is not an official process known as Urfi Contracts and Ghafra System.

Bedouin tribes claim rights of these lands based on their knowledge of the area and the alleged history of their family living there for generations, even though they do not have official documents to support such claims. This practice is followed up by "Urfi" contracts however such documents are not considered by the GoE as official documents and are not considered to be supported legally. Furthermore, aiming at declaring their possession of the lands, separate houses are built and scattered in such lands. The residents construct the houses with no legal license (RCREEE, ECO Consult and EcoConServ, May 2020). If the land is not being used or inhabited by any Bedouin groups then the Ghafra system is not considered applicable.

In order to avoid conflicts with Bedouins, companies involved in development projects over lands claimed by Bedouins always try to get into certain arrangements with the tribes. In general, developers employ Bedouin groups to provide support in implementing their projects and providing security and protection for an agreed financial compensation. They can also work on various tasks related to the project (such as becoming security guards, provision of raw materials, provision of food supplies and water to the workers, etc.). In terms of engagement and information disclosure, the most important person to engage will be their community leader (i.e. the male head of the family) (RCREEE, ECO Consult and EcoConServ, May 2020).

Consultations were undertaken with the head and elders of such Bedouin families. Key outcomes are summarised below:

- Currently, there are no Bedouin families residing at or near the Project site. Such Bedouin families settle in Ras Gharib town, Zaafarana, Wadi Dara.
- There are no economic activities undertaken by Bedouin families in or near the Project site such as agricultural activities, grazing, etc.
- Bedouin families undertake security and guarding practices for existing projects and projects under construction located in the areas in which they exist based on agreements signed between the Developer or EPC Contractor and a representative of these Bedouin families.

7.3 Geology, Hydrology and Hydrogeology

This section provides an assessment of baseline conditions within the Project site and surrounds in relation to geology, hydrology, and hydrogeology.

7.3.1 Baseline Assessment Methodology

The assessment was based on review of secondary data to include literature review of previous publications and studies related to geology, hydrology and hydrogeology. In addition, a site assessment was undertaken to confirm and verify the outcomes of the literature review and document conditions on the ground.

Geology

The Project site is a part of Gharib plain which extends Northeast (NE)- Southwest (SW) parallel to the Gulf of Suez and is bounded from the west by the higher mountainous range and from the east by western coast of the Gulf of Suez.

Geologically, the Project site is located in the sedimentary basin called West Bakr that has many productive petroleum wells. As noted in the figure below, Quaternary deposits (Post-Miocene) are the main exposed sediments covering the entire Project site.

These deposits are composed of gravels, sand, clay, aeolian sand sheets and sand accumulations. They are mainly clastic sediments of different textures ranging from silt to gravel size. The composition of the Quaternary deposits is mainly the weathering products of the surrounding exposed rocks. The colour of the soil cover (Quaternary deposits) reflects the source of the sediments. The area within and around the Project site consists mainly of granitic rocks rich in feldspars reddish in colour, while the soil cover in this region predominantly reddish as it consists of fragments of granite and feldspars, the weathered products of granites.

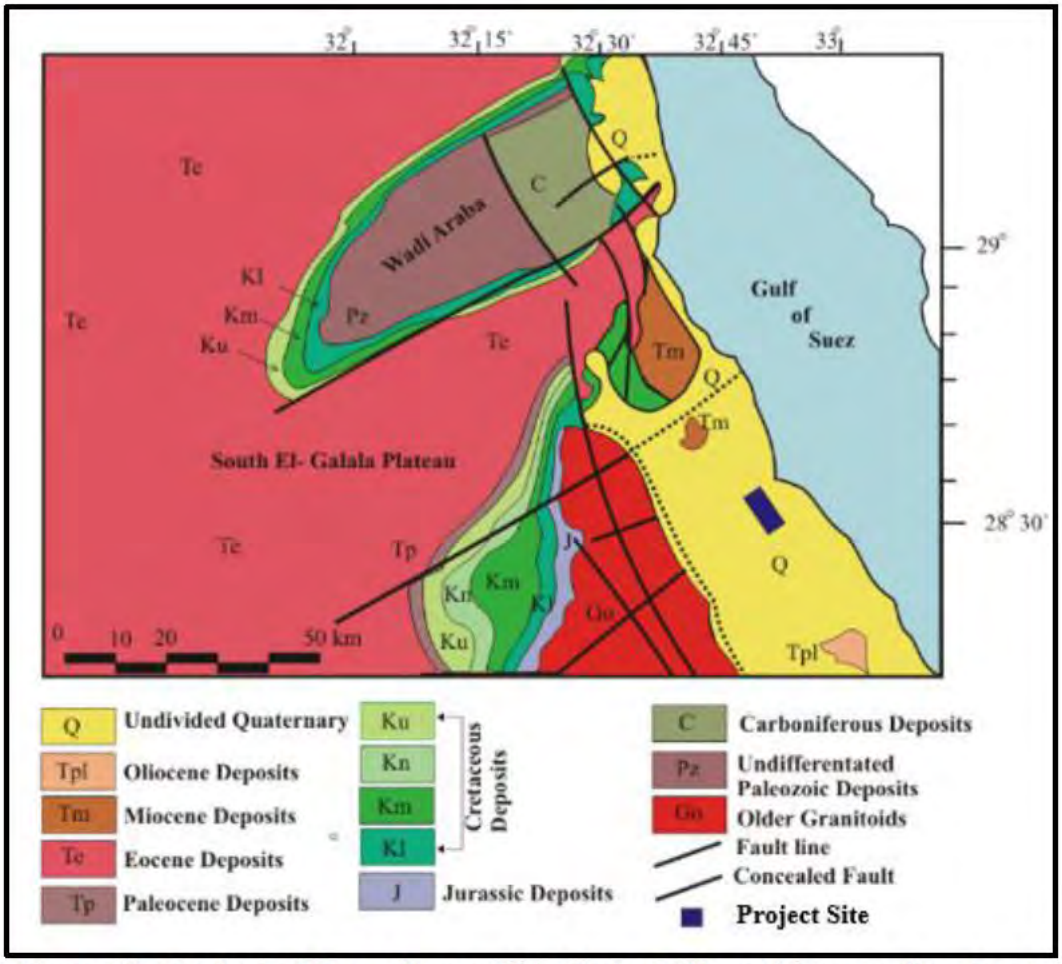


Figure 20: Geological Formations within Project Site and Surrounding Areas

During the field survey, with the help of geological maps and aerial photographs, the different types of soil, characteristics and their location in the Project area were investigated. This includes 3 alluvium terraces as noted in the figure and table below.

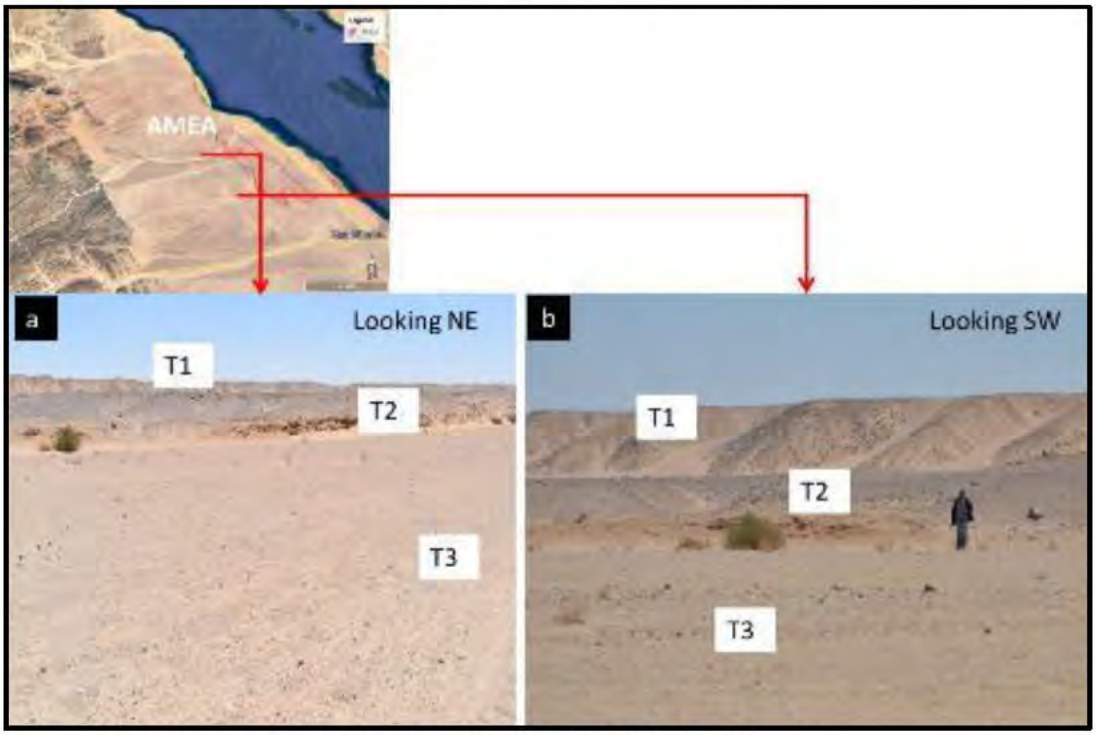


Figure 21: Distribution of Alluvium Terraces

Table 17: Description of Alluvium Terraces within Project Site

Type	Description
T1	These terraces are exposed along the western part of the site and cut by numerous shallow and wide tributaries drain eastward to the Gulf of Suez. The maximum elevation of the terraces at the northwest part is about 135 m (a.m.s.l) while it attains about 120 m (a.m.s.l.) at the southwest part. The height of the of the terrace above the ground level (the level of the following terrace) varies from 1 m to about 4 m at the northwest while it varies from 1 m to about 3 at the southwest. This terrace composed of very coarse chert nodules, cobbles and boulders of granite, basalt, impeded in fine clay and sand.
T2	These terraces are exposed along the floor of the tributaries cutting through the terrace T1. The height of the terrace T2 above the ground level (the level of the following terrace) varies from 0.5 m to about 2.5 m at the northwest while it varies from 0.5 m to about 1.5 at the southwest. This terrace composed of medium sized chert nodules, fragments igneous rocks impeded in fine clay and sand. The fine clay and sand fraction is greater than that in the previous terrace (T1).
T3	These terraces are exposed along the floor of the tributaries cutting through the terrace T2. The height of the terrace T3 above the ground level (the level of the following terrace) varies from <0.5 m to about 1 m. the northwest while it varies from 0.5 m to about 1 at the southwest. This terrace composed of small nodules, fragments of igneous rocks impeded in fine clay and sand. The fine clay and sand fraction is greater than that in the previous terrace T2.

Hydrology

The physiographic features of the area that includes the location of the Project and surroundings could be differentiated into a high, medium and low relief unit as noted below.

- High Relief Unit: this unit comprises the mountainous area which is composed essentially of Pre-Cambrian basement rocks and representing the main catchments area of El Hawashyia basin. This area rises above 500 m above mean sea level
- Medium Relief Unit: this unit occupies the eastern foot slopes of the mountainous area. This area is composed of hilly dissected and weathered zone. The elevation range of this unit ranges from 150 up to 500 m (amsl).
- Low Relief Unit: the unit occupies the low land area between the hilly unit area and the Gulf of Suez. The ground surface elevation of this unite is less than 150 m (a.m.s.l). It comprises the following geomorphic units. Masoud et al. (2012) considered this unit as a piedmont plain. This unite comprise the morphotectonic depression that occupies the area between the foot cliff of the mountainous area to the west and the gorge of El Hawashyia basin to the east. It is surrounded to the north and south by the dissected alluvial terraces and the dissected peneplain. It represents a good collecting basin for surface water runoff. It has a ground elevation ranging between 260 and 370 m, with general surface slope towards the east.

In addition, the following geomorphic features are expected in this plain:

- Dissected alluvial terrace unit: it occupies an extended plain covered by thick alluvial terraces. It faces the hilly area and received its outwash of the weathering products.
- Coastal plain unit: it occupies a limited zone towards the east between the dissected alluvial plain and the Gulf of Suez shore line. This coastal plain is narrow to the north and becomes wider towards the south. It receives the finer sediments carried through streams, which cut the dissected alluvial plain and the peneplain.
- Salinas and lakes unit: it occupies a low land area north of Ras Abu Bakr and appear below sea level. Sabkhas, salt marshes and ponds of saline water surround it. They receive their water through inundation and seepage from the surrounding flow.
- Southern dissected peneplain unit: it occupies the elevated land south Hawashiya basin and slopes towards the south and northeast.
- Wadi channel unit: it occupies the main channels of the 5 Wadies dissecting the area of the Project which are from the north to south, Wadi North Hawashiya, Wadi Hawashiya, Wadi South Hawashiya, Wadi Bakr and wadi North Abu Had as presented in the figure below.

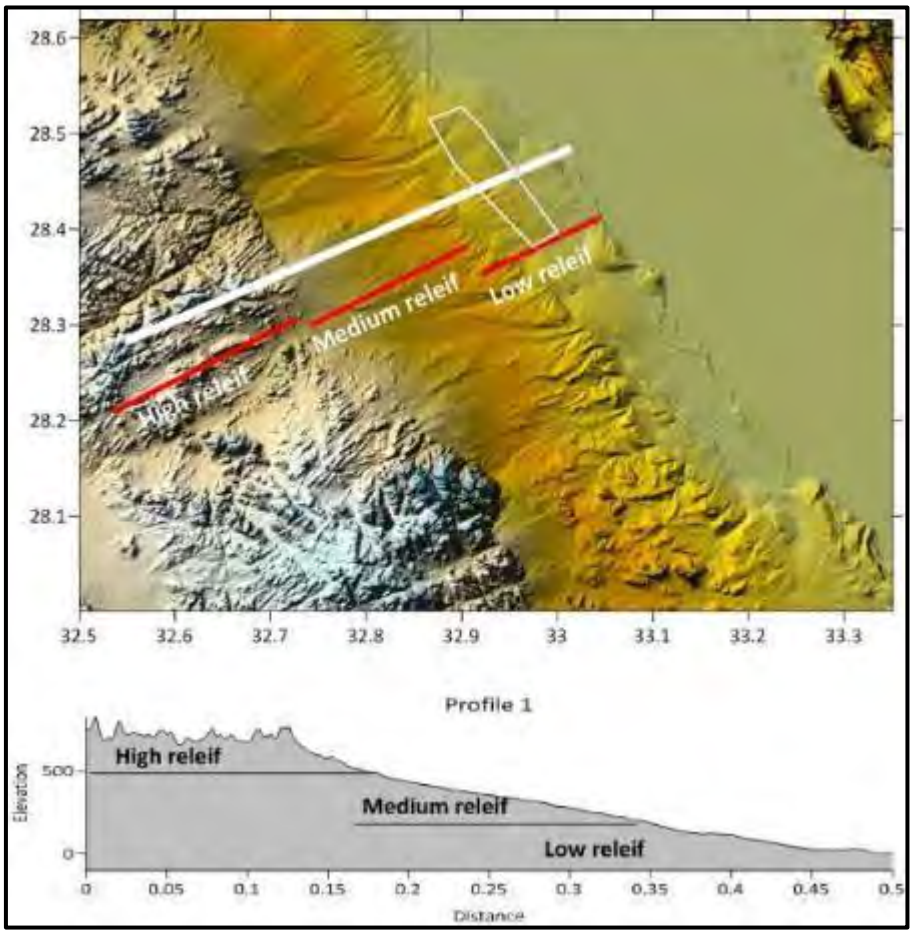


Figure 22: Physiography of the Project Site and Surrounding Areas

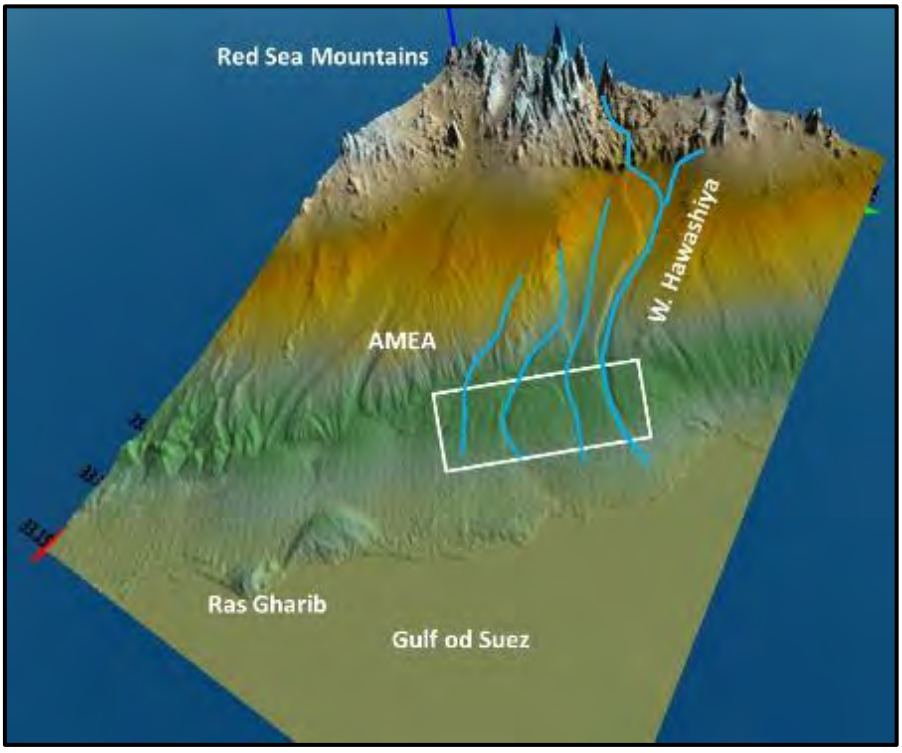


Figure 23: Elevation Model of the Project Area

Based on the site visit undertaken, it is clear that the Project concession is located in a simple relief area characterized by:

- Simple relief wide plain area with a very gentle slope towards Gulf of Suez.
- Complete absence of any deep drainage lines and or well-developed alluvial fans.
- The main drainage lines traversing the Project site are very weak, shallow and the surface signs of their existence disappear on the way to the Gulf of Suez except Wadi Hawashiya that is crossing the northern part of the site.
- A complete absence of strong and well-developed geomorphic features like deep wadies, depressions, steep slope scarps, conspicuous hill heights. Therefore, the project location is very ideal concerning the accessibility.

Hydrogeology

The figure below presents the hydrogeological conditions of the Project site and surrounding areas, based on the hydrogeological map of Egypt of 1999. As noted, the Project site is located in an area of wadi deposits with moderate to low productive aquifers with insignificant surface recharge and limited sub-surface recharge. This entails that there are no shallow groundwater aquifers with a continuous source of fresh water recharge, and this is due to the lack of rain and large drainage basins to collect rainwater.

There is no utilization of groundwater in the Project site, even with the petroleum and oil companies operating in the region. In the wide area surrounding the site, the recent well inventory and available literature show that groundwater wells are concentrated within Wadi Araba, located about 50 km north of Project site. Wadi Araba was considered as a wadi with high groundwater possibility (Aggour, 1990). Rocks belonging to Carboniferous and Lower Cretaceous sandstone represent the main source of water in the Wadi Araba Depression. The water is tapped from springs, shallow wells and occasionally deep wells. The collected information from shallow groundwater wells and springs in Wadi Araba reveals that the water salinity varies between 1025 to parts per million (ppm) and 50,233 ppm.

In the GoS, groundwater is used mainly for touristic and industrial purposes. According to the rates of groundwater withdrawal with respect to water requirements, the Gulf province includes areas into which the groundwater represents 10-40% of the utilized water supplies. The daily discharge ranges from 260 to 3000 m3/day at Wadi Araba and El Sukhna-Zafrana localities respectively (Sewidan and Misak, 1992). The continuous use of such water potentially stresses its quantity and quality.

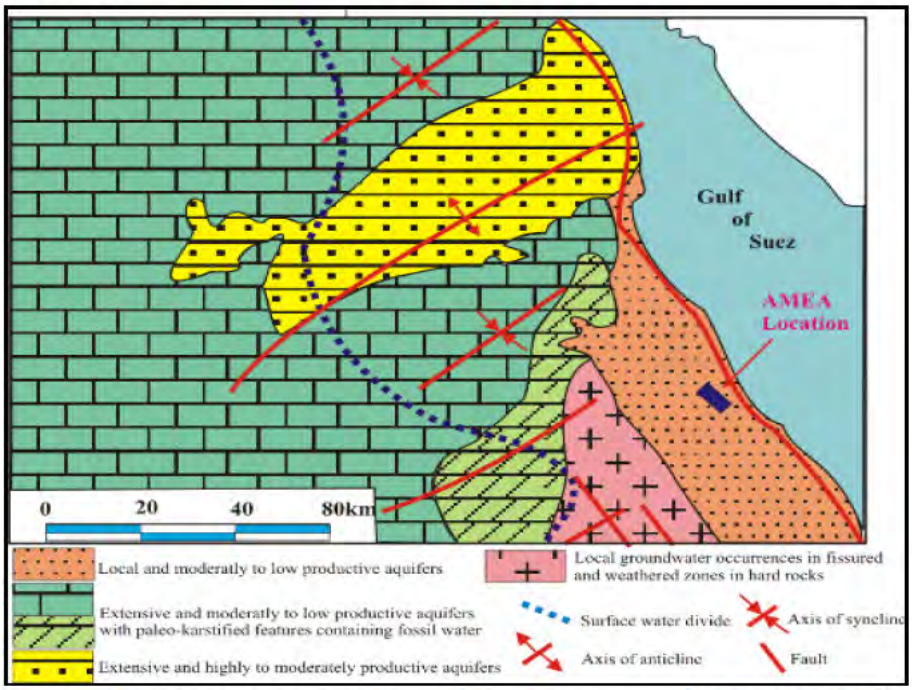


Figure 24: Hydrogeological Map of the Area around the Project Site

7.4 Biodiversity

This section provides an assessment of baseline conditions within the Project site and surrounds in relation to biodiversity. It is important to note that biodiversity assessed in this section excludes birds (avi-fauna) and bats, which are discussed separately in "Section 7.5" and "Section 7.6" respectively.

7.4.1 Baseline Assessment Methodology

The baseline assessment of the Project site was based on a literature review, which was based on previous studies, data, surveys, and records available in published scientific papers, books, and journals on flora and fauna species recorded within the study region in general. It is important to note that since the available literature on the Project site and its vicinity is relatively limited, the literature reviewed included a wide spectrum of references including international references that have a wider focus than the region of the Project. Additionally, a special consideration was given to the Strategic and Cumulative Environmental and Social Assessment for an Area of 284 km^2 at the Gulf of Suez (SESA) (2018).

A field survey was undertaken at the Project site during the spring 2020. 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 field survey mainly included field observations, where the site was examined carefully for the presence of active animals, animal signs and tracts, active burrows, remains or any other vital signs that indicate the activity of animals. Due to the large size of the Project site, the research team focused on areas of high priorities; mainly wadis since they are believed to be the main corridors that animals would use in moving around the site. Similar approach was followed for the flora survey where the survey focused on sides of wadis and any areas where vegetation was noticed. In addition, the site was surveyed for occurring plant species which were noted and recorded to include number of species, coverage interception per species, etc.

Fauna and Flora Species status

All species recorded as part of the literature review had their conservation status identified according to International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2020), which provides the global conservation status of evaluated species. Since Egypt does not have national Red Lists for most taxa, the regional assessments of the Mediterranean region and North African region were reviewed for any species that could be of conservation value on the regional level.

7.4.2 Results

In accordance with the methodology discussed above, the results below discuss the findings and outcomes for flora and fauna based on the literature review and field survey.

(i) Flora

According to Olson et al (2001), the project area is located in the Desert and Xeric Shrublands Biome and more specifically in the Ecoregion of Red Sea Coastal Desert. Applying the classification elaborated by Harhash et al. (2015) to the habitats found in the Project area, the whole Project area must be attributed to the main habitat system "Desert". The vast majority of the Project area can be classified as "Hamada Desert" (Sub-System: "Plain Land") that is crossed by "Valleys and Canyons" (i.e. wadis) which belong to the Sub-System "Low Land".

According to SESA (RCREEE, 2018), the Project area consists mainly of flat pebble desert cut by shallow drainage lines; wadis. As typical for desert regions, habitats are limited in diversity and coverage. Wadis, which have a relatively high level of diversity, are marked with fine sand and clay sediments deposited by old, slow surface flows. Vegetation cover in the Project area was found to be extremely sparse and restricted to single drainage channels. Vegetation within the

Project area generally has a low species composition, density and a very patchy distribution. The wadis tend to support the most vegetation due to generally higher soil moisture levels.

According to Abd El-Ghani et al. (2014), the Project site is located in what is defined as the Eastern Desert of Egypt. More specifically, the Project area is located in the Red Sea Coastal Land. Climatically, the project area lies within the hyper-arid provinces (Ayyad et al., 1993). Generally, the desert vegetation in the Project area is characterised by openness and composed of a permanent framework of perennials, the interspaces of which may be occupied by ephemerals after winter rains. The appearance of ephemerals and their duration depend on the irregular rainfall. The modification of the plant cover is relative to the soil thickness. A thin soil will be moistened during the rainy season but will be dried in a short time. Deep soils allow the storage of some water in the subsoil providing a continuous supply of moisture for the deeply seated roots of perennials.

Figure 25: Location of Project in Reference to Ecoregions of the World (TEOW)

According to literature review of the flora recorded along the coastal desert of the Red Sea, a total of 68 species were recorded in the Project site and its vicinity (Abd El-Ghani et al, 2014), see table below. Out of the 68 species documented to be recorded in the Project area and its vicinity from the literature review, only five were found to be evaluated on the global level of IUCN's Red List of Threatened Species (IUCN, 2019), all of which are evaluated as Least Concern.

Table 18: List of Plant Species Recorded during Field Visit and Literature Review

Family	Scientific name	IUCN Red List of Threatened Species (2020)
Ephedraceae	*Ephedra aphylla* Forssk.	Least Concern
Amaranthaceae	*Aerva javanica* (Burm. f.) Juss. ex Schult.	Not Evaluated
	Amaranthus viridis L.	Not Evaluated
Apocynaceae	*Calotropis procera* (Aiton) W.T. Aiton	Not Evaluated
	Leptadenia pyrotechnica (Forssk.) Decne.	Not Evaluated

Family	Scientific name	IUCN Red List of Threatened Species (2020)
	Pergularia tomentosa L.	Not Evaluated
Asteraceae	*Artemisia judaica* L.	Not Evaluated
	Centaurea calcitrapa L.	Not Evaluated
	Centaurea scoparia Sieber ex Spreng.	Not Evaluated
	Cotula cinerea Delile	Not Evaluated
	Echinops spinosus L.	Not Evaluated
	Ifloga spicata (Forssk.) Sch. Bip.	Not Evaluated
	Iphiona mucronata (Forssk.) Asch. et Schweinf.	Not Evaluated
	Launaea spinosa (Forssk.) Sch. Bip. ex Kuntze	Not Evaluated
	Limbarda crithmoides (L.) Dumort.	Not Evaluated
	Pluchea dioscoridis (L.) DC.	Least Concern
	Pulicaria incisa (Lam.) DC.	Not Evaluated
	Pulicaria undulata (L.) C.A. Mey.	Not Evaluated
	Reichardia tingitana (L.) Roth	Not Evaluated
	Senecio glaucus L.	Not Evaluated
	Sonchus oleraceus L.	Not Evaluated
Boraginaceae	*Heliotropium bacciferum* Forssk.	Not Evaluated
	Trichodesma africanum (L.) R. Br.	Not Evaluated
Brassicaceae	*Diplotaxis harra* (Forssk.) Boiss.	Least Concern (Europe)
	Farsetia aegyptia Turra	Not Evaluated
	Matthiola longipetala (Vent.) DC.	Not Evaluated
	Zilla spinosa (L.) Prantl	Not Evaluated
Capparaceae	*Capparis spinosa* L.	Not Evaluated
Caryophyllaceae	*Polycarpaea robbairea* (Kuntze) Greuter & Burdet	Not Evaluated
Chenopodiaceae	*Anabasis articulata* (Forssk.) Moq.	Not Evaluated
	Arthrocnemum macrostachyum (Moric.) K. Koch	Not Evaluated
	Atriplex halimus L.	Not Evaluated
	Chenopodium album L.	Not Evaluated
	Halocnemum strobilaceum (Pall.) M.Bieb.	Not Evaluated
	Halopeplis perfoliata (Forssk.) Bunge ex Asch.	Not Evaluated
	Haloxylon salicornicum (Moq.) Bunge ex Boiss.	Not Evaluated
	Salsola imbricata Forssk.	Not Evaluated
	Suaeda monoica Forssk. ex J.F. Gmel.	Not Evaluated
Cleomaceae	*Cleome amblyocarpa* Barratte &Murb.	Not Evaluated
	Cleome droserifolia (Forssk.)Delile	Not Evaluated
Convolvulaceae	*Convolvulus hystrix* Vahl	Not Evaluated
Euphorbiaceae	*Ricinus communis* L.	Not Evaluated
Fabaceae	*Acacia seyal* Delile	Not Evaluated
	Acacia tortilis (Forssk.) Hayne	Not Evaluated
	Alhagi graecorum Boiss.	Not Evaluated
	Lotus hebranicus Hochst. ex Brand	Not Evaluated
Fabaceae (cont.)	*Taverniera aegyptiaca* Boiss.	Not Evaluated
Frankeniaceae	*Frankenia hirsuta* L.	Not Evaluated
Geraniaceae	*Erodium glaucophyllum* (L.) L'Hér.	Not Evaluated
Nitrariaceae	*Nitraria retusa* (Forssk.) Asch.	Not Evaluated
Orobanchaceae	*Cistanche phelypaea* (L.) Cout.	Not Evaluated
Polygonaceae	*Calligonum polygonoides* L.	Not Evaluated
Resedaceae	*Ochradenus baccatus* Delile	Not Evaluated
	Reseda pruinosa Delile	Not Evaluated
Solanaceae	*Hyoscyamus muticus* L.	Not Evaluated
Tamaricaceae	*Reaumuria hirtella* Jaub. & Spach	Not Evaluated
	Tamarix nilotica (Ehrenb.) Bunge	Least Concern
	Tamarix tetragyna Ehrenb.	Not Evaluated
Urticaceae	*Forsskaolea tenacissima* L.	Not Evaluated
Zygophyllaceae	*Fagonia arabica* L.	Not Evaluated
	Fagonia bruguieri DC.	Not Evaluated
	Fagonia mollis Delile	Not Evaluated
	Zygophyllum album L.f.	Not Evaluated
	Zygophyllum coccineum L.	Not Evaluated

Family	Scientific name	IUCN Red List of Threatened Species (2020)
	Zygophyllum simplex L.	Not Evaluated
Juncaceae	*Juncus rigidus* Desf.	Not Evaluated
Poaceae	*Pennisetum setaceum* (Forssk.) Chiov.	Least Concern
	Phragmites australis (Cav.) Trin. ex Steud.	Least Concern

(ii) Fauna

The specific outcomes of the field survey in relation to faunal species are discussed below covering mammals and reptiles & amphibians.

a. Mammals

The study site in particular was not studied in detail in previous faunal studies. According to SESA (RCREEE, 2018), mammals distribution is associated with the distribution and abundance of vegetation cover and therefore most species are found in vegetated wadis, rocky hillsides or mountain slopes. However, literature review has shown that 23 species occur in the Project site and its vicinity (Hoath, 2004), see table below. It should be mentioned that some of the species are listed since their distribution range maps have shown that they are present in the general area of the Project site although no specific studies have confirmed that. Additionally, some of the species listed are known to be present in the highlands to the west of the Project site and therefore are considered to be present in the vicinity of the Project site, even if small numbers.

Out of the 23 species listed, twenty are listed as Least Concern according to IUCN's Red List of Threatened Species while two are evaluated as Threatened (both Vulnerable); *Capra nubiana* and *Gazella dorcas,* while the remaining species is evaluated as Near Threatened; *Hyaena hyaena*. The *Capra nubiana* and *Gazella dorcas* have the area of the Project site as part of their distribution range. Regarding the *Capra nubiana*, the species typical habitats include mountainous areas and is expected to be present, if at all, to the west of the Project site in the mountains. As for *Gazella dorcas*, considering the degraded habitats in the general area of the Project site and the high level of human disturbance, especially accessibility of the site, it is highly unlikely that the species could be present in the general area of the Project site. Finally, regarding the Striped Hyaena (Near Threatened), the species is known to have a very wide home range reaching up to 60km. Although it could still be present in the Project site, its numbers are believed to be extremely low and would be generally confined to areas with very low human presence. In addition, it is important to note that no mammals were recorded opportunistically onsite during the field surveys undertaken in the bird monitoring surveys.

Table 19: Mammal species (excluding bats) Recorded in Project Site and its Vicinity

Family	Scientific name	Common name	IUCN Red List of Threatened Species (2020)
Erinaceidae	*Hemiechinus auritus*	Long-eared Hedgehog	Least Concern
Leporidae	*Lepus capensis*	Cape Hare	Least Concern
Muridae	*Jaculus jaculus*	Lesser Egyptian Jerboa	Least Concern
	Gerbillus gerbillus	Lesser Egyptian Gerbil	Least Concern
	Gerbillus henleyi	Pygmy Gerbil	Least Concern
	Gerbillus dasyurus	Wagner's Gerbil	Least Concern
	Gerbillus pyramidum	Greater Egyptian Gerbil	Least Concern
	Gerbillus floweri	Flower's Gerbil	Least Concern
Muridae (cont.)	*Sekeetamys calurus*	Bushy-tailed Jird	Least Concern
	Acomys russatus	Golden Spiny Mouse	Least Concern
	Acomys cahirinus	Cairo Spiny Mouse	Least Concern
	Meriones crassus	Sundevall's Jird	Least Concern
Herpestidae	*Herpestes ichneumon*	Egyptian Mongoose	Least Concern
Canidae	*Felis silvestris*	Wild Cat	Least Concern
	Vulpes rueppellii	Ruppell's Fox	Least Concern
	Vulpes zerda	Fennec Fox	Least Concern
	Canis lupaster /	African Wolf /	Least Concern

Family	Scientific name	Common name	IUCN Red List of Threatened Species (2020)
	Canis aureus	Golden Jackal	
	Hyaena hyaena	Striped Hyena	Near Threatened
Procaviidae	*Procavia capensis*	Rock Hyrax	Least Concern
Bovidae	*Capra nubiana*	Nubian Ibex	Vulnerable
	Gazella dorcas	Dorcas Gazelle	Vulnerable

b. Reptiles and Amphibians

Virtually no previous specific studies on the reptiles and amphibians were conducted within the boundaries of the Project site. According to SESA (RCREEE, 2018), reptiles are the most diverse vertebrate group in the desert habitats like the Project area, and consist entirely of typical desert species. This herpetofauna is composed of lizards and snakes that are adapted to rocky and sandy desert habitats. Additionally, according to Baha El Din (2006), there are 34 species that are documented, or at least expected, to be present in the Project area and its vicinity, see table below. On the other hand, the 34 species listed belong to eight families. Out of all those species, twelve are assessed on the global level of the IUCN Red List of Threatened Species. Eleven of these species are evaluated as Least Concern while one species is evaluated as threatened (Vulnerable); *Uromastyx aegyptia*.

Table 20: Reptilian Species Known to Occur within Study Area

Family	Scientific name	Common name	IUCN Red List of Threatened Species (2020)
Gekkonidae	*Cyrtopodion scabrum*	Keeled Rock Gecko Rough Bent-toed Gecko	Least Concern
	Hemidactylus flaviviridis	Yellow-bellied Gecko	Not Evaluated
	Hemidactylus turcicus	Turkish Gecko	Least Concern
	Ptyodactylus guttatus	Spotted Fan-toed Gecko	Not Evaluated
	Ptyodactylus hasselquistii	Egyptian Fan-toed Gecko	Not Evaluated
	Ptyodactylus siphonorhina	Saharan Fan-toed Gecko	Not Evaluated
	Stenodactylus petrii	Sand Gecko	Not Evaluated
	Stenodactylus stenodactylus	Elegant Gecko	Not Evaluated
	Tropiocolotes steudneri	Steudner's Pigmy Gecko	Not Evaluated
Agamidae	*Agama spinosa*	Spiny Agama	Least Concern
	Pseudotrapelus sinaitus	Sinai Agama	Not Evaluated
	Trapelus mutabilis	Changeable Agama	Not Evaluated
	Trapelus pallidus	Pallid Agama	Not Evaluated
	Uromastyx aegyptia	Egyptian Dabb Lizard	Vulnerable
Lacertidae	*Acanthodactylus boskianus*	Bosc's Lizard	Not Evaluated
Lacertidae (cont.)	*Acanthodactylus scutellatus*	Nidua Lizard	Not Evaluated
	Mesalina guttulata	Small-spotted Lizard	Not Evaluated
	Mesalina olivieri	Olivier's Lizard	Least Concern
	Mesalina rubropunctata	Red-spotted Lizard	Not Evaluated
Varanidae	*Varanus griseus*	Desert Monitor	Not Evaluated
Scnincidae	*Chalcides ocellatus*	Ocellated Skink	Least Concern
	Scincus scincus	Sandfish	Not Evaluated
	Sphenops sepsoides	Audouin's Sand-skink	Least Concern
Colubridae	*Lytorhynchus diadema*	Diademed Sand Snake	Least Concern
	Malpolon moilensis	Moila Snake	Not Evaluated
	Platyceps rogersi	Spotted Racer	Least Concern

Family	Scientific name	Common name	IUCN Red List of Threatened Species (2020)
	Platyceps saharicus	Saharan Cliff Racer	Not Evaluated
	Psammophis aegyptius	Saharan Sand Snake	Not Evaluated
	Psammophis schokari	Schokari Sand Snake	Not Evaluated
	Spalerosophis diadema	Diadem Snake	Not Evaluated
Elapidae	*Walterinnesia aegyptia*	Black Desert Cobra	Least Concern
Viperidae	*Cerastes cerastes*	Horned Viper	Least Concern
	Cerastes vipera	Sand Viper	Least Concern
	Echis coloratus	Burton's Carpet Viper	Not Evaluated

(iii) *Summary*

In summary, based on the literature review undertaken to date, it can be concluded that the Project site in general is considered of low ecological significance due to its natural setting that is characterized by having low vegetation cover in an arid environment with low level of diversity. In addition, no key or sensitive habitats were noted within the Project site, and all floral and faunal species recorded where in general considered common and typical to such habitats and of least concern. Although three species that are believed to be present in the Project site are evaluated as globally threatened (Vulnerable), none of them are believed to be present in globally significant numbers. However, special consideration should be given to the globally threatened Egyptian Dabb Lizard *Uromastyx aegyptia* since the Project site provides a typical habitat for the species, although it is believed not to be present in high numbers due to the low vegetation cover of perennial plants which normally provide major refuge for the species.

7.5 Birds

This section provides an assessment of baseline conditions within the Project site and surrounds in relation to birds.

7.5.1 Methodology

Background

The methodology and scope of work designed for this project followed the standard methodology for bird census being implemented using the Vantage Point (VP) (or Observation Points - OPs) technique according to the Scottish Natural Heritage guidance (SNH 2010a), and in accordance with methodology described in Sutherland (1996) that has been broadly used in ornithological wind farm assessments internationally.

In addition, the methodology also followed the Egyptian requirements (including field technique requirements) that most importantly include: (i) "Environmental Impact Assessment Guidelines and Monitoring Protocols for Wind Energy Development Projects along the Rift Valley/Red Sea Flyway (RVRSF)" that is developed by Egyptian Environmental Affairs Agency (EEAA 2013); and (ii) "Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program for Wind Power Projects in the Gulf of Suez (2019)".

The objective of the survey is to provide an assessment of the use of the migratory and resident soaring birds in the Project site, while providing a detailed analysis of the durations and the elevations at which they are present. This would eventually provide an in-depth understanding of the predicted impacts of the Project on bird species.

Vantage Point Selection

Based on a view-shed analysis that was undertaken for the Project, eight (8) VP were considered sufficient to cover the entire area. The Project was monitored through these VPs to allow a good view of the migratory birds and provided a complete coverage of all turbines. All VPs are located at the top of a hill overlooking the surrounding area in a way that enable the observer to scan as much as possible of the project ground and maintain visual contact between VPs. The location of the VPs is presented in the figure that follows.

Since the VP's as shown in the figure below are overlapping, 4 VP's that are covered on the same day are selected in a manner to avoid any points of overlap, to minimize the chances of double-counting as much as possible. As noted in the figure below this entails working on Group A (VP1, VP3, VP5 and VP7) and Group B (VP2, VP4, VP6 and VP8) for monitoring activities.

Each VP covers a view of 360 degrees extending for a maximum of 2.5km as required. Also, this distance is considered sufficient for a qualified bird observer to identify the birds into the species level under good visibility conditions.

The table below presents the coordinates of the VPs.

Table 21: Coordinates of the VPs

Vantage Point	Coordinates (UTM)	
	Easting	Northing
VP-1	488439	3154410
VP-2	492295	3152563
VP-3	489768	3149952
VP-4	492913	3145163
VP-5	494247	3149872
VP-6	495948	3146264
VP-7	493682	3142342
VP-8	497296	3143981

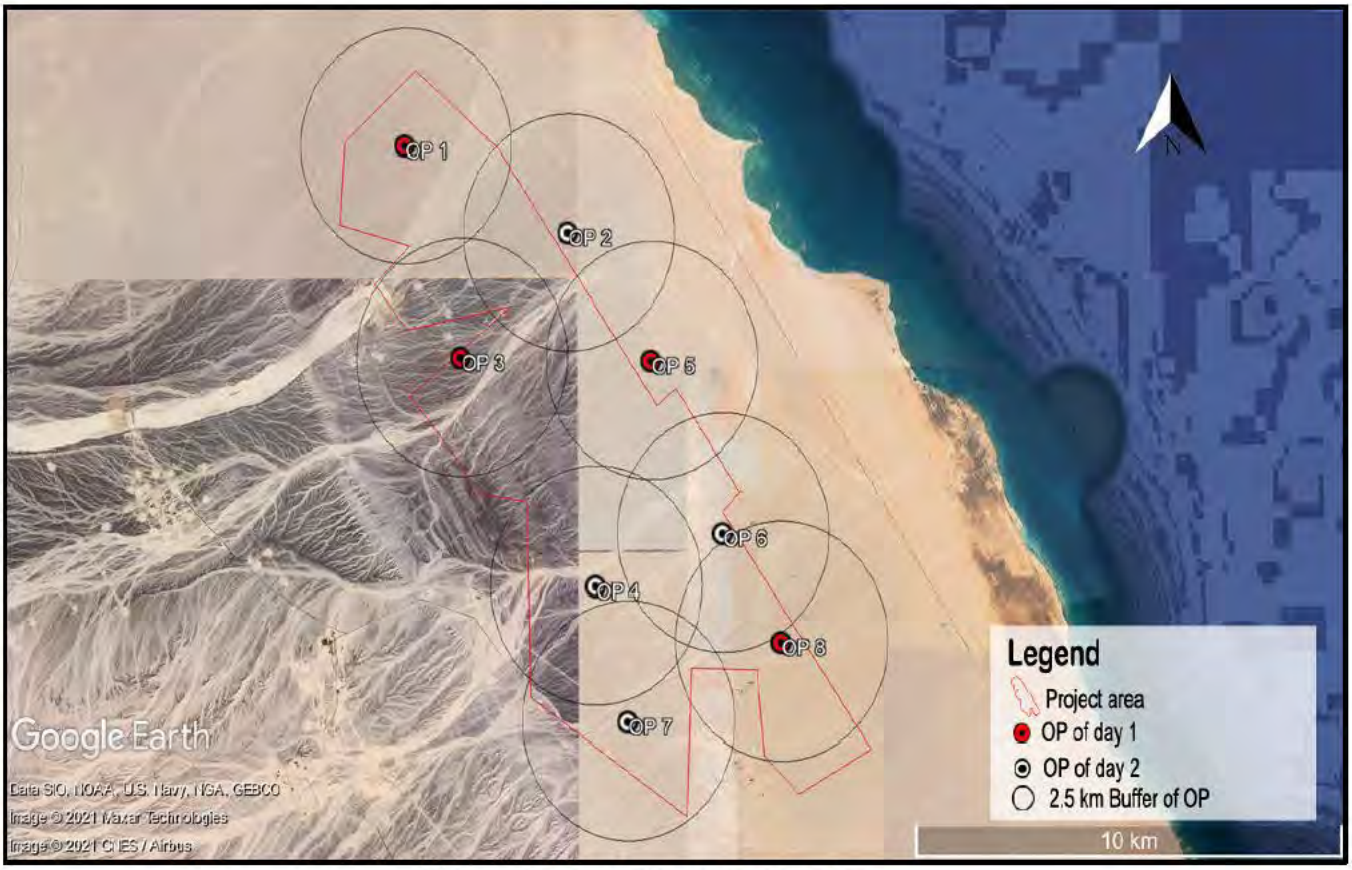


Figure 26: Location of Project VPs

Monitoring Protocol

The field assessment team was composed of 4 qualified observers with adequate previous experience in avifaunal assessments for wind farms. Each VP was covered by a single observer over observation periods covering the predicted peaks of migration, based on previous assessments as outlined in the required guidelines.

Monitoring from VP's was carried out daily following a rotational system to ensure that the 8 VPs are covered regularly, while also covering the various periods of daylight from dawn to sunset. Observation periods from each VP was conducted for a maximum of 4 hours in order to ensure that the quality of monitoring does not get affected by the observers' exhaustion. A minimum of a 1-hour break was provided between each observation period. In total, a maximum of 4 VP were covered every day, where each observation period is covered a minimum of 8 hours per day; 4 hours in the morning followed by a minimum of 1-hour break and 4 hours in the afternoon.

Note: although a 1-hour break is provided between each two observation periods, our approach ensured that this does not affect quality of recording. Therefore, we adopted a system in which the 1-hour break is undertaken through an alternate method between observers (i.e. one observer takes the break for example from 1pm-2pm while the second observer keeps watching, then second observer takes the break while first observer goes back to watching, and so on so forth). This would ensure that the entire daylight hours are covered and continuous monitoring is undertaken from start to finish throughout the day.

The start and end of observation periods will vary depending on the following conditions:

- The season being covered and therefore the duration of daylight hours of the season
- Weather conditions, including visibility
- The records of the previous observation sessions, as this could reflect on the expected bird activity

Data was recorded on spreadsheets forms, as shown below. These spreadsheets are filled on a daily basis. It is important to highlight that, during the data collection, accounting for zero bird count days (days with no records of migrating birds) was taken into account in the datasheets. This parameter can help to better understand the interactions of birds and their response to changes in weather conditions and limiting factors of crossing the GoS, and determine the favourable and unfavourable weather conditions of migration generally or specifically for a certain species.

The recording of observations broadly followed the methods described by Band et al. (2007), which are summarized below.

Observers at VPs position themselves to minimize their effects on bird behavior. A complete circle of 360 degrees is scanned using a combination of naked and 10x binoculars[2].

If a target species is detected, it will be followed until it ceases flying or is lost from view. For each observation of a target species, date collected included the following:

- The time the target species was detected
- The flight duration of the target 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 and to be at least divided into four classes:
  - Band 1= Turbine from the bottom to the tip height (0-120 m)

[2] Note that this deviates from the method described in Band (2007) which recommends a viewing arc for a single observer of 180 degrees or less

- Band 2= above turbine height (120-150 m)
- Band 3= 150-200 m
- Band 4= above 200m

Note: for the spring season of 2020 and 2021 and the autumn season of 2020 a height band of 0-120m and > 120m were considered, while for the spring season 2022 and autumn season of 2021 all 4 height bands identified above were considered. The reason for this is that during spring season of 2020 and 2021 and the autumn season of 2020 the turbine tip height that was considered was 120m. However, at a later stage this was changed to a higher height and thus new additional height bands were added.

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, was also recommended. Observers constantly scan, using a combination of naked-eye and binoculars, the whole covered buffer of 360 degrees around, from each OP until a target species is detected.

Weather conditions (wind intensity and direction, visibility, cloud cover and precipitation) were recorded at start time of monitoring activities, then at every subsequent hour and at the end time of monitoring activities.

Ideally, observations should be made in a range of wind conditions. This is particularly important in the case of soaring birds when wind direction and strength is likely to affect migration behaviour and flight routes. It is not necessary to record these conditions by all observers and the team leader can identify one of the observers to record.

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

As shown in the data sheet forms on the next page, it was proposed to have one sheet for targeted species (priority species; MSBs) and another sheet for accidental observations of passerines and non-targeted species.

Basic Data Units

- Date (year/month/day)
- Vantage point (VP1 to VP8)
- Observer name (initials)
- Time at the start of the observation period
- Time at the end of the observation period
- Observation time in hours and minutes format (00: 00)
- Species - every bird species will be recorded using a code consisting of the first three letters of the two parts of the binominal (genus and species) scientific names (e.g., Aquila nipalensis is Aqu nip). For unidentified birds it will be referred to the nearest identifiable systematic position, e. g. two close species Cir aer/pyg, or to genus level, e.g., Aqu sp., if not possible to the closest group e. g. Unidentified Raptor (UR). The survey area is being scanned constantly until a target MSB species is detected in flight.
- Number – number of birds of the same species (mixed species flocks should have one line and one key number for each species)
- Sex and Age - Sex: M/F; Age: Juvenile (J), Immature (I), Adult (A).
- Height classes as discussed earlier

- Origin – cardinal/intercardinal direction of the point where the bird was first detected in relation to the observer.
- Direction – cardinal/intercardinal main direction of the bird(s)'s trajectory
- Other VPs – indication of other VPs know to have also recorded the bird(s)
- Relevant behaviour of flying – Soaring, Gliding, Active flying
- Observation numbers
- Observation distance
- Recorded Inside or Outside the project site
- Map of recorded birds within the wind farm area, trajectories will be drawn.
- a column identifies the number of the map sheet in which the movement was drawn
- Any other noteworthy remarks will be noted.
- All units will be collected for all recorded targeted species inside and outside the project area.
- None targeted species will be recorded in a separate accidental datasheet, and mainly basic data of observation time, species, number of individuals, flying direction, etc. will be recorded. No trajectories will be mapped.

Weather Data

- This sheet will only be filled by one of the senior observers assigned by the Team Leader.
- The following weather variables will be recorded hourly.
- Cloud cover (%)
- Visibility (km)- following predefined categories: 1 = 2.5 km, 2 = 5 km 3 = 7.5 km, 4 = 10 km
- Temperature (ºC)
- Wind direction (cardinal/intercardinal points)
- Wind speed (Beaufort)
- Precipitation: Yes/No. Heavy (H)/Moderate (M)/Light (L)

Mapping

- Date (Year/month/day)
- Observation Point (1 to 8)
- Observer name
- Targeted species trajectories must be drawn documenting their flight paths over and around the project site
- Each trajectory must be numbered with a key number which will correspond to the key number for that movement in the main targeted species sheet
- Each trajectory will be represented by a line segment ending with an arrow signalling the direction of movement
- Movement ID (key number) should be written at the start of the origin of the line segment.
- If mixed species flocks occur, the same line in the map can be used for both species. The same applies to different movements that follow the same trajectory
- Trajectory numbers must be clearly legible and a new map should be used whenever many trajectories need to be drawn, in order to make the interpretation as clear as possible
- If a flock splits, the sub-flocks must be drawn as separate movements (and identified in the baseline data sheet as such)

Data Sheets

- Refer to figure below

Communication Approach and Protocol

The team in the field were in contact during the reporting period in the field via mobile phones and a "WhatsApp Group". This would ensure immediate communication to follow up on the migrating flocks and individuals over the Project area, and avoid double count of same flocks/individuals, while also ensuring full and accurate perception about the record spatial and temporal aspects.

This is considered crucial given that if there was no communication, if more than one flock of the same species (or a flock later divided into smaller groups) are flying simultaneously in different parts of the Project area, the group may be recorded more than once (double count) in different times, or some of the smaller groups may be missed.

Updates on the daily fieldwork were shared from the onsite activities to the Client through another "WhatsApp Group", supported by photographic documentation when suitable. This is important in normal migration days as well as exceptional situations such as sandstorms and heavy rain to update the Client on the fieldwork implementation status and assure the Client that the work is going smoothly and safely.

However, there were limitations within the approach above as discussed below.

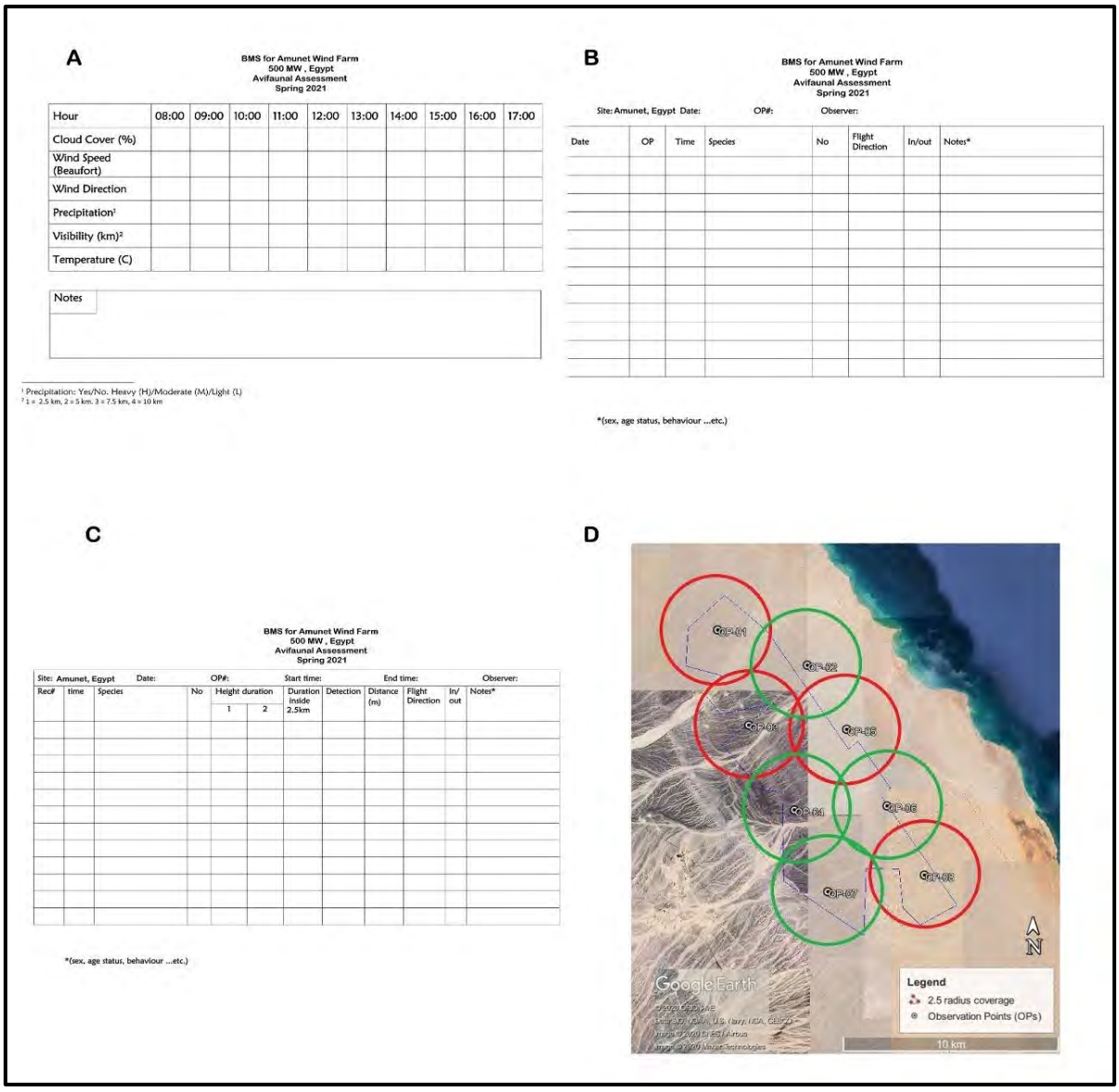


Figure 27: Data Sheets

Issues and Limitations

Survey limitations existed during the bird monitoring undertaken for the Project. Some of the key limitations and issues include the following:

- The survey technique was based on visual observation, which limits the detectability of birds and getting accurate measurements of flight heights and trajectories.
- The wind farm has not yet been constructed. Without a reference, flying heights could entail some degree of error, especially in the very narrow bands at turbine level.
- Poor mobile phones coverage and weak signal in some cases caused communication and coordination issues between field observers, especially in coordinating counts during intense migration times when the network connection is lost.
- The collision fatality assessment presented throughout this report did not take into account the potential collision risk posed by met masts and the existing or planned powerlines in the area.
- It was not possible to always start monitoring at the beginning of the migration season (mainly for spring 2022 and which was due to logistical delays that are beyond the control of the ESIA consultant). As a result, it is likely that the early part of the migration for some species, most importantly Steppe Eagle, may have been missed

7.5.2 Spring 2020, 2021 and 2022

This section presents the baseline monitoring results for the spring seasons.

Monitoring/Sampling effort

The wind farm was monitored every day during the migratory seasons. The start and end time of daily monitoring were adjusted according to length of daylight and temperature, in order to provide adequate sampling of the whole migration season. The monitoring dates are presented in the table below, while the table that follows presents the total monitoring hours. However, as noted earlier, in spring 2022 it was not possible to start monitoring at the beginning of the migration season due to logistical delays that are beyond the control of the ESIA consultant. Table 22: Monitoring Dates

Spring	2020	2021	2022
Dates	20-Feb to 20-May	10-Feb to 19 May	09-Mar to 20 May
Hours	2,551 hr. 09 min	2,894 hr. 12 min	2,157 hr. 49 min

The following initial remarks should be taken into account before proceeding in the detailed analysis presented at a later stage:

- The **monitoring times were different between the same seasons in the three years**: Considering the year 2021 as the representative of the 100% of monitoring effort, in 2020 monitoring was 11.85% lower, and 2022 was 25.47% lower. Reasons for this may be multiple and affected which could include for example the frequency of sandstorms. However, in 2022, the lower effort was due to delay in start of the monitoring as Client had informed the team to proceed in the monitoring after the season had already started by a couple of weeks.

- **Monitoring dates**: Despite in the three seasons the end of monitoring happened by May 20th, the starting times were different. Monitoring started earlier in 2021 (by ten days compared to 2020) or later in 2022 (by 16 days compared to 2020, and twenty-six days compared to 2021). Check reasons mentioned above.

- Because of the **different monitoring times per season/year, the analysis cannot directly compare neither the overall or species-specific counts within and between each season.** Reasons for this is that the different monitoring times may result in different counts. The higher number of monitoring hours increases the chance of observing more birds. In addition, regarding monitoring dates, the lack of monitoring in February 2022, resulted in losing information about early migrant species, as discussed later. Therefore, results must be standardized before any analysis or variations are considered. Taking this into account, a new variable was calculated for the datasets – **the birds /hour rate (number of birds/hours of observation) for each species and year.**

- In any migratory count, either related to wind farms assessments or not, **there is a chance of lack of individual identification of all birds/ group of birds.** Reasons for this may be multiple and defined in the scientific literature. Citing Porter (2006): "*Counting soaring birds and using the results for monitoring purposes is fraught with problems."... "The identification of many species is challenging and requires much training and practice as birds are often at a distance and several species are very similar. Identification of the Aquila eagles (Steppe, Greater Spotted and Lesser Spotted), buzzards and large falcons is especially difficult. Second, the actual counting can be problematic as birds frequently fly over at heights which make them invisible to the naked eye; they can also be in large mixed flocks - thus making both counting and identification difficult.*"

  Thus, it is common to find in all bird monitoring databases several records annotated as "eagle species", "Buzzard sp.", "and falcon", "harrier sp.". **For any analysis these records**

must be excluded, otherwise they introduce biases in the overall results. This includes a total of 1,673 individuals. Although such species could be individuals of priority species but in general it is too risky to assign such numbers to a certain species as a single count as it could impact the overall results.

Preliminary results: monitoring time

During the three spring monitoring seasons 2020-2022, the bird monitoring covered the entire migratory periods between February-May (please note delay in monitoring of spring 2022 as discussed earlier).

The figures below present the distribution of monitoring hours through 2020 to 2022 among the 8 VPs in the spring seasons. As noted, the uneven distribution of the monitoring time each year resulted in different monitoring efforts per VP, and this in turn influences the bird numbers recorded (i.e. higher number of monitoring hours will increase the chance of observing more birds). *This requires the need of working with passing bird rates (birds /hour rate) instead raw bird numbers in the analyses throughout the subsequent sections, unless clearly stated otherwise.*

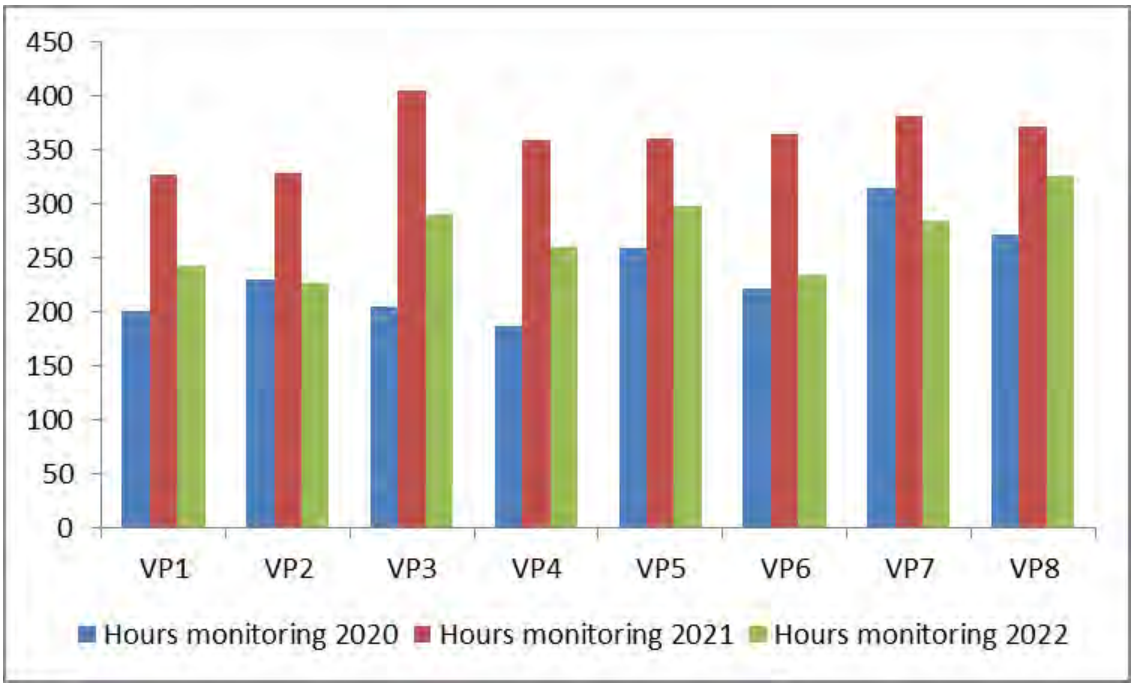


Figure 28: Hours of Monitoring per VP and Year

Landscape and Migratory Soaring Birds (MSBs)

It is well known that MSBs rely on air updrafts. Using QGIS 3.6.3 we developed a Digital Elevation Model (DEM) of the project footprint. Then, we outlined the contour lines, and generated a slope map from the elevation raster.

As we can see, the landscape looks plain (small slope) so MSBs have no specific features which they could use for improving their flight capabilities. There are small darker spots in the figure, especially around the VP3 which corresponds to slopes of low magnitude elevations. Considering the scale of the area compared to these elevated points, the influence they might have for soaring has to be minimal.

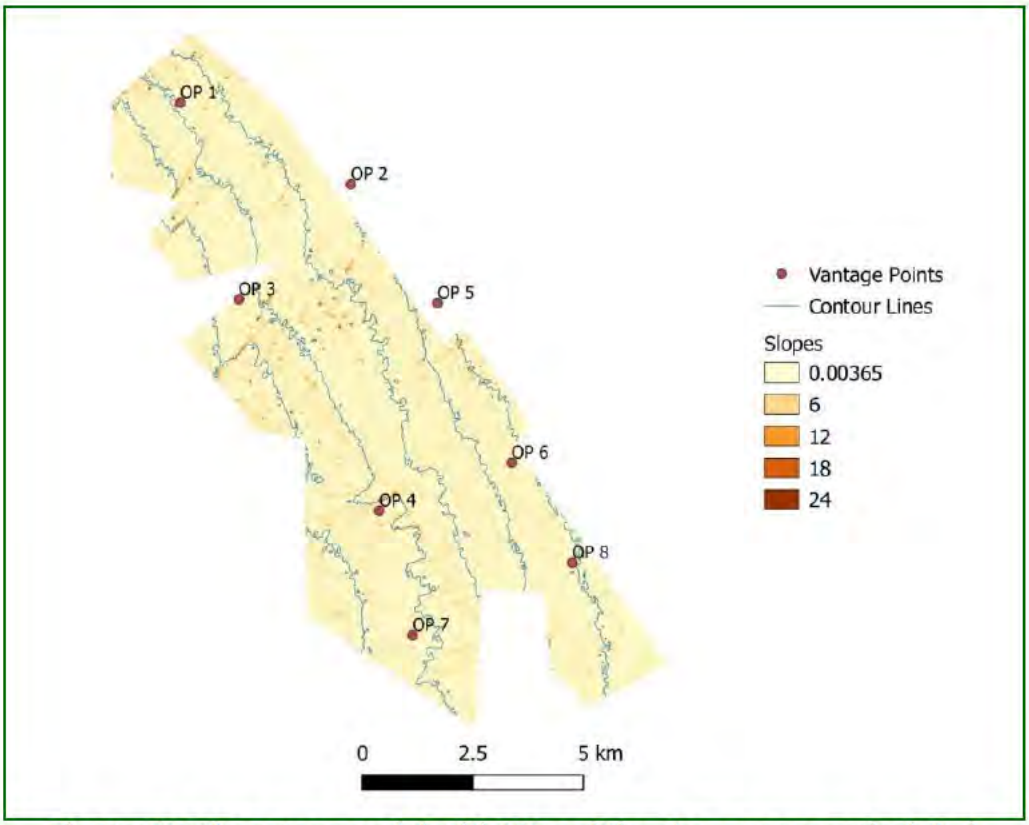


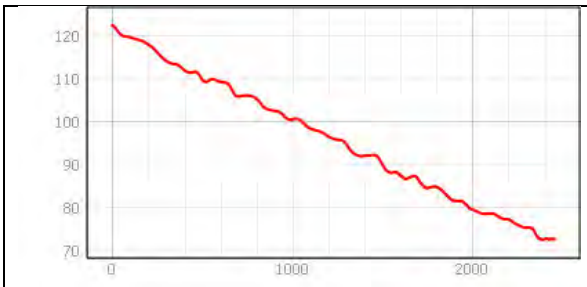
Figure 29: Slope map model with VP and the slope ranges calculated

To further illustrate the landscape, we calculated the percent slope; we divide the difference between the elevations of two points by the distance between them, and then multiply the quotient by 100. The difference in elevation between points is called the *rise*. The distance between the points is called the *run*. Thus, percent slope = (*rise / run*) x 100

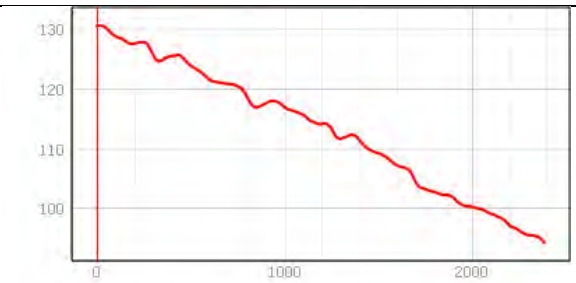
We outlined cross-section profiles at each VP, except for VP2 and VP6 which are set out of the footprint. We drew profiles along a straight-line crossing through any VP, and for a length longer than 1.5 km each. For any figure, the Y-axis represents the altitude above sea level, and the X-axis the distance over which the slope was measured: E.g., At VP1, the highest altitude a.s.l. is reached around 120 m and the lowest one nearly at 70 m. The X-axis ranges from zero to 2,400 m (*run*). So, along this distance, there is a decrease of 120-70 = 50 m in altitude (*rise*).

Table 23: Values of rise and run (in meters), and slope calculations for each VP

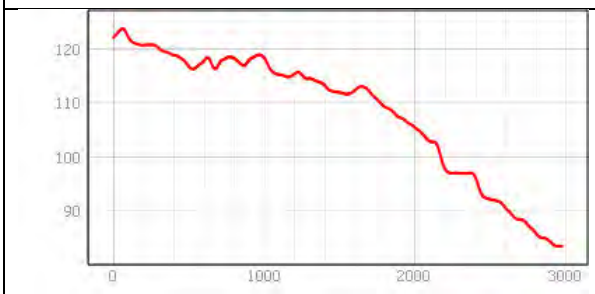
	rise	run	slope
OP1	49.7	2,454	2.02%
OP2	-	-	-
OP3	36.3	2,387	1.52%
OP4	35.4	2,977	1.19%
OP5	-	-	-
OP6	15.0	815	1.85%
OP7	29.4	2,738	1.07%
OP8	19.7	1,339	1.48%



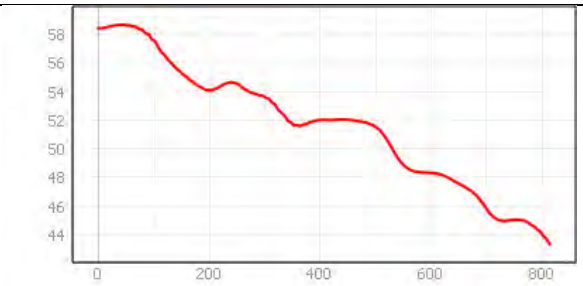
OP1; percent slope = 2.02%



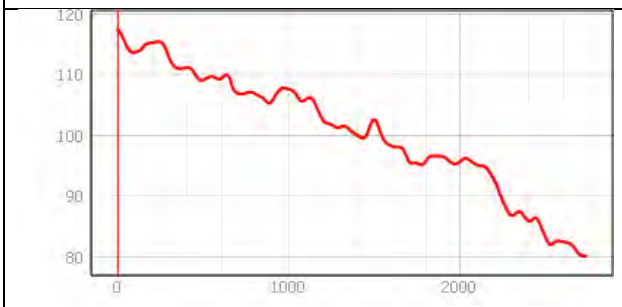
OP3; percent slope = 1.52%



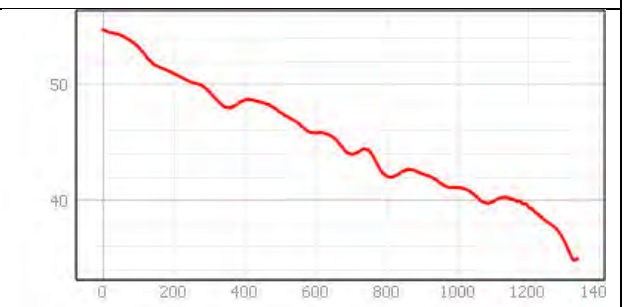
OP4; percent slope = 1.19%



OP6; percent slope= 1.85%



OP7; percent slope = 1.07%



OP8; percent slope= 1.48%

From these calculations it is concluded that the AMUNET project footprint has a very gentle slope/gradient all around. The potential effect for MSBs using specific landscape features is limited but is also equal if it exists. *However, there are no landscape features which could influence the passing rates of every single species.*

General Analysis

In the spring seasons of 2020 to 2022, without accounting for the different monitoring times, decreasing numbers of MSBs have been detected from 2020 (194,353 birds), to 2021 (162,848), and 2022 (98,648), as noted in the table below.

A total of twenty-six (26) species were recorded overall throughout the three monitored seasons. Differences in species recorded between years occurred with the scarcest species, like the Common Crane and Red-footed falcon (recorded in 2021 but not in 2020) and Sooty falcon (recorded in 2020 but not in 2021), or the Lanner Falcon, detected in 2022 but not before. This could be related to several causes which could include that the species does not need to migrate every season through the Project area, or some birds like the falcons remained undetected because of their low numbers or small size compared to e.g., eagles, as noted in the table below which only accounted for 1 bird each.

Seven (7) species accounted for 99% of birds recorded in 2020, comprising the Black Kite, Black and White storks, European Honey Buzzard, Great White Pelican, Steppe Buzzard and

Eagle. In 2021, only five out of these accounted for the 95% (Black Kite, White stork, European Honey Buzzard, Steppe Buzzard and Eagle). In 2022, the number of species was only four (96.4%): the Black Kite, European Honey and Steppe buzzards, and the White Stork.

Nevertheless, the general idea is that considering all the species together, there were general lower numbers in 2021, which were even lower in 2022. However, when comparing the passing rates (birds/hr) it is just the opposite, there are increasing passing rates from 2020 to 2022, as shown in Table 25 below.

The effect of proximate conditions (e.g. weather conditions at the studied site) and ultimate conditions (intrinsic migration patterns or the weather at the sites they come from), affect the numbers and passing rates. For example, the wind preconstruction studies do not include the dates of departure of a bird species from its wintering areas; it neither considers the stopover areas, but just the conditions **AT the site** where the wind farm is planned. With the existing preconstruction studies, moreover in a migration corridor or flyway, the understanding of all these factors and how they do affect the passing of birds over the project is very limited. This would mean that caution should be taken into account when making assumptions which must be supported with robust data analysis.

Five (5) species were classified as Vulnerable (VU) according to the IUCN Red List (Eastern Imperial and Greater Spotted eagles, and the Sooty Falcon) or Endangered (EN) (Egyptian Vulture and the Steppe Eagle). A sixth could be considered of special interest being Near Threatened (NT), the Pallid Harrier.

Table 24: Number of Birds and Records in 2020 and 2021

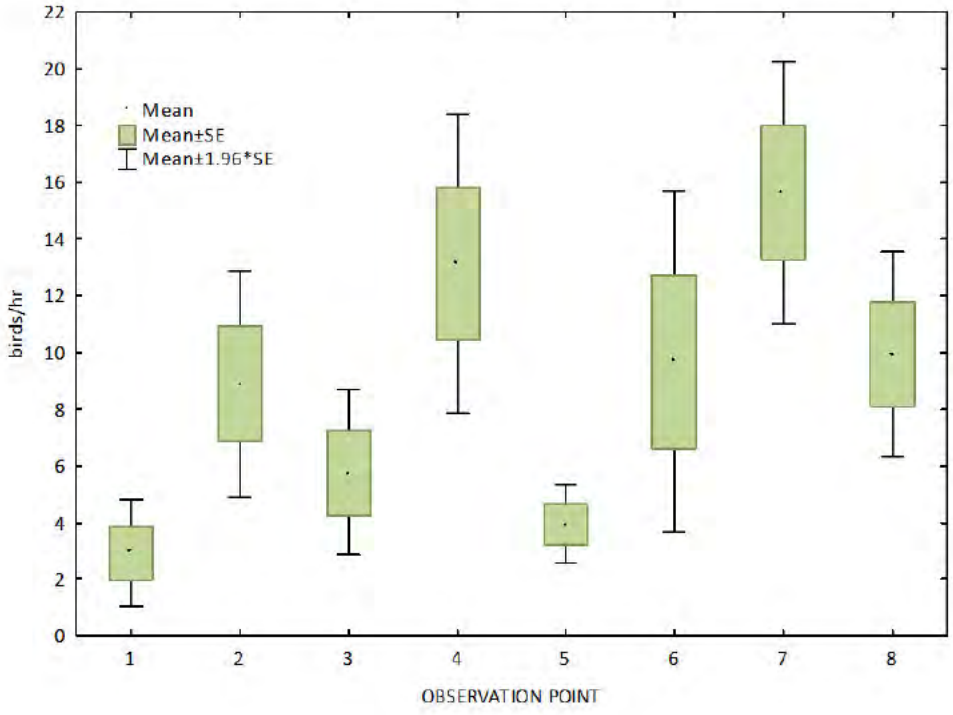
Species	IUCN	Scientific name	Recs 2020	# Birds 2020	Recs 2021	# Birds 2021	Recs 2022	# Birds 2022
Black Kite	LC	*Milvus migrans*	753	6,711	520	4,900	434	7,927
Black Stork	LC	*Ciconia nigra*	69	3,202	40	359	50	552
Booted Eagle	LC	*Aquila pennata*	99	131	37	40	47	50
Common crane	LC	*Grus grus*	0	0	3	85	2	18
Common Kestrel	LC	*Falco tinnunculus*	55	64	52	55	48	49
Eastern Imperial Eagle	VU	*Aquila heliaca*	13	19	4	5	9	9
Egyptian Vulture	EN	*N. percnopterus*	41	58	18	21	32	50
Eurasian Sparrowhawk	LC	*Accipiter nisus*	20	36	22	61	28	43
European Honey Buzzard	LC	*Pernis apivorus*	255	6,728	106	2,280	123	2,985
Griffon Vulture	LC	*Gyps fulvus*	0	0	0	0	1	1
Great White Pelican	LC	*Pelecanus onocrotalus*	27	19,616	9	780	17	1,201
Greater Spotted Eagle	VU	*Clanga clanga*	19	21	4	4	0	0
Lanner Falcon	LC	*Falco biarmicus*	0	0	0	0	3	3
Lesser Spotted Eagle	LC	*Clanga pomarina*	82	173	23	39	69	135
Levant Sparrowhawk	LC	*Accipiter brevipes*	2	198	12	6,060	3	30
Long-legged Buzzard	LC	*Buteo rufinus*	71	149	35	60	42	53
Montagu's Harrier	LC	*Circus pygargus*	5	5	4	4	17	18
Osprey	LC	*Pandion haliaetus*	6	6	2	2	4	4
Pallid Harrier	NT	*Circus macrourus*	21	26	4	5	15	15
Red-footed Falcon	LC	*Falco vespertinus*	0	0	1	1	1	1
Short-toed Snake Eagle	LC	*Circateus gallicus*	265	523	112	154	114	221
Sooty Falcon	VU	*Falco concolor*	1	1	0	0	0	0
Steppe Buzzard	LC	*Buteo vulpinus*	1087	24,482	860	29,711	493	17,347
Steppe Eagle	EN	*Aquila nipalensis*	709	4,581	455	6,791	206	1,067

Western Marsh Harrier	LC	*Circus aeruginosus*	14	16	30	35	31	40
White Stork	LC	*Ciconia ciconia*	177	127,607	150	111,396	131	66,830
TOTALS			**3,791**	**194,353**	**2,503**	**162,848**	**1,924**	**98,648**

Spatial Distribution

The figure below presents the average passing rates (birds/hour) per VP in spring 2020 (first figure), 2021 (second figure), and 2022 (third figure). As noted below, in 2020, variable passing rates were noted across the VPs with VPS 7 being the highest (at around 16 birds/hr), followed by VP 4 (at around 14), and then VP 2, 8 and 6 (at around 9). However, in 2021, rates were nearly consistent with the same rate at all VPs (between 7 and 10).

In 2022 the highest and more variable passing rate was at VP6 compared to all the remaining VPs, reaching values up to 60 birds/hr. An important conclusion from the three years of monitoring is that, overall, **there are no preferred VPs where birds migrate through, and bird migration varies from year to year in an unpredictable way.** Observations of each year cannot be conclusive of the overall migration pattern of birds, but a snapshot of such a specific year.



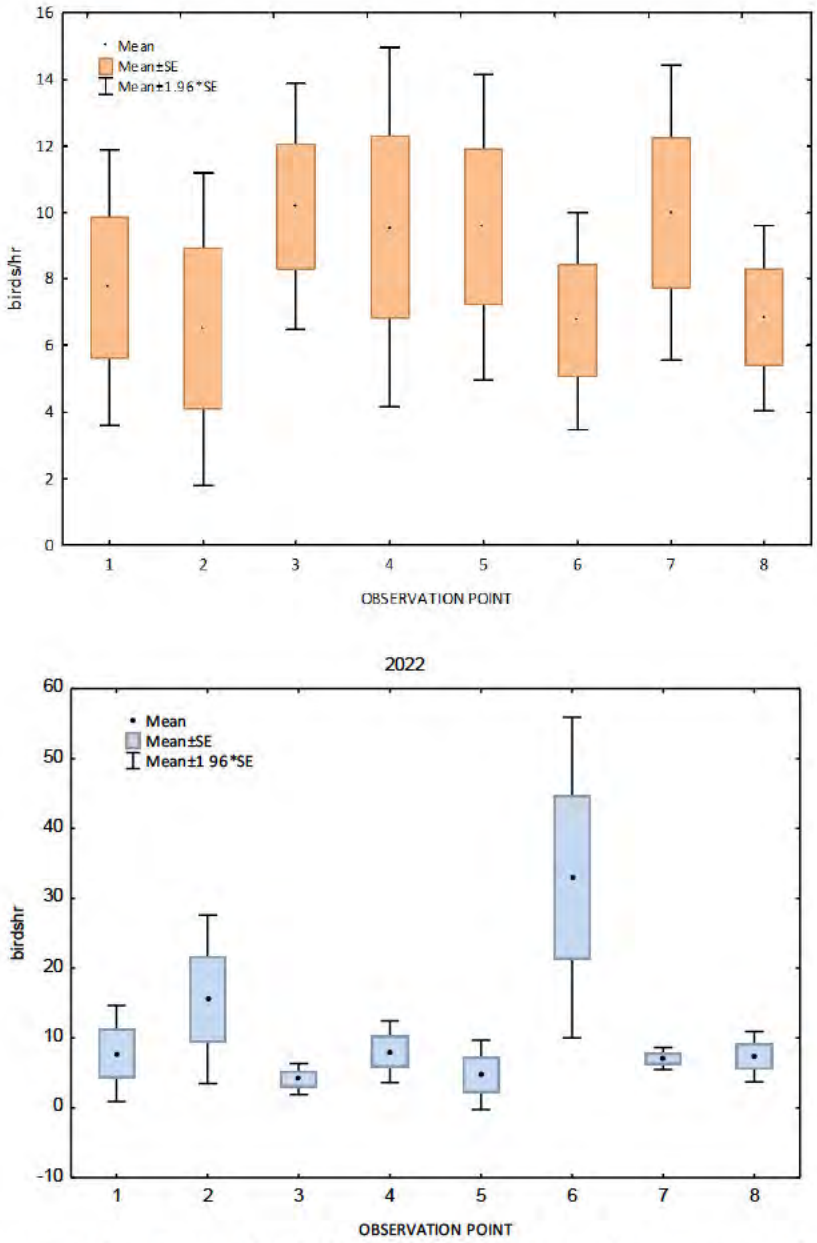


Figure 30: Average Passing Rates (birds/hr) per VP in the spring seasons of 2020, 2021, and 2022

The table below presents the mean passing rates per species, the confidence interval (95%) for the mean, the number of records, and the maximum and minimum passing rates recorded.

As noted below, there are mainly six (6) species forming groups /flocks which result in higher passing rates (highlighted in the table below). Two of them have either a lower detectability rate, like the Levant Sparrowhawk, or despite its size does not pass every season and year, as the Common Crane. The Levant Sparrowhawk, due to its smaller size compared to other MSBs, could remain undetected at large distances and lower numbers; the cranes remain detectable because of the large size, but they are not true obligate soaring birds, so they may use alternate routes within the flyway. The White Stork, Great White Pelican, Steppe, and Honey buzzards, always appear whatever the season it is.

The table also shows the interannual changes of passing rates for any single species like the Levant Sparrowhawk, being quite abundant in 2020, but almost absent in 2021 and 2022, and the same for the Great White Pelican. On the contrary, there are consistent rates for the White Stork, and the Steppe Buzzard.

Table 25: Passing Rates for the Bird Species

Year	Species	Birds/hr. Mean	Confidence +95%	Confidence -95%	Min.	Max.
2020	Black Kite	1.25	1.09	1.40	0.11	22.97
	Black Stork	6.35	2.63	10.08	0.12	83.14
	Booted eagle	0.20	0.16	0.24	0.09	2.00
	Eastern I. eagle	0.24	0.10	0.39	0.09	1.00
	Common crane	-	-	-	-	-
	Egyptian vulture	0.19	0.15	0.23	0.11	0.82
	Eurasian Sparrowhawk	0.24	0.15	0.33	0.11	0.93
	E. Honey Buzzard	3.95	2.67	5.24	0.12	83.33
	G. White Pelican	97.88	38.35	157.40	0.66	638.29
	G. Spotted eagle	0.15	0.13	0.17	0.10	0.19
	Lesser Spotted Eagle	0.30	0.20	0.39	0.12	3.63
	Levant Sparrowhawk	16.32	0.00	143.18	6.33	26.30
	Long-legged Buzzard	0.27	0.22	0.33	0.11	1.55
	Montagu's Harrier	0.15	0.13	0.17	0.13	0.17
	Osprey	0.17	0.13	0.20	0.12	0.21
	Pallid Harrier	0.16	0.12	0.21	0.12	0.60
	Short-toed Snake Eagle	0.27	0.24	0.30	0.10	1.79
	Steppe Buzzard	3.03	2.65	3.41	0.10	70.92
	Steppe Eagle	0.88	0.70	1.06	0.10	56.74
	W. Marsh Harrier	0.16	0.13	0.19	0.12	0.31
	White Stork	104.36	77.70	131.01	0.12	1142.86
2021	Black Kite	1.23	1.05	1.40	0.11	22.43
	Black Stork	1.23	0.71	1.75	0.11	6.41
	Booted eagle	0.15	0.13	0.16	0.11	0.30
	Common crane	3.23	0.00	15.89	0.12	9.11
	Eastern I. Eagle	0.14	0.07	0.21	0.11	0.21
	Egyptian vulture	0.15	0.13	0.18	0.11	0.29
	Eurasian Sparrowhawk	0.47	0.03	0.92	0.12	4.81
	E. Honey Buzzard	3.40	2.29	4.51	0.12	44.44
	G. White Pelican	14.52	0.00	38.14	0.12	95.24
	G. Spotted eagle	0.11	0.10	0.12	0.10	0.12
	Lesser Spotted Eagle	0.20	0.12	0.28	0.10	0.83
	Levant Sparrowhawk	86.31	22.71	149.91	0.15	356.08
	Long-legged Buzzard	0.22	0.13	0.32	0.11	1.79
	Montagu's Harrier	0.16	0.14	0.17	0.15	0.17
	Osprey	0.13	0.00	0.36	0.11	0.15
	Pallid Harrier	0.14	0.05	0.23	0.11	0.23
	Short-toed Snake Eagle	0.19	0.17	0.21	0.10	0.58
	Steppe Buzzard	4.28	3.71	4.85	0.11	87.38
	Steppe Eagle	1.76	1.32	2.19	0.10	45.71
	W. Marsh Harrier	0.16	0.13	0.19	0.10	0.50
	White Stork	95.37	77.01	113.73	0.11	525.00
2022	Black Kite	3.15	2.57	3.73	0.00	54.54
	Black Stork	1.90	1.02	2.77	0.10	15.25
	Booted eagle	0.18	0.14	0.21	0.10	0.81
	Eastern I. eagle	0.16	0.11	0.21	0.10	0.25
	Common crane	2.36	0.00	29.92	0.19	4.53
	Egyptian vulture	0.21	0.15	0.26	0.10	0.69
	Eurasian Sparrowhawk	0.25	0.18	0.32	0.11	0.82
	E. Honey Buzzard	3.38	2.45	4.30	0.10	34.28
	G. White Pelican	8.18	3.23	13.12	0.21	29.29
	G. Spotted eagle	0.19	0.00	0.39	0.08	0.10
	Lesser Spotted Eagle	0.29	0.22	0.35	0.10	1.62
	Levant Sparrowhawk	2.01	0.00	6.40	0.14	3.66
	Long-legged Buzzard	0.17	0.14	0.20	0.10	0.47
	Montagu's Harrier	0.17	0.14	0.20	0.10	0.29

	Osprey	0.17	0.03	0.30	0.11	0.29
	Marsh Harrier	0.21	0.17	0.25	0.10	0.58
	Pallid Harrier	0.16	0.13	0.20	0.10	0.28
	Short-toed Snake Eagle	0.29	0.24	0.34	0.10	1.42
	Steppe Buzzard	5.53	4.58	6.48	0.00	103.01
	Steppe Eagle	0.68	0.47	0.89	0.10	18.18
	White Stork	94.18	64.22	124.14	0.11	1200.00

Non-parametric Kruskal-Wallis test

We have seen that overall passing rates per VP show no preference between years, and changes occur from year to year. To understand if the observed significant differences of passing rates per VP additional statistical analysis has been undertaken. For that, the non-parametric Kruskal-Wallis test was performed and the results are provided below for the only species for which enough data exists as to make comparisons. It compares the passing rates (birds per hour) for each species among the 8 VPs for the three years. The table provides the results of the test and the level of significance as per common standards in statistics.

The outcome revealed significant differences for some species in the passing rates among the VPs in all years, but only two species at all springs. This means passing rates were not equal among vantage points each year.

Table 26: Results of the Non-parametric Kruskal-Wallis test

Species	2020	2021	2022
Black Kite	H (7, N= 753) =21.8 **p <0.001**	H (7, N= 520) =23.33 **p <0.01**	H (7, N= 435) =8.59 p=0.28
European H. Buzzard	H (7, N= 255) =28.15 **p < 0.001**	H (7, N= 106) =11.40 p=0.12	n.a.
Great W. Pelican	H (7, N= 27) =4.99 p =0.66	n.a.	n.a.
Western Marsh Harrier	n.a.	H (7, N= 30) =10.53 p =0.16	H (7, N= 31) =8.83 p =0.26
White Stork	H (7, N= 177) =13.25 p =0.06	H (7, N= 150) =11.85 p =0.10	H (7, N= 131) =21.18 **p <0.01**
Short-toed S. eagle	H (7, N= 264) =12.30 p =0.09	H (7, N= 112) =28.33 **p <0.01**	H (7, N= 114) =10.38 p =0.16
Steppe Eagle	H (7, N= 709) =32.74 **p<0.001**	H (7, N= 455) =23.19 p **<0.01**	H (7, N= 206) =23.36 **p < 0.01**
Lesser S. eagle	H (7, N= 82) =9.38 p p=0.22	n.a.	n.a.
Steppe Buzzard	H (7, N= 1087) =33.86 **p<0.001**	H (7, N= 860) =23.65 **p <0.01**	H (7, N= 494) =44.87 **p < 0.01**
Long-legged Buzzard	H (7, N= 71) =7.80 p=0.35	H (7, N= 35) =2.59 p p=0.92	H (7, N= 42) =8.36 p =0.30
Greater S. Eagle	H (7, N= 19) =11.01 p =0.13	n.a.	n.a.
Black Stork	H (7, N= 69) =4.24 p =0.75	n.a.	n.a.
Egyptian vulture	H (7, N= 41) =13.78 p =0.06	n.a.	n.a.
Booted Eagle	H (7, N= 99) =9.72 p =0.20	H (7, N= 37) =17.36 p **p<0.05**	H (7, N= 47) =5.22 p =0.63
Eastern I. eagle	n.a.	n.a.	n.a.
Levant Sparrowhawk	n.a.	n.a.	n.a.
Common crane	-	n.a.	n.a.

There were four, five, and three species showing significant differences in the passing rates among the VPs in either 2020, 2021, and 2022 and only two had such differences in all seasons

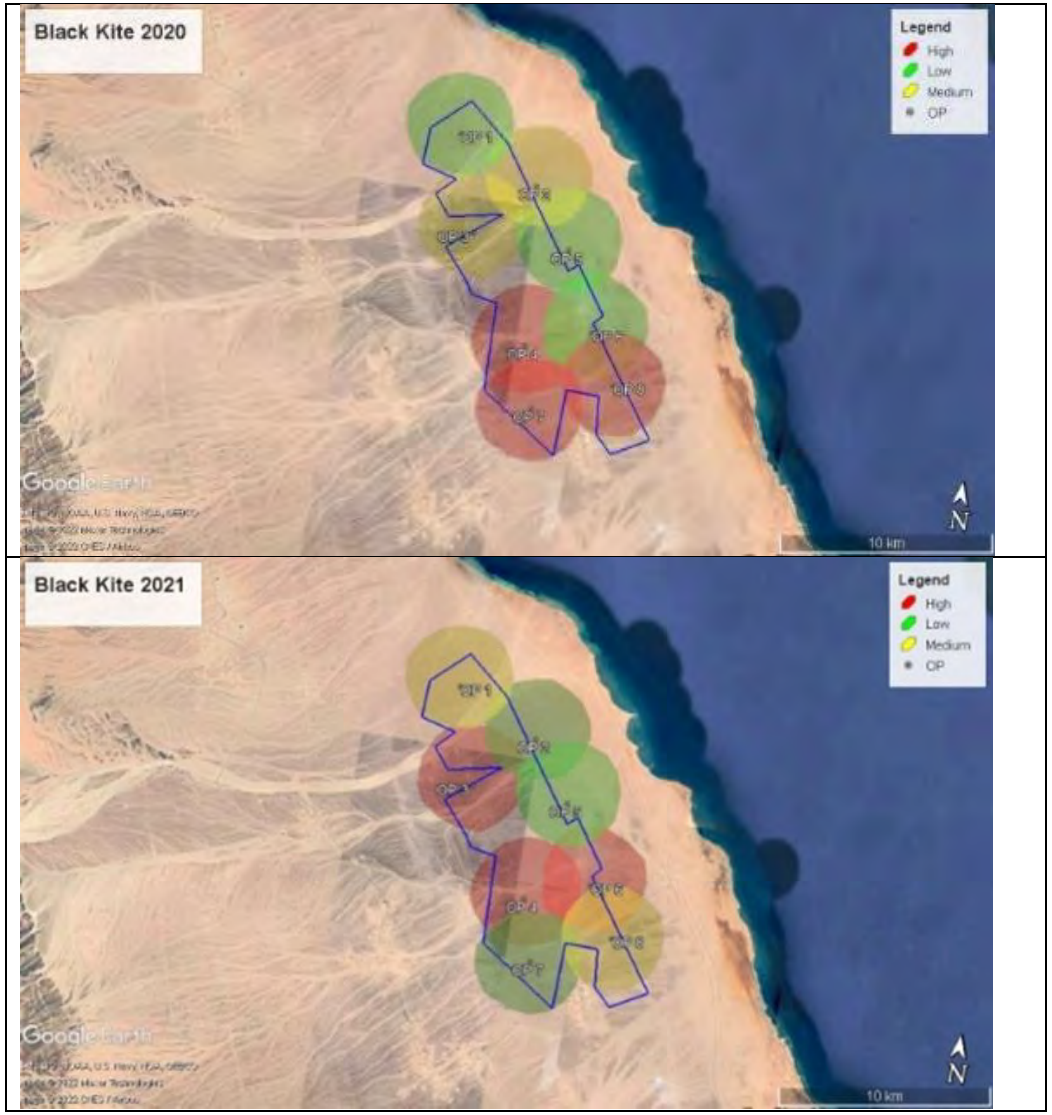
(Steppe Eagle and Steppe Buzzard). The fact that the VPs with higher /lower passing rates were also different between seasons (figures 31 to 36) indicates these species did not pass through the same sites at higher rates during the three years. Reasons for these variations may be related to multiple factors (weather variables like wind speed and direction) which force birds to use one area and not the other.

On the other side, the longer the monitoring, the greater differences detected among years supporting the idea of not considering one single year for taking conclusions about the bird behaviour in the project.

For those species with irregular passes and low numbers there were no chance of analyses because the samples were very small –low numbers recorded- as to perform any kind of analysis (noted as n.a. in the table); and most of the species passing did not show differences/preferences among OPs.

In other words, it means there is NO PREFERENCE to pass over any VP, despite the high numbers recorded at some VPs. The differences are because their numbers from year to year, and not because a true preference. Birds do not need to follow, and they do not followany specific route or flight path within the wind farm. Any turbine micro-siting when designing the layout might be useless, because of the eclectic behaviour the birds exhibit from year to year.

This is further supported with the figures presented below that have been prepared, where the intensity of the passing rates compared between VPs for the different years and some of the highlighted species in table above earlier. As noted again within the following figures, such birds pass randomly with no preferred sites.


Black Kite 2020
Legend
High
Low
Medium
OP
10 km
N
Black Kite 2021
Legend
High
Low
Medium
OP
10 km
N

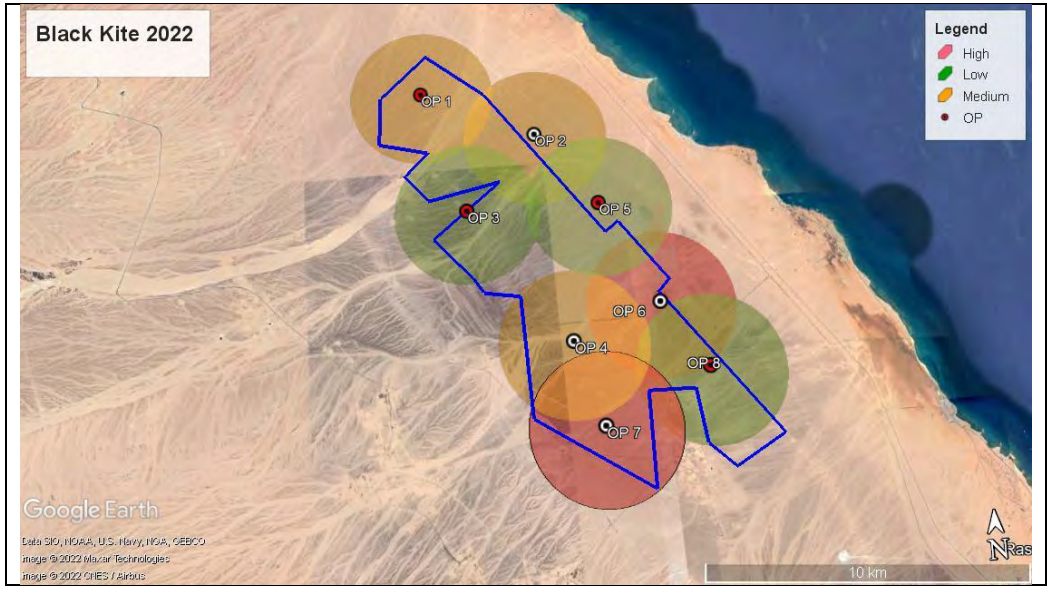
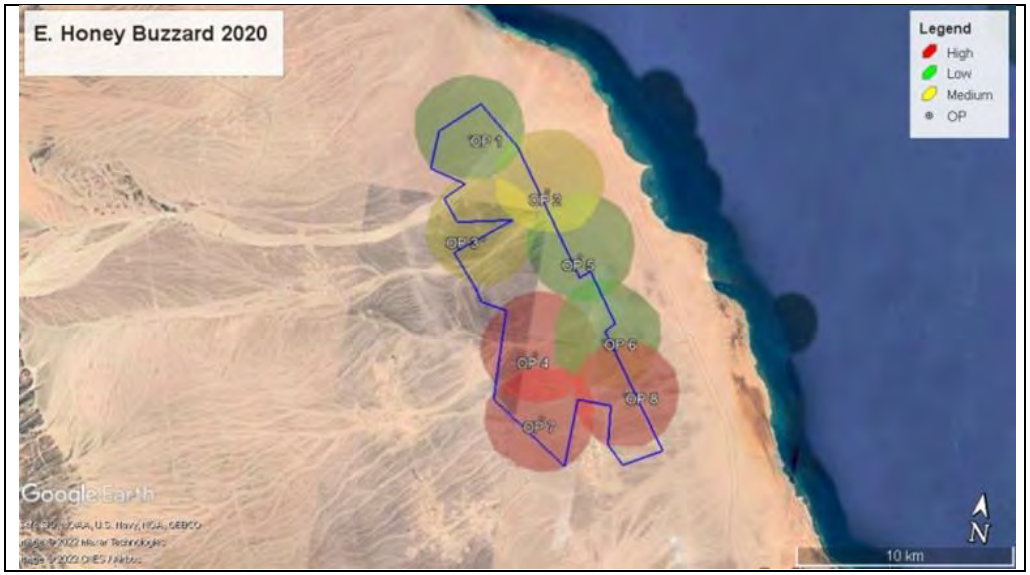


Figure 31: Passing rates for the Black Kite (highest: red, medium: yellow, and green: lowest) per VP and year



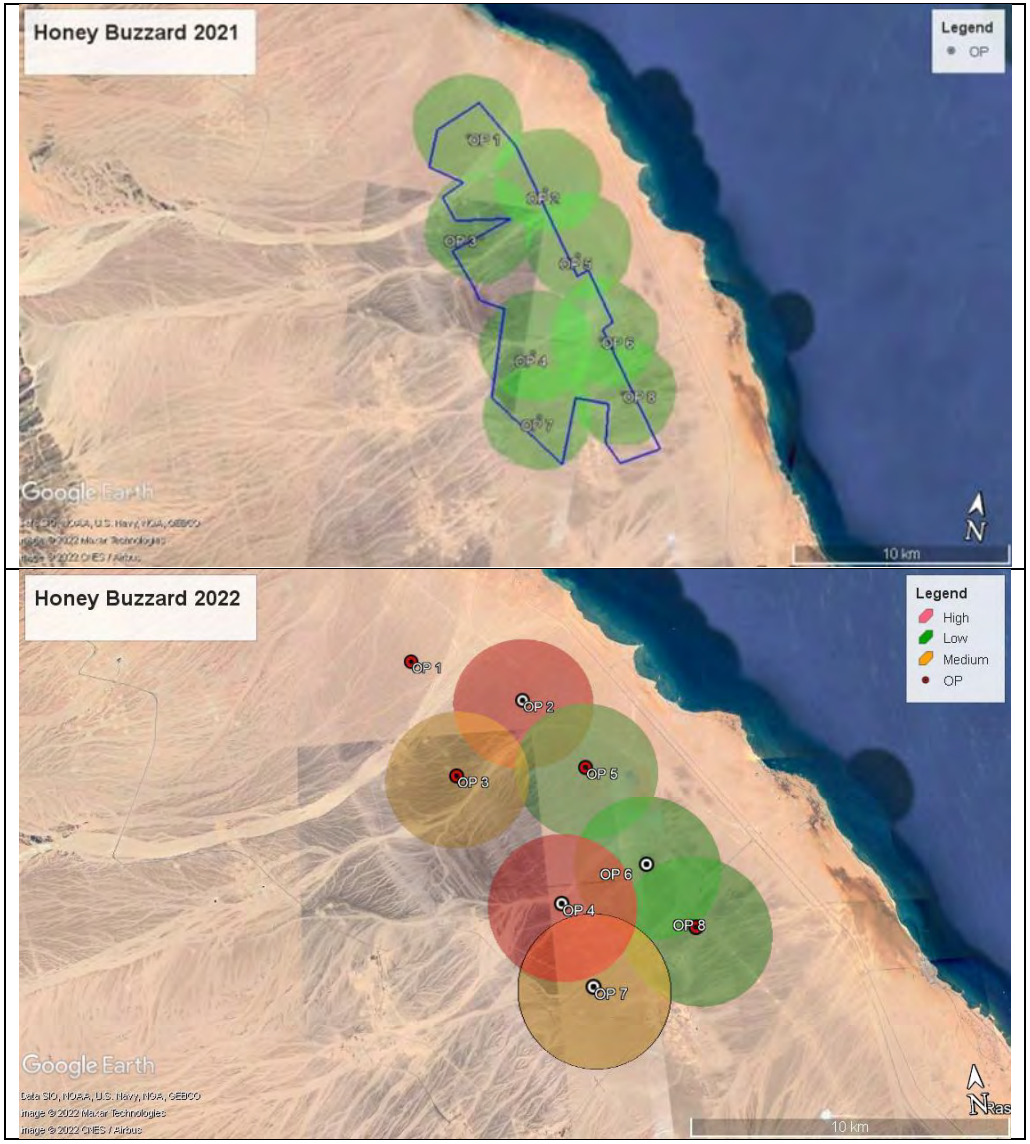
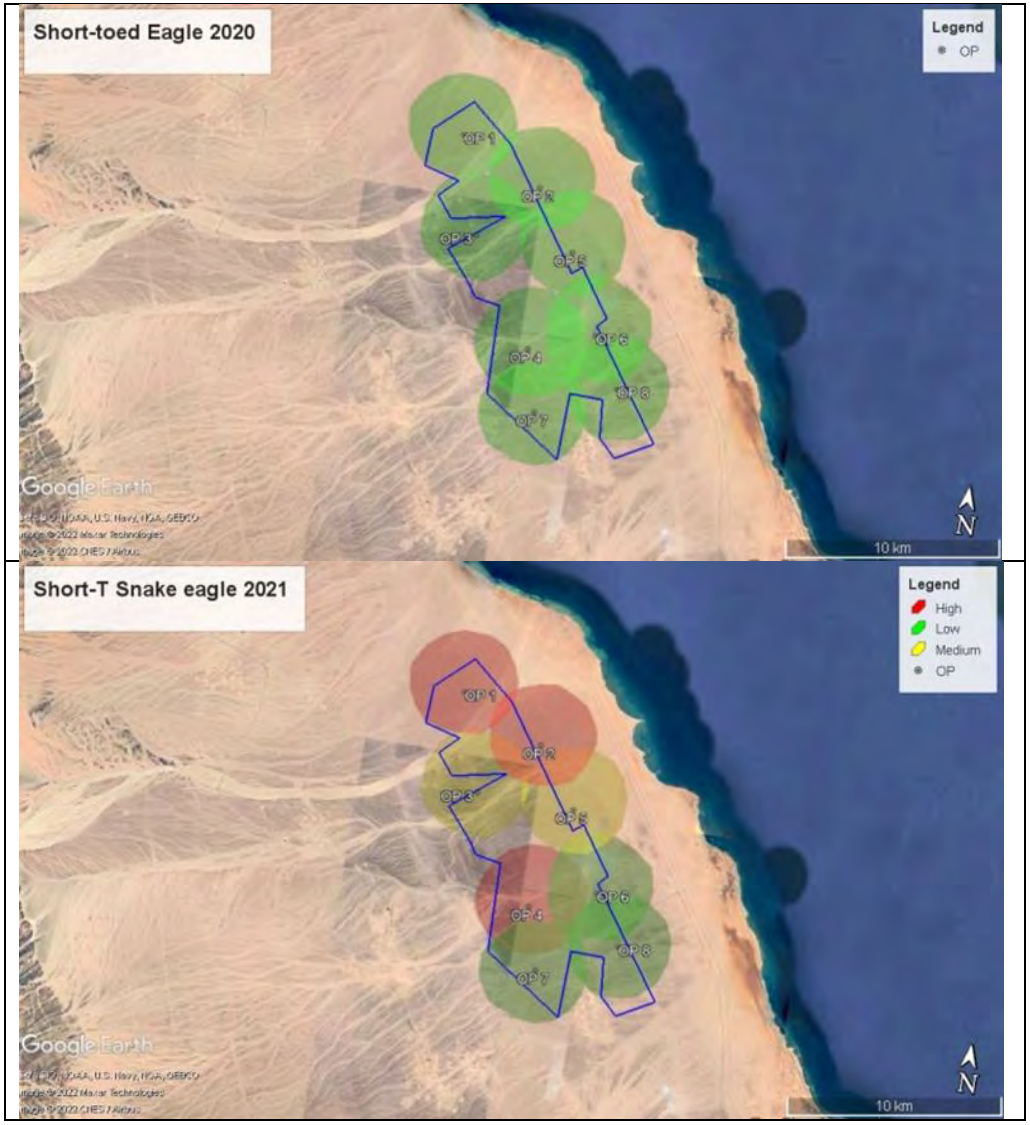


Figure 32: Passing rates for the Honey Buzzard (highest: red, medium: yellow, and green: lowest) per VP and year


Short-toed Eagle 2020
Legend
OP
OP 1
OP 2
OP 3
OP 5
OP 6
OP 4
OP 8
OP 7
Google Earth
10 km
N
Short-T Snake eagle 2021
Legend
High
Low
Medium
OP
OP 1
OP 2
OP 3
OP 5
OP 6
OP 4
OP 8
OP 7
Google Earth
10 km
N

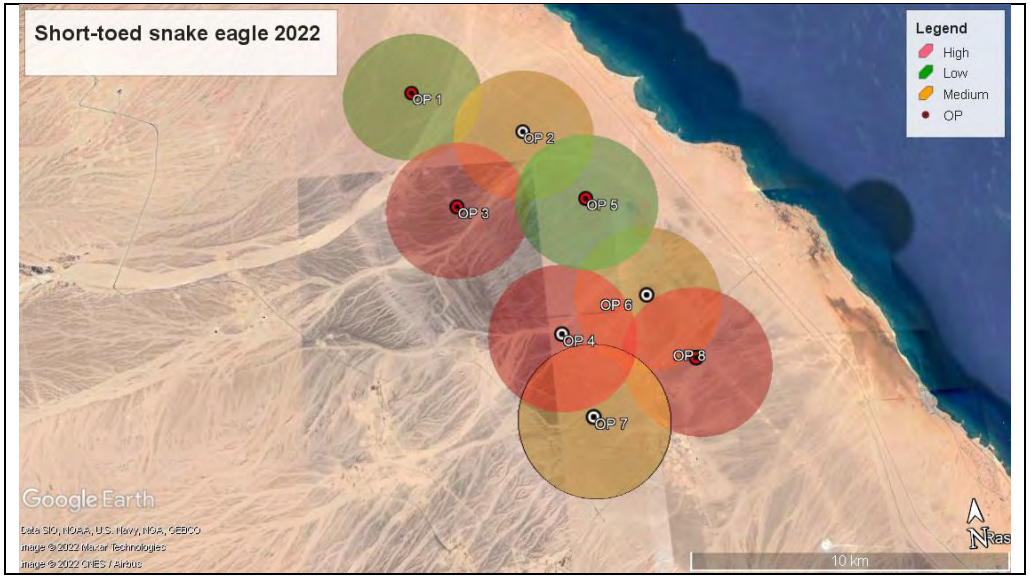
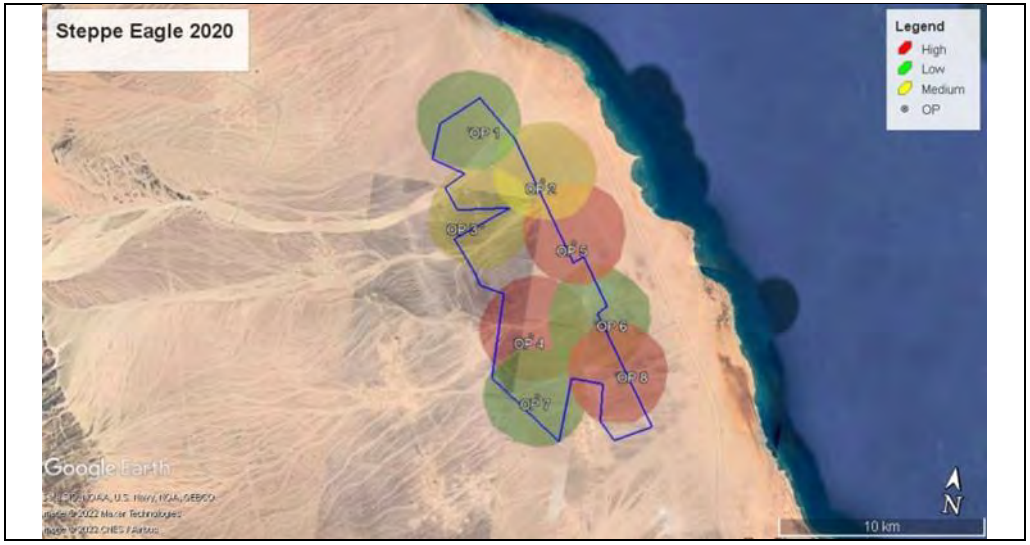


Figure 33: Passing rates for the Short-toed eagle (highest: red, medium: yellow, and green: lowest) per VP and year



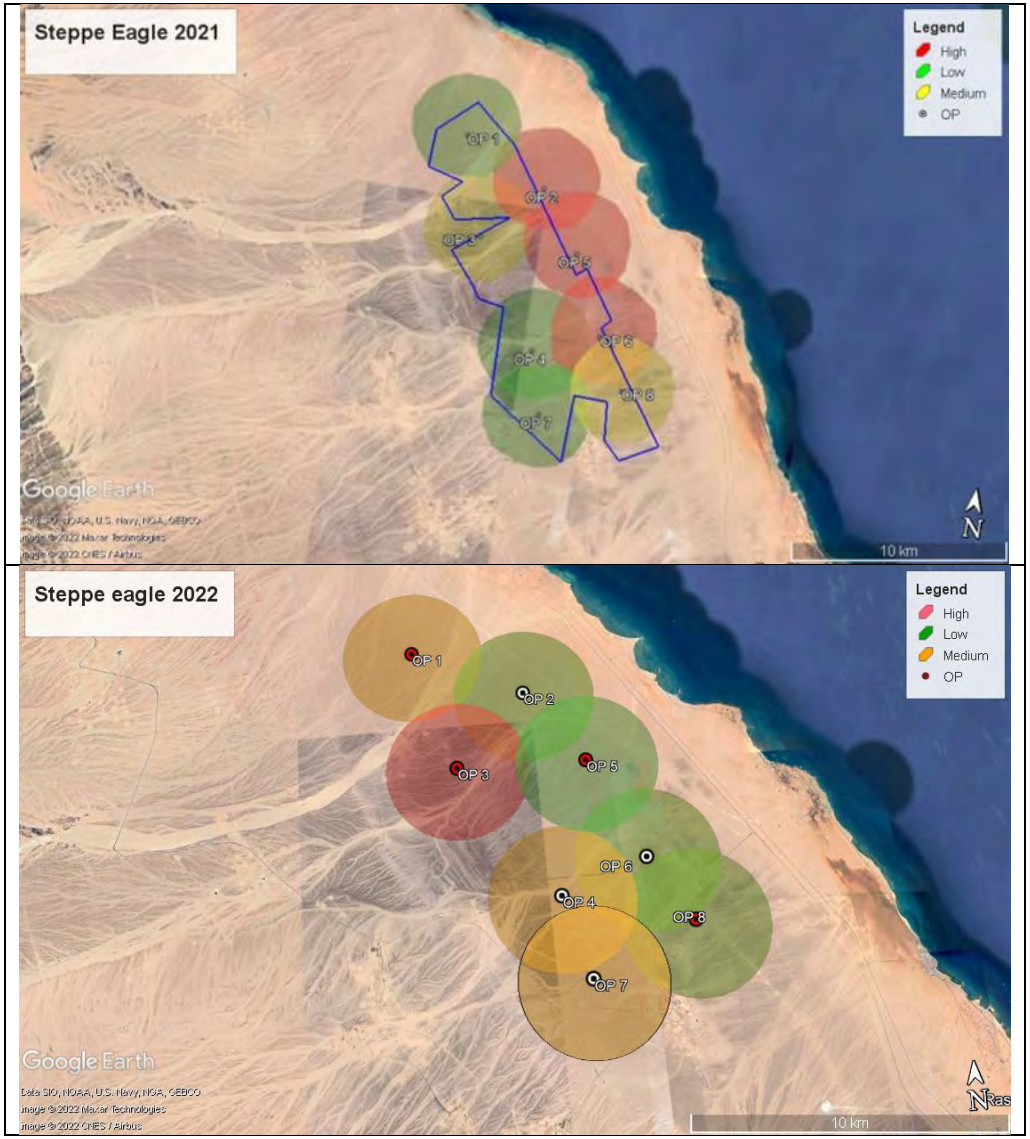
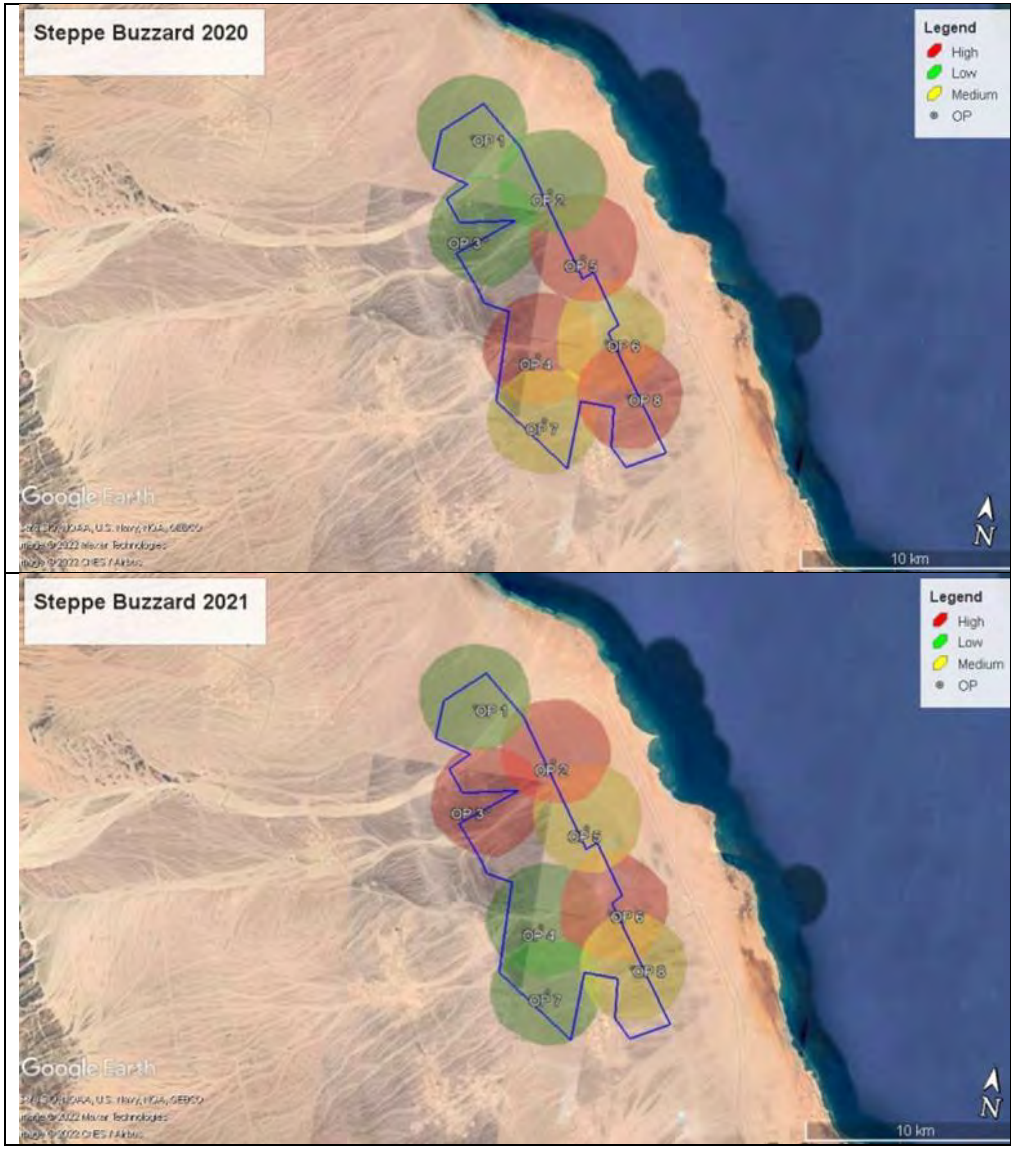


Figure 34: Passing rates for the Steppe eagle (highest: red, medium: yellow, and green: lowest) per VP and year


Steppe Buzzard 2020
Legend
High
Low
Medium
OP
OP 1
OP 2
OP 3
OP 5
OP 6
OP 4
OP 8
OP 7
Google Earth
10 km
N
Steppe Buzzard 2021
Legend
High
Low
Medium
OP
OP 1
OP 2
OP 3
OP 5
OP 6
OP 4
OP 8
OP 7
Google Earth
10 km
N

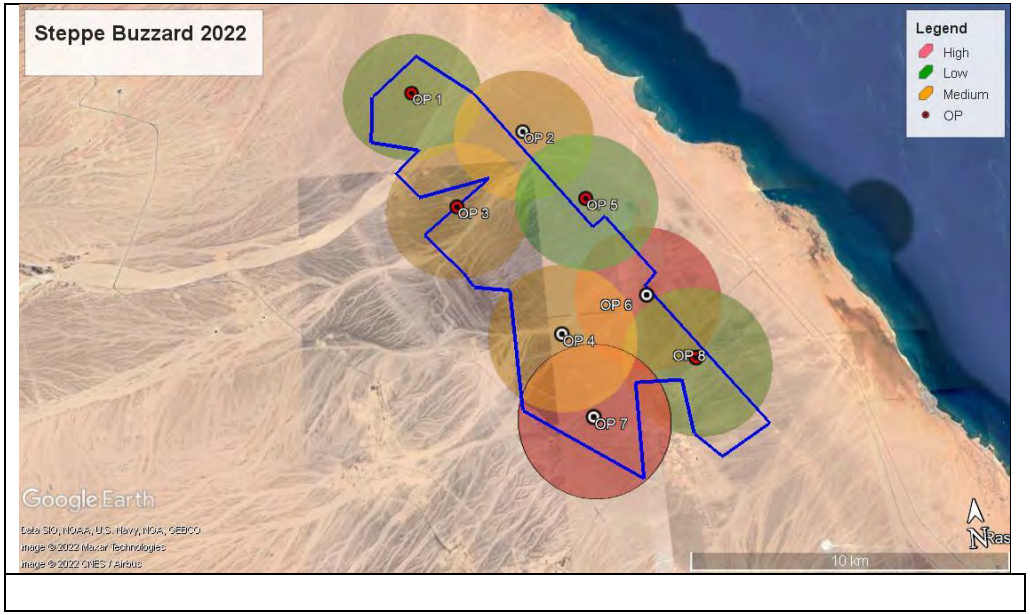
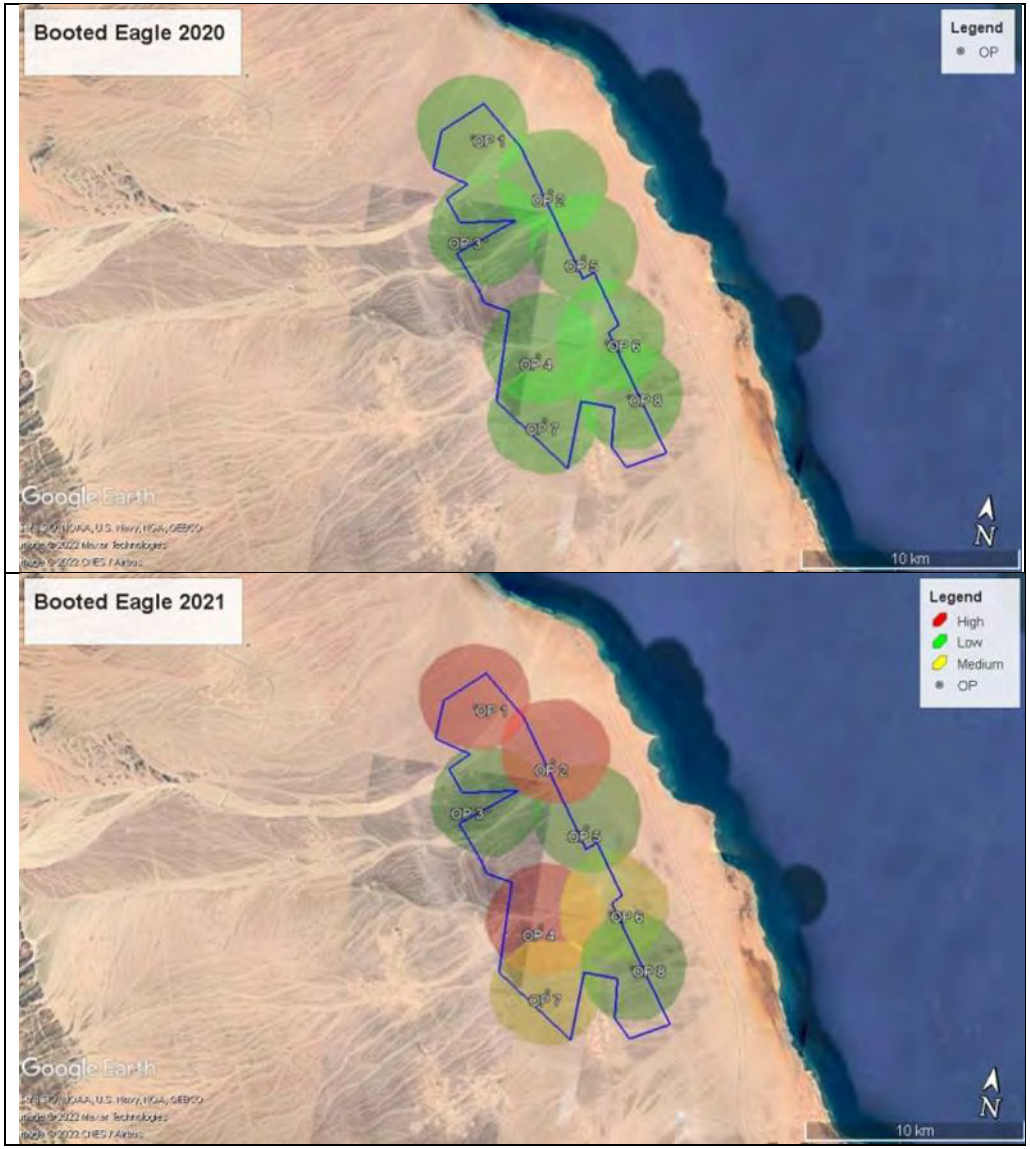


Figure 35: Passing rates for the Steppe Buzzard (highest: red, medium: yellow, and green: lowest) per VP and year


Booted Eagle 2020
Legend
OP
OP 1
OP 2
OP 3
OP 5
OP 6
OP 4
OP 8
OP 7
Google Earth
10 km
N
Booted Eagle 2021
Legend
High
Low
Medium
OP
OP 1
OP 2
OP 3
OP 5
OP 6
OP 4
OP 8
OP 7
Google Earth
10 km
N

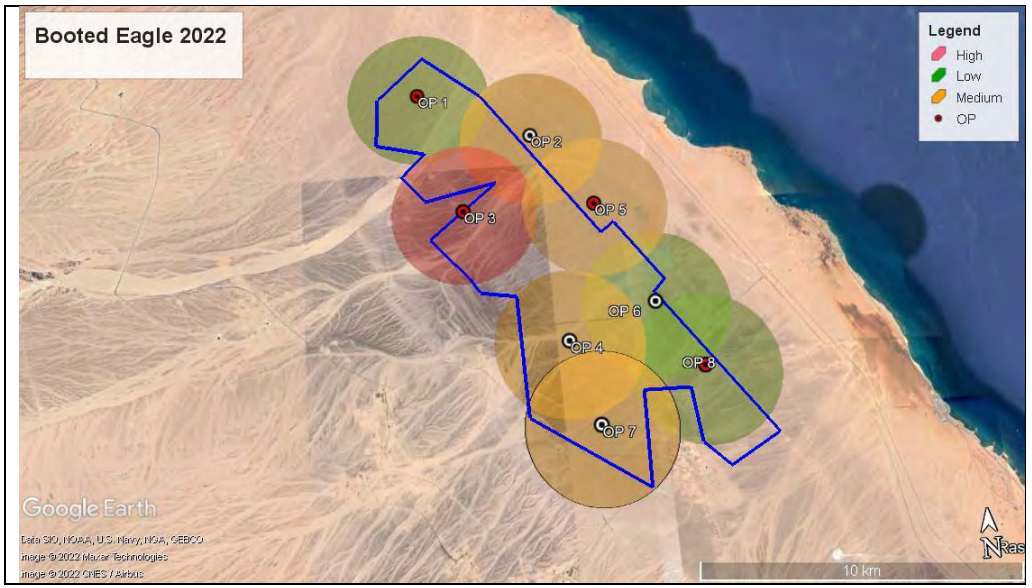


Figure 36: Passing rates for the Booted eagle (highest: red, medium: yellow, and green: lowest) per VP and year

Migration Patterns: Time of Weeks/Months

In the following step, the timing of passage was analysed according to the month and week in the spring season. For each species a single figure showing the passages altogether in 2020, 2021, and 2022 was produced. Bird numbers are generally classified according to the week of the year for a better understanding of the data. The first figure below presents the weeks of the year for the spring monitoring period undertaken which is from mid-February (starting at week 8 of the year) until mid-May (ending at week 21 of the year). Only for 2022 the monitoring started a little bit later, a point which will be discussed when referring to species that migrate within such weeks were monitoring did not occur.

The passage considering the global bird numbers per week/month is presented in the figure below. As noted, there is low migration flux during mid-late February and first two weeks of March. After that, there is a peak around mid-March in 2020 till the end of the month after which another great peak is reached by mid-April (during which the highest numbers are reached), after which number start to decrease gradually until the end of the monitoring season by mid-May. However, in 2021, the migration is split in three up and down patterns with peaks at end of March, early April, and end of April – however those are difficult to explain with the existing data.

Overall, the passing time extends along fourteen (14) weeks however it is important to note that this is the period/time that is established to monitor the spring migration as described in the methodology (for example there are species which migrate even earlier in February like the Short-toed eagle for which numbers could be underestimated).

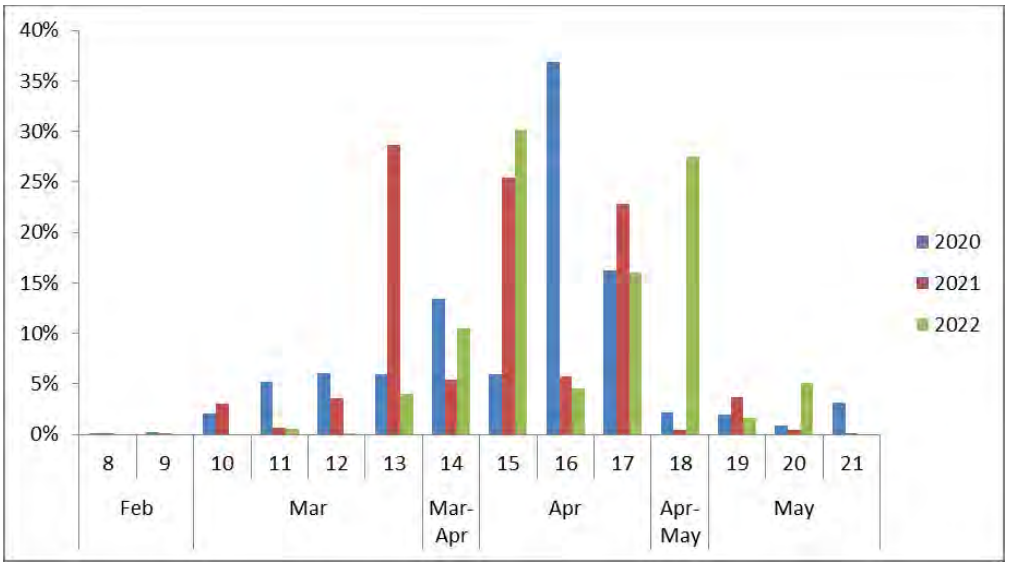


Figure 37: Percentage of Birds per Week and Months in 2020,2021, and 2022

When looking to the overall weekly cumulative data, Figure 38, most of the birds (around 95%) passed by the end of April.

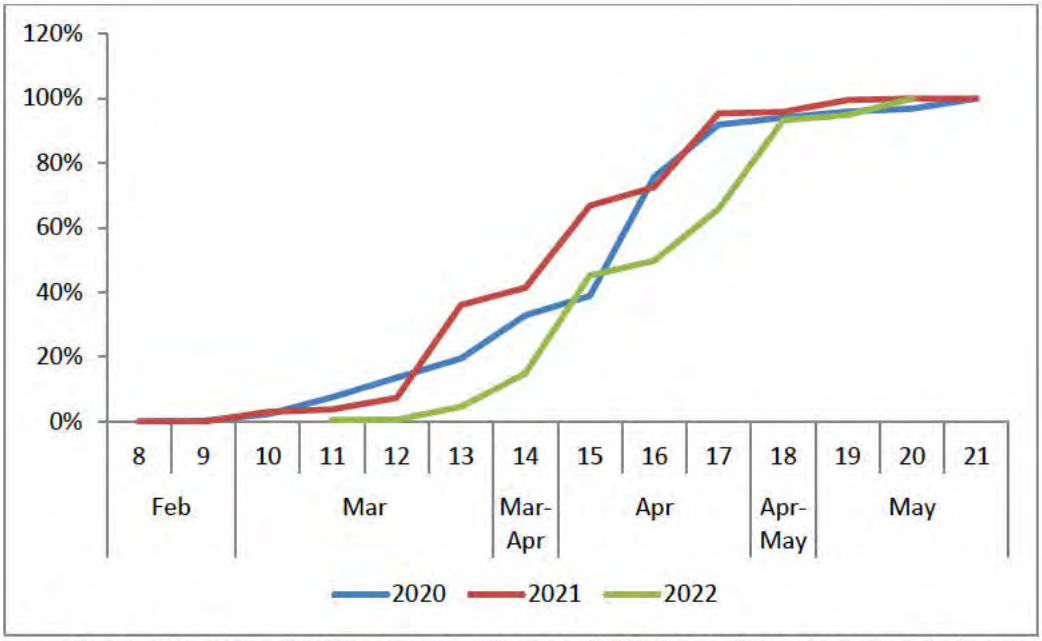


Figure 38: Cumulative curves of overall bird numbers passing between 2020 and 2022

To analyse the migration pattern of the species recorded those species with enough data, observations and individuals were selected. Based on that, the species selected are: Black Kite, Black and White storks, Honey Buzzard, Steppe Buzzard, Great White Pelican, Steppe eagle. This is mainly due to their huge numbers in 2020 which would allow meaningful analysis to be undertaken.

Despite wind energy is a new development in the region, studies on bird migration are not, and have been developed for decades now. In general, **what is clear for such studies is that not all the species migrate at the same time**.

The most comprehensive monitoring of bird migration in the Middle East comes from the work by Shirihai et al. (2000) *"Raptor Migration in the Middle East. A summary of 30 years of field research"*. As the title says, it includes more than thirty years of established monitoring. The authors explain that counts at the Gulf of Suez of migratory birds in both autumn and spring were observed and recorded already in the 80´s and 90`s with specific references there such as Biljsma (1982, 1983), Wimpfheimer et al. (1983), Meininger & Atta (1994), or other counts in the Southern Red Sea Area (Sorensen 1982, Grieve 1996). The authors also provide details on and how migration occurs both in spring and winter along the entire Middle East, from Djibouti to Jordan and Lebanon, from Egypt to Yemen, providing also data from latitudes further north like Bosphorus. The assessment below compared the results with the Shirihai et al. (2000) study in order to understand and compare the migratory patterns recorded within the Project site since it is more focused in the Middle East.

The figure below presents the migration pattern for the Black Kite. This species appeared from March to May (a total of 12 weeks) with the highest numbers occurring between late-March and mid-April. This pattern differs a little bit when compared to what is referenced by Shirihai et al. (2000), as they do not mention so many kites in the second fortnight of April. There the peak was noted in the last week of March and first week of April (as opposed to mid-March and mid-April based on our results) – therefore the project results have recorded a 1 week advance in pattern from what is published by Shirihai et al. (2000) for both 2020 and 2021.

Reasons for this are not clear. However, there might be several causes which could include for example: (i) an advanced timing of migration; (ii) a common pattern extending globally (e.g. due to climate change); or (iii) probably differences in study sites from which they took the data for Shirihai et al. (2000) further north from the wind resource areas in Egypt.

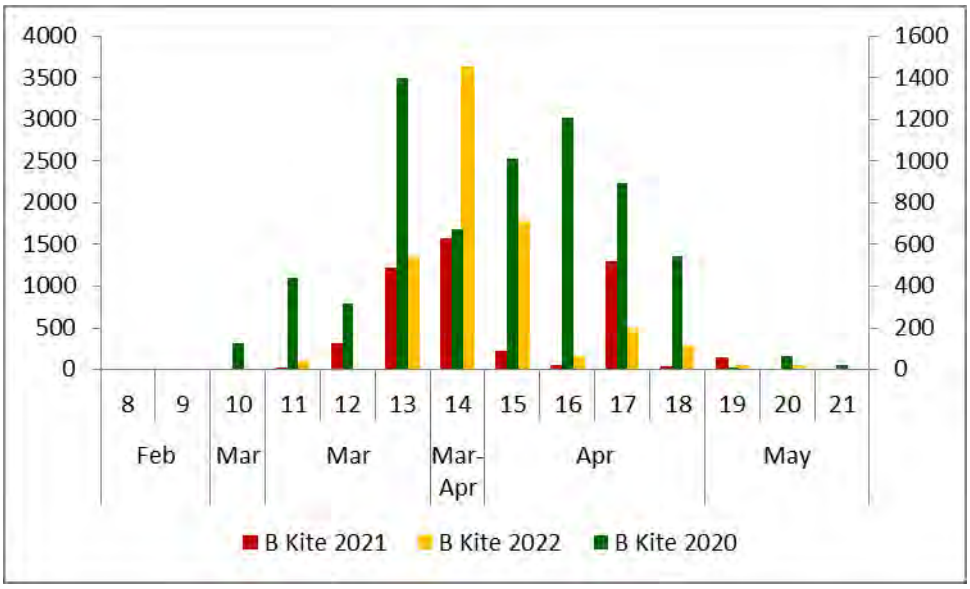


Figure 39: Migration pattern of the Black Kite 2020-2022 (2020 and 2022 left Y-axis, 2021 right Y-axis)

The figure below presents the migration pattern for the Black Stork, an irregular migrant in terms of bird numbers that is not recorded at all times (weeks) and in some years they could pass, while in others they might not.

The Project data showed an extended passage time between mid-March and mid-May with two peaks in late March and the second half of April. For this species we have compared our data with those from Arslangndodu et al.(2011) "Spring migration of the Black Stork, Ciconia nigra, over the Bosphorus, Zoology in the Middle East, 53:1, 7-13". Note: the Shirihai et al. (2000) study is related to raptor migration and given that the Black Stork is not a raptor it cannot be included her.

Despite being further north in the Flyway, the data serves for some comparison, as the Black Stork is a species with not many studies in the region. In the Bosphorus the migration extends from March to end of May. However, it is noteworthy that the peak of the migration is nearly the same by mid-April as recorded within the Project site. There was almost no difference between 2020 and 2021 at the AMUNET Project site as noted below.

In general, this is not a species that migrates in large flocks such as the White Stork, and also shows a more irregular migration compared to that. However, the numbers in 2020 were quite high – five and eight times -compared to 2021 and 2022

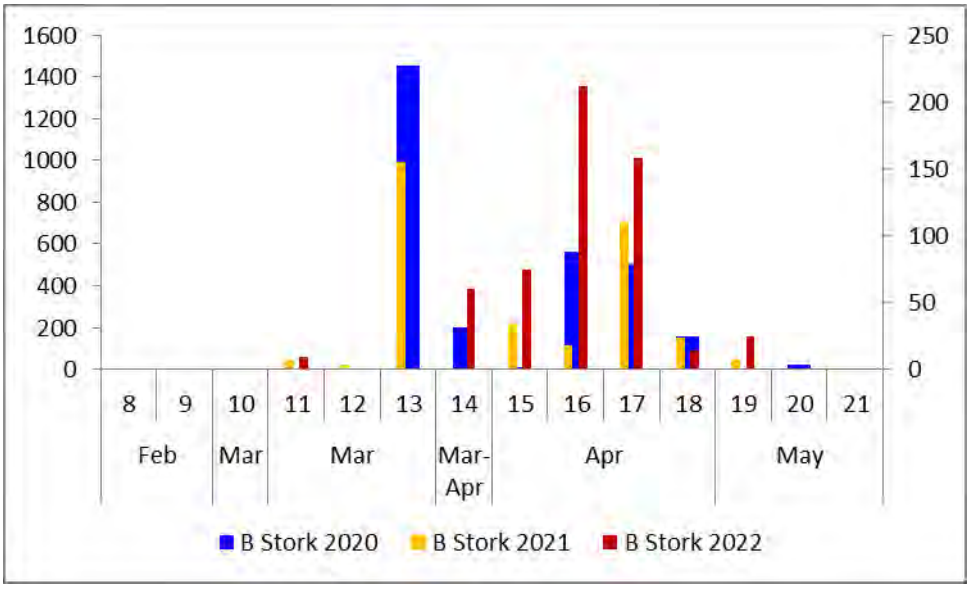


Figure 40: Migration pattern of the Black Stork in 2020-2022 (2020 left axis)

The figure below presents the migration pattern for the European Honey Buzzard. As expected, according to the well-known migratory patterns in the region, the European Honey Buzzard peaks in May, despite an incipient migration in the last week of April. Shirihai et al. (2000) refers to the European Honey Buzzard with a migration period which extends from mid-March to mid-June and recorded the peak between late April and late May. Here the figure slightly differs between 2020 and 2021. In 2020 more birds were recorded and the pattern followed that referenced by Shirihai et al. (2000), whilst in 2021 and 2022 the major counts were in May. As what has occurred with the Black Stork, more birds were recorded in 2020 compared to 2021 and 2022. The figure is a good example of the within season variations in the passing times from year to year.

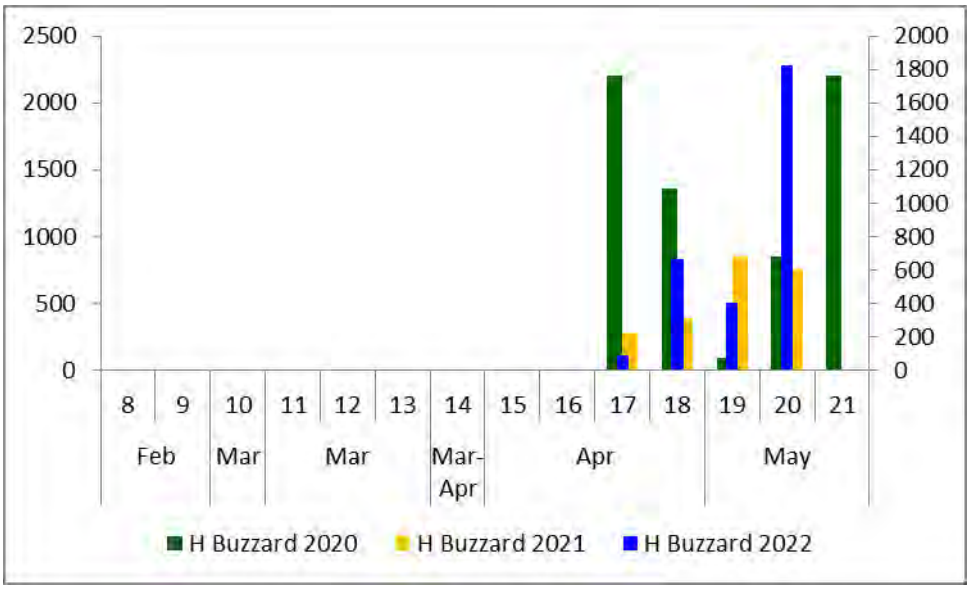


Figure 41: Migration pattern of the Eurasian Honey Buzzard

The next figure below presents the migration pattern for the Steppe Buzzard which extends from mid-March to May. However, large numbers start in early-March, peaks by the mid and end of the month, and continuously decreases till late-April. The migration at the site extends over nine weeks, but counts in 2021 and 2022 were with some delay compared to 2020 by around a week. For this species numbers in both years are rather similar with a lower amount in 2022. Shirihai et al. (2000) mentions that 90% of the total numbers passes between 22 March and 15 April. Our results do not fully match this pattern, starting earlier and finishing later to such times.

Reasons for this are not clear. However, there might be several causes which could include for example: (i) an advanced timing of migration; (ii) a common pattern extending globally (e.g. due to climate change); or (iii) probably differences in study sites from which they took the data for Shirihai et al. (2000) further north from the wind resource areas in Egypt.

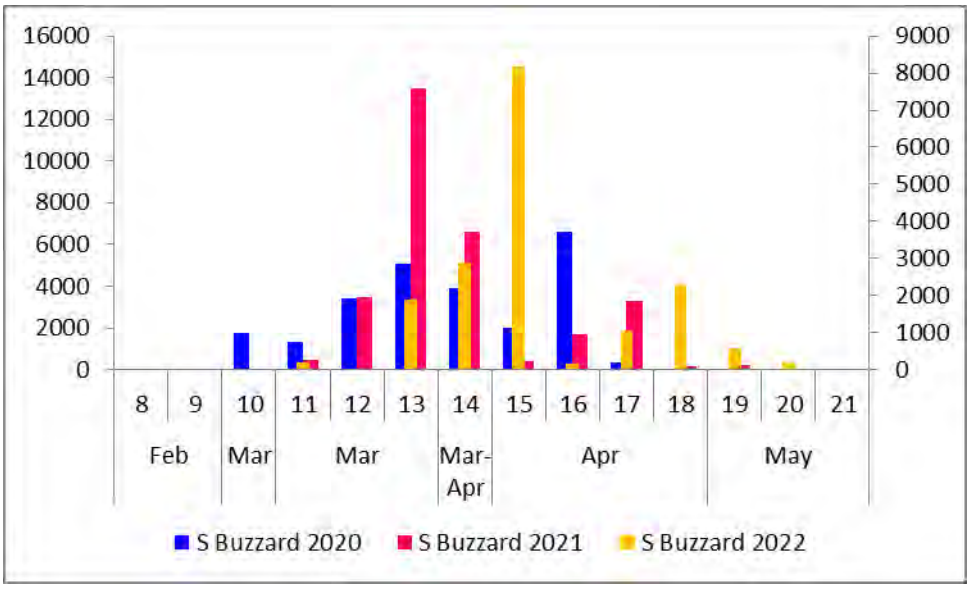


Figure 42: Migration pattern of the Steppe Buzzard in 2020 and 2021 (left axis), and 2022

The figure below presents the migration pattern for the White Stork. This species has been recorded from March (2020) or late March (2021) to May, with peaks in the first half of April. For the study and comparison of the passage of the White Stork we relied on the work by Van den Bossche (2002), who uses data from the 90's for his analyses. Note: the Shirihai et al. (2000) study is related to raptor migration and given that the White Stork is not a raptor it cannot be included her.

The Van den Bossche (2002), study refers to smaller flocks in April and May. The site results show a different pattern as we had big flocks all the time: March (508 birds/flock), April (878 birds), and May (485 storks). However, the pattern of migration has greatly changed over the entire Palearctic, with a proportion of the population becoming sedentary due to feeding from dumpsites along the way. In 2022 the numbers continue to decrease compared to the previous years.

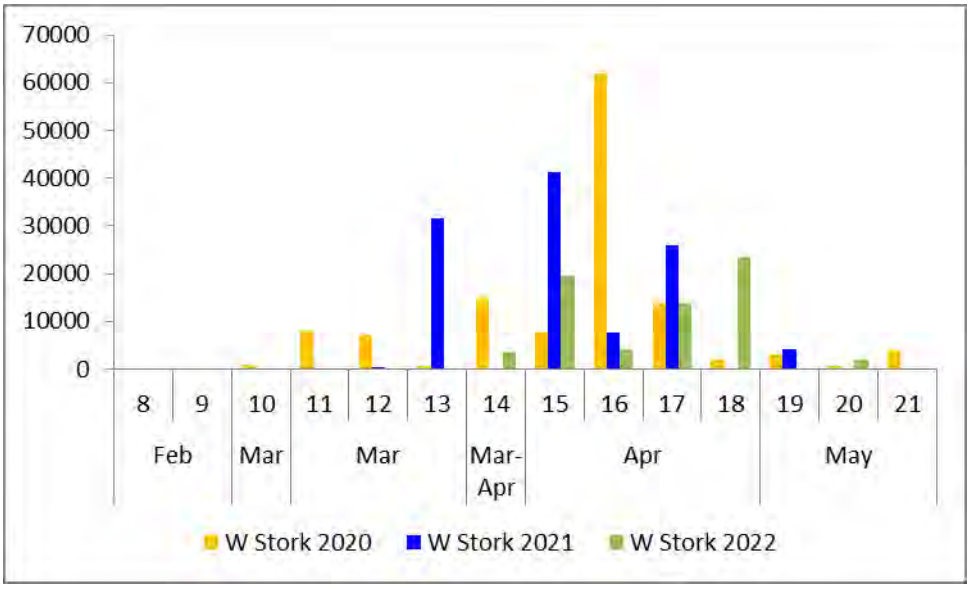


Figure 43: Migration pattern of the White Stork between 2020-2022

The figure below presents the migration pattern for the Steppe Eagle. As noted, this species migrates between mid-February and May (a total of 12 weeks), showing its peak between mid-March and April. Results showed there are "two waves" which were similar in numbers in 2020; in 20201 there was only one peak in mid-April. The Steppe eagle according to Shirihai et al. (2000) has two main periods of migration, late Feb to mid-March with a peak in the second

week of March, and another during third week of March-early April, with a few recorded before February or after May 10th.

In general, the pattern here is similar to Shirihai et al. (2000) with variations in one week related to this pattern. Reasons could be the location from where data have been collected in this study when compared to Shirihai et al. (2000). Variations of just 7 days in 2021, and the lack of more data for further comparisons make us not to think there has been a change in the migratory patterns of the species and just probably a very slight variation of the common trend.

In 2022 the monitoring started later compared to 2020-2021 (see methods). Because of that reason, the numbers recorded are for sure underestimated, as no monitoring occurred for weeks 8 to 10. To estimate the number of steppe eagles which could have migrated during such weeks, we have calculated the proportion of eagles in 2020 and 2021 over the total spring counted population. In 2020, it was a 25.80%, and a 65.79% in 2021. We added such amount to the counts in 2022 as a potential raw number of eagles. These make an estimate ranging from 3,133-3,384 eagles in 2022. This number is lower compared to previous seasons but allowed us to prepare the Figure 44.

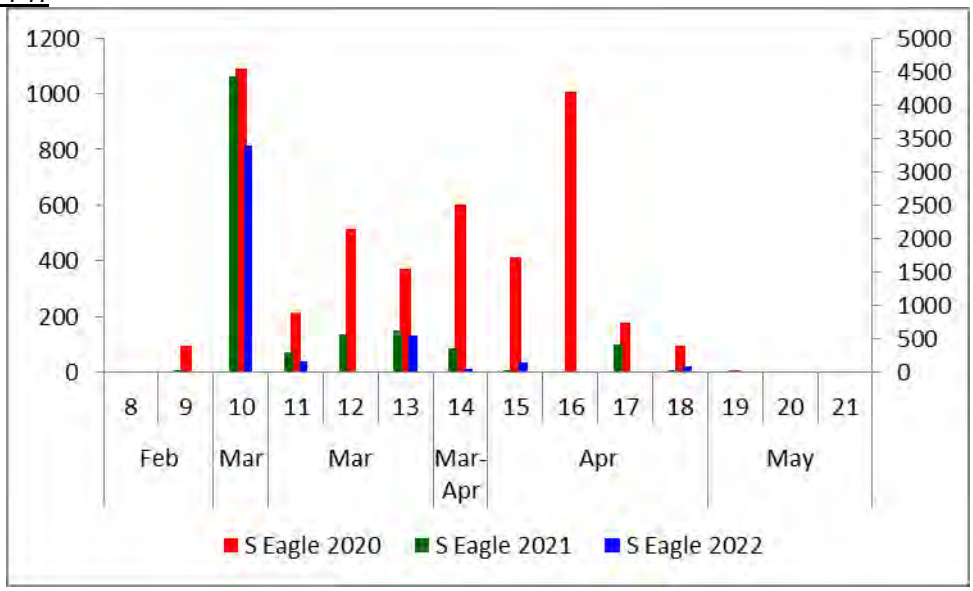


Figure 44: Migration pattern of the Steppe eagle

For the Short-toed eagle the migration pattern fits well with that described by Shirihai et al. (2000). However, because of a later start in the monitoring compared to the migration dates of this species, some individuals could have been missed in early February. However, the end of passage matches quite well. This is another species for which the numbers recorded in 2020 outnumber those in 2021 and 2022. The numbers in 2022 seem delayed compared to 2020-2021. It is a species which migrates early in the seasons, so we do not find an explanation to the delay in 2022.

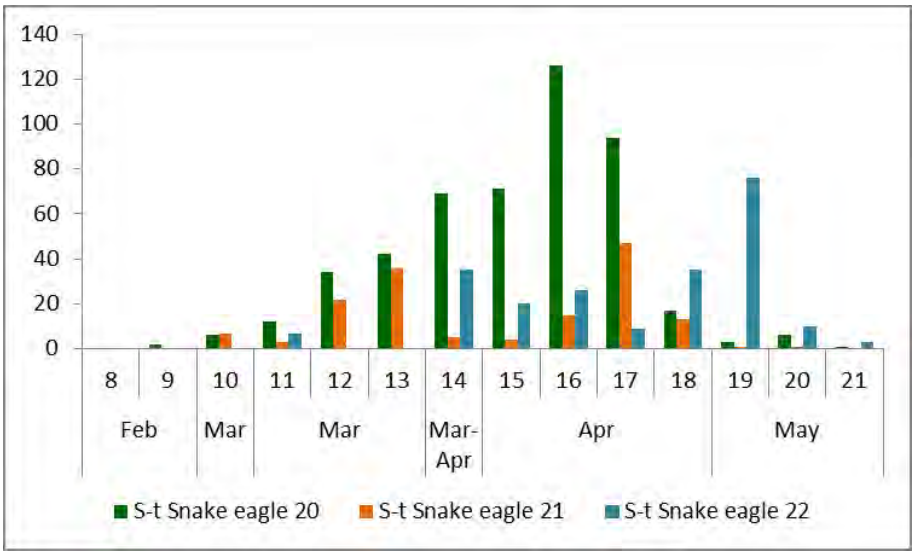


Figure 45: Migration pattern of the Short-toed Snake eagle

Another group of species are those which migrate along broad fronts, which are not soaring birds but soar from time to time when having an opportunity and are able to fly over the sea. Within this heterogeneous group there are the following:

- Falcons like the Sooty and Red-footed falcons. Their numbers recorded for the area all are less than 5 individuals. They are powered flyers using flapping flight and, when necessary, the soaring one.
- Harriers: Western Marsh. Pallid or Montagu´s. They are not true soaring birds but also well known to cross the open sea. Because of that, the population migrating through the wind projects cannot be directly compared to their overall ones, as they do not need bottlenecks to cross. Thus, counts in areas like this project are neither accurate nor representative as to draw clear patterns. Numbers recorded for are all are less than 50 individuals each.
- The Osprey: it is also a well know species to migrate over water extensions easily using flapping flight. Only six, two, and four individuals have been recorded.
- Finally, there are three species like the Common Crane, the Levant Sparrowhawk, and the Great White Pelican which account for a small number of observations but a large number of birds per observation. Patterns cannot be achieved, as a few counts could be considered incidental. They do not migrate every year/season and may appear or not during the counts.

  Many Common cranes remain wintering in northern latitudes without crossing the Gulf of Suez. This is well known in the Western Palearctic as well. In the Project area only a few have been recorded in 2021 but this does not mean they can be much higher any other coming year. The numbers are negligible, with no records in 2020, and a few birds in 2021 and 2022.

  The Great White Pelican also happens like the common Crane. Many pelicans remain without crossing the GoS. Records rarely occur but account for a large number of individuals because being species with high gregarism. In 2020 there was a quite high number migrating that turned into only several cents in 2021 as noted in the figure below. It migrates irregularly through the project, as occurs along the Red Sea with peaks in some years but lower numbers others.

  Finally, the Levant-Sparrowhawk is a gregarious species like the two previous ones but of small size which make it difficult to identify at long distances. As distance from the OP increases visual acuity decreases. There were eight records but 6,696 individuals (a few very large flocks) in 2020, but negligible counts in 2021 and 2022.

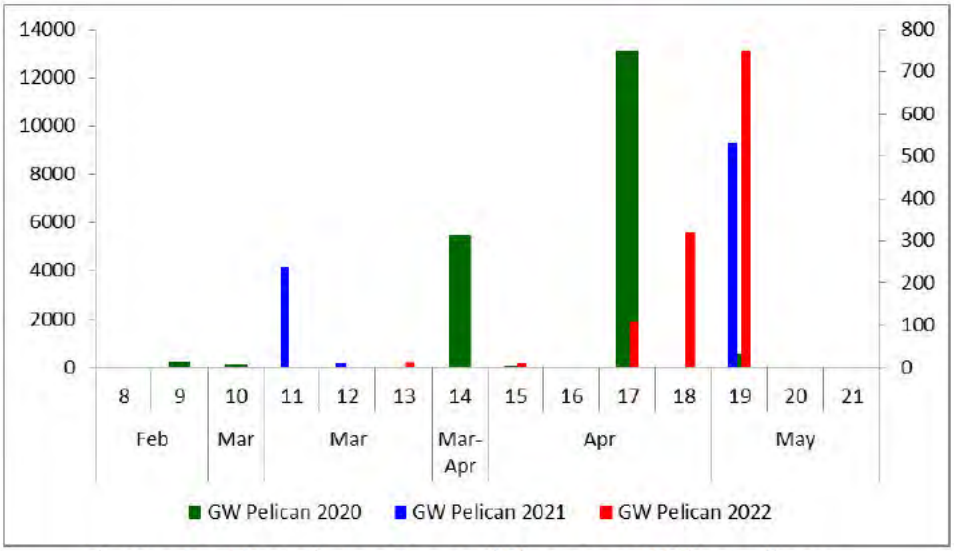


Figure 46: Migration pattern of the Great White Pelican

Migration Patterns: Flocking behaviour

We cannot forget an essential aspect of the migratory behaviour which links with the previous discussion and presented figures; one is the time of passage as we have presented earlier, but the second one is the flocking behaviour (group size).

There are species which migrate solitary or in small groups, whilst others form very large flocks. Both variables have implications for any mitigation measure we could apply, as large flocks may cause a large number of fatalities in one single event compared to individuals flying singly.

The table following the figure presents the average flock size (birds /flock) for all species, its confidence interval ± 95%, the number of records, and their minimum and the maximum values. As noted, by far the Great White Pelican, Levant Sparrowhawk and the White Stork had the largest flock sizes. However, notice that also the flock size changes between years for some of the species like the Great White Pelican, but also the Common Crane or the Levant Sparrowhawk. Generally, most of the remaining species were all estimated at less than 15.

Based on the below it is clear that all the eagles migrate in small groups, as do the harriers and small falcons, which do almost individually, while only seven species do in large ones.

Species	year	No. - Means	Conf. - 95%	Conf.+95%	No. Records	Min	Max
European Honey Buzzard	2020	26.38	18.03	34.74	255	1	500
	2021	21.51	14.28	28.74	106	1	300
	2022	24.27	16.78	31.76	123	1	300
Black Kite	2020	8.91	7.84	9.99	753	1	180
	2021	9.42	8.01	10.83	520	1	200
	2022	18.23	15.29	21.17	435	1	280
Montagu's Harrier	2020	1.00			5	1	1
	2021	1.00			4	1	1
	2022	1.06	0.93	1.18	17	1	2
Steppe Buzzard	2020	22.52	19.72	25.33	1087	1	500
	2021	34.55	29.77	39.33	860	1	750
	2022	35.12	28.58	41.65	494	1	800
Pallid Harrier	2020	1.24	0.83	1.64	21	1	5
	2021	1.25	0.45	2.05	4	1	2
	2022	1.00			15	1	1

Booted Eagle	2020	1.32	1.20	1.44	99	1	4
	2021	1.08	0.99	1.17	37	1	2
	2022	1.06	0.97	1.16	47	1	3
Steppe Eagle	2020	6.46	5.14	7.78	709	1	400
	2021	14.93	11.13	18.72	455	1	400
	2022	5.18	3.43	6.93	206	1	150
Long-legged Buzzard	2020	2.10	1.67	2.53	71	1	12
	2021	1.71	0.85	2.58	35	1	16
	2022	1.26	1.08	1.45	42	1	3
Great White Pelican	2020	726.52	287.76	1165.27	27	5	4500
	2021	86.67	0.00	210.81	9	1	500
	2022	70.65	25.56	115.74	17	1	250
Marsh Harrier	2020	-			0		
	2021	-			0		
	2022	1.29	1.10	1.48	31	1	3
Western Marsh Harrier	2020	1.14	0.93	1.35	14	1	2
	2021	1.17	0.93	1.41	30	1	4
	2022	-			0		
White Stork	2020	720.94	543.68	898.21	177	1	8000
	2021	742.64	598.75	886.54	150	1	4000
	2022	510.15	371.12	649.18	131	1	4500
Lesser Spotted Eagle	2020	2.11	1.45	2.77	82	1	26
	2021	1.70	1.01	2.38	23	1	8
	2022	1.96	1.55	2.37	69	1	8
Egyptian Vulture	2020	1.41	1.11	1.72	41	1	6
	2021	1.17	0.98	1.36	18	1	2
	2022	1.56	1.16	1.96	32	1	5
Black Stork	2020	46.41	19.41	73.40	69	1	600
	2021	8.98	5.22	12.73	40	1	55
	2022	11.04	6.21	15.87	50	1	75
Short-toed Eagle	2020	1.97	1.75	2.20	265	1	15
	2021	1.38	1.24	1.51	112	1	5
	2022	1.94	1.61	2.27	114	1	11
Levant Sparrowhawk	2020	99.00	0.00	874.08	2	38	160
	2021	505.00	146.45	863.55	12	1	2000
	2022	10.00	0.00	31.22	3	1	18
Eastern Imperial Eagle	2020	1.46	0.93	1.99	13	1	4
	2021	1.25	0.45	2.05	4	1	2
	2022	1.00			9	1	1
Greater Spotted Eagle	2020	1.11	0.95	1.26	19	1	2
	2021	1.00			4	1	1
	2022	-			0		
Spotted Eagle	2020	-			0		
	2021	-			0		
	2022	1.00			3	1	1
Common Crane	2020				0		

	2021	28.33	0.00	139.55	3	1	80
	2022	9.00	0.00	110.65	2	1	17

Migration Patterns: Time of Day

The next step was to analyse the time of passage according to the time interval in the day. The monitoring extends continuously from around 7:00 am to 5:00 pm daily. The number of birds each year according to the time intervals (1 hour) from starting till the end was sorted.

The first figure shows the overall trend of all bird species pooled together. Since 7 am there is a sudden increase in number of birds recorded. However, in 2022 there is a one-hour delay in the passage till 8:00; then remains high till around 12:00 to 13:00 pm. The numbers start to decrease, at least in 2021and 2022 – but in 2020 there is a second peak in the late afternoon around 15 to 16:00 pm. The reason for this was explored and detailed throughout this section as it is caused by one single species.

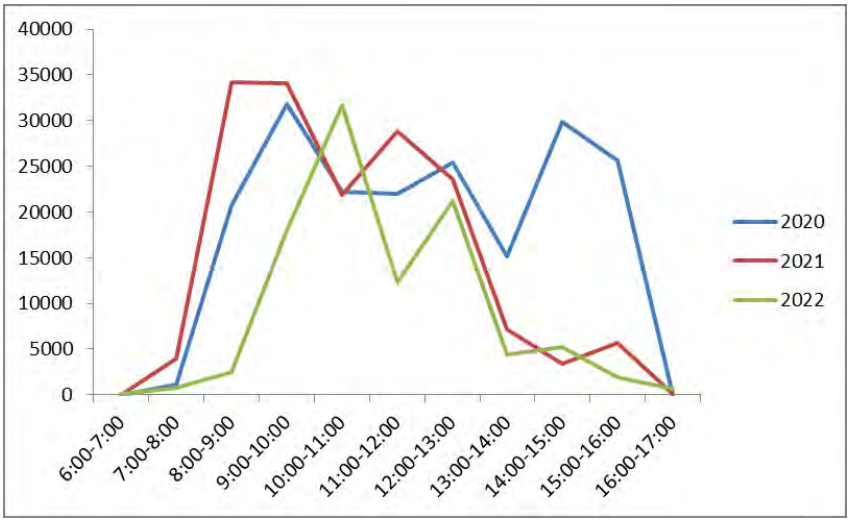


Figure 47: Bird numbers recorded at the project site in spring 2020, 2021, and 2022

The analysis below presents the trend that was drawn of the contacts throughout the day – i.e. number of records per hour interval in 2020,2021, and 2022. This is critical as it allows observers during the ATMP implementation to know when to pay more attention for migratory birds. *A key trend is noted for the three years with the exact same pattern that suggests the peak of the migration taking place within the mid-daylight hours (9:00 am to 13:00 pm). This indicates that this is the most critical time for the observers to track the birds.* The reason of late birds in 2020 could be a delayed migration time or the effect of variables forcing birds to do so late.

When dealing with the records per hour interval, the three years follow exactly the same pattern, Figure 48, with most records by 10:00-11:00 am, and a peak interval from 9:00 to 14:00. Basically, the highest number of records and birds occur during a specific period within the day.

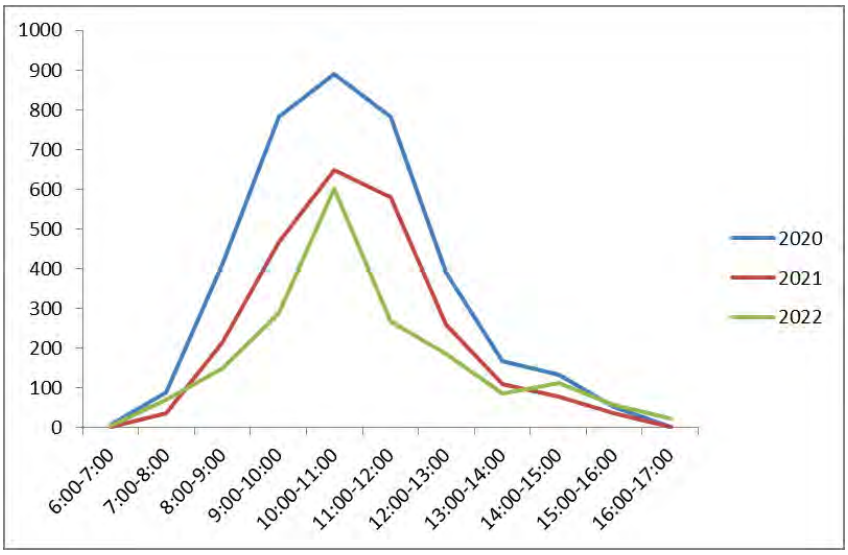


Figure 48: Number of records per hour interval in 2020, 2021, and 2022

The analysis below investigated further the migration for those key species noted earlier. As discussed, to analyse the migration pattern of the species recorded those species with enough data, observations and individuals were selected.

The first species is the Black Kite, which shows a quite similar and identical pattern in 2020-2022 except for 2022 when a later pass of birds happened. Most of the passage occurred between 9:00 am and 12:00 pm.

For the Honey Buzzard the trend resembles that of the Black kite, as it migrates earlier in the day in 2020 (with the higher numbers around 9:00-10:00 am in 2020) but a little bit later in 2021 and 2022 (10:00 to 12:00 pm). However, again it is important to reiterate that there were more birds in 2020 compared to 2021 and 2022. As for the Black kite, there is also a late count around 15:00 hr.

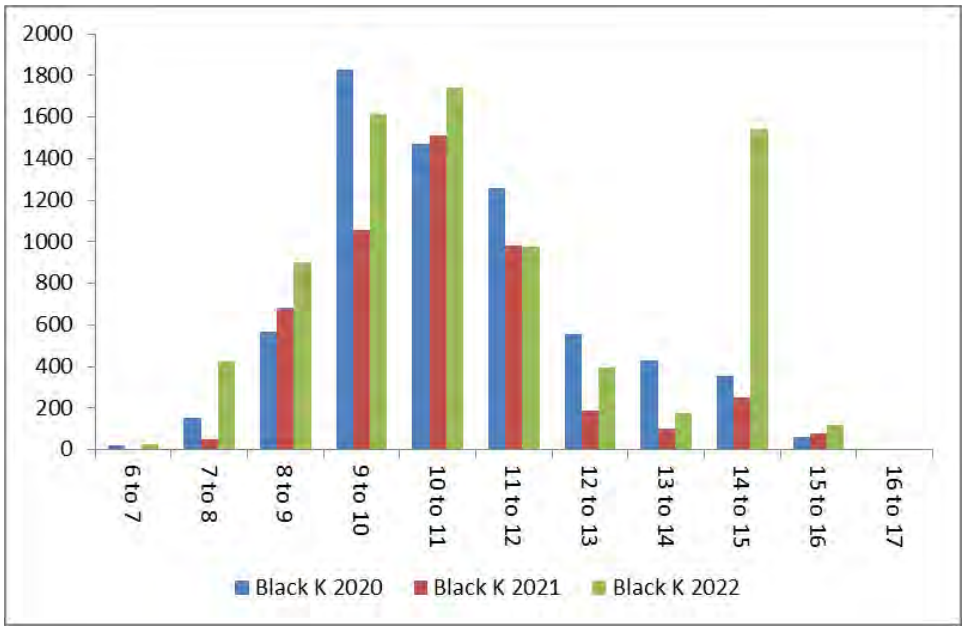


Figure 49: Daily migration pattern (hr. of the day) of the number of Black Kites

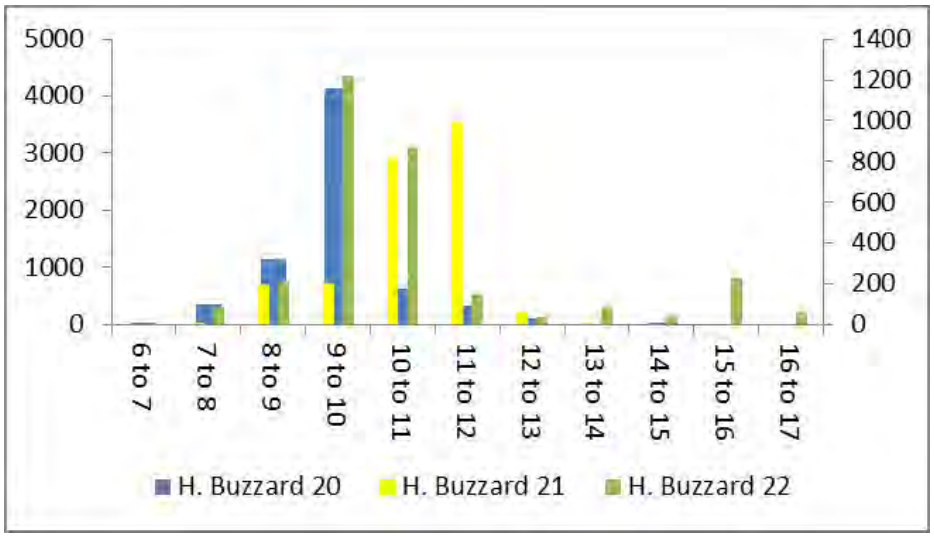


Figure 50: Daily migration pattern (hr. of the day) of the Honey Buzzard numbers (2020 left axis, 2021 and 2022 right axis)

The White Stork also has a different pattern in 2020 compared to 2021 and 2022. Reasons for this could be the time the species migrates over the Red Sea. Individuals arriving late in the afternoon to the vicinity of project area of influence would depart in the early morning (blue bars between 14 pm to 16 pm, which do not occur the two second years). As the storks are already on the mainland, they would not need to wait to the better weather uplifts in the midday, continuing migration as soon they can in the following day. The bars in the afternoon could correspond with birds arriving late to the project area. On the contrary, such peak does not appear in 2020, when White Storks migrated much earlier. The conclusion would be more or less similar to what we discussed above for the Honey Buzzard (i.e. reasons related to migratory route of this species outside of the project area).

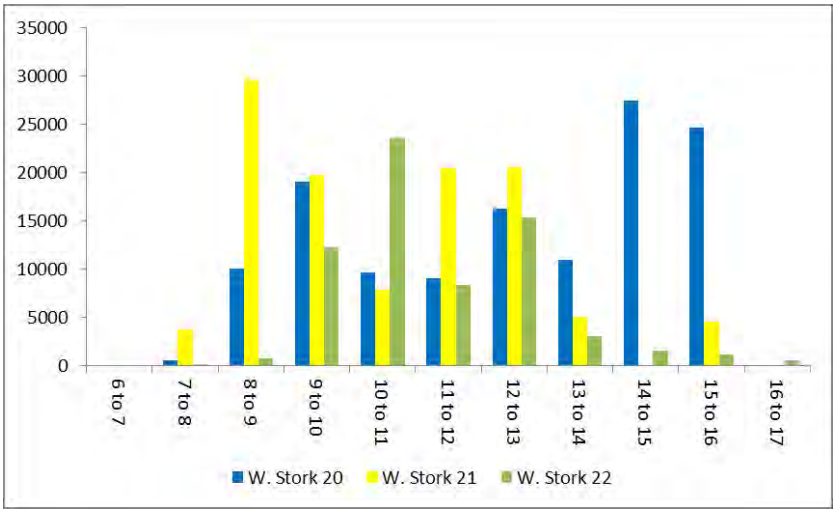


Figure 51: Daily migration pattern (hr. of the day) of the White Stork in 2020-2022

The Black Stork exhibits a similar pattern 2021 and 2022, but different in 2020, higher numbers and later passage of large groups in that year. Again, global conditions (similar to what was explained for the White Stork and Honey Buzzard earlier) would be affecting the birds in the same way in 2020, causing such a delay in the first spring.

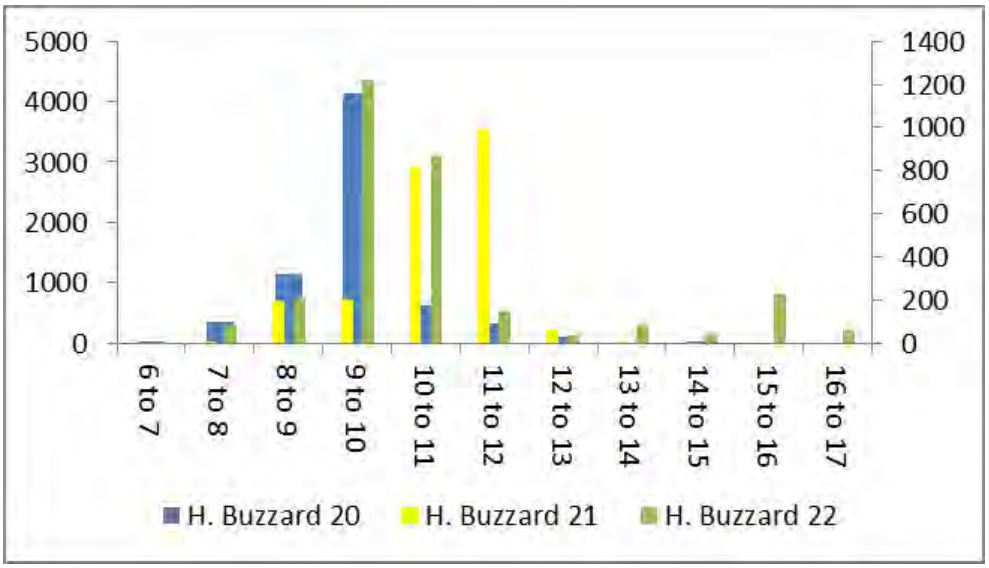


Figure 52: Daily migration pattern (hr. of the day) of the Black Stork

Finally, the Steppe eagle surprisingly exhibited the same trend. For this species, and because of the deficiency in the data collection during the first weeks, we have used percentages, instead of the raw counts. Most of the eagles have a peak between 10 am to 12 pm, like the Black Kite. This reinforces the idea of birds using the most suitable weather conditions for soaring. Also, a similar case is noted for the Short-toed Eagle below. Despite potential differences in the detection rates by observers, both the Steppe and Short toed Snake eagle, show almost equal migratory strategies.

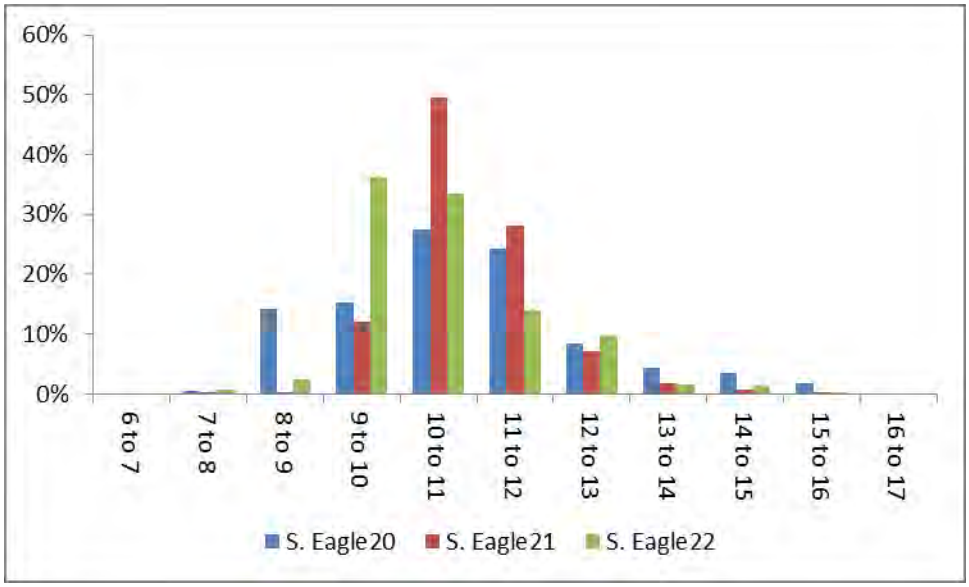


Figure 53: Daily migration pattern (hr. of the day) of the Steppe Eagle

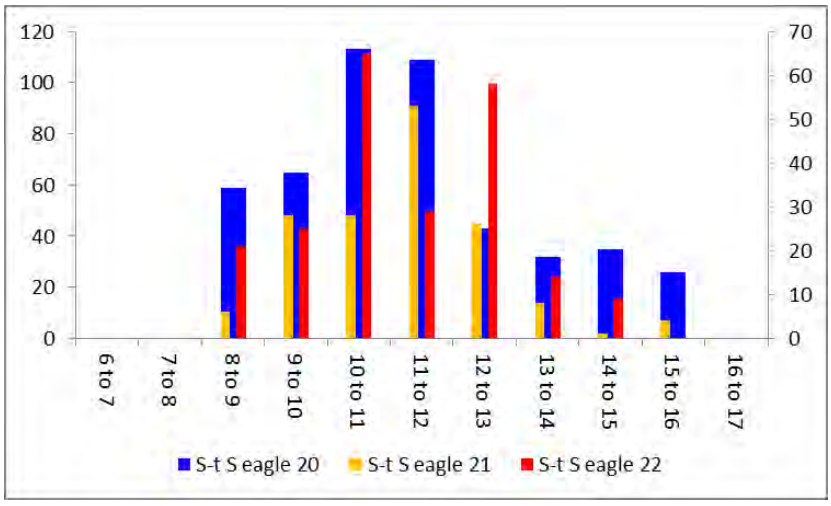


Figure 54: Short-toed Snake eagle (2020 left axis, 2021 and 2022 right axis)

All the above findings – timing of migration, distribution throughout the day, formation of flocks – support what is known about the migration; each species has its time of migration through the region and passage times and patterns that depend on the migratory strategy they follow, e.g., crossing the Red Sea or flying through the Gulf of Suez. Throughout the migratory route, birds are influenced by external forces which funnel them through different regions, which may result in the numbers detected.

- The migratory numbers change from year to year. Reasons for that are unknown considering the data available, e.g., data on arrival time of the different species to the vicinity of the project, place where the species do overnight before crossing the footprint, conditions which make species specific numbers to increase/decrease…
- Data from 2021 and 2022 show consistency in numbers, whilst those from 2020 are slightly different. This occurs specially with some species which passed late in the day.
- Despite the differences in bird monitoring times, there are also differences in the passing rates/bird numbers. This is noteworthy among the most abundant species like the White Stork, Great White Pelicans or Honey Buzzard. However, qualitatively the species migrating through is always the same, as they are the passing times as well.
- In addition to the above, as will be demonstrated below, the results also affect the risk flights with variations among species and years.

Flight Direction

The main flight directions for the three spring seasons appear in the figures below. There is a clear orientation to the NW, which could be related to the intention of birds to follow the ridgeline of the mountains surrounding the Red Sea. Such mountains at variable distance from the coast would help the birds to migrate in an easier way, relying on the up-air currents which appear when a mountain slope diverts the winds, causing air currents to climb. This is the so-called slope soaring. Following the mountain range, birds would reach the Gulf of Suez in a much easier way compared to flying over the plain desert and only using the thermal soaring and despite the good conditions of the region for such kind of flight. Flight direction has not changed over time during the three years. This is demonstrated because of a statistical test of Friedman ANOVA Chi Sqr. (N = 9, df = 2) = 0.40 p = 0.81.

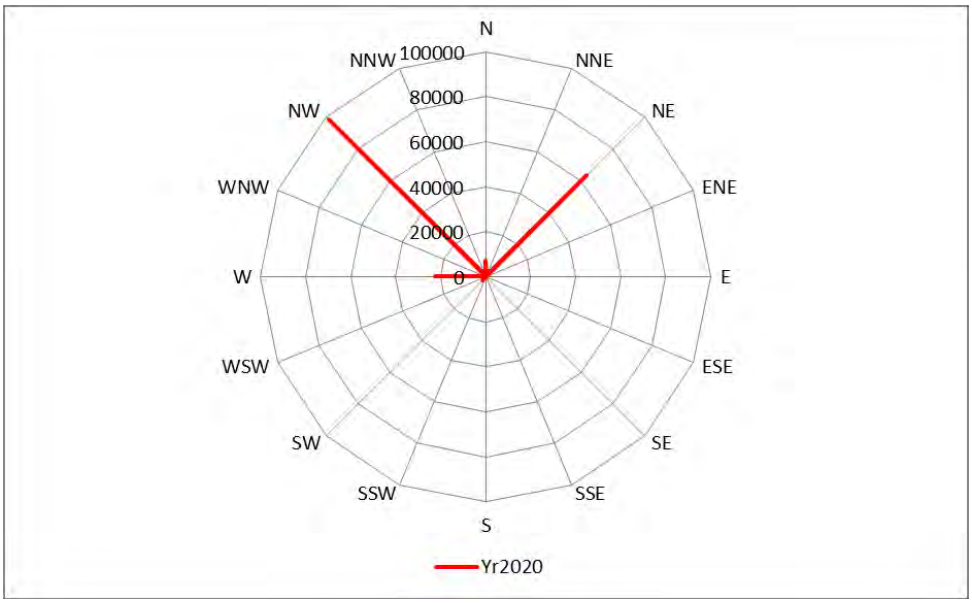


Figure 55: Observed flight direction of the migratory soaring birds in 2020

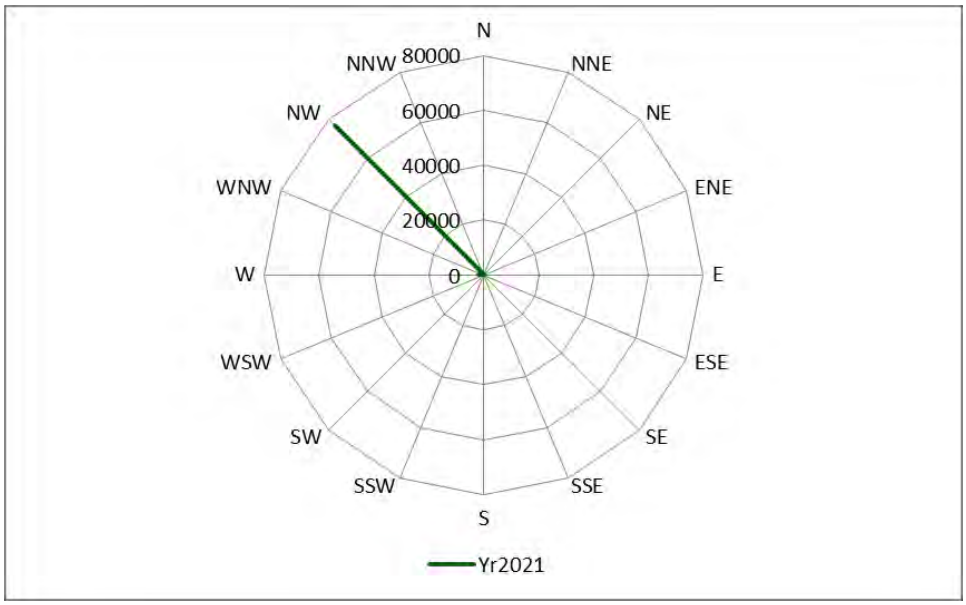


Figure 56: Observed flight direction of the migratory soaring birds in 2021

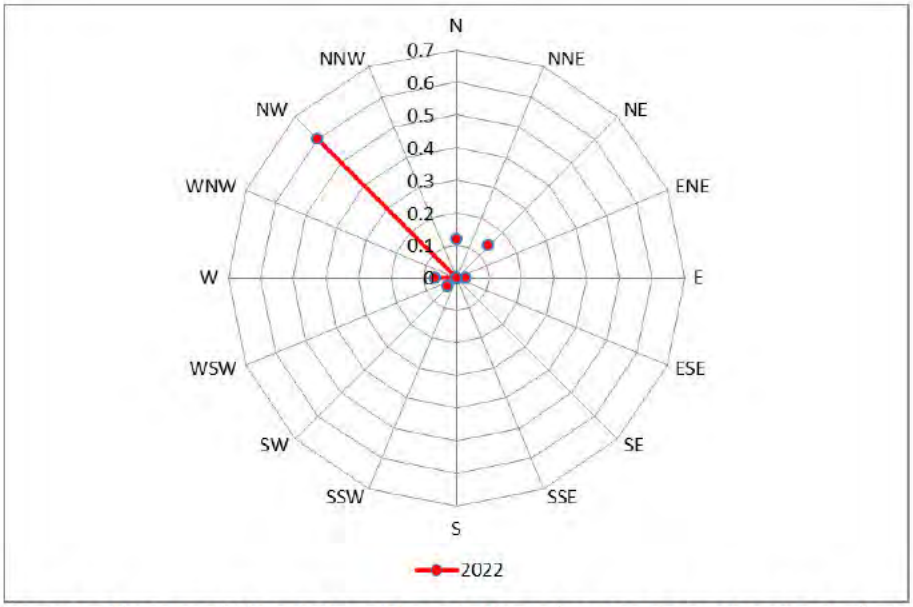


Figure 57: Observed flight direction of the migratory soaring birds in 2022

7.5.3 Autumn 2020 and 2021

This section presents the baseline monitoring results for the autumn seasons.

Monitoring/Sampling effort

The wind farm was monitored every day during the migratory seasons. The start and end time of daily monitoring were adjusted according to length of daylight and temperature, to provide adequate sampling of the whole migration season.

The monitoring dates are presented in the table below, while the table that follows presents the total monitoring hours.

Table 27: Monitoring Dates

DATES	2020	2021
Autumn	15-Aug to 10-Nov	10-Aug to 10 Nov

Table 28: Monitoring Hours

Hours	2020	2021
Autumn	2,814 hr. 55 min	3,098 hr. 21 min

The following **initial remarks** are noted:

- The **monitoring times were different between the same seasons in the two years**, with an increase of 110% in the autumn season. Reasons for this may be multiple and affected which could include for example the frequency of sandstorms.
- Because of the **different monitoring times per season/year, the analysis cannot directly compare the results within and between each season**. The key reason for this is that different monitoring times may result in different counts. As a general rule, the higher number of monitoring hours will increase the chance of observing more birds. Therefore, results must be standardized before any analysis or variations are considered. taking this into account, a new variable was calculated for the datasets – **the birds /hour rate (number of birds/hours of observation).**

- In any migratory count, either related to wind farms assessments or not, **there is a chance that identification of all birds and/or group of birds are not identified properly.** Reasons for this may be multiple but could include for example a short period of time to see the birds, the background does not allow a proper identification, or as Porter (2006) said: *"Counting soaring birds and using the results for monitoring purposes is fraught with problems."... "The identification of many species is challenging and requires much training and practice as birds are often at a distance and several species are very similar. Identification of the Aquila eagles (Steppe, Greater Spotted and Lesser Spotted), buzzards and large falcons is especially difficult. Second, the actual counting can be problematic as birds frequently fly over at heights which make them invisible to the naked eye; they can also be in large mixed flocks - thus making both counting and identification difficult."*

  Thus, it is not surprising to find in all bird monitoring databases several records annotated as "eagle species", "Buzzard sp.", "and falcon", "harrier sp.". **For any analysis these records must be excluded, otherwise they may introduce biases in the overall results**. This includes a total of 144 individuals. Although such species could be individuals of priority species but in general it is too risky to assign such numbers to a certain species as a single count as it could impact the overall results.

Data Analysis

During the standard field observations, a total of twenty-two (22) species were recorded between both years, accounting for 18,213 birds (783 records), and 14,881 birds (813 records) respectively in 2020 and 2021. The table below presents the detailed breakdown for records and species per year.

Two globally threatened species were recorded, the endangered (EN) Egyptian vulture and the vulnerable (VU) Sooty Falcon. There was an additional Near Threatened (NT) species, the Pallid Harrier. Three species dominated the migratory counts, the European Honey Buzzard (42%-72%), The Great White Pelican (2.6%-6%), and the White Stork (22.5%-50%). They accounted for 97%-98% of all the birds recorded in 2020 and 2021 respectively, and between 70%-73% of all records. All the remaining species did not reach the 1%.

Despite the global counts that these three species comprised, with a similar % in 2020 and 2021, it **is noteworthy that specific passage numbers differ between years for the Eurasian Honey Buzzard and the White Stork**. The latter recorded one third of the number in 2020 during 2021 (i.e .from 9,130 to 3,346), whilst the Honey Buzzard increased by around 40% (i.e. from 7,651 in 2020 to 10,735 in 2021). Reasons for that are not clear – but there are no fixed numbers of birds passing every year over the wind projects in the Red Sea region; they change from year to year depending on multiple conditions over their migratory route.

All the remaining species appeared in low numbers like several species of falcons: the Sooty, Red-footed, Lanner, Eurasian Hobby, and Lesser Kestrel. The Common Kestrel could be considered as a resident species. The difference in the species recorded, seventeen in 2020 and twenty in 2021 may result from different causes which could include: (i) due to scarcity their low detectability may influence the observers; or (ii) these species migrate in a broad front that do not require to pass through the same site –the project area- every autumn.

Table 29: Species Recorded in Autumn 2020 and 2021

Species	IUCN	Scientific name	Records 2020	# of Birds 2020	Records 2021	# of Birds 2021
Black kite	LC	*Milvus migrans*	56	93	63	76
Black Stork	LC	*Ciconia nigra*	2	2	1	2
Booted Eagle	LC	*Aquila pennata*	4	5	1	1
Common crane	LC	*Grus grus*	1	16	1	2
Common Kestrel	LC	*Falco tinnunculus*	36	36	26	28
Egyptian vulture	EN	*N. percnopterus*	0	0	2	3
Eurasian Hobby	LC	*Falco subbuteo*	0	0	1	4

Eurasian Sparrowhawk	LC	*Accipiter nisus*	4	4	3	3
European H. Buzzard	LC	*Pernis apivorus*	546	7,651	533	10,735
Great W. Pelican	LC	*Pelecanus onocrotalus*	11	1,133	6	368
Lanner Falcon	LC	*Falco biarmicus*	0	0	1	2
Lesser Kestrel	LC	*F. naumanni*	0	0	4	4
Levant Sparrowhawk	LC	*Accipiter brevipes*	1	3	5	129
Montagu´s harrier	LC	*Circus pygargus*	26	29	15	15
Osprey	LC	*Pandion haliaetus*	1	1	0	0
Pallid Harrier	NT	*Circus macrourus*	13	17	14	15
Short-toed snake eagle	LC	*Circaetus gallicus*	3	4	0	0
Red-footed Falcon	LC	*Falco vespertinus*	0	0	7	22
Sooty Falcon	VU	*Falco concolor*	2	2	6	6
Steppe Buzzard	LC	*Buteo vulpinus*	10	17	31	54
Western Marsh Harrier	LC	*Circus aeruginosus*	54	70	58	66
White Stork	LC	*Ciconia ciconia*	13	9,130	34	3,346
TOTALS			**783**	**18,213**	**812**	**14,881**

Spatial Distribution

The figure below presents the average passing rates (birds/hour) per VP in Autumn 2020 (first figure) and Autumn 2021 (second figure). As noted below, in 2020, variable passing rates were noted across the VPs with VP 5 being the highest (at around 6), followed by VP 2 (at around 4), VP 1 (at around 2) followed by the rest of the VPs at around 1. Similarly, in 2021, variable rates were also noted with VP 7 being the highest (at around 12), followed by VP 2 and VP 6 (at around 4), and then the rest of the VPs at around 1-2.

From the two figures below the following can be considered:

- If there would be preferred passing VPs in the project area, the pattern of the passing rates between 2020 and 2021 should be similar or the same, however they are not. The first year the highest passing rates occurred at VP5, whilst in 2021 this was at VP7. In addition, the passing rates at VP2 in 2020 were higher than 2021. Birds do not pass through the same VP every year with the same rates.
- Because the passing rates differ between years, different numbers of birds are registered, therefore RISK is not fixed at each VP and changes between years. Therefore, we CANNOT calculate collision risk per Vantage Point.
- Because of the very low numbers recorded for several species comparisons are not possible. This includes Black Stork, Booted eagle, Common crane, Egyptian vulture, Eurasian hobby and Sparrowhawk, Lanner, Sooty, and Red-footed falcons, lesser kestrel, Levant Sparrowhawk, Montagu's and Pallid harriers, and Short-toed Snake eagle.

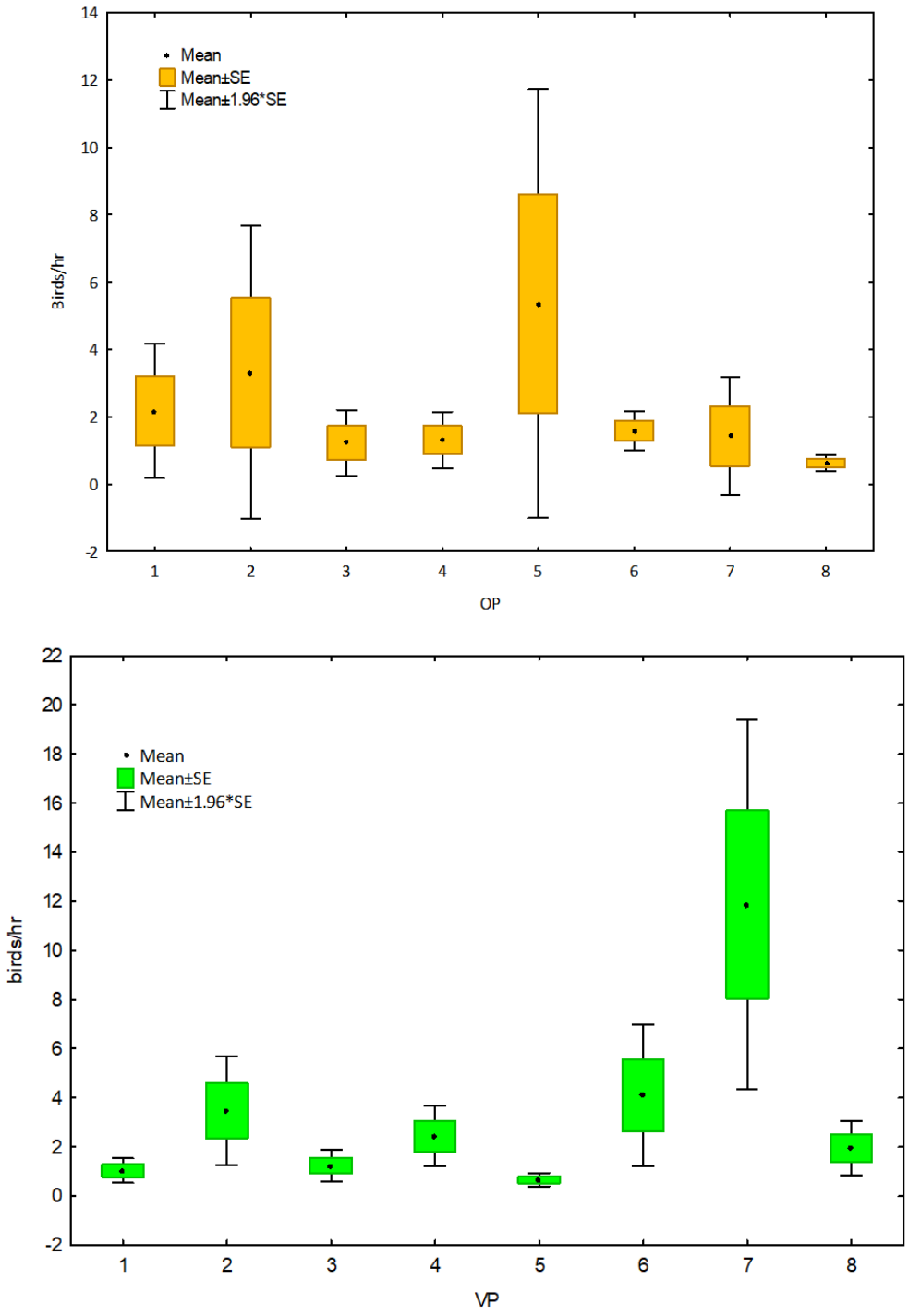


Figure 58: Average Passing Rates per VP in Autumn 2020 and 2021

To further demonstrate the above initial conclusions in which it is stated that there is no preferred passing VPs in the project area and that birds do not pass through the same VP every year with the same rates – the Kruskal-Wallis test is undertaken and presented throughout this section.

First, the table below presents the mean passing rates per species, the confidence interval (95%) for the mean, the number of records, and the maximum and minimum passing rates recorded. This has been calculated for the five (5) most abundant species. From the table below the following can be concluded:

- The Great White Pelican and the White Stork pass in large groups (high passing rate).

- The Eurasian Honey Buzzard also pass in flocks but in not so large numbers as in spring.
- The Black Kite and the Western Marsh Harrier have rather constant passing rates; also, the Black Kite does not form large flocks in autumn.
- Passing rates are rather similar for the Black kite, E. Honey Buzzard, and the W. Marsh harrier between 2020 and 2021. However, for the Great White Pelican, the passing rates decreased by 60% from 2020 to 2021, and the White Stork were around 7 times lower. These numbers suggest that there are key influence factors (as discussed below) that affect bird numbers and that also such numbers are not consistent over years.
- The number of birds per hour depends on multiple factors of the project area but also from areas further away. The weather conditions (wind and temperature) allow the bird to decide whether to cross the sea or not; otherwise, they could die drowning in the sea. Once they have left the coast, there is a point of no return, so they have to cross facing all risks. If such crossing is difficult, they may be too exhausted when reaching Ras Gharib coast, where they could land for rest before continuing their journey. Depending on the time in the day, the birds must overnight or continue the migration as soon as they refuel. That's the time when observers record the so called "roosting birds", which are in fact, exhausted birds or those that feed and find some food whilst migrating.

Table 30: Passing Rates for Selected Species

Year	Species	Birds/hr. Mean	Confidence +95%	Confidence -95%	Min.	Max.
2020	Black Kite	0.19	0.14	0.25	0.10	1.25
	E. Honey Buzzard	1.71	1.44	1.98	0.10	40.77
	G. White Pelican	12.38	3.91	20.84	1.62	33.70
	W. Marsh Harrier	0.15	0.09	0.22	0.10	1.87
	White Stork	86.69	-4.67	178.07	0.11	454.54
2021	Black Kite	0.14	0.13	0.16	0.11	0.37
	E. Honey Buzzard	2.43	1.60	3.25	0.10	171.42
	G. White Pelican	7.45	0.75	14.16	1.93	19.39
	W. Marsh Harrier	0.13	0.12	0.14	0.10	0.33
	White Stork	11.95	5.80	18.09	0.10	75.00

Secondly, to understand if the observed significant differences of passing rates per VP additional statistical analysis has to be undertaken. For that, the Kruskal-Wallis test was undertaken and the results are provided below. With this purpose, the non-parametric Kruskal-Wallis tests for the passing rates (birds per hour) for each species among the 8 VPs was undertaken for the two years for the passing intensity of the most abundant species. The table provides the results of the test and the level of significance as per common standards in statistics.

Table 31: Non Parametric Kruskal-Wallis test

Species	2020	2021
Black Kite	H (7, N=119) =20.82 **p <0.01**	H (7, N= 63) =20.54 **p <0.01**
European H. Buzzard	H (7,N=1079) =10.09 p =0.18	H (7,N=533) =23.83 **p<0.01**
Great W. Pelican	**n.a.**	n.a.
Western Marsh Harrier	H (7, N=112) =56.82 **p <0.001**	H (7, N=58) =28.12 p **<0.001**
White Stork	H (7, N= 47) =13.16 p =0.06	n.a.

From the table above, the following can be concluded:

1. A total of 3 species (highlighted and which have p <0.01) tended to present significant differences among VPs in terms of passage rates during either in 2020 and/or 2021 (**i.e.**

they tended to pass in greater numbers through specific VPs compared to others). However, comparing the data for 2020 and 2021 only 2 species have exhibited such behaviour in both seasons (Black Kite and Western Marsh Harrier). Nevertheless, it is important to note that for these species the intensity of the passing rates was mapped and is presented in the figures below. As noted, the VPs which had higher passage rates (i.e. tended to pass in greater numbers through them) were not the same between 2020 and 2021. This indicates that the passage of these birds is not the same throughout both years.

The other species (Honey Buzzard) only exhibited such behaviour during one of the seasons only, while within the second season such behaviour shows significant difference (i.e. p is higher than 0.01) which is discussed more below.

2. The European Honey Buzzard and White Stork showed no significant differences (i.e. p is higher than 0.01) either in 2020 or 2021 (i.e. indicates that they migrate throughout the site randomly without any specific preference for any VP).

3. The final group are those for which no further analysis can be performed because their data are too scarce (marked in n.a.) (i.e. Great White Pelican).

From the table above *it can be concluded that birds pass randomly, with not preferred sites*, as the landscape does not force them to follow specific routes once they are within the windfarm. Again, this is further supported with the figures presented below that have been prepared, where the intensity of the passing rates are compared between the two years for the highlighted species in table above earlier. As noted again within the figures, such birds pass randomly with no preferred sites.

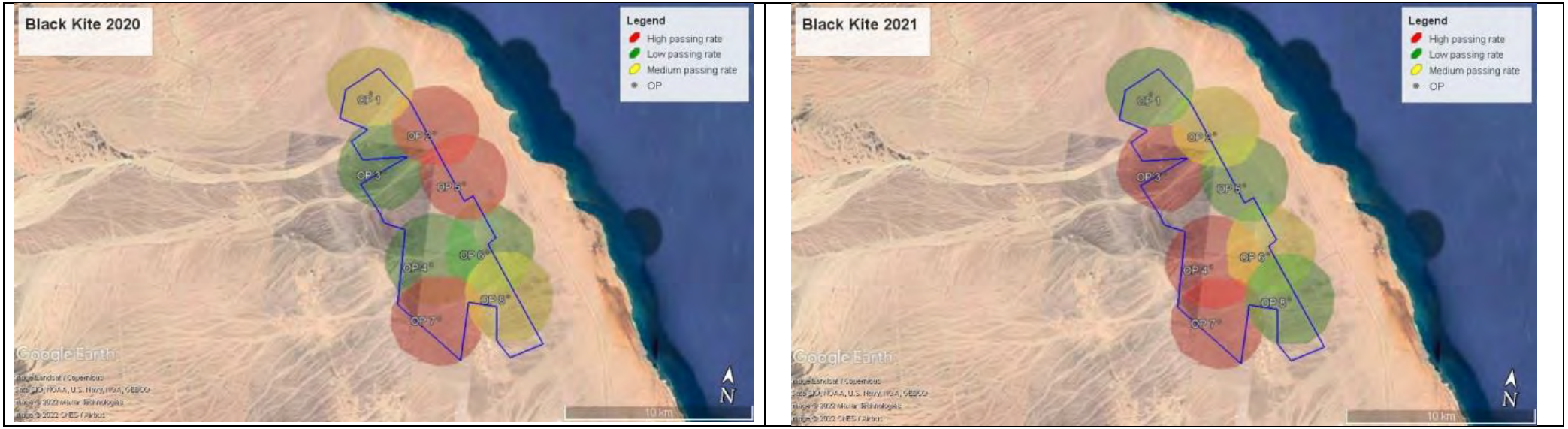


Figure 59 Passing rates for the Black Kite (highest: red, medium: yellow, and green: lowest) per VP and year

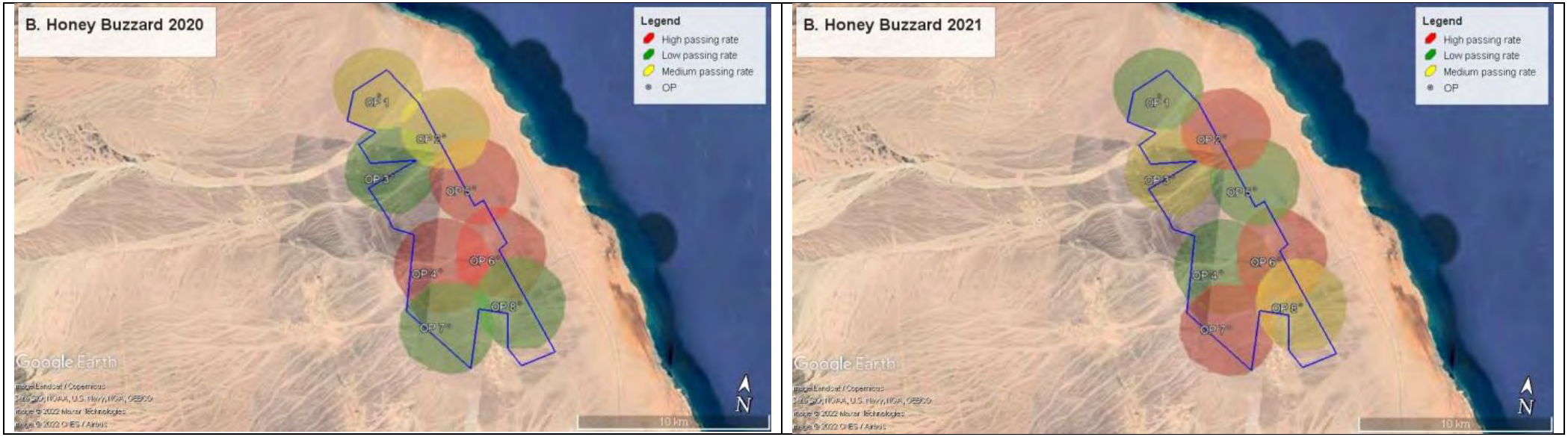


Figure 60 Passing rates for the Honey Buzzard (highest: red, medium: yellow, and green: lowest) per VP and year

Figure 61: Passing rates for the Western Marsh Harrier (highest: red, medium: yellow, and green: lowest) per VP and year

Migration Patterns: Time of Weeks/Months

The timing of passing according to the months and weeks in the autumn season have been analysed. Bird numbers are generally classified according to the week of the year for a better understanding of the data. The figure below presents the weeks of the year for the autumn monitoring period undertaken which is from August (starting at week 33 of the year) until November (ending at week 46 of the year).

The passage considering the global bird numbers per week/month is presented in the figure below. Overall, the passing time extends along fourteen weeks, but this is the time established for the autumn migration monitoring. In 2020, the highest numbers occur by the last week of August, with high migration numbers continuing throughout September and a decrease over the last week until the end of the season. The pattern in 2021 is roughly the same but reaches the peak one week later compared to 2020 (last week of September). However, the decrease occurs at the same point (week number 39, end of September). Therefore, in general, the patterns are similar in both years.

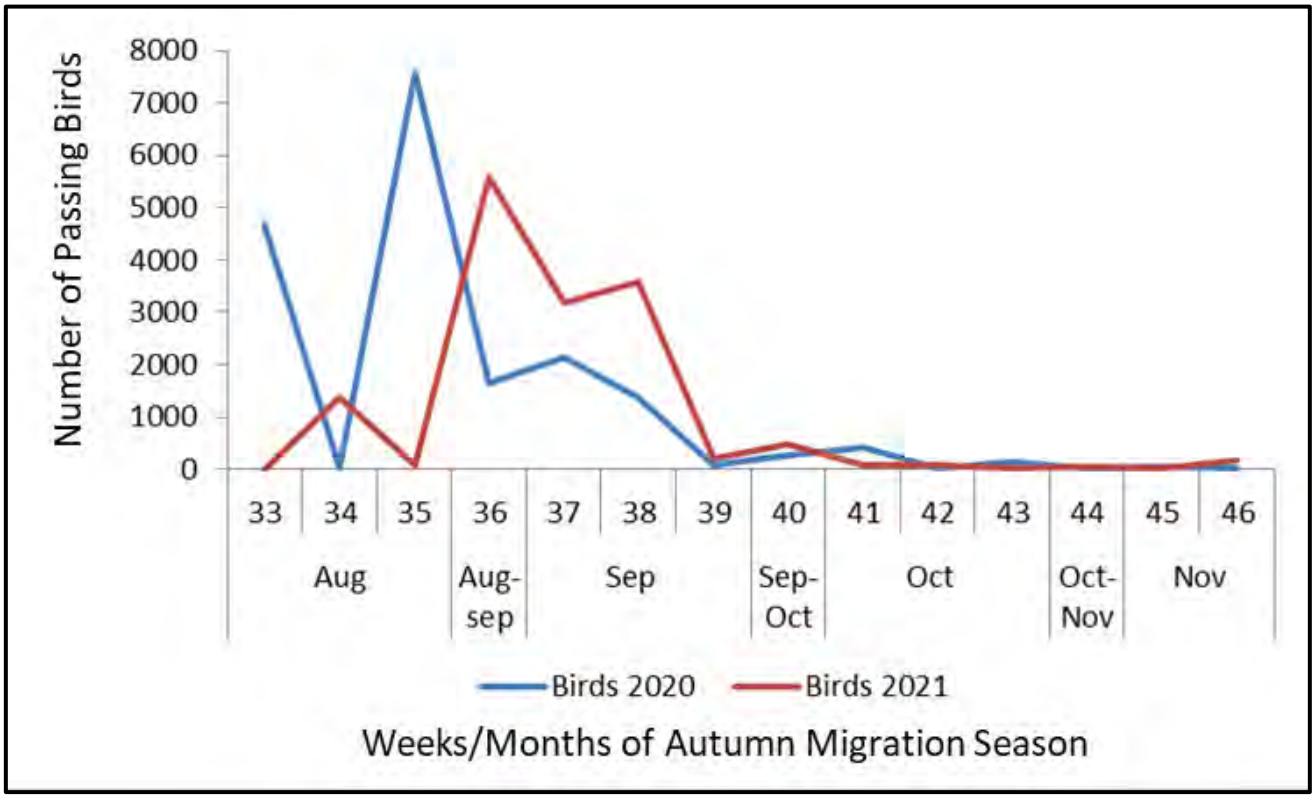


Figure 62: Bird numbers migrating per week in the autumn seasons

These results are highly influenced by the species-specific numbers over the site. Despite wind energy is a new development in the region, studies on bird migration are not, and have been developed for decades now. In general, what is clear for such studies is that not all the species migrate at the same time. The peak is clearly influenced mainly by the two species with the highest numbers; the White Stork and the European Honey Buzzard (94.91 and 92.85% of the birds recorded in 2020 and 2021), but also other species forming flocks.

The most comprehensive monitoring of bird migration in the Middle East comes from the work by Shirihai et al. (2000) "Raptor Migration in the Middle East. A summary of 30 years of field research". As the title says, it includes more than thirty years of established monitoring. The authors explain that counts at the Gulf of Suez of migratory birds in both autumn and spring were observed and recorded already in the 80´s and 90`s with specific references there such as Biljsma (1982, 1983), Wimpfheimer et al. (1983), Meininger & Atta (1994), or other counts in the Southern Red Sea Area (Sorensen 1982, Grieve 1996). The authors also provide details on and how migration occurs both in spring and winter along the entire Middle East, from Djibouti to Jordan and Lebanon, from Egypt to Yemen, providing also data from latitudes further north like Bosphorus. The assessment below focused more on the Shirihai et al. (2000) study in order to

understand and compare the migratory patterns recorded within the Project site since it is more focused in the Middle East.

To analyse the migration pattern of the species recorded those species with enough data, observations and individuals were selected only. Based on that this includes Eurasian Honey Buzzard, White Stork, Black kite, and the Great White Pelican, mainly due to its huge numbers in 2020 and 2021 seasons.

The figure below presents the migration pattern of the Black Kite. This species appears in the late days of August passing through the site till mid-November. The numbers are insignificant compared to the flyway population (less than 100 birds each year) but these dates are well known in the region and match perfectly with the data described by Shirihai et al (2000).

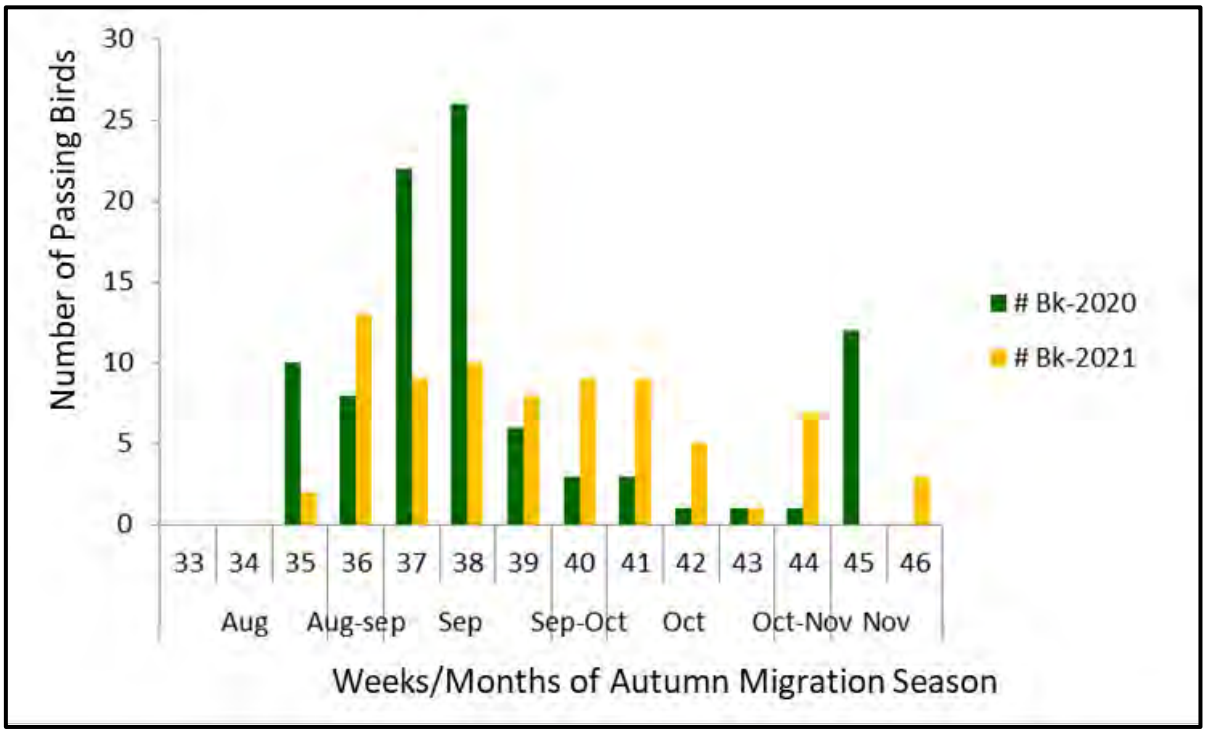


Figure 63: Migration pattern of the Black Kite

The figure below presents the migration pattern of the European Honey Buzzard. It is an early migrant starting around end of August and finishing its migration by mid-September or early days of October. These dates match perfectly with Shirihai et al. (2000), who showed exactly the same pattern within this monitoring period.

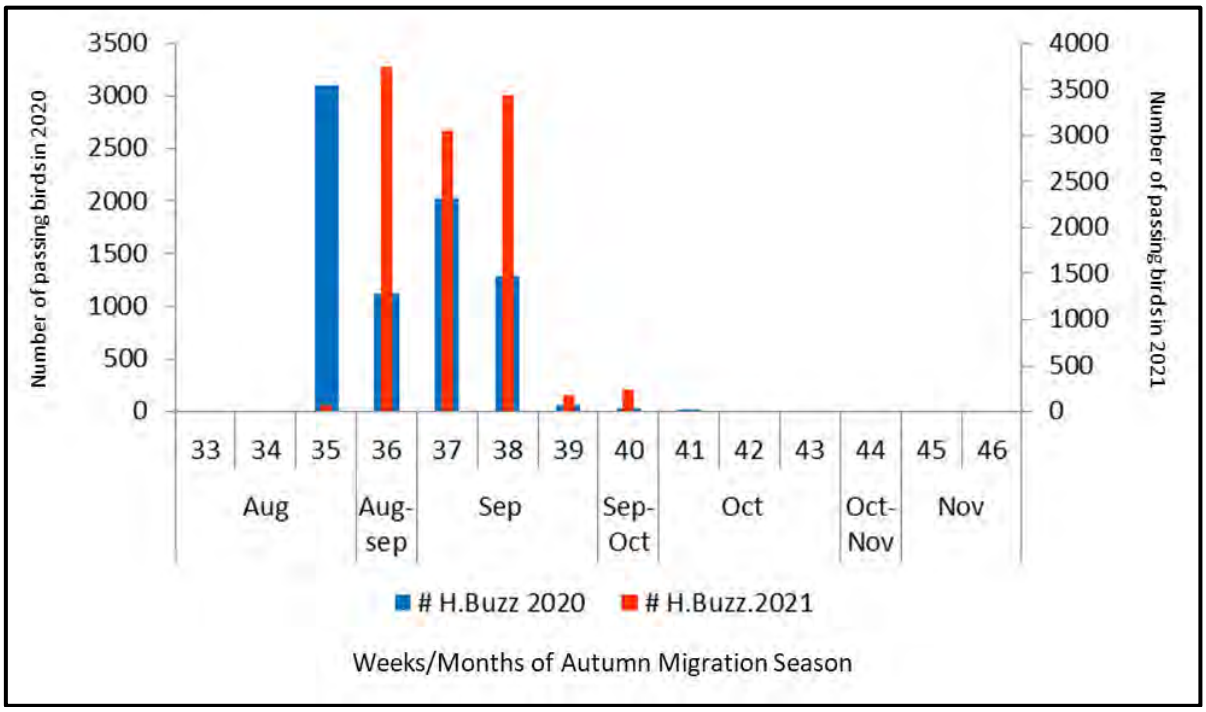


Figure 64: Migration pattern of the European Honey Buzzard

The White Stork was recorded from early August and decreases in magnitude with very little numbers in September. The pattern in general is similar to that included within Van den Bossche (2002) who mentions that the storks needed only 14 to 24 days to fly from the breeding area to Sudan, but more than twice as much to cover the same distance in spring. This author also mentions how different a stopover site may be, with distances separated around 35 km one from the others. This is an interesting point when discussing roosting behaviour. Interesting description is that for migratory movements: "The tagged storks could have avoided the crossing of the Red Sea by flying through Suez, but none of them did so and they crossed the southern part of the Gulf of Suez near El Tor, which was also observed by Koch et al. (1966) and Safriel (1968). Small numbers cross the Gulf of Suez south of El Tor at Ras Mohammed, the southern point of Sinai". El Tor is located only 37 km to the south of the project area but on the opposite side.

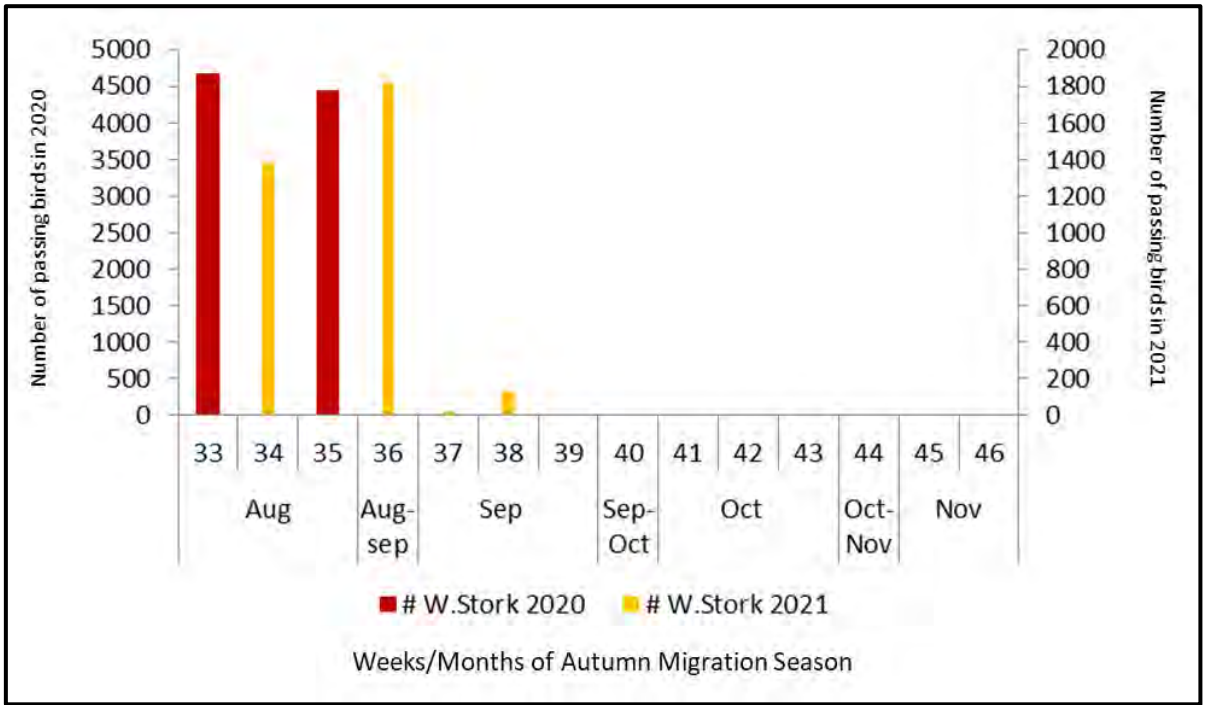


Figure 65: Migration pattern of the White Stork

The Great White Pelican appears irregularly with a great difference between years (1,133 birds in 2020 against only 368 in 2021). This irregular pattern is just the result of the strategy of the species, which migrates over the Red Sea. Despite being a large soaring bird, we cannot forget it is a species with capabilities for landing on water bodies.

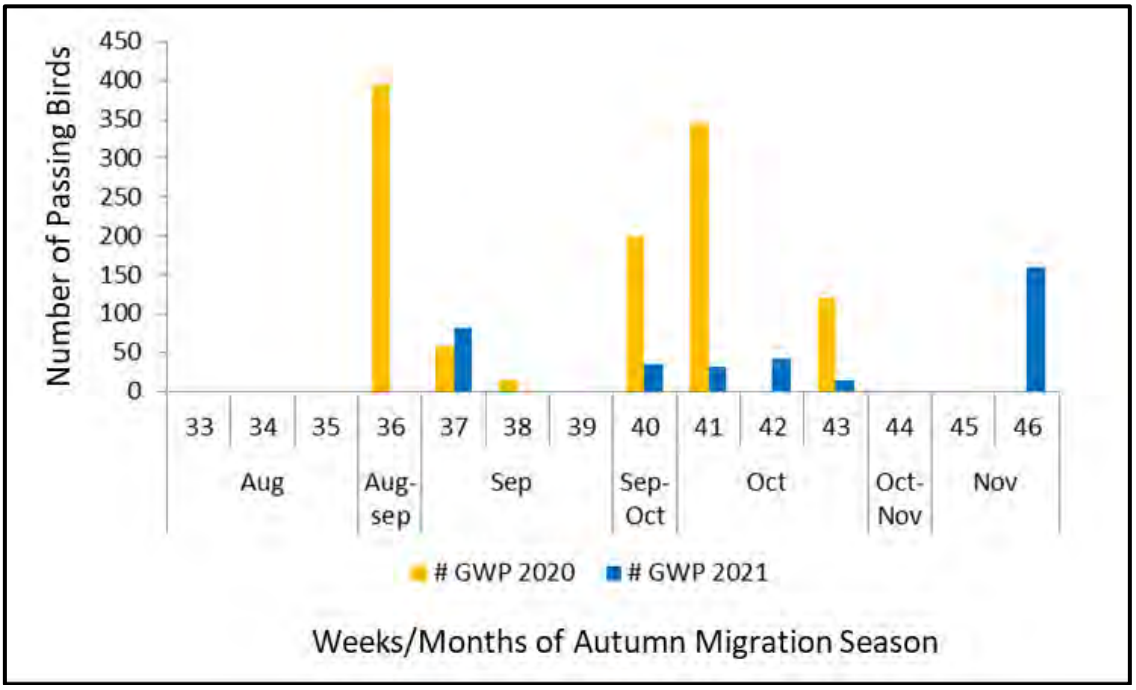


Figure 66: Migration pattern of the Great White Pelican

Migration Patterns: Time of Day

The time of passage according to the time interval in the day was analysed. The monitoring extended continuously from around 7:00 am to 5:00 pm daily. We have sorted the number of birds each year according to the time intervals (1 hour) from start till end. Similar to earlier rationale, the analysis only considered key species to include the Eurasian Honey Buzzard, White Stork, Black kite, and the Great White Pelican.

The first species is the Black Kite, which shows a different pattern in 2020 and 2021. However, the number of birds is quite small compared to other species. In 2020 birds arrived earlier compared to 2021 when they mostly passed in the afternoon. Caution should be taken into account before making any further assumptions or conclusions for such small amount of kites.

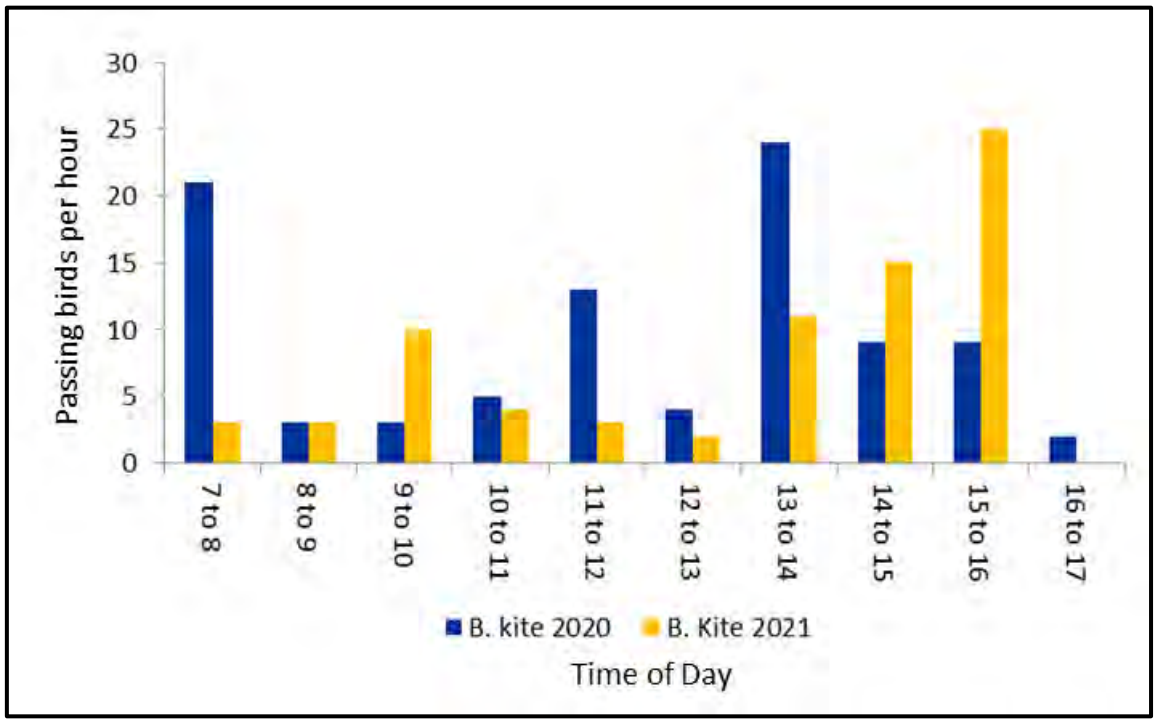


Figure 67: Daily migration pattern (hr. of the day) of the Black Kite

For the Honey Buzzard the trend is quite similar in both years, with higher numbers around noon. However, there were more birds in 2021 compared to 2020; this has an implication if other analyses is to be undertaken such as the CRM, because of the different bird numbers and time spent at rotor height.

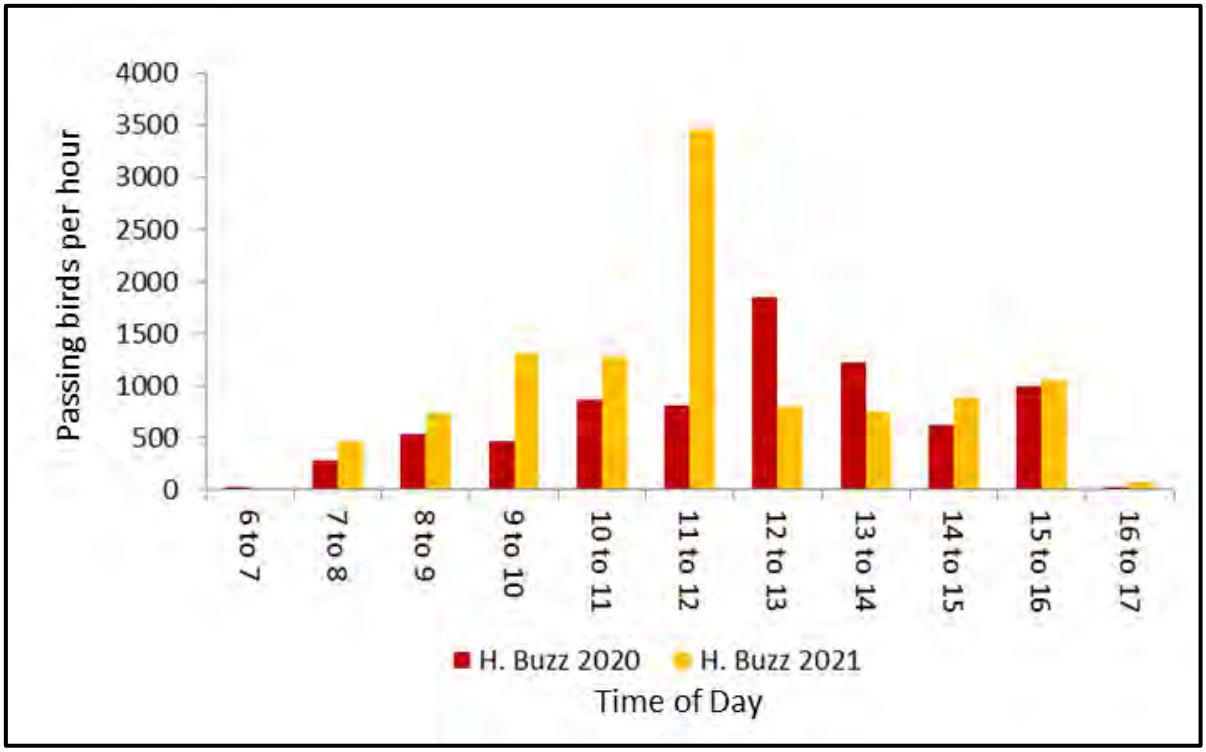


Figure 68: Daily migration pattern (hr. of the day) of the Honey Buzzard

The White Stork also has a different pattern between years. Reasons for this could be the time the species has migrated over the Red Sea. Individuals arriving late in the afternoon to the vicinity of project area of influence would depart in the early morning (blue and yellow bars between 7 am to 10 am). As the storks are already on the mainland, they would not need to wait to the better weather uplifts in the midday, continuing migration as soon they can in the

following day. The bars in the afternoon could correspond with birds crossing late, and arriving to the site afterward.

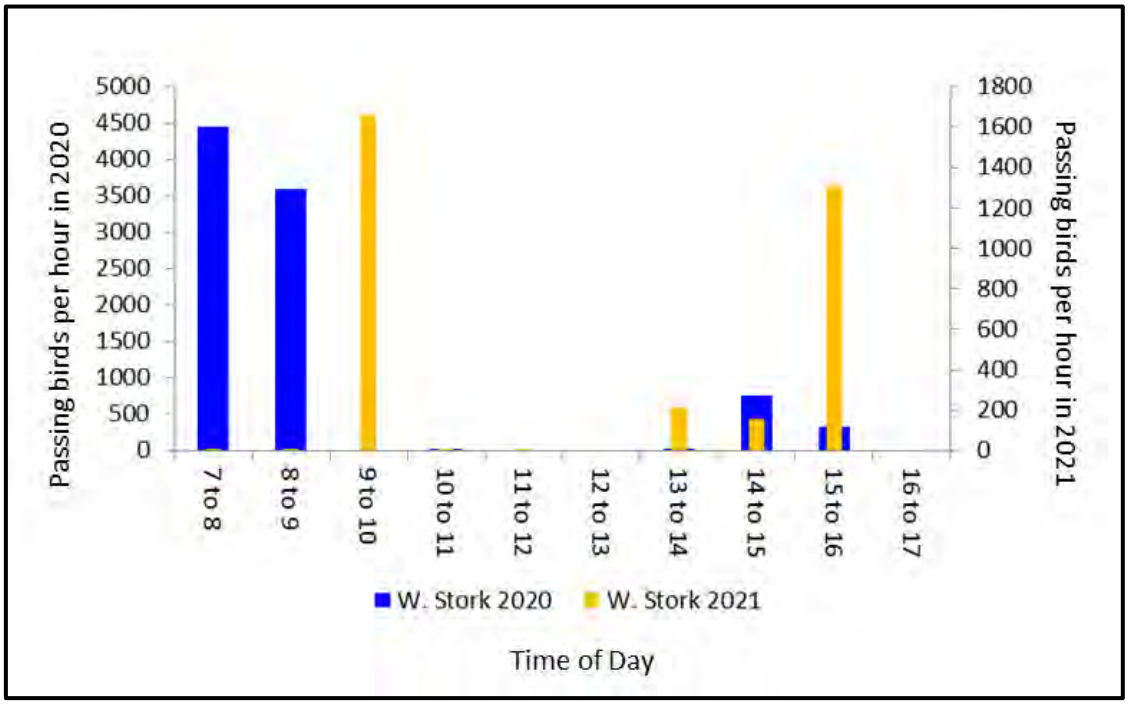


Figure 69: Daily migration pattern (hr. of the day) of the White Stork

Finally, the Great White Pelican showed an irregular pattern with more birds in 2020 (1,113) compared to 2021 (368), but also uneven distribution throughout the day.

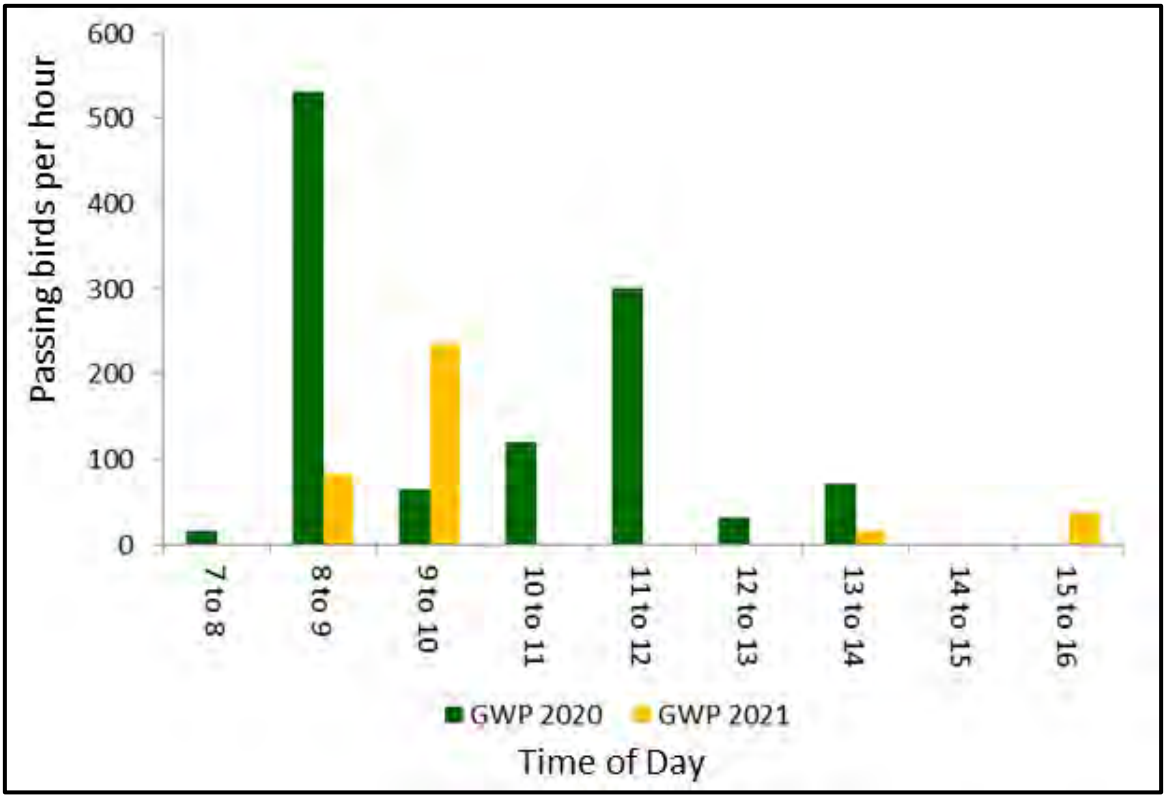


Figure 70: Daily migration pattern (hr. of the day) of the Great White Pelican

The findings suggest what is known about the migration; each species has its time of migration through the region and passage times and patterns depend from the migratory strategy they follow, e.g., crossing the Red Sea or flying through the Gulf of Suez. Once in the area, those obligated soaring like the storks, may stay for a while before continuing.

Overall, the migratory numbers may change from year to year resulting in large variations among the most abundant species like the White Stork, Great White Pelicans or Honey Buzzard.

Flight Directions

The flight directions both in 2020 and 2021 have a preferred bearing (SW), with 52.3% and 69.95% of all the birds recorded. The second direction was SE, accounting for 44.46% and 22.52%. Birds would tend to cross the desert as soon as possible, but other could move further south-east to suitable habitat in the Important Bird Area of Gebel Zeith.

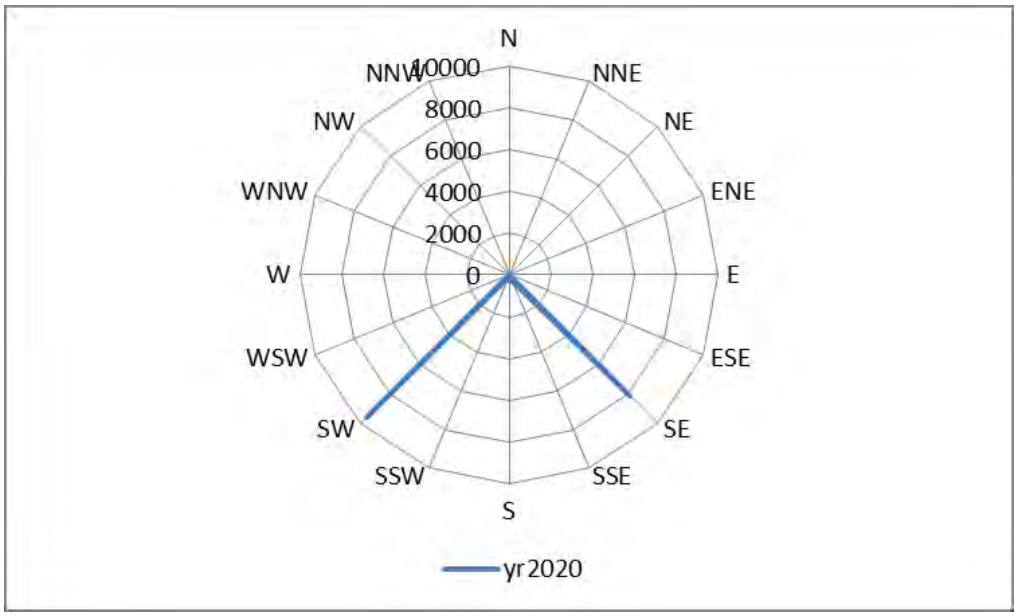


Figure 71: Bird migration directions recorded in 2020

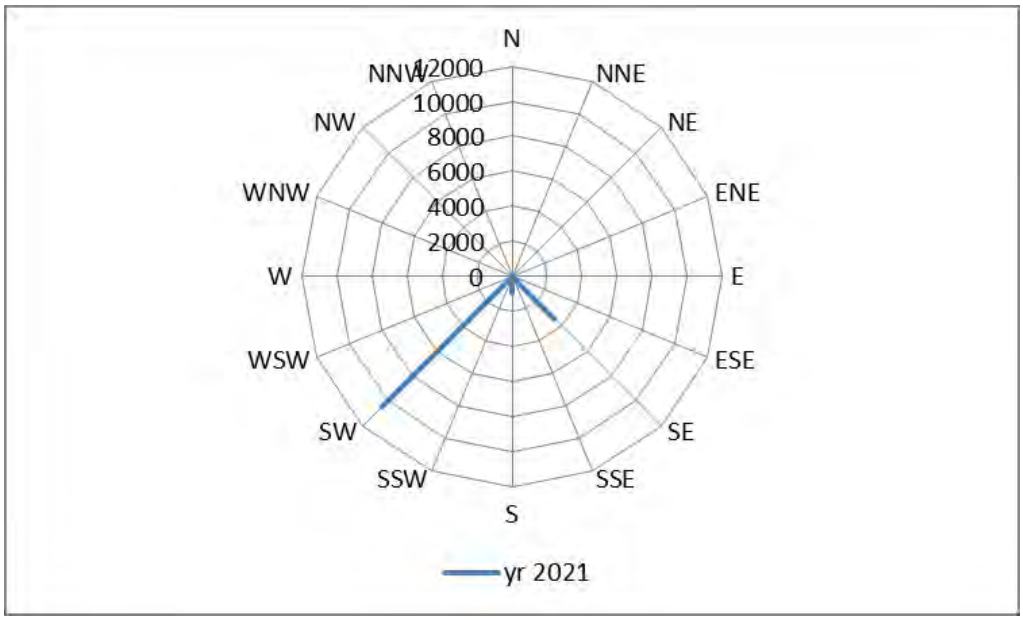


Figure 72: Bird migration directions recorded in 2021

Non-priority species

During the monitoring field work in the spring and autumn seasons 2020-2021 the observers registered non-targeted birds' species. Those are small and medium sized birds and all observations should be considered as incidental, as they do not provide a reliable sample of the community on site or during the migration.

The following table includes the list of species recorded and the individuals during spring and autumn counts. None of the species in the table are of conservation concern.

Table 32: Non-Priority Species

Species	Scientific name	Spring	Autumn
Phalacrocoracidae			
Great Cormorant	*Phalacrocorax carbo*	498	488
Ardeidae			
Grey Heron	*Ardea cinerea*	0	56
Purple Heron	*Ardea purpurea*	0	30
Threskiornithidae			
Euarsian Spoonbill	*Platalea leucorodia*	0	274
Glareolidae			
Collared Pratincole	*Glareola pratincola*	3	0
Sternidae			
White-cheeked Tern	*Sterna repressa*	0	5
Pteroclididae			
Crowned Sandgrouse	*Pterocles coronatus*	27	13
Spotted Sandgrouse	*Pterocles senegallus*	114	65
Columbidae			
Rock Dove	*Columba livia*	1	0
Laughing Dove	*Streptopelia senegalensis*	1	0
Turtle Dove	*Streptopelia turtur*	2	0
Apodidae			
Common Swift	*Apus apus*	2	0
Meropidae			
European Bee-eater	*Merops apiaster*	677	13
Upupidae			
Eurasian Hoopoe	*Upupa epops*	2	0
Corvidae			
Brown-necked Raven	*Corvus ruficollis*	125	69
Alaudidae			
Greater Short-toed	*Calandrella*	96	0

Lark	*brachydactyla*		
Lesser Short-toed Lark	*Calandrella rufescens*	0	7
Greater Hoopoe-lark	*Alaemon alaudipes*	0	1
Crested Lark	*Galerida cristata*	1	0
Desert Lark	*Ammomanes deserti*	25	1
Hirundinidae			
Barn Swallow	*Hirundo rustica*	1270	10
Sand Martin	*Riparia riparia*	37	0
Common House Martin	*Delichon urbicum*	21	0
Red-rumped Swallow	*Cecropis daurica*	93	0
Phylloscopidae			
Common Chiffchaff	*Phylloscopus collybita*	1	0
Willow Warbler	*Phylloscopus trochilus*	2	6
Sylviidae			
Rüppell's warbler	*Sylvia rueppelli*	0	1
Lesser Whitethroat	*Sylvia curruca*	9	3
Muscicapinae			
Common stonechat	*Saxicola torquatus*	1	1
Isabelline Wheatear	*Oenanthe isabellina*	0	2
Desert Wheatear	*Oenanthe deserti*	2	0
Northern Wheatear	*Oenanthe oenanthe*	4	0
Motacillidae			
Yellow Wagtail	*Motacilla flava*	2	1
White Wagtail	*Motacilla alba*	22	4

7.5.4 Overall Conclusions

1. The results of the monitoring revealed substantial differences in the bird numbers; this is not only for spring but also autumn seasons 2020 and 2021.

2. During both spring and autumn, birds pass randomly with no preference in any way for any specific areas or sites within the Project. This was confirmed through the comparison of passage rates between the eight (8) VPs for 2020 and 2021, undertaking a statistical analysis (Kruskal-Wallis tests) and preparation of intensity maps for bird species related to passing rates. The passage is random as it depends on multiple factors that go beyond this assessment as it depends on factors and influences affecting the migration timing throughout the entire migration pathway.

3. Migration patterns in terms of passage time in weeks/months was analyzed and compared with historical migration patterns in the region as established by Shirihai et al. (2000) (with over 30 years of data). It was concluded that migration patterns in general are similar to those established by Shirihai et al. (2000) with minor differences. This might be several causes which could include: (i) advanced timing of migration for this specific year; (ii) a common pattern extending globally (e.g. due to climate change); or (iii) probably differences in study sites from which they took the data

4. Flocking behaviour was analysed and it was clear that all the eagles migrate in small groups, as do the harriers and small falcons, which do almost individually, while only limited number of species migrated in large ones.

5. The migration pattern in terms of passage during time of day was analyzed. **There are no specific time slots preferred by all species, as they may change depending on species-specific conditions, not only at the site, but elsewhere** (e.g., the sites where the birds have been roosting the night before.) It is well known for example that the arrival of birds at one site depends on the conditions at the place of departure.

6. The survey **did not identify any key, important or significant habitats for roosting or breeding sites.** Given the homogeneous landscape characteristics of the area in general, the entire species pass over the Project area given that the habitat is mostly unsuitable for breeding – this is mainly due to habitat characteristics with lack of trees or cliff shelters.

7. However, **common trends and patterns were noted for both years and seasons**. hose include:

   - The **peak of the migration taking place within the mid-daylight hours** (9:00 am to 13:00 pm). This indicates that this is the most critical time for the observers to track the birds.

   - For most species the **high percentage of risk flights is from the start of the monitoring up to 9:00 am after which such risk decreases significantly**. Some species also have an increase of risk by 1:00-2:00 pm

   - The **group of most abundant species are those forming large groups** (i.e. those with flocking behavior)

8. Taking the above into account and based on the outcomes there is **no requirement to consider any site-specific constraints or area of concern for placement of turbines within the Project site**. However, installing fewer, larger turbines that occupy a smaller area is likely to reduce collision impacts for raptors see. Rastran et. al. 2018.

7.6 Bats

This section provides an assessment of baseline conditions within the Project site and surrounds in relation to bats.

7.6.1 Baseline Assessment Methodology

The baseline assessment of the Project site was based on a literature review, which is discussed in detail below. This was based on previous studies, data, surveys, and records available in published scientific papers, books, and journals on bats of Egypt and the Gulf of Suez. The conservation status of the bat species listed from the literature review are based on IUCN's Red List of Threatened Species (IUCN, 2019).

7.6.2 Results

Based on literature, a total of 22 bat species are known to occur in Egypt as a whole. Out of which, at least ten species are known to have a presence within the Project site and its vicinity as part of their distribution range. In addition to those ten species, there are at least four more species that have their distribution range adjacent to the area of Gulf of Suez. All ten species listed in the literature are species of Least Concern according to the IUCN Red List of Threatened Species, see table below.

Table 33: List of Bat Species Recorded in Project Site and Vicinity Based on Literature Review

Family	Scientific name	Common name	IUCN Red List of Threatened Species (IUCN, 2019)
Hipposideridae	*Allesia tridens*	Geoffroy's Trident Leaf-nosed Bat	Least Concern
Nycteridae	*Nycteris thebaica*	Cape Long-eared Bat	Least Concern
Vespertilionidae	*Pipistrellus kuhlii*	Kuhl's Pipistrelle	Least Concern

Family	Scientific name	Common name	IUCN Red List of Threatened Species (IUCN, 2019)
	Pipistrellus rueppellii	Ruppel's Pipistrelle	Least Concern
	Nycticeinops schliefenni	Schlieffen's Bat	Least Concern
	Eptescisu bottae	Botta's Serotine	Least Concern
Rhinopomatidae	*Rhinopoma microphyllum*	Greater Mouse-tailed Bat	Least Concern
	Rhinopoma hardwickii	Lesser Mouse-tailed Bat	Least Concern
	Rhinopoma cystops	Egyptian Mouse-tailed Bat	Least Concern
Emballonuridae	*Taphozous nudiventris*	Naked-rumped Tomb Bat	Least Concern

It is important to note that bat activity in general is correlated to insect activity. Where insects are present it is likely that bat activity will be present given that they feed on them. Within the site, nocturnal insect activity is expected to be very low, if not absent, due to the arid nature of the Project site and the very low vegetation coverage (as discussed in "Section 7.4" earlier). Vegetation coverage is the main source for many insects (e.g. moths) where they breed and feed.

In addition, based on the biodiversity survey undertaken earlier, it does not seem that the Project site supports any roosting sites for bats (however this will require verification through the bat survey that will be required as discussed below). Potential areas for roosting sites could be within the mountainous areas to the west of the Project site.

Finally, it is important to note that one previous bat survey and assessments with bat detectors has been undertaken in the GoS in 2021 and another is currently undertaken (May – September 2022). Both surveys were undertaken for wind farms that are located close to the Project site. Both surveys have showed zero bat activity which is very likely due to the reasons noted earlier above.

7.7 Archaeology and Cultural Heritage

This section provides an assessment of baseline conditions within the Project site and surrounds in relation to archaeology and cultural heritage.

7.7.1 Baseline Assessment Methodology

The baseline assessment of the Project site was based on a literature review and a field survey, each of which is discussed below.

(i) *Literature Review*

Literature review included a comprehensive review of archives, publications, and studies on previous archaeological and cultural heritage work and surveys undertaken in the area, and which are available through desktop review as well as through the Red Sea Antiquities Inspection Office and Suez Antiquities Inspection Office. Such literature review included information available through the French Institute for Oriental Archaeology, French Institute in Cairo, and data published by the French mission working at in Sukhna city.

(ii) *Field Survey*

A field survey was undertaken by an archaeology and cultural heritage expert. The objective of the field survey was to ascertain the presence of any surface archaeological or cultural heritage remains within the Project site. The survey was undertaken to cover the entire Project site

boundary. The surface area was walked by the expert in order to inspect the entire ground surface. Based on the survey, should any sites of interest be recorded the following will be undertaken:

- Sketch plans and /or a photograph as appropriate
- GPS coordinates for the area
- Undertake an analysis to categorize the sites and archaeological features and making an assessment of their significance.

7.7.2 Results

This section presents the results in accordance with the methodology discussed above. Based on the literature review, it is concluded that there are no registered archaeological sites with the Project area itself. The closest sites that are considered of great archaeological, historical and cultural heritage value are described in the table below and presented in the figure that follows.

Table 34: Description of Closest Archaeological Sites to the Project

Site	Description	Distance to Project
Wadi Jarf / Red sea coast	A harbour complex which was used regularly during the second half of the Old Kingdom and the Middle Kingdom (from 2550 to 1700 b.c.e.). It was used by the expeditions seeking turquoise and other products from south Sinai. Moreover, it's also known for its very famous wadi jarf papyrus which dates to the reign of king khufu and which describes the organization of labour under the supervision of their leader Merer who recorded the diary of the mission on a long papyrus sheet.	30km to the north
Saint Anthony Monastery (Deir erl Qidis Antun)	Saint Anthony's disciples founded the monastery between 361 and 36 (Starkey.2012:205)	50km to the north
Saint Paul Monastery (Deir el Qidis Nulus):	The monastery is located in front of mount el galala. The caves in this area were used by Christian monks who used the limited resources available in the harsh desert for living, while the cave and chapel of Saint Paul in particular were considered the base for the current monastery (Starkey.2012: 207).	30km to the north

Figure 73: Location of Closest Archaeological Sites to the Project Area

Finally, based on the site survey undertaken, no archaeology and cultural heritage sites were identified or recorded within the Project site. In addition, it is important to note that in 2008, an official letter has been issued by the Supreme Council of Antiquities (SCA) to NREA which states that the SCA has no objection on the development of wind farms within the NREA land plots allocated for wind energy developments. The official letter is presented in the figure below.

6. A letter from the Supreme Council of Antiques

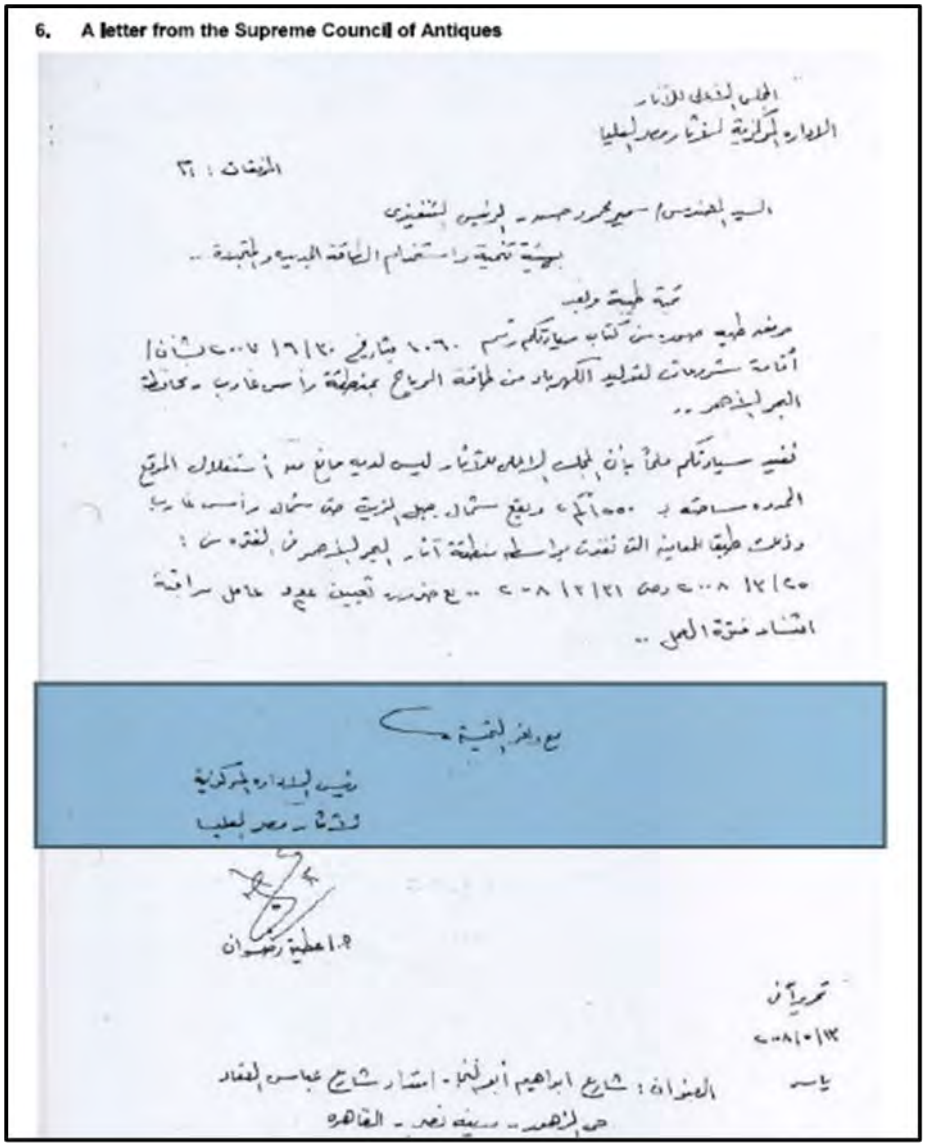


Figure 74: Letter Issued by SCA

7.8 Air Quality and Noise

This section provides an assessment of baseline conditions within the Project site and surrounds in relation to air quality and noise.

7.8.1 Baseline Assessment Methodology

Assessment of baseline conditions was based on an onsite air quality and noise monitoring program undertaken at the Project site. Additional details are discussed below.

(i) Selection of Parameters

Monitoring was undertaken for the following parameters: (i) gases to include Carbon monoxide (CO), Sulphur Dioxide (SO_2) and Nitrogen Dioxide (NO_2), (ii) Suspended Particulate Matter to include Total Suspended Particulate (TSP) and Respirable Particulates (i.e. Particulate Matter smaller than 10.0 (PM10) and 2.5 microns (PM2.5) in diameter); and (iii) Noise Pressure Levels (NPL). These parameters were selected based on the following rationale:

- Such parameters are likely to be present within the Project site given its characteristic and attributes. Suspended particulate matter is expected given the barren nature of the site. On the other hand, pollutants (such SO_2, NO_2,) are expected onsite but rather at minimal

concentrations as the site is relatively in a remote area; nevertheless, motor emissions particularly from vehicles passing casually through the site (or from the main road) could be a source of such pollutants. Finally, noise levels are expected from vehicular movement and to some extent from onsite and surrounding areas and activities.

- Such parameters are likely to be affected mainly during the Project's construction and operational activities. All air pollutant parameters selected are expected to be slightly impacted and increase specifically during the Project's construction activities. Emissions from vehicles and machinery used onsite and their movement onsite will increase gaseous emissions, suspended particulate matter, as well as noise pressure levels.

(ii) *Selection of Locations*

To assess the air quality and noise baseline conditions within the Project area, 4 monitoring points were selected taking – three of which represent the various part of the Project site (north, middle and southern) while the fourth was located at nearest receptor within the Project area. Monitoring was undertaken for 8h at each point respectively.

The coordinates for the monitoring points and location is presented in the table and figure that follows.

Table 35: Location of Monitoring Points

Locations	North	East
Point #1	28 53 96.36	32 88 19.69
Point #2	28 48 80.38	32 90 73.56
Point #3	28 43 91.75	32 97 08.75
Point #4	28 44 22.57	32 96 47.37

Figure 75: Location of Monitoring Points

(iii) *Legislative Requirements*

With regards to air quality, the results of the measurements were compared to the national limits as set within Annex 5 of the Executive Regulation (D1095/2011) for ambient air quality. The

table below identifies the corresponding applicable national ambient air quality permissible limits. The limits included for 'industrial' areas where used for comparison given the industrial nature of the site that includes petroleum activities and wind farms.

Table 36: Applicable National Ambient Air Quality Permissible Limits (Annex 5 of the Executive Regulation (D1095/2011) for ambient air quality)

Pollutant	Location	Maximum Limit (µg/m³)			
		1 Hour	8 Hours	24 Hours	1 Year
Sulfur Dioxide (SO_2)	Urban Industrial	300 350	--- ---	125 150	50 60
Carbon Monoxide (CO)	Urban Industrial	30 mg/m³	10 mg/m³	--- ---	--- ---
Nitrogen Dioxide (NO_2)	Urban Industrial	300 300	--- ---	150 150	60 80
Total Suspended Particles (TSP)	Urban Industrial	--- ---	--- ---	230 230	125 125
Respirable Particulates (PM_{10})	Urban Industrial	--- ---	--- ---	150 150	70 70
Solid Particulates < 2.5 µm	Urban Industrial	--- ---	--- ---	80 80	50 50

With regards to noise, the results were compared to the national limits set in Annex 7 of the Executive Regulation (D710/2012) for the 'Day' and 'Night' intervals. The table below lists the different area classifications and their corresponding applicable permissible limits for noise. Similarly, the limits included for 'industrial' areas where used for comparison given the industrial nature of the site that includes petroleum activities and wind farms, which is set at 70dB(A) for both night and day.

Table 37: Applicable National Permissible Limits for Noise (Annex 7 of the Executive Regulation (D710/2012))

Type of Area	Permissible Limit for Noise Intensity [dB (A)]	
	Day (7 am to 10 pm)	Night (10 pm to 7 am)
Sensitive areas to noise	50	40
Residential suburb with low traffic and limited activities service	55	45
Residential areas in the city and have commercial activities	60	50
Residential areas are located on roads less than 12 m and have some workshops or commercial activities or administrative activities or recreational activities … etc.	65	55
Residential areas located on roads equal or more than 12 m, or industrial zones with light industry and some other activities	70	60
Industrial areas (heavy industries)	***70***	***70***

7.8.2 Results

Air Quality

The tables below present the overall results for the air quality monitoring that was undertaken. As noted in the tables below, at all monitoring points and for all parameters monitored, the results are significantly lower than the maximum allowable ambient air levels indicated within the legal limits and IFC/WB permissible standards.

Table 38: Results for Monitoring Point 1

Time	NO (µg/m³)	NO2 (µg/m³)	NOx (µg/m³)	SO2 (µg/m³)	CO (mg/m3)	PM2.5 (µg/m³)	PM10 (µg/m³)	T.S.P (µg/m³)
10:AM	13.8	11.5	22.3	10.6	2.3	21	101.69	122.29
11:00	12.8	12.3	19.1	11.2	2.7			
12:00	18.5	17.2	32.7	12.2	2.3			
13:00	14.2	18.2	25	13.2	2.4			

Time	NO (µg/m³)	NO2 (µg/m³)	NOx (µg/m³)	SO2 (µg/m³)	CO (mg/m3)	PM2.5 (µg/m³)	PM10 (µg/m³)	T.S.P (µg/m³)
14:00	10.1	16.7	30.2	12.1	2.8			
15:00	13.2	11.8	20	14.9	2.6			
16:00	16.2	9.8	25	14.8	2.2			
17:00	11.5	15.9	30.4	15.9	2.1			
Limits								
1 hour	-	**300**	-	**300**	**30**	-	-	-
8 hours	-	-	-	-	**10**	-	-	-
24 hours	-	**150**	-	**125**	-	**80**	**150**	**230**
	IFC / WB EHS Guidelines		**200 (per hour)**		**125 (24h)**	**75 (24h)**	**150 (24 h)**	

Table 39: Results for Monitoring Point 2

Time	NO (µg/m³)	NO2 (µg/m³)	NOx (µg/m³)	SO2 (µg/m³)	CO (mg/m3)	PM2.5 (µg/m³)	PM10 (µg/m³)	T.S.P (µg/m³)
10:AM	15.8	13.5	22.3	10.6	1.9	24	90.60	118.56
11:00	14.8	14.3	19.1	11.2	2.2			
12:00	19.5	17.2	32.7	12.2	2.3			
13:00	15.2	18.2	25	13.2	2.1			
14:00	11.1	16.7	31.2	12.1	2.8			
15:00	14.2	11.8	29.5	14.9	2.8			
16:00	18.2	10.8	28.54	14.8	2.3			
17:00	12.5	15.9	31.4	15.9	2.4			
Limits								
1 hour	-	**300**	-	**300**	**30**	-	-	-
8 hours	-	-	-	-	**10**	-	-	-
24 hours	-	**150**	-	**125**	-	**80**	**150**	**230**
	IFC / WB EHS Guidelines	**200 (per hour)**	**125 (24h)**	**75 (24 h)**	**150 (24h)**			

Table 40: Results for Monitoring Point 3

Time	NO (µg/m³)	NO2 (µg/m³)	NOx (µg/m³)	SO2 (µg/m³)	CO (mg/m3)	PM2.5 (µg/m³)	PM10 (µg/m³)	T.S.P (µg/m³)
10:AM	11.8	12.5	25.3	11.6	1.8	22	98	115.29
11:00	10.8	13.3	27.1	13.2	2.2			
12:00	17.5	16.2	32.7	10.2	2.1			
13:00	13.2	15.2	25	11.2	2.9			
14:00	9.1	18.7	29.2	10.1	2.4			
15:00	11.2	14.8	23	13.9	2.9			
16:00	14.2	9.8	21	14.8	3.1			
17:00	10.5	13.9	18.4	13.9	2.7			
Limits								
1hour	-	**300**	-	**300**	**30**	-	-	-
8 hours	-	-	-	-	**10**	-	-	-

Time	NO (µg/m³)	NO2 (µg/m³)	NOx (µg/m³)	SO2 (µg/m³)	CO (mg/m3)	PM2.5 (µg/m³)	PM10 (µg/m³)	T.S.P (µg/m³)
24 hours	-	150	-	125	-	80	150	230
	IFC / WB EHS Guidelines		200 (per hour)		125 (24h)	75 (24h)	150 (24h)	

Table 41: Results for Monitoring Point 4

Time	NO (µg/m³)	NO2 (µg/m³)	NOx (µg/m³)	SO2 (µg/m³)	CO (mg/m3)	PM2.5 (µg/m³)	PM10 (µg/m³)	T.S.P (µg/m³)
10:AM	13.8	11.5	21.3	11.6	1.9	20	90	127.56
11:00	12.8	15.3	18.1	12.2	1.8			
12:00	17.5	18.2	30.7	14.2	2.1			
13:00	14.2	16.2	21	15.2	2.8			
14:00	13.1	14.7	30.2	14.1	2.0			
15:00	15.2	13.8	27.5	16.9	2.2			
16:00	17.2	11.8	23.54	14.8	2.6			
17:00	14.5	14.9	33.4	18.9	2.9			
Limits								
1 hour	-	**300**	-	**300**	**30**	-	-	-
8 hours	-	-	-	-	**10**	-	-	-
24 hours	-	**150**	-	**125**	-	**80**	**150**	**230**
	IFC / WB EHS Guidelines	**200 (per hour)**	**125 (24h)**		**75 (24h)**	**150 (24h)**		

Noise

The following tables present the overall results for the noise monitoring that were undertaken (the LAeq average noise level at each monitoring point). As noted in the tables below, all results are within the maximum allowable noise limits set for the area for local limits as well as IFC/WB EHS Guidelines with no exceedances recorded.

Table 42: Outcomes of Noise Monitoring at Point 1

Time	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA)
	LAeq	LA10	LA50	LA90	LA95	LCpeak	National & IFC/WB Limit
10:00	59.60	49.51	40.23	32.27	42.40	117.57	70
11:00	55.68	47.10	36.87	24.89	29.23	123.01	
12:00	54.88	56.71	41.62	35.97	39.98	104.82	
13:00	56.25	53.29	47.04	41.27	36.32	107.57	
14:00	55.64	50.51	44.00	36.39	36.03	97.71	
15:00	59.90	49.51	39.45	39.06	38.39	99.54	
16:00	57.71	55.80	49.43	40.13	40.07	107.73	
17:00	58.31	52.60	44.84	32.94	31.53	90.40	

Table 43: Outcomes of Noise Monitoring at Point 2

Time	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA)
	LAeq	LA10	LA50	LA90	LA95	LCpeak	National & IFC/WB Limit
10:00	57.64	53.43	48.07	37.17	35.54	117.57	70
11:00	55.82	47.10	38.83	29.79	28.25	128.89	
12:00	58.92	51.81	48.48	36.95	39.00	105.80	
13:00	57.33	51.33	43.12	40.29	39.26	107.57	
14:00	58.70	53.45	46.94	38.35	36.03	95.75	
15:00	58.92	53.43	46.70	39.06	37.41	103.46	
16:00	55.75	53.84	52.37	45.03	43.01	102.83	
17:00	56.35	52.60	48.76	37.84	35.45	93.34	

Table 44: Outcomes of Noise Monitoring at Point 3

Time	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA)
	LAeq	LA10	LA50	LA90	LA95	LCpeak	National & IFC/WB Limit
10:00	58.41	48.52	39.43	31.62	41.55	115.22	70
11:00	51.43	46.16	36.13	24.39	28.65	120.55	
12:00	59.66	55.58	40.79	35.25	39.18	102.72	
13:00	60.03	52.22	46.10	40.44	35.59	105.42	
14:00	50.41	49.50	43.12	35.66	35.31	95.76	
15:00	58.70	48.52	38.66	38.28	37.62	97.55	
16:00	56.56	54.68	48.44	39.33	39.27	105.58	
17:00	57.14	51.55	43.94	32.28	30.90	88.59	

Table 45: Outcomes of Noise Monitoring at Point 4

Time	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA)
	LAeq	LA10	LA50	LA90	LA95	LCpeak	National & IFC/WB Limit
10:00	57.24	47.55	38.64	30.99	40.72	112.92	70
11:00	59.20	45.24	35.41	23.90	28.08	118.14	
12:00	58.47	54.47	39.97	34.55	38.40	100.67	
13:00	58.83	51.18	45.18	39.63	34.88	103.31	
14:00	59.20	48.51	42.26	34.95	34.60	93.84	
15:00	57.53	47.55	37.89	37.51	36.87	95.60	
16:00	55.43	53.59	47.47	38.54	38.48	103.47	
17:00	56.00	50.52	43.06	31.63	30.28	86.82	

7.9 Infrastructure and Utilities

This section provides an assessment of baseline conditions in relation to infrastructure and utilities.

7.9.1 Baseline Assessment Methodology

Assessment of baseline conditions was based on an onsite survey undertaken for the Project and surrounding areas as well as consultations with relevant entities that are managing such infrastructure and utility elements as applicable. Additional details are discussed below.

7.9.2 Existing Roads and Networks

Based on the survey undertaken on the Project site it was indicated that there are the following main roads:

- The access to the Project area is via the Suez-Hurghada road, a four-lane road, runs at distances of 2.5 to 4.5 km to the eastern boundary of the Project area from north to south. The Suez-Hurghada road is connected with Ras Ghareb-El Shaikh Fadel road, an asphalt road with two lanes, running at distances of at least 5.8 km south of the Project area from west (the Nile Valley) to east (the Red Sea coast). This road has very little traffic load compared to its capacity and it is fit for heavy transports. Hence, there is no bottleneck with regard to traffic / heavy transport capacity on public roads.
- The Project site itself can be reached via asphalt roads owned by West Ras Bakr Petroleum Company and Petro Dara Company starting from the Suez-Hurghada road north of Ras Ghareb and by single tracks already built in the context of wind farm development. The roads have sufficient strength and width and would be suitable for heavy transport.
- Unpaved tracks cross the Project area and these can be accessed via off-road tracks and by the use of 4-wheel drive cars.

This concludes that the Project teams have several ways to access to the plot. The following table provides description for the closest existing roads.

Table 46: Description of the Existing Roads in the Project Area

Name of Road	Distance to the site (km)	Direction	Number of lanes/directions	Status
Zaafarana- Hurghada Road	5 km	East	2	In operation
External road 1	0.50km	East	1	In operation
External road 2	0.50km	West	1	In operation
Internal road	0 km	South, passes through farm areas	1	In operation

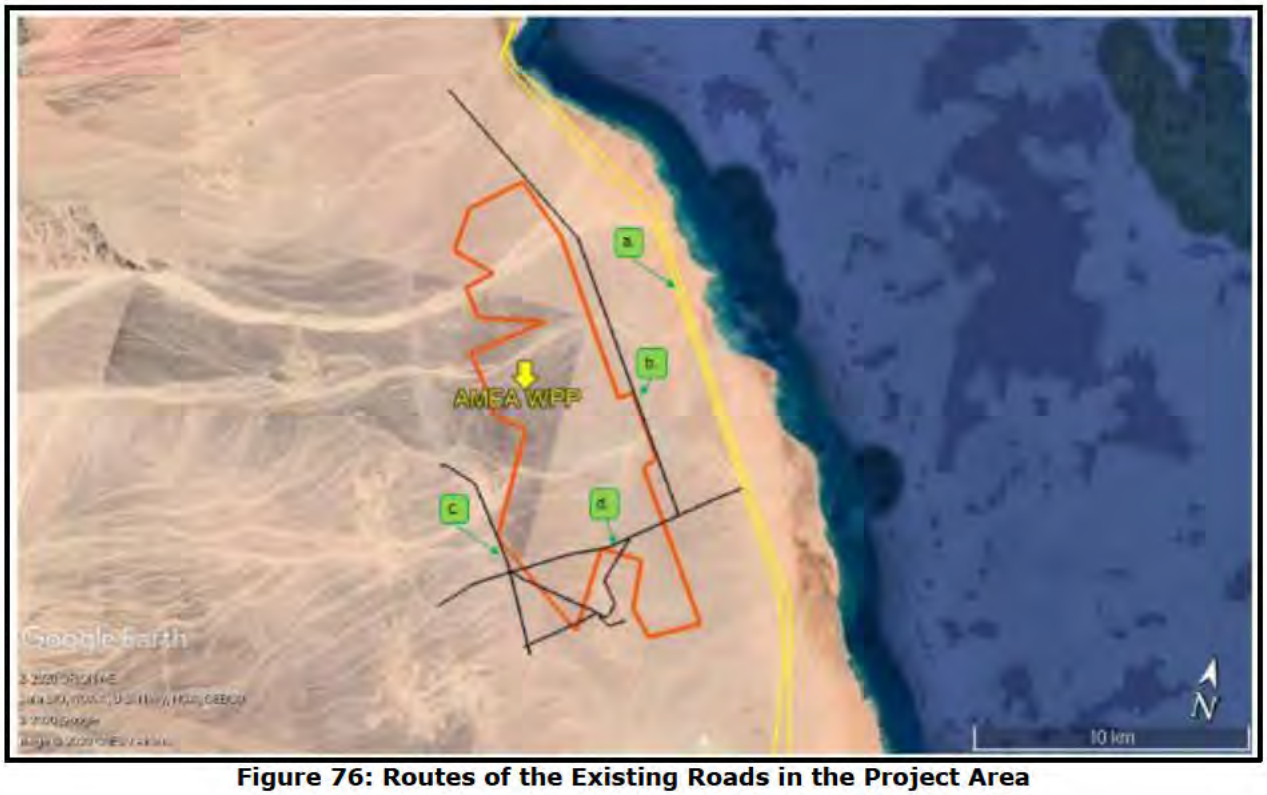


Figure 76: Routes of the Existing Roads in the Project Area

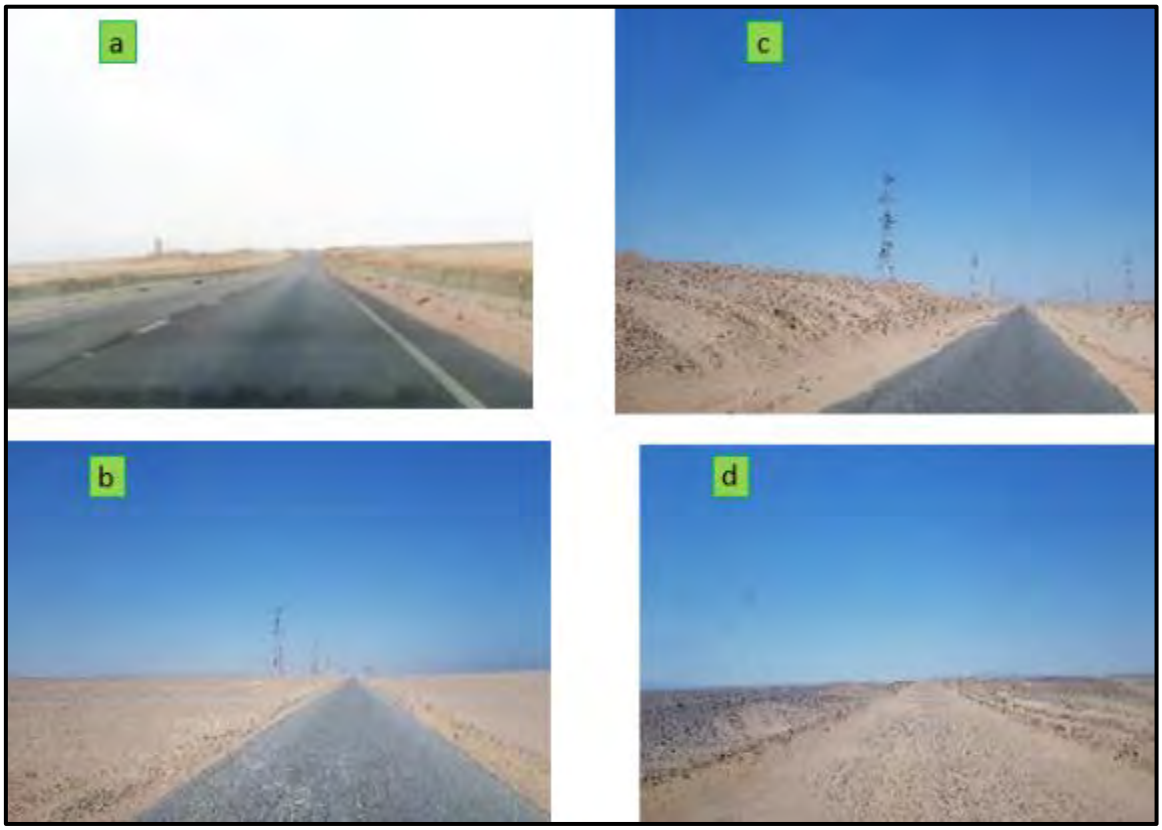


Figure 77: A) Zaafarana-Hurghada Road, B) External Road 1, C) External Road 2 and D) Internal Road

7.9.3 Electricity Lines

There are no electricity distribution system infrastructure components in the area. Each of the petroleum companies surrounding the project depends on their own electricity system by generators suitable for on-site activities during the various stages of the project.

Some overhead transmission lines (OHTL) run along to the eastern border of the project area at a distance of around 600m outside the site. The electricity line is under the responsibility of the Egyptian Electricity Transmission Company (EETC).


Figure 78: Overhead Transmission Line (OHTL) in the Project Area

7.9.4 Petroleum Pipelines

There are some petroleum pipelines that pass close to the Project area at the south direction and through the land of the Project site from the north direction.

Figure 79: Petroleum Pipelines in the Project Area

7.9.5 Water Management

Based on consultations with Ras Ghareb Water Company there are no existing or planned water connections to the Project area. In addition, it was indicted that developments in such areas in general have to rely on water trucks and tankers from Ras Ghareb to deliver water requirements to the site while the drinking water is mostly bottled water.

7.9.6 Waste Management (solid waste, wastewater, and hazardous waste)

With regards to wastewater, this is disposed through the Ras Ghareb Water Company whom have tankers that collect wastewater and dispose it at the Ras Ghareb Wastewater Treatment Plant (WWTP).

Regarding solid waste management, the Red Sea Governorate has only one controlled dumpsite for the disposal of solid waste. This is known as the Ras Gharib Public dumpsite, located 4 Km East of the City of Ras Ghareb. The dumpsite is owned and operated by the Ras Ghareb City Council. However, this dumpsite in particular is no longer in use and has been closed by the City Council. Currently, an updated disposal facility is being developed by the Ras Gharib City Council.

Finally, with regards to hazardous waste management, in Egypt there are currently 2 approved hazardous waste disposal facilities in Alexandria and Helwan which are about 600 and 400 km respectively from site. The hazardous waste facilities are managed by the Nasiriya Hazardous Waste Treatment Centre (NHWTC) in Alexandria and in Arab Abu Saed the 2 facilities are privately owned and managed by First and EcoConServ Services.

7.9.7 Civil and Military Radars and Aviation

As discussed earlier, located around 9 km from the Project site is an Air Force Unit. The Unit includes a military radar; however, no additional details could be obtained on this. In addition, no details are available on civil aviation radars in the area.

7.9.8 Dams

There are three dams within the area as noted in the figure below.

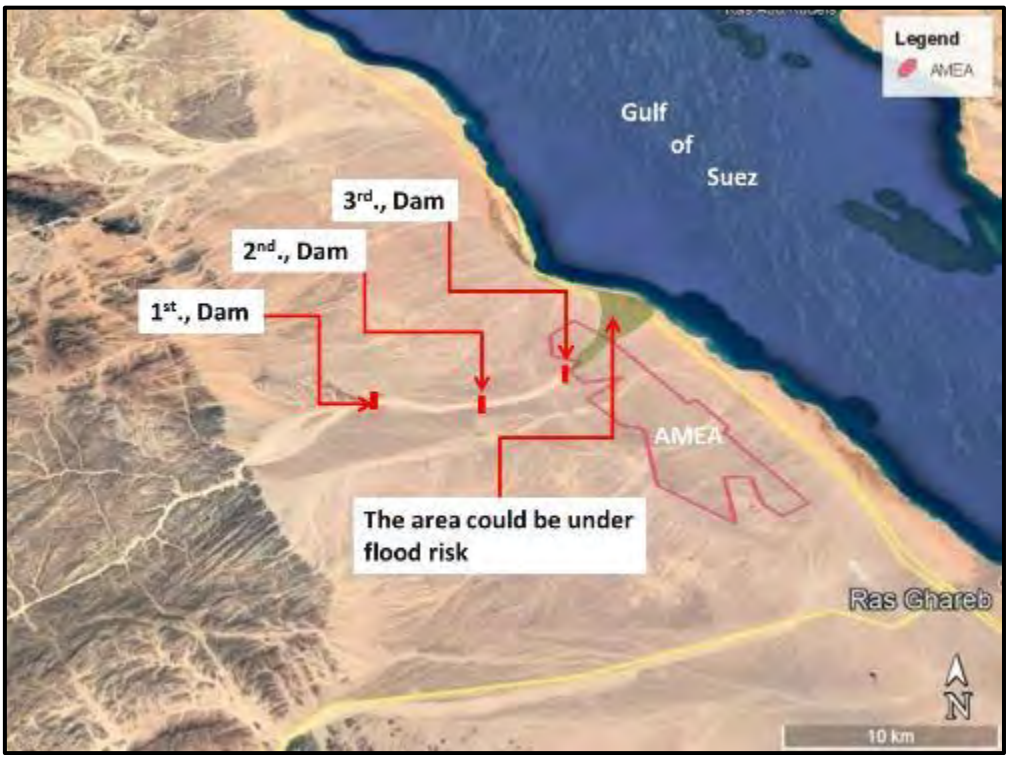


Figure 80: Location Map of the Project Site Showing the Location of the Three Constructed Dams

- The first dam: located at the far west just below the foot slope the high lands (watershed area). An artificial lake was constructed in front of the dam. The average dimension of the dam and its lake are as follows:

The dam dimensions

- Length: 250 m
- Width: 70 m
- Height: 5 m

The artificial lake dimensions:

- Length: 450 m
- Width: 250 m
- Depth: 3 m

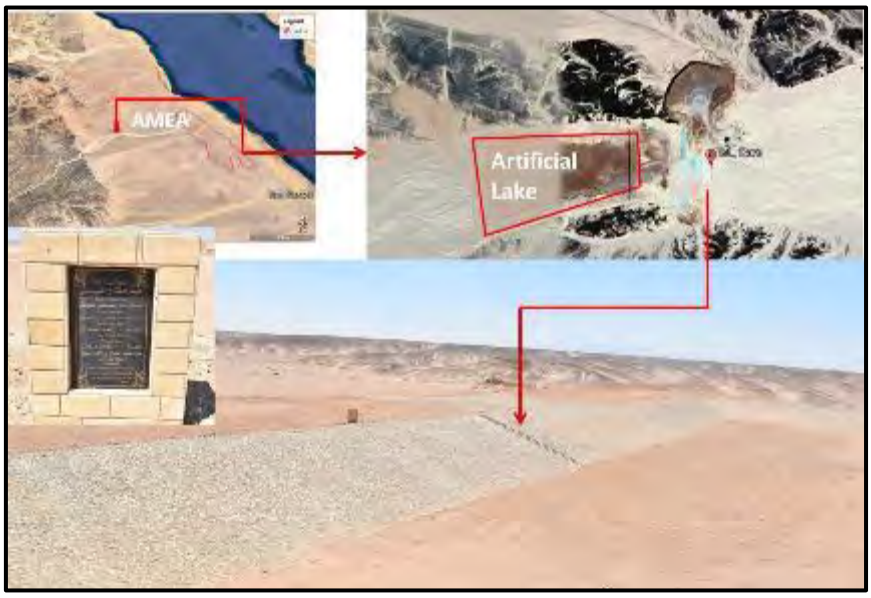


Figure 81: The First Dam at the West of Wadi Hawashiya

- The second dam: was built to the east of the first one by about 6 km.

The Dam dimensions

The artificial lake dimensions

- Length: 350 m
- Width: 70 m
- Height: 5 m

- Length: 450 m
- Width: 350 m
- Depth: 3 m

Figure 82: The Second Dam at the West of Wadi Hawashiya

- The third dam: is down gradient from the second dam by around 7 km to the east. The dam is located at the northwest corner of the Project site

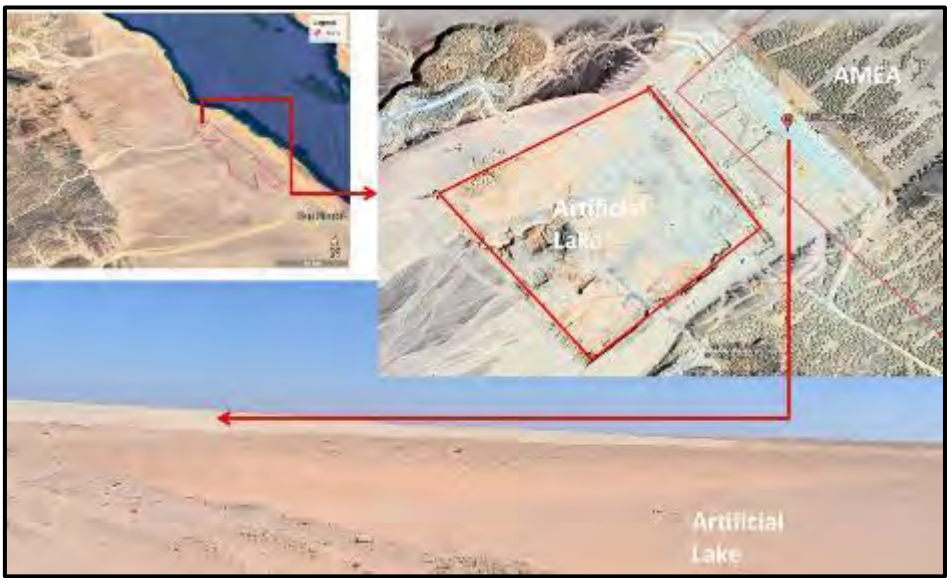


Figure 83: The Third Dam at the West of Wadi Hawashiya

The Dam

- Length: 450 m
- Width: 70 m
- Height: 5 m

The artificial lake:

- Length: 400 m
- Width: 350 m
- Depth: 3 m

7.9.9 Telecommunication Tower

A telecommunication tower is located outside of the Project area to the south at the following coordinates (28 23 43.16 N, 32 57 48.09 E), as presented in the figure below.

Figure 84: Telecommunication Tower

7.10 Public Health and Safety

This section provides an assessment of baseline conditions within the Project site and surrounds in relation to public health and safety.

As discussed earlier, the closest human settlements to the Project site are located 9km to the southeast (Ras Ghareb city) and 65km to the north (Zaafarana village); both of which are considered at a distance from the area. *These are considered sensitive receptors.*

In addition, as discussed within the land use section (refer to "Section 7.2") it was concluded that the Project site in particular is uninhabited and vacant with no indication or evidence of any physical or economical land use activities. There are several ongoing petroleum activities within the surrounding areas (to include 4-5km radius from the site in particular). Based on consultations, it was indicated that there are no lodging facilities within such receptors and it only include employees during normal working hours. *Therefore, such receptors are not considered key sensitive receptors* defined as areas where the occupants are more susceptible to the adverse effects of a wind farm. This includes but not limited to educational facilities (e.g. school or university), places of worship (e.g. mosque), dwelling houses or units, health care facilities (e.g. hospital or health centre), workforce accommodation, etc.

7.11 Socio-economics

This section provides an assessment of baseline conditions in relation to socio-economics.

7.11.1 Baseline Assessment Methodology

Socioeconomic conditions were assessed mainly through a desk-based study on the socio-economic conditions of such local communities on the "BOO Wind Power Plant 500MW at the Gulf of Suez Site Specific ESIA and Analysis and Assessment of the Potential Risks and Impacts on habitats and the Biodiversity" (RCREEE, ECO Consult, EcoConServ, 2020). Such baseline was based on site visits, secondary data on socio-economic indicators, and consultations with relevant stakeholders to include Red Se Governorate official and Ras Gharib City Council officials.

7.11.2 Results

Basic Demographic Characteristics

- *Population Profile:*

Based on information from the Statistical Yearbook 2018, the total population of the Red Sea Governorate was 366,000, which represents 0.39% of the total national population. Further information about the population in the project area is presented in the following table.

Table 47: Population and Households Figures in the Project Area (Red Sea Governorate Information Centre, 2018)

Area	Households	Population		Total Population
		Male	Female	
Red Sea Governorate	90,748	189,081	173,919	363,000
Ras Gharib	15,446	32,870	28,916	61,786
Hurghada	23,944	49,021	46,758	95,779
Safaga	16,836	34,327	33,019	67,346
Quseir	17,086	34,921	33,424	68,345
Marsa Alam	4,554	10,265	7,951	18,216
Shalateen	6,717	14,456	12,412	26,868
Halayeb	6,165	13,221	11,439	24,660

Ras Gharib represents 17% of the total population of the Red Sea Governorate, where the majority of population is located in Hurghada, due to the large-scale touristic activities in the city. However, services and population activities are concentrated in Ras Gharib City.

The following figure shows the distribution of the population in the Red Sea Governorate according to each city:

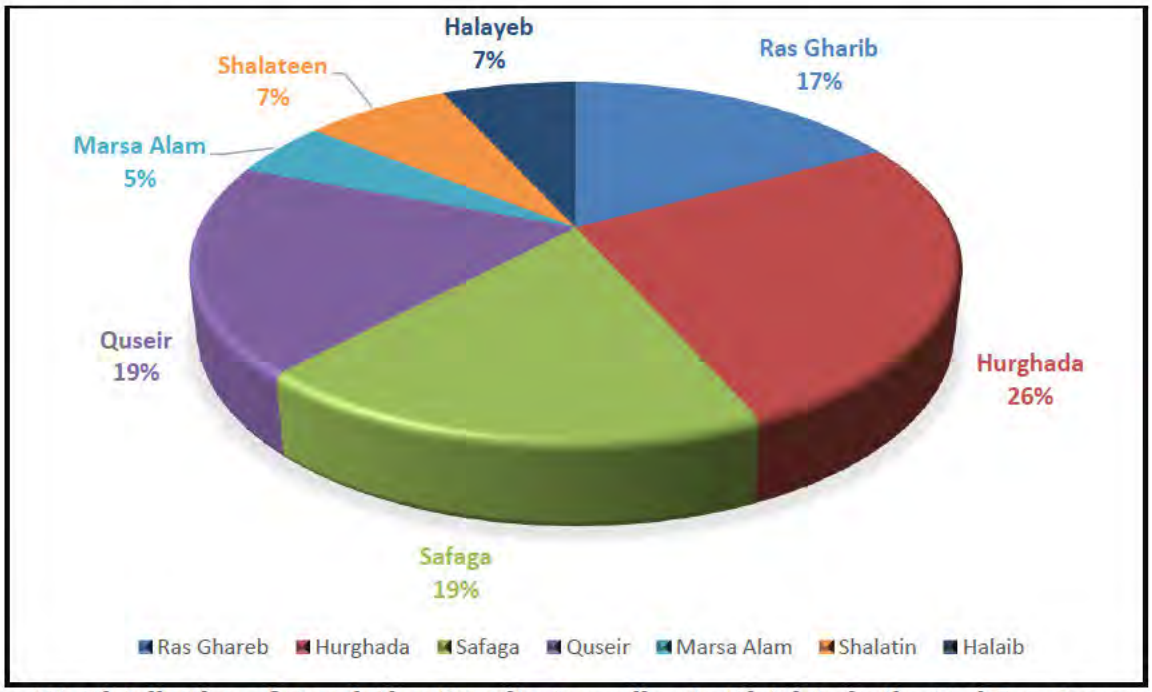


Figure 85: Distribution of Population Density According to Districts in the Red Sea Governorate

The majority of the Governorate's population is located in urban centres, and only a small number is located in rural areas in Zaafarana and Wadi Dara.

Bedouin communities in Ras Gharib are from Ma'ayza, Bashareya, and Ababdeh tribes. They are mostly unsettled, and live deep in the desert, away from the city and the villages. They currently settle permanently in Ras Gharib town (9km from the site), Zaafarana (65km from the site) and Wadi Dara (50km from the site). Such Bedouin groups generally engage in traditional economical activities such as agriculture and animal husbandry and in addition, they are also employed in the Development projects in the area (mainly the petroleum companies) either as guides, security guards, or contractors (more details in are provided throughout this section).

The demographic trend also includes migrant workers from neighbouring governorates. The predominant majority of these migrant workers work for oil companies located in the area, and a very small number work in farms in Wadi Dara village.

- *Age and Gender Distribution*

Data from CAPMAS Statistical Yearbook 2018 indicate that the population in the Red Sea Governorate is predominantly young. Based on the outcomes of the 2014 population consensus, up to 86.7% of the population of the Red Sea Governorate are under the age of 45. With respect to gender, statistical data indicates a male/female ratio in the Governorate (194,759: 171,241).

- *Rate of Natural Increase*

The total population in the Red Sea Governorate has grown by 25.30/1000 (*Red Sea Governorate Information Center, Statistical Yearbook of Red Sea Governorate, 2017-2018*), which is the highest rate over the past five years in terms of the natural increase rate. However, it is considered amongst the lowest 10 governorates in terms of birth rate.

The following table illustrates demographic trends in the Red Sea Governorate:

Table 48: Demographic Trends in the Red Sea Governorate (Red Sea Governorate Information Center, Statistical Yearbook of Red Sea Governorate, 2017-2018)

Demographic Trends	Value
Average Household Size (persons)	3.8
Natural Growth Rate (per 1,000 persons)	25.30
Urban Population (% of total Egyptian population)	0.39
Birth Rate (Births per 1,000 persons)	29.60
Mortality Rate (Deaths per 1,000 persons)	4.30

A household is defined as family (and non-family) members who share a residence and operates as a single social and economic unit. According to CAPMAS Poverty Map for 2013, the average family size in the city of Ras Gharib is estimated at four persons.

Labour Profile

CAPMAS statistical data indicates that the official unemployment rate decreased to 9.9% in the second quarter of 2018, marking the lowest rate in the past eight years. The job outlook has improved due to steadily accelerating economic growth, with Gross Domestic Product (GDP) growing by 5.4% year-on-year in the third quarter of the year 2017/2018 (January-March), according to data issued by the Ministry of Planning, Monitoring and Administrative Reform.

This followed a growth of 5.2% and 5.3%, respectively, in the first and second quarters, and despite low household incomes and high inflation rates, more of the country's unemployed youth are being absorbed by the labour market, despite the low wages. Workforce research results for the second quarter (April - June) of 2018 in Egypt are provided in the table below.

Table 49: Workforce Research Results for Q2 2018 (CAPMAS, Workforce Research Results for the Second Quarter of 2018)

Workforce[3]	Total No. of Employed Persons 26.161 Million		Total No. of Unemployed Persons 2.875 Million		Unemployment Rate 9.9%		Labour Force (by Occupation)		
	Males 80.8%	Females 19.2%	Males 53.1%	Females 46.9%	Males[4]	Females[5]	Agriculture	Industry	Service
29.036 Million	21.138 Million	5.023 Million	1.527 Million	1.348 Million	6.7%	21.2%	28.2%	24.7%	47.1%

The table above shows that the service sector forms the biggest part of the employment sector in the Governorate which accounts for around 47% of the workforce. The Agriculture sector constitutes around 28% of the total workforce, while the industry sector constitutes the lowest percentage of the working population, accounting for around 25%. In addition, the data shows that the rate of unemployment is higher amongst females compared to males.

The following table shows data from the Directorate of Manpower in the Red Sea Governorate, excluding the informal sector. The Governorate's workforce—as a percentage of the local population is estimated at 34.61%.

Table 50: The Distribution of the Project Area's Population by Work Status & Sex - Red Sea Governorate (Directorate of Manpower in the Red Sea Governorate, 2018)

Workforce	Total No. of Employed Persons 89.20 Thousand		Total No. of Unemployed Persons 25.7 Thousand		Unemployment Rate 21.7%	
	Males	Females	Males	Females	Males	Females
116.60 Thousand	77.5%	22.5%	59.8%	40.2%	17.6%	27.3%

According to the Statistical Yearbook 2018 of the Red Sea Governorate, the service sector constitutes 60.3% of the Governorate's workforce. Hurghada City represents the largest proportion of employment, due to the presence of coastal touristic areas, followed by Safaga City.

According to Ras Gharib City Council officials, the majority of the workforce can be divided into three main categories: Government/Public Sector, Oil and Gas (O&G) Petroleum Sector, and Fishing.

There is also a percentage of wageworkers. Agricultural activities are relatively minor, compared to petroleum-related activities. In addition, tourism-related activities are limited in Ras Gharib, even though some residents work in the tourism sector in other cities in the Governorate, such as Hurghada and Safaga.

Based on discussions with City Council officials, it was indicated that there is a rise in the unemployment rate in Ras Gharib City due to the limited tourism in the Governorate during recent years, which increased the lack of employment opportunities.

Table 51: Labour Status of Ras Gharib & Zaafarana (CAPMAS Poverty Map, 2013)

Employment Information	Ras Gharib City	Zaafarana Village
Male Workforce (aged 15+) from Total Population	48%	55.5%
Female Workforce (aged 15+) from Total Population	23.2%	12%
% of Employed Adults (aged 24+) from the Total Workforce	56%	59.3%
Distribution of Workforce by Sector		
Self-Employed Males	48%	20%
Self-Employed Females	23.2%	33.3%
Male Workers in the Agricultural Sector	1.7%	39.7%
Female Workers in the Agricultural Sector	0.05%	83.3%

[3] Including the number of employed and unemployed persons.

[4] Out of the total number of males (15 years of age and above) nationwide.

[5] Out of the total number of females (15 years of age and above) nationwide.

Employment Information	Ras Gharib City	Zaafarana Village
Workers in the Public Sector	54%	19.04%

Ras Gharib City attracts many migrant workers from neighbouring governorates, such as Beni Suef, Minya, Assyut, Sohag, Qena and Luxor. Workers also come from the Delta Governorates and Sinai, and the majority of them work for oil companies, while few of them work as farmers, particularly in Wadi Dara Village.

Economic Activities and Well Being

Economic activities in the city of Ras Gharib and its affiliated villages include oil and gas production, as well as agricultural activities. According to the representative of Ras Gharib city Council, tourism is not a key economic activity in the city, compared to other regions in Red Sea Governorate.

According to Ras Gharib City Council officials, government employees earn between 1,200 and 3,000 Egyptian pound (EGP) per month, while employees of oil and gas companies earn between 6,000 and 20,000 EGP per month. As for wageworkers (e.g. plumbers, electricians and service workers), they earn between 80 and 120 EGP per working day.

According to City Council officials, family expenses can reach 5,000 EGP, which is disproportionate compared to the current level of income. CAPMAS Poverty Map 2013 indicated that consumption[6] in Ras Gharib City marked 7320.52 per capita, compared to 6066.47 in Zaafarana Village.

Cultivated Lands: The area of cultivated lands in the Red Sea Governorate in 2012/2013 is almost 0.02% of the total nationwide cultivated lands. The Red Sea Governorate relies on rain and underground water in agriculture, which causes fluctuations in cultivated areas.

Fisheries: The Red Sea Governorate contributes to supplying fish, since the Governorate's coastline extends across 1,080 km and 240 km wide. The southern part of the Governorate is rich in fish resources.

Livestock: 78.74% of the total number of livestock is butchered in state-owned slaughterhouses. The Red Sea Governorate has no livestock feed or poultry feed plants. Heifers account for 35% of cattle butchered in state-owned slaughterhouses.

Industrial Activity: The total number of registered industrial firms is 53, operating in four industrial zones. The total number of workers in registered industrial firms is 4,340 workers (*Source: Red Sea Governorate Official Website, 2018).*

Social Services Profiles

- *Education*

Education is one of the most important criteria for measuring the progress of people and their ability to advance and improve their standard of living. According to CAPMAS, September 2018 announced that Egypt's illiteracy rate dropped from 39.4% in 1996 to 29.7% in 2006, and then to 25.8% in 2017.

Ras Gharib City contains 18 schools covering the three basic stages of education (primary, preparatory and secondary), which include two experimental schools. Additionally, there are two

[6] Household spending is the amount of final consumption expenditure made by resident households to meet their everyday needs, such as food, clothing, housing (rent), energy, transport, durable goods (notably cars), health costs, leisure, and miscellaneous services. It is typically around 60% of gross domestic product (GDP) and is therefore an essential variable for economic analysis of demand (Source: OECD National Accounts Statistics: National Accounts at a Glance, https://data.oecd.org/hha/household-spending.htm).

secondary vocational training schools. According to Ras Gharib City Council officials, the main objective of the two secondary vocational training schools is to provide their students with the necessary basic skills that enable them to work in oil companies.

CAPMAS Poverty Map 2013 shows that 19.22% of males and 19.44% of females of Ras Gharib City received basic education. Likewise, the percentage of males and females who finalized their basic education in Zaafarana is approximately 18% and 16% respectively. The following table details the educational status of inhabitants of Ras Gharib and Zaafarana.

Table 52: Education Mapping of Ras Gharib & Zaafarana (CAPMAS Poverty Map, 2013)

Education Information	Ras Gharib City	Zaafarana Village
University Degree Holders/Males	16%	8%
University Degree Holders/Females	13.45%	0%
Male School Enrolment/Males (age: 6-18)	99.26%	71.4%
School Enrolment/Females (age: 6-18)	99.35%	73.3%
School Drop-outs/Males	0.22%	0%
School Drop-outs/Females	0.25%	0%

According to CAPMAS Poverty Map 2013, the illiteracy rate in Ras Gharib City is estimated at 23.3% for males and 18.1% for females, while the illiteracy rate in Zaafarana was 40.17% among males and 48% among females.

Table 53: Education Mapping of Ras Gharib City (The Statistical Yearbook, Ras Gharib City Information Center, 2018)

Area	University Degrees		Above Intermediate Education		Intermediate Education		Less than Intermediate Education		Workers	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Ras Gharib	133	31	112	39	281	199	301	70	232	68

- *Health*

Data from the Health Affairs Directorate in the Red Sea Governorate showed that the Governorate is free of the following diseases:

- Endemic diseases
- Infectious diseases
- Diseases related to water and air quality

The data indicated that non-communicable diseases include diabetes, and hypertension. Other common diseases include digestive system and cardiovascular diseases. Cancer is also increasing, and the most common cancers include breast, liver, bladder and lymph nodes. In addition, there are other communicable diseases to include diarrhoeal diseases (especially in children), cold and flu, fever and inflammations or infections of the ear, nose or throat, as well as skin rashes and infections.

The Red Sea Governorate suffers from a lack of specialized health services which are suitable for the middleclass. Furthermore, these services are concentrated in Hurghada City, and are absent in some other cities, such as Shalateen and Halayeb. The following tables show the health services available in the Governorate.

According to the statistics of the Directorate of Health Affairs (DHA) in Red Sea Governorate, there are 7 hospitals in Governorate with approximately 330 beds, they are government hospitals; one of them is a public and central hospital, in addition to 13 Private hospitals with 399 beds.

Table 54: Ministry of Health Hospitals & Other Entities in the Red Sea Governorate (The Statistical Yearbook, Red Sea Governorate Information Center, 2018)

Item	Value
Hospitals Affiliated with the Ministry of Health	7
Hospitals of the General Authority for Health Insurance	0
Medical Treatment Institutions	0

Item	Value
Educational Hospitals	0
No. of Public & Central Hospitals	1
No. of Specialized Hospitals	1
Public Sector Hospitals (Including Military Hospitals)	4
Private Sector Hospitals	13
No. of Haemodialysis Centres Affiliated with the General Authority for Health Insurance	0
No. of Ambulance Vehicles	48

Ras Gharib City contains one central hospital, one ambulance station, and one civil defence unit, in addition to a limited number of private clinics and health centres. All health services are concentrated in Ras Ghareb City. The central hospital serves all the areas and villages administratively affiliated with Ras Gharib Local Government Unit (LGU). The hospital is equipped with an Emergency room section, and has outpatient clinics. There is an ambulance unit on Zaafarana--Ras Gharib Road north of Ras Ghareb city, near the Project site; these is the nearest ambulance unit to the project area.

Human resources is one of the main factors for the success and continuity of health services, and the absence of qualified medical staff affects the quality of services provided. The following table illustrates available human resources in the health sector in the Red Sea Governorate.

Table 55: Number & Categories of Health Sector Workers in the Red Sea Governorate (CAPMAS, Census of Population Activities of the Governorates, Arab Republic of Egypt, 2016)

Area	No. of Doctors		No. of Pharmacists		No. of Dentists		No. of Nursing Staff		No. of Assistants	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Red Sea Governorate	255	137	60	170	49	29	79	412	102	0

Investment and Development

There is large focus on investment in the Red Sea Governorate, and many fields of investment are available (touristic, industrial, services), which positively impact comprehensive development in the Governorate.

The following table shows the fields of investment in the Red Sea Governorate and Ras Gharib City

Table 56: Fields of Investment in the Red Sea Governorate & Ras Gharib City (Red Sea Governorate Official Website, 2018)

Item	Red Sea Governorate	Ras Gharib
Mineral Production	The Red Sea is one of the important Egyptian governorates in the field of mineral production, as it contains deposits of most of metallic and non-metallic minerals, decoration stones and construction materials. The Red Sea Governorate stretches across the larger part of Eastern Desert, which forms one-fourth of Egypt's total area (about 250,000 km^2), and contains huge mineral resources.	There are several metal production sites in Ras Gharib, including: ▪ Gold in Abu-Marwat ▪ Iron in Abu-Marwat ▪ White sands in Dakhl Valley ▪ Gypsum in the northwest of El-Dob Valley ▪ Marble in Al-Shaikh Fadl Road and El-Dob Valley ▪ Granite in Al-Shaikh Fadl Road
Fish Production	The Red Sea Governorate is an important region that can be utilized to increase fish production, as it has a 1,080 km-long coastline, with an average width of 240 km. There are various coral reef sites, with 3-5 square mile-area each. Different kinds of fish pass by these sites in certain seasons. Fish food is four times more	There are several fish production sites in Ras Gharib: ▪ Al-Mallaha fish farm which is located between Ras Gharib and Shoqair, with an area of 15,000 acres and a total annual production of more than 250 tons. ▪ Suez Gulf fish farm with an

Item	Red Sea Governorate	Ras Gharib
	abundant in the southern part of the Red Sea coast compared to the northern part.	area of 12,000 acres, and a total annual production of more than 400 tons. ▪ Gamsha Gulf fish farm with an area of 9000 acres and total annual production of more than 350 tons.
Agricultural & Livestock Projects	Agriculture is a basic element in the regional comprehensive and integrated development in the Red Sea Governorate either through providing the food supply required for the development in the region or taking part in the attraction of new population from the crowded places over the Nile banks and confronting the expected increase in the population and consumption. The southern triangle (Shalateen, Halayeb, Abu-Ramad) is one of the most important places for the agricultural investment in addition to other cities in the Governorate.	Suggested areas for agricultural investment in Ras Gharib include: ▪ Cultivation of 500,000 acres in Wadi Araba (to the south of Zaafarana), which can be irrigated by groundwater from El-Bowerat well. ▪ Cultivation of Gharib basin using groundwater in the area, as it is possible to extract 4,000 m3 of medium-salinity water per day, which can be used in irrigating citrus fruits and barley. ▪ Cultivation of Wadi Dara village.
Touristic Investment	**The General Tourist Planning of the Red Sea Governorate** Red Sea Governorate contains a number of planned touristic zones.	▪ Zaafarana Sector ▪ Gamsha Sector
	Available Elements for Supporting the Establishment of Touristic Projects in the Red Sea Governorate: ▪ A colourful, rocky mountain range extends along the Red Sea coast, providing a wonderful backdrop to the beach. The area is teeming with mines that had been exploited during ancient ages; mines that once rendered Egypt as one of the richest nations in ancient times, which were used to excavate gold, diamonds and valuable stones like Schist, white granite, etc. ▪ The beaches of the Red Sea coast are renowned for their clear blue waters, calm waves, and a paradise of colourful underwater coral reefs, which contains a multitude of rare and colourful fish. ▪ The yearlong moderate climates attract tourists both in summer and in winter to Red Sea Governorate resorts. ▪ The Governorate hosts various national parks, which contain a multitude of biological diversity. ▪ The Governorate contains valleys and archaeological, religious and curative sites. ▪ The Red Sea is also renowned for its black sands, which are used to cure rheumatoid and psoriasis.	
	Touristic Projects Proposed for Implementation in the Governorate: ▪ Touristic villages, hotels, motels and camps in Safaga, Qoseir and Marsa Alam, the southern triangle (Shalateen, Abu-Ramad & Halayeb), as well as Zaafarana. Project lands are allocated according to vacant areas. ▪ Cinemas, amusement parks and malls proposed to be established in Hurghada, Safaga, Qoseir & Marsa Alam. ▪ Fairs, aquariums, sports centers, golf courses, billiard halls and bowling alleys proposed to be implemented in Hurghada, Safaga, Qoseir, Marsa Alam & Zaafarana. ▪ Centers for providing diving equipment in Hurghada, Safaga, Qoseir & Marsa Alam. ▪ Tourist companies that provide safari trips in Hurghada, Safaga, Qoseir & Marsa Alam. ▪ Shipyards in Hurghada, Safaga, Qoseir & Marsa Alam. ▪ Internal shipping lines connecting the ports of Hurghada, Safaga & Marsa Alam with the ports of Al-Tour, Nuweiba, Taba & Sharm El-Sheikh, as well as Port	

Item	Red Sea Governorate	Ras Gharib
	Tawfik in Suez. Additionally, an international shipping line is proposed to connect the Governorate's ports with the ports the Red Sea and the Arabian Gulf. ▪ Establishing integrated projects for underwater imaging in Hurghada and Marsa Alam. ▪ An international conference center in Hurghada. ▪ A hotel school in both Hurghada and Qoseir. ▪ Schools for teaching diving and swimming, drawing on graduate divers and specialized trainers in Hurghada, Safaga & Marsa Alam. ▪ Utilizing the islands in the construction of suitable projects in accordance with environmental laws. ▪ Small and medium industries for providing hotel equipment.	

8. Environmental and Social Impact Assessment

This Chapter first provides an overview of the strategic environmental and economic impacts related to the Project development, after which it assesses the anticipated impacts from the Project throughout its various phases on all E&S receptors and attributes.

8.1 Overview of Strategic Environmental and Economic Impacts

8.1.1 Governmental Vision for the Energy Sector

The GoE has taken bold steps to adopt an energy diversification strategy with increased development of renewable energy and implementation of energy efficiency, including assertive rehabilitation and maintenance programs in the power sector (IRENA, 2018).

To this extent, in 2013, the Arab Republic of Egypt (through the Supreme Council of Energy) had developed and adopted the ISES 2015 – 2035, which provides an ambitious plan to increase the contribution of renewable energy to 20% of the electricity generated by the year 2020, of which 12% of wind power plants if foreseen.

To promote renewable energy sources and in order to open the way for private sector to effectively participate in the implementation of renewable energy project, the Renewable Energy Law (Decree Law 203/2014) has been issued. With this law, investors had the opportunity to identify and develop renewable grid-connected electricity production through the BOO scheme as discussed earlier in "Section 1.1".

In line with the above, this development allows for more sustainable development and shows the commitment of the Government of Egypt to realizing its energy strategy and meeting the set targets for renewable energy sources.

8.1.2 Energy Security

Recently, most policy makers around the world are grappling with issues related to energy security, energy poverty, and an expected increase in future demand for all energy sources – and Egypt is no exception. Almost certainly, the most spoken words by policy makers and government bodies in Egypt in the last couple of years revolved around 'energy security'.

Through various strategies and visions, Egypt has emphasised on the importance of energy security. This includes for example the Egypt Sustainable Development Strategy, Egypt Vision 2030, in which the sustainable development targets include energy and in which Goal I specifically addresses security of supply to ensure the availability of reliable energy supplies to satisfy the future development needs of the country through adoption of a more diverse energy mix. Similarly, the ISES 2015 – 2035 addresses energy import dependence and diversification of electricity generation.

In line with the above, the Project in specific will contribute to increasing energy security through reliance on an indigenous, inexhaustible and mostly import-independent energy resource. The estimated electricity generation from the Project is estimated at a minimum of 2,200 Gigawatt hours (GWh) per year on average; which will serve the annual electricity needs of more than 800,000 local households.

The above has been calculated based on statistics obtained from Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS). The total household electricity consumption in Egypt for 2016 – 2017 (latest statistics available online) was 64,100 GWh (CAPMAS, 2018). In addition, in 2016 – 2017 the total number of household beneficiaries from the public electricity network was 23,383,521 Households (CAPMAS, 2017). Therefore, average electricity consumption per household per year can be assumed to be around 2,700 (kWh/household).

8.1.3 Environmental Benefits

The negative environmental impacts from generating electricity through conventional fossil fuel burning at thermal power plants are very well known. This most importantly includes air pollutant emissions such as ozone, Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), Particulate Matter (PM), and other gases which are the cause of some serious environmental concerns such as smog, acid rain, health effects, and many others.

In addition, the burning of fossil fuels results in carbon dioxide emissions; a primary greenhouse gas emitted through human activities which contributes to global warming. The main human activity that emits CO_2 is the combustion of fossil fuels for electricity production and transportation. Concurrently, global climate change has become an issue of concern and so reducing greenhouse gas emissions have also emerged as primary issues to be addressed as the world searches for a sustainable energy future.

Generating electricity through wind power is rather pollution-free during operation. Compared with the current conventional way of producing electricity in Egypt through thermal power, the clean energy produced from renewable energy resources is expected to reduce consumption of fossil fuels, and will thus help in reducing GHG emissions, as well as air pollutant emissions. The Project will likely displace more than 1 million metric tons of CO_2 annually.

The above has been calculated based on statistics obtained from Egyptian CAPMAS. Carbon Dioxide (CO2) emissions for 2016 – 2017 (latest statistic available) was 210 million tons, in which the electricity sector accounted for 43.3% of (i.e. around 91 million tons) (CAPMAS, 2019). In addition, the total electricity generated for 2016 – 2017 was around 190,000 GWh (CAPMAS, 2018). Therefore, CO2 emissions (Tones) per kWh is around 479g per kWh.

8.2 Landscape and Visual

This Section identifies the anticipated impacts on landscape and visual from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

8.2.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the wind turbines and the various Project components to include substation, transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

Construction activities would create a temporary effect on the visual quality of the site and its surroundings. The visual environment during the construction phase would include the presence of elements typical of a construction site such as equipment and machinery to include excavators, trucks, front end loaders, compactors and others.

However, as discussed in "Section 7.1", there are no key sensitive visual receptors within the Project site and surrounding vicinity with the exception of Ras Ghareb city which is located 9km from the Project site. However, such impacts during construction will not be visible from the city due to the distance from the Project site.

The visual environment created during the construction period would be temporary, of a short-term duration, limited to the construction phase only. For the duration of construction, the visual impacts will of a negative nature and be noticeable, and therefore of a medium magnitude. As there are no key sensitive visual receptors which would be affected, the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase and which include:

- Ensure proper general housekeeping and personnel management measures are implemented which could include:
  - Ensure the construction site is left in an orderly state at the end of each work day.
  - To the greatest extent possible construction machinery, equipment, and vehicles that are not in use should be removed in a timely manner and kept in locations to reduce visual impacts to the area.
  - Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in "Section 8.4.2".

Following the implementation of these mitigation measures, the significance of the residual impact is categorised as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by EPC Contractor during the construction phase:

- Inspections of the works should be carried out at all times to ensure the above measures are implemented.

8.2.2 Potential Impacts during the Operation Phase

Visual impacts associated with wind energy projects typically concern the turbines themselves (e.g. colour, height, and number of turbines) and impacts relating to their interaction with the character of the surrounding landscape and the visual receptor which might be present.

Turbines are tall structures (180m in the case of the Project where in July 2022 a governmental decision was issued for approval of a maximum tip height of 220m) that can be seen from several kilometres away and impose a change on the landscape of the area where they are installed. However, visual impacts depend on several factors such as distance, size, visibility, landscape and geography, and the presence of potential sensitive visual receptors.

Nevertheless, visual impacts created from the development of the Project are not considered an issue of concern due to the following:

- The only critical visual receptor within the Project area and the 15km radius would be Ras Gharib city that is located 9km to the southeast of the Project site. At such distances such turbines are more likely to be seen as part of the wider landscape as only minor elements (if seen at all). There are no other critical or sensitive visual receptors within such distances.
- Project area is considered a barren and desert area and in general is located within an industrial area with petroleum activities for which its aesthetical value loses some importance.
- There are several existing and under construction wind farm developments in the area as well as several electricity distribution and transmission lines so the addition of this Project will not be a significant impact to the visual and landscape characteristics of the area.
- Being visible is not necessarily the same as being intrusive. Aesthetic issues are by their nature highly subjective. For some viewers, a Wind Farm could be regarded as manmade structures with visual burdens while to others it represents a positive impact in the sense that they introduce a break in the otherwise dull and monotonous view.

Given all of the above, the potential impacts on landscape and visual are of a long -term duration throughout the Project operation phase. The impacts will be of a negative nature, and medium magnitude given that such elements of the Project will be visible. However, given the key visual

receptors in the project route and its surroundings the receiving environment is considered of low sensitivity. Given all of the above, such an impact is considered of low significance.

Mitigation Measures

There are no mitigation measures per se that can be implemented to eliminate the visual impacts from the Project. However, given the outcomes of the assessment presented above, no mitigation measures are required.

8.3 Land Use

This Section identifies the anticipated impacts on land use from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

8.3.1 Potential Impacts during the Planning and Construction and Operation Phase

As noted earlier, the Project site location does not conflict with any of the relevant governmental entities formal planning context. Therefore, there are no impacts on formal land use from the Project.

With regards to informal or 'actual land use' as discussed earlier, the following is concluded:

- The Project site itself in general is uninhabited and vacant and does not include any physical or economical land use activities (with the exception of the petroleum activities as discussed further below). Therefore, physical and economical displacement impacts are considered irrelevant.
- As noted earlier, within the surrounding areas of the Project site there are several petroleum activities and in addition within the northern parts of the site there are old and obsolete areas with no ongoing activities and which are no longer in use (e.g. old and obsolete oil wells). The "Work Coordination Agreement" that has been signed between NREA and the General Petroleum Company includes specific requirements which must be taken into account as part of the wind farm designs. The preliminary layout prepared by the Developer has taken such issues into account as relevant. However, as discussed earlier, based on the "Work Coordination Agreement" that is signed between NREA and the General Petroleum Company in 2005, the company has exploration rights within the allocated area (including the Project site) and certain measures are required to be implemented by the Developers as part of the Agreement. Inappropriate management of such requirements could result in key land use impacts and disputes with the General Petroleum Company as well as other indirect impacts related to health and safety.
- Around 1km^2 of the is Gabal El Zeit IBA is located within the Project site. Although there is no relevant Egyptian legislation which prevents development projects (including wind farms) within IBAs or legislations which identify any specific constraints to be taken into account, the SESA approval requirements identifies specific measures which should be considered as part of the wind farm designs. The preliminary layout prepared by the Developer has taken such issues into account as relevant. Note: no turbines or Project activities (road, quarries, batching plants, etc.) will be permitted to occur within the 1km^2 overlap with the IBA.
- The Project site is owned by NREA and will be utilised for the Development of the Project. However, as discussed earlier, Bedouin Groups in general implement the Ghafra system in such land areas to include the Project site. Therefore, the Developer should be aware of Al-Ghafra system, and other aspects of Bedouin culture. The Developer's understanding of Bedouin culture plays a major role in regulating the relationship between them and the tribes in the region. Inappropriate management of such issues could result in potential conflicts with such groups.

Nevertheless, should the above issues not be taken into account as part of the planning phase of the Project, it could result in impacts that are considered of long-term duration, of negative nature, and of medium magnitude and high sensitivity given that it could result in land use impacts and disputes with both Bedouin Groups and the General Petroleum Company. Given all of the above, the impact is considered of moderate significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the Developer during the planning phase and which include:

- No turbines or Project activities (road, quarries, batching plants, etc.) will be permitted to occur within the 1km^2 overlap with the IBA
- Establish coordination via NREA/EETC with the General Petroleum Company and other relevant entities as applicable on the Project specific level to: (i) agree on final requirements to be taken into account as part of the detailed design based on the "Work Coordination Agreement"; (ii) present and provide detailed design to include turbine locations, cables, roads, etc. along with key requirements identified under point (i) earlier; (iii) further identify access to land requirements, conditions and communication protocol for the Project; (iv) demonstrate safety compliance of all Project components based on excepted activities that could be undertaken by the General Petroleum Company (e.g. drilling and survey activities), and (v) any other issues as applicable.
- Undertake consultations through RCREEE with the Technical Committee which includes representatives from EEAA and EETC to discuss the preliminary layout and identify any additional requirements which should be taken into account in relation to avi-fauna migration (if any) and its location in relation to Gabal El Zeit IBA. This is further discussed in "Section 8.6"; and
- Establish coordination with the Bedouin Groups for inclusion and engagement in employment and procurement opportunities. This issue is further discussed in "Section 8.13".

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractors during the construction phase and which include:

- Submission of proof of coordination and agreement with Bedouin groups;
- Submission of formal communication letter (or similar) with General Petroleum Company; and
- Submission of formal communication letter (or similar) with Technical Committee.

8.4 Geology, Hydrology and Hydrogeology

This Section identifies the anticipated impacts on hydrology and hydrogeology from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

8.4.1 Potential Impacts from Flood Risks on the Project Site

In general, it is important to investigate potential risks of local flood hazard from the wadi systems (as noted in the figure below) during the rainy season and especially during flash flood events which in turn could affect the Project components. Such risks must be taken into

consideration throughout the planning phase of the Project as they could inflict damage to the Project and its various components.

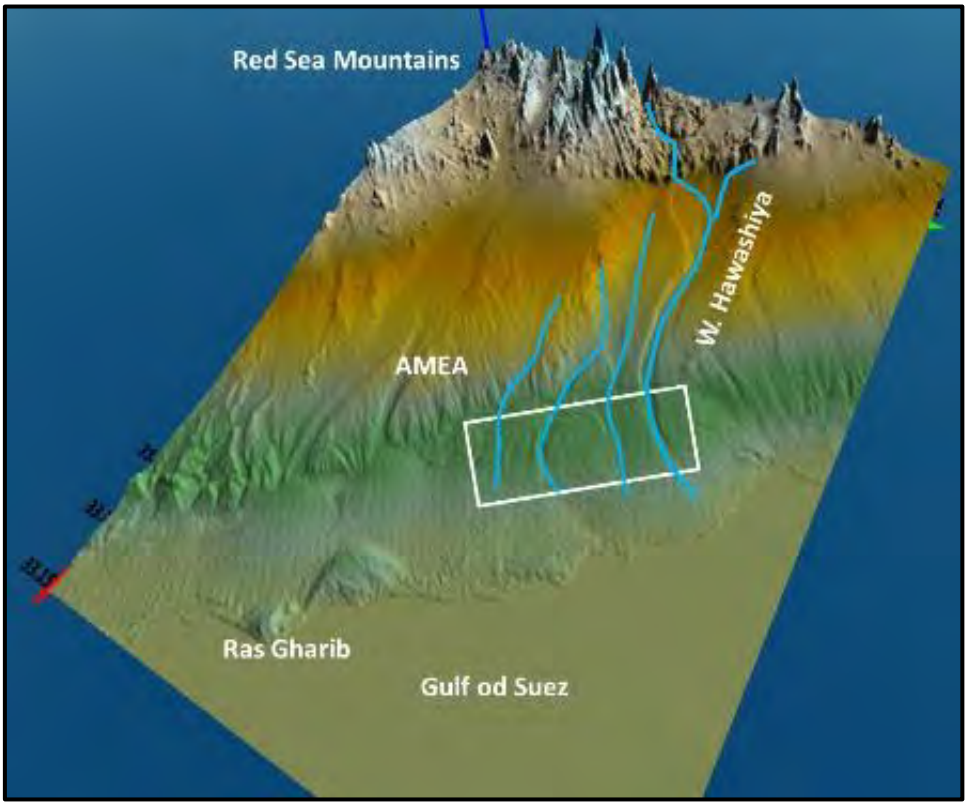


Figure 86: Wadi Systems within the Project Site

To this extent, the Developer has undertaken a flood risk assessment to investigate such risks. The assessment is provided as a standalone document. However, the study concludes the following:

- The bed rocks of the Project site location are mainly clastic deposits rich in clays, sand, gravels and reworked rock fragments with high porosity and permeability. These deposits extend to great depth. This means, the surface layers of the area have a great tendency to absorb large volume of surface water runoff in times of rain.
- The regional slope of the high mountains is due to East. This means that, many dry wadis are directed to the East, Northeast and Southeast toward the Gulf of Suez and cross the Project site as noted in the figure above.
- The concession site is in a very simple relief area with a very gentle slope in east and southeast direction.
- There is no sign of deep dray wadis crossing the concession site or even large alluvial fan deposits reflecting strong surface flow.
- The concession site has been crossed by the outlet of Wadi Hawashiya at its northern part that could expect serious flooding. The other drainage lines that drain the Project site are very short, wide and shallow that reflect a complete absence of floods except at the outlet of wadi Hawashiya.
- Flood protection facilities have been constructed along the course of Wadi Hawashiya to mitigate the flash flood hazards in times of heavy rain fall. This includes in particular 3 key dams as noted in the figure below.
- A flood modelling has been undertaken for the wadi systems that cross the Project site. The model concludes that the risk factor of the project site is medium and limited to the outlet area of Wadi Hawashiya (as presented int figure below in green). This means that mitigation measures for flash floods should be applied in the Wadi Hawashiya only. However, this has already been implemented on the ground with the construction of three dams along the

course of Wadi Hawashiya. These dams are enough to protect the area from any flash floods which may be exposed in the future. Note: the area in green in the figure below is the flood risk area considered before construction of the dams.

Taking the above into account there are no impacts anticipated in relation to flood risks onsite.

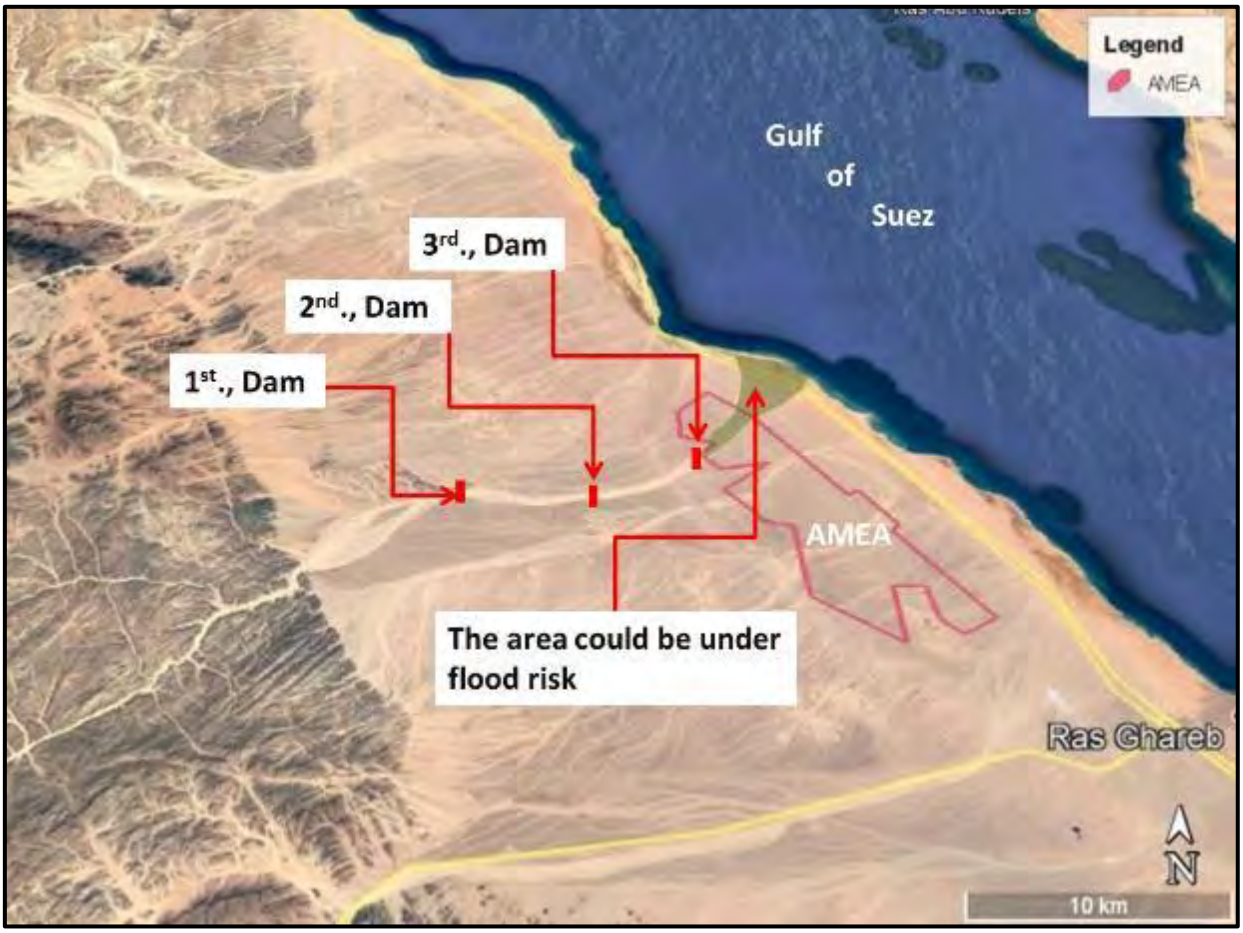


Figure 87: Flood Risk Areas and Location of Dams

8.4.2 Potential Impacts from Improper Management of Waste Streams during Construction and Operation

Given the generic nature of the impacts on soil and groundwater for both phases of the Project (construction and operation) those have been identified collectively throughout this section. Generally, this includes potential impacts from improper housekeeping practices (e.g. improper management of waste streams, improper storage of construction material and of hazardous material, etc.).

Improper housekeeping practices during construction and operation (such as illegal disposal of waste to land) could contaminate and pollute soil which in turn could pollute groundwater resources. This could also indirectly affect flora/fauna and the general health and safety of workers (from being exposed to such waste streams). Generally, such impacts can be adequately controlled through the implementation of general best practice housekeeping measures as highlighted throughout this section, and which are expected to be implemented by the EPC Contractor throughout construction phase and Project Operator during the operation phase.

The potential impacts from improper management of waste steams could be of a long-term duration throughout the construction and operation phase. Such impacts are negative in nature, and could be noticeable and are therefore of medium magnitude. However, they are considered of low sensitivity as they are generally controlled through the implementation of general best

practice housekeeping measures. Given all of the above, such an impact is considered to be of minor significance.

Following the implementation of the mitigation measures highlighted throughout this section, the residual significance can be reduced to not significant.

(i) Solid Waste Generation

Solid waste is expected to be generated from construction and operational activities. Solid waste generated will likely include construction waste (such as debris) and municipal solid waste (during construction and operation such as cardboard, plastic, food waste, etc.).

Municipal solid waste and construction waste generated will likely be collected and stored onsite and then disposed to the closest approved landfill or, if possible, reused in the construction activities.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase and the Project Operator during the operational phase unless stated otherwise:

- Coordinate with Ras Gharib City Council for the collection of solid waste from the site to the municipal approved dumpsite or for recycling (as discussed in further details below);
- Prohibit fly-dumping of any solid waste to the land;
- Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste";
- EPC Contractor only - during construction, distribute a sufficient number of properly contained containers clearly marked as "Construction Waste" for the dumping and disposal of construction waste.
- EPC Contractor only – during construction, it is recommended that recycling measures are implanted. It is recommended that recycling is undertaken in the following approach: (i) separation and disposal of recyclables in a separate container (cardboard, paper, glass, metal, etc.); and (ii) separation and disposal of non-recyclable materials in a separate container (e.g. food waste). Each container must be clearly marked. In addition, EPC Contractor must seek ways to reduce construction waste by reusing materials (for example through recycling of concrete for road base coarse);
- Implement proper housekeeping practices on the construction site at all times; and
- Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill. The numbers within the records are to be consistent to ensure no illegal dumping at the site or other areas.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the rm EPC Contractor during the construction phase and the Project Operator during the operational phase unless stated otherwise:

- Inspection of waste management practices onsite;
- Review of records and manifests for volume of waste generated to ensure consistency; and
- Regular environmental reporting on implementation of the waste management practices onsite.

(ii) Wastewater Generation

Wastewater is mainly expected to include black water (sewage water from toilets and sanitation facilities), as well as grey water (from sinks, showers, etc.) generated from workers during the

construction and operation phase. Wastewater quantities are expected to be minimal. It is expected that wastewater will be collected and stored in fully contained septic tanks and then collected and transported by transportation tankers to be disposed at the closest Wastewater Treatment Plant (WWTP) (being Ras Ghareb WWTP) – however a due diligence assessment is to be undertaken to ensure discharges are within allowable parameters as per WBG EHS Guidelines.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase and the Project Operator during the operational phase unless stated otherwise:

- Coordinate with Ras Gharib Water Company to hire a private contractor for the collection of wastewater from the site to the closest WWTP (being Ras Gharib WWTP). Undertake a due diligence assessment is to be undertaken to ensure discharges are within allowable parameters as per WBG EHS Guidelines;
- Prohibit illegal disposal of wastewater to the land;
- Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the WWTP. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas;
- EPC Contractor only - ensure that constructed septic tanks during construction and those to be used during operation are well contained and impermeable to prevent leakage of wastewater into soil; and
- Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the Project Operator during the operational phase unless stated otherwise:

- Inspection of wastewater management practices onsite;
- Review of records and manifests for volume of wastewater generated to ensure consistency; and
- Regular environmental reporting on implementation of the wastewater management practices discussed above.

(iii) Hazardous Waste Generation

Hazardous waste is expected to be generated throughout both the construction and operation phase and this could include consumed oil, chemicals, paint cans, etc. Hazardous waste generated will likely be collected and stored onsite and then disposed at the approved hazardous waste disposal facilities managed by the Hazardous Waste Management Project and supervised by the governorate and the EEAA.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase and the Project Operator during the operational phase unless stated otherwise:

- Coordinate and hire a private contractor for the collection of hazardous waste from the site to the approved hazardous waste disposal facilities;
- Ensure that hazardous waste is disposed in a dedicated area that is enclosed; of hard surface; with proper signage and suitable containers as per hazardous waste classifications and that they are labelled for each type of hazardous waste.

- Ensure hazardous waste storage area is equipped with spill kit, fire extinguisher and anti-spillage trays and a hazardous waste inventory is available.
- Prohibit illegal disposal of hazardous waste to the land;
- Possibly contaminated water (e.g. runoff from paved areas) must be drained into appropriate facilities (such as sumps and pits). Contaminated drainage must be orderly disposed of as hazardous waste;
- Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing; and
- Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the hazardous waste disposal facilities. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the Project Operator during the operational phase unless stated otherwise:

- Inspection of hazardous waste management practices onsite;
- Review of records and manifests for volume of hazardous waste generated to ensure consistency; and
- Regular environmental reporting on implementation of the hazardous waste management practices onsite.

(iv) Hazardous Material

The nature of construction and operational activities entail the use of various hazardous materials such as oil, chemicals, and fuel for the various equipment and machinery. Improper management of hazardous material entails a risk of leakage into the surrounding environment either from storage areas or throughout the use of equipment and machinery.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase and the Project Operator during the operational phase unless stated otherwise:

- Ensure that hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of hard impermeable surface, flame-proof, accessible to authorized personnel only, locked when not in use, and prevents incompatible materials from coming in contact with one another;
- Maintain a register of all hazardous materials used and accompanying Material Safety Data Sheet (MSDS) must present at all times. Spilled material should be tracked and accounted for;
- Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.);
- Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refuelling) must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material;
- Ensure general-purpose spill absorbent is available at hazardous material storage facility. Appropriate absorbents include zeolite, clay, peat and other products manufactured for this purpose. This should be dependent on the largest storage tank onsite or truck that brings hazardous materials to the site (i.e. largest conceivable spill); and

- If spillage on soil occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.
- All hydrocarbons to be stored within hardstanding within secondary containment bunds capable of retaining 110% of the contents of the largest vessel or 25% of the inventory (if more than one vessel), whichever is the greatest. Ensure the integrity of the secondary bund and Oil/water separators to be used to discharge rainwater after visual inspection to ensure no oil contamination of rainwater.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the Project Operator during the operational phase unless stated otherwise:

- Inspection for storage of hazardous materials to include inspections for potential spillages or leakages; and
- Report any spills and the measures taken to minimize the impact and prevent from occurring again.

8.4.3 Potential Impacts from Erosion and Runoff during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the various Project components to include wind turbines, substation, cables, etc. are expected to include land clearing activities, excavation, grading, etc.

The nature of construction activities discussed above could disturb soil, exposing it to increased erosion during rainfall events. If onsite erosion and runoff are not controlled, they can result in siltation of surface water. Generally, such impacts can be adequately controlled through the implementation of general best practice housekeeping measures as highlighted throughout this section, and which are expected to be implemented throughout construction phase.

The potential impacts from erosion and runoff is of short-term duration as it is limited to the construction phase. Such impacts are negative in nature, and could be noticeable and are therefore of medium magnitude. However, they are considered of low sensitivity as they are generally controlled through the implementation of general best practice housekeeping measures. Given all of the above, such an impact is considered to be of minor significance.

Following the implementation of the mitigation measures highlighted throughout this section, the residual significance can be reduced to not significant.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase:

- Avoid executing excavation works under aggressive weather conditions.
- Place clear markers indicating stockpiling area of excavated materials to restrict equipment and personnel movement, thus limiting the physical disturbance to land and soils in adjacent areas.
- Erect erosion control barriers around work site during site preparation and construction to prevent silt runoff where applicable.
- Return surfaces disturbed during construction to their original (or better) condition to the greatest extent possible.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase:

- Inspection for erosion and runoff control to include inspections for implementation of mitigation measures.

8.5 Biodiversity

This Section identifies the anticipated impacts on biodiversity from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

It is important to note that biodiversity assessed in this Chapter excludes birds (avi-fauna) and bats, which are discussed separately in "Section 8.6" and "Section 8.7" respectively.

8.5.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the wind turbines and the various Project components to include substation, transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

Such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal. Nevertheless, although alterations are considered to be minimal, such activities would still likely result in the alteration of the site's habitat and thus potentially disturb existing habitats. Other impacts on the biodiversity of the site are mainly from improper management of the site, which could include improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc.).

However, as discussed earlier, the Project site is general is considered of low ecological significance but special consideration should be given to the globally threatened to the Egyptian Dabb Lizard *Uromastyx aegyptia* since the project site provides a typical habitat for such species.

Given all of the above, the potential impacts on biodiversity created during the construction phase would be of a long-term duration as they would result in a permanent change in the natural biodiversity of the site. Such impacts are considered of negative nature and of a medium magnitude given that the change in the natural biodiversity of the site will be noticeable in limited individual footprints. In addition, as the site is considered of low ecological significance, the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Additional Surveys and Mitigation

- As discussed above, the permit issued by the 300km^2 ESIA identifies specific buffer distance requirements for turbine design related to the Egyptian Dabb Lizard. However, this is not considered a feasible or practical solution given that burrows can change and are not fixed (an active burrow this year can become inactive next year given that they continuously move to other locations). Therefore, it is recommended that as alternative and more feasible option that a detailed survey is undertaken prior to construction through a biodiversity expert. The expert should have an educational background in a related field (bachelor's degree at a minimum) (e.g. biology, biodiversity or similar) with demonstrated work experience and track record in planning and implementing biodiversity assessments, surveys and studies in the region including reptiles in particular.

  The survey should focus on all construction activities areas and in particular the Wadi systems where such a species is likely to be located. If the species is present in these areas the biodiversity expert will design and implement a pre-construction capture and relocation programme based on demonstrated good practice for the relocation of this type of species.

A detailed report should be submitted which documents all of the above.

- Implement proper management measures to prevent damage to the biodiversity of the site. This should include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping which include the following:
  - Prohibit hunting of any wildlife at any time and under any condition by construction workers onsite;
  - Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in "Section 8.4.2";
  - Restrict activities to allocated construction areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances; and
  - Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures as detailed in "Section 8.9.1".

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The project will require the EPC contractor to conduct monitoring and reporting during the construction phase including::

- Submission of pre-construction Egyptian Dabb Lizard survey report and subsequent reports should relocation be necessary.
- Regular, scheduled, and documented inspection of all construction phase activities that could impact on biodiversity, with reporting submitted to the project for review.

8.5.2 Potential Impacts during the Operation Phase

The only impacts anticipated during the operation phase are related to improper management of the site as discussed earlier. This could include improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc.).

The potential impacts on biodiversity would of a long-term duration throughout the operation phase of the Project. Such impacts are of negative nature and of a medium magnitude. However, as the site is considered of low ecological significance, the receiving environmental is determined to be of low sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the Project Operator during the operation phase and which include:

- Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping which include the following:
  - 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 in "Section 8.4.2"; 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.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the Wind Farm Operator during the operation phase and which include:

- Regular, scheduled, and documented inspection of all operations phase activities that could impact on biodiversity, with reporting submitted to the project for review.

8.6 Birds

This Section identifies the anticipated impacts on birds (avi-fauna) from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation and monitoring measures, additional requirements, etc.) have been identified to eliminate or reduce the impact to acceptable levels.

Before discussing the outcomes of the above, it is important to state that the potential impact of wind turbines on birds is considered one of the key issues related to wind farm developments which must be thoroughly addressed within the ESIA.

8.6.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the wind turbines and the various Project components to include substation, transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

Such activities in particular could impact avi-fauna which use the site for foraging and as a breeding ground– to include soaring and non-soaring resident and migratory species. Generally, such construction activities would not result in any major alteration of the site's habitats and thus would not affect the foraging and feeding area of such species, given that such activities are limited to the relatively small individual footprint of these facilities and where the actual area of disturbance is relatively minimal. The Project site is considered of low ecological significance due to its natural setting; characterised by being heavily degraded and arid.

On the other hand, there are additional potential impacts during the construction phase on breeding birds within the site. Construction activities could disturb existing habitats of birds breeding and within the Project site. Such potential impacts are created during the construction phase only and thus are of long-term duration. However, such impacts are considered of negative nature and of a low magnitude given that the construction activities' actual area of disturbance is relatively minimal. In addition, given that breeding activities are likely within the Project site, the receiving environmental is determined to be of a medium sensitivity. Given all of the above, such an impact is considered to be minor significance.

Mitigation Measures by the Developer/EPC Contractors

- Implementation of proper housekeeping measures to reduce impacts including:
  - Restrict activities to allocated construction areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances.
  - Prohibit hunting of birds at any time and under any condition by construction workers onsite.
  - Implement proper measures, which would prevent attraction of birds to the site. This includes measures such as prohibiting illiterate dumping and ensuring waste streams are disposed appropriately in accordance with the measures identified in "Section 8.4.2".
  -
  - Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular

maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level, etc.

- Develop a protocol to swiftly report and dispose of any dead or injured wildlife or animals recorded onsite.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirement

The following summarises the monitoring requirements for the projects which must be undertaken and which include:

- EPC Contractors to submit construction schedule and plan and demonstrate that construction is planned to avoid areas of concern during breeding season.
- Submission of dead animal handling protocol

8.6.2 Potential Impacts during the Operation Phase

Wind turbines are associated with impacts on birds from risks of collision and electrocution for both migratory soaring birds (which could pass over the site during the spring and autumn migration seasons) and resident soaring birds in the area.

Egypt is one of the main crossroads for migratory soaring birds (MSBs) crossing from breeding grounds in Europe and Asia to their wintering areas in Africa. High wind energy potentials in the Gulf of Suez (GoS) stimulated rapid development of wind energy facilities, which poses additional risk to migratory birds using the area. Principal risks to these species are from fatal collisions with turbines and with overhead powerlines and disturbance/barrier effects.

Based on the foregoing and given the importance of the area for bird migration routes and the implementation of related international commitments, the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) initiated the "Active Turbine Management Program" (ATMP) aiming to determine the optimum wind turbines operations periods during the heavy bird migratory seasons (spring and autumn) during pre, under, and post-construction phases of wind farms.

This program aims to ensure the protection and risk mitigation of the environment while increasing the feasibility and the productivity of the wind turbines over the project lifetime. Therefore, RCREEE has succeeded in launching the study and providing an innovative coordination and execution strategic framework among public and private stakeholders, including three governmental institutions; the New and Renewable Energy Authority (NREA), the Egyptian Environmental Affairs Agency (EEAA) and the Egyptian Electricity Transmission Company (EETC) by releasing a Bird Migration Protocol (BMP) called the "Executive Framework for Strategic Cumulative, Environmental & Social Assessment & Program of Ornithological monitoring and Active Turbine Management for Wind Energy Developments in Gulf of Suez". One of the objectives of the Bird Migration Protocol is to strengthen the protection of birds in their migration path in Egypt from the potential effects of wind-energy projects through a series of practical activities in the GoS area, as well as facilitate cooperation among relevant stakeholders.

Background

As part of the ESIA study for the Project, three (3) spring migratory seasons (2020 to 2022) and two (2) autumns (2020 and 2021) have been completed. These pre-construction studies were performed with the assumption of installing turbines of 120 m tip height. However, recent changes in turbine technology have evolved to bigger turbines with a higher output. Since the early 2000s, wind turbines have grown in size—in both height and blade lengths—and generate more energy as noted in the figure below. Turbine towers are becoming taller to capture more energy as winds generally increase as altitudes do. The change in wind speed with altitude is

called wind shear. At higher heights above the ground, wind can flow more freely, with less friction from obstacles on the earth's surface such as trees and other vegetation, buildings, and mountains.

As discussed earlier, at a later stage the Developer has decided to go with installing turbines with a 180 m top height following approvals from the Government of Egypt.

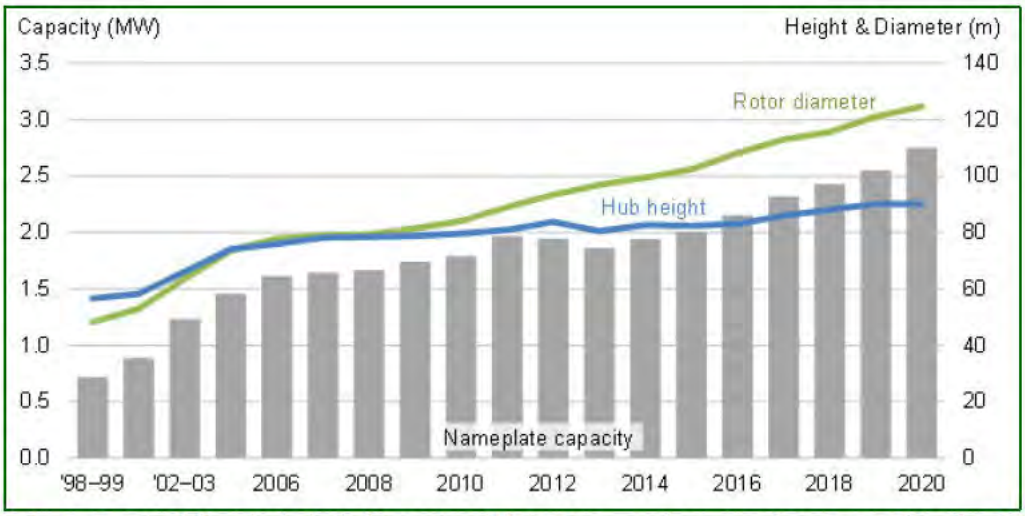


Figure 88: Average turbine hub height, rotor diameter, and nameplate capacity for land-based wind projects from the Land-Based Wind Market Report: 2021 Edition

Objective

The goal of this section is to provide field documentation of migration patterns of MSBs across the Project Area for wind turbines of different size, 120 versus 180 m tip heights, and to assess potential associated collision risks. This report will aim to present the following in particular for Project based on the autumn 2021 and spring 2022 – as these are the only two seasons for which monitoring has been performed using the two tip heights as discussed earlier in "Section 7.5.1":

The objective of the assessment within this section is to:

- Identify number of birds flying at risk height for wind turbines of 120 and 180 m tip height;
- Evaluate the Collision Risk of the different species according to Collision Risk Modelling (CRM); and
- Evaluation of potential biases not only for the two above mentioned autumn 2021 and spring 2022 but also the previous spring 2020-2021 and autumn 2020.

Project Components

At an early stage of the Project development, the specifications of the turbines included the following with a tip height of 120m.

Number of Wind Turbines	172
Rated Power per Turbine (MW)	3.05
Rotor Diameter (m)	114
Hub Height (m)	63
Tip height (m)	120

However, at a later stage the new specifications with the allowed increase in tip height in the GoS region has changed so that it takes into account the specification below.

Number of Wind Turbines	77

Rated Power per Turbine (MW)	6.50
Rotor Diameter (m)	171
Hub Height (m)	94.5
Tip height (m)	180

The comparison of the two turbines is as follows: despite only 1% increase in Rotor Swept Area (RSA) with the newer 6.5MW turbines, the total volume of the rotating blades is 1.51 times (33.81%) larger.

TURBINE SIZE	3.05MW (172)	6.50MW (77)
Rotor Swept Area (RSA) per turbine	10,207.05	22,965.88
Total RSA all project (m^2)	1,755,614.04	1,768,372.86
Total volume occupied (m^3) per turbine	775,736.44 m^3	2,618,110.48 m^3
Occupation (m^3 of volume RSA)	133,426,667.40 m^3	201,594,507.00 m^3

Analyses: Collision Risk Modelling-CRM

Collision Risk Modelling (CRM) using the Band model (2012), has become a standard method in international industry practice for obtaining quantitative predictions of estimated fatality rates of birds at wind farms.

The Band Model predicts the expected collision rates of particular bird species or species groups at a given wind farm based on the specific dimensions and physical characteristics of the rotors, the birds, the wind farm, and the density of bird flights recorded in the wind farm area. The latter parameter is termed "bird density" and is derived from the VP survey data, further differentiated with regard to the altitude of the birds' flights relative to the rotor swept altitudes of the rotors. Generally, collision risk models are regarded as a useful aid in the assessment of collision risks. However, the model has some limitations as it does not consider aspects related to weather variables (e.g. temperature or wind speed and direction), landscape features, or prey availability for a specific species. Therefore, predictions may be coarse.

To illustrate this, we have also analysed the effect the wind and temperature have in the passing rates. It is well known from scientific studies that, out of bottlenecks, birds are under different pressures whilst maintain the main migration direction between the breeding and wintering grounds (see Panuccio et al. 2021 *Migration Strategies of Birds of Prey in Western Palearctic* and references therein for species-specific studies over the last decade). Wind speed and wind direction interact when flying, the winds create effects on the bird trajectory. The winds push the bird in the air and the individual shall compensate for these effects to land or to perform navigation.

If the winds are pure tailwinds, the bird will follow the wind. The crosswind component is null, and the direction of travel is the same direction of the wind. If the winds are pure headwinds, the bird will face the wind, and the crosswind component is null. The direction of travel is the opposite direction of the wind.

However, when existing crosswind, it creates a trajectory slip and the wind will push the bird off the desired track. The wind flow does not follow the flight path axis all the time. It often comes from the left or the right.

We have calculated the cross and tail wind components for each observation (record) based on wind speed measured at the met masts of the project, wind direction and flight direction of the bird taken from the field database. We then used correlation analysis to explore the relationship of these variables with the passing birds per hour. Results are in the Table 57, highlighting in red those which were significant

Table 57: Relationship (Spearman coefficient) between crosswinds, tailwinds, and temperature and the passing rates (birds/hr.) for the period spring 2020-2022. Those in red mean significant relationships.

	Black Kite	Black Stork	B. Eagle	E. Vulture	H. Buzzard	L. S. Eagle

crossw	0.16	0.18	0.00	-0.16	0.16	0.14
tailw	-0.20	-0.10	-0.06	0.36	-0.20	0.02
temperature	0.16	-0.03	0.01	0.07	0.21	0.13

	All Harriers	S-t Eagle	S. Buzzard	S. Eagle	W. Stork	L.L. Buzzard
crossw	0.40	0.04	0.05	0.16	0.05	-0.02
tailw	-0.39	-0.03	-0.10	-0.01	0.10	0.10
temperature	0.28	0.10	0.24	0.10	-0.11	0.17

Six out of the ten species in the table showed any kind of relationship with either cross winds, tails winds, or temperature. The Black Kite, Steppe Eagle, and the Honey Buzzard had positive relationship with the cross winds (more birds passed with higher crosswinds), and negative with the tail winds (not for the eagle). Also, temperature favoured more birds to cross, which is not unexpected given we are dealing with birds using soaring flight. In the end, more birds passing could yield to more birds' also at-risk level. Other species like the Steppe Buzzard had only two relationships and the Steppe Eagle and Egyptian vulture had just one: whilst more Egyptian vulture were recorded with tailwinds, more Steppe eagles did it with cross winds. Due to the low amount of data for the autumn we did not repeat the same analyses.

These effects are not considered by the CRM. An important concept is the ability or tendency of birds to alter their flight paths in response to the presence of wind turbines (avoidance), and such behaviour is believed to be a very important dynamic influencing actual bird collision rates at wind farms (Cook et. al. 2012), hence a "collision avoidance rate" parameter is typically applied for each bird species or species group when conducting CRM (Whitfield and Madders 2006a, 2006b, Garvin et al. 2011, Band 2012, SNH 2014, Whitfield and Urquhart 2015). The CRM was conducted for the purpose of obtaining quantitative predictions of collision risk during the migratory seasons.

It was established in "Section 7.5.4" earlier that birds pass in a random way –no VP selected- during both the spring and autumn seasons. Thus, we have calculated a single collision risk value, instead of getting one per each VP, as it has been done in other projects.

Data inputs for the CRM analysis were derived from the results of the VP surveys, as well as the above-mentioned turbine specifications and the following assumptions:

Rotation speed (rpm)	7.5	Average value calculated from manufacturer's Specifications for similarly sized turbine.
Percent of time operational	Monthly values ranging from 64% to 85%	Project specific data not available, representative values taken from SOSS example
Maximum blade width (m)	4.5	From manufacturer's specifications
Pitch (degrees)	47.5	Mean value from manufacturer's specifications

In addition to bird densities derived from VP survey data, CRM using the Band model requires certain data on the physical and observational characteristics of each bird species. Input values used in the CRM analysis are presented in the table below. Data on physical dimensions of birds were derived from Cornell Lab of Ornithology's Birds of the World (https://birdsoftheworld.org and references therein), while information specific to the VP survey observations, such as typical flight speeds, flight styles, and maximum effective radius of observation/identification were generated using input from the databases.

Table 58: Physical and observational characteristics of each bird species included within the CRM

Scientific name	English Common Name	Length (m)	Wingspan (m)	Flight type	Flight speed (m/sec)
Ciconia nigra	Black Stork	1.00	1.55	gliding	16.0

Pernis apivorus	Honey Buzzard	0.6	1.5	flapping	18.06
Pelecanus onocrotalus	Great White Pelican	1.56	2.93	flapping	15.60
Neophron percnopterus	Egyptian Vulture	0.62	1.6	gliding	13.90
Aquila pennata	Booted eagle	0.51	1.38	gliding	11.3
Gyps fulvus	Eurasian Griffon	1.01	2.52	gliding	19.40
Circaetus gallicus	Short-toed Snake-Eagle	0.66	1.77	gliding	11.30
Aquila nipalensis	Steppe Eagle	0.70	1.9	gliding	18.06
Aquila heliaca	Eastern Imperial Eagle	0.71	1.9	gliding	18.06
Falco tinnunculus	Common Kestrel	0.31	0.68	flapping	13.90
Falco naumanni	Lesser Kestrel	0.31	0.66	flapping	13.90
Falco cherrug	Saker Falcon	0.51	1.12	flapping	22.20
Grus grus	Common Crane	1.08	1.9	flapping	16.67
Circus aeruginosus	Western Marsh-Harrier	0.48	1.3	gliding	11.10
Circus cyaneus	Hen Harrier	0.46	1.1	gliding	11.10
Milvus migrans	Black Kite	0.55	1.37	gliding	11.7
Accipiter nisus	Eurasian Sparrowhawk	0.34	0.67	flapping	19.40
Buteo buteo	Steppe Buzzard	0.46	1.23	gliding	16.67
Buteo rufinus	Long-legged Buzzard	0.53	1.3	gliding	16.67
Falco tinnunculus	Eurasian Kestrel	0.31	0.68	flapping	13.90
Clanga clanga	Greater Spotted eagle	0.71	1.80	gliding	11.7
Clanga pomarina	Lesser spotted eagle	0.67	1.68	gliding	11.7
Accipiter brevipes	Levant Sparrowhawk	0.37	0.74	flapping	11.1
Pandion haliaetus	Osprey	0.66	1.59	gliding	11.4
Circus pygargus	Montagu's Harrier	0.49	1.23	gliding	8.4
Falco vespertinus	Red-footed falcon	0.32	0.75	flapping	12.8
Falcon concolor	Sooty falcon	0.36	0.88	flapping	11.3
Ciconia ciconia	White Stork	1.02	1.65	gliding	16.0

The flight duration of the target species was recorded 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 heights to be classified flight based on turbine specifications and to be at least divided into two classes; at collision risk and above collision risk. Although at the time of the undertaking of the survey the specifications of turbines were not finalized, the scenarios proposed all present a small area below collision risk, while above collision risk is above 120 (2020-2022) for all scenarios. Based on this, the two classes were used for collision risk height:

- Band **1= Turbine from the bottom to the tip height (≤ 120 m)**
- Band 2= above turbine height (> 120 m)

However, at a later stage throughout the Project, the client considered a change in the turbine size, increasing the tip height to 180 m. For this reason, during the autumn 2021 and spring 2022 monitoring, there was a change in data collection with birds classified into four classes as follows:

- Band 1= Turbine from the bottom to the tip height (0-120 m)
- Band 2= above turbine height (120-150 m)
- Band 3= 150-200 m
- Band 4= above 200m

As the data were being collected according to the above-mentioned bands, the CRM was estimated for the 200m as it is considered the most representative for the 180 m tip height. The following table shows the percentage of records at risk height for each spring season and species plus the time such flights were at risk height. Data were recorded during the three spring seasons considering the tip height of the turbine being 120 m. Bird observations

were collected using the following height bands: 0-120, 120-150,150-200 and above 200 m. Due to the changes in the turbine size, the collision risk was estimated at 120 m and 200 m tip height - again it important to reiterate that this this is considered the most representative heigh band for the 180 m turbine model is rather a precautionary figure. This has been done for the autumn 2021 and spring 2022.

Table 59: Observational data from the VP surveys used to derive bird density inputs for the spring CRM analysis. For each species and year, the tip height (120 or 200 m) there is the % of risk flights and the time (in minutes) at risk height.

Species	2020	Time120 (min.)	2021	Time120 (min.)	2022 (120m)	Time120 (min.)	2022 (200 m)	Time200 (min.)
Black Kite	24.09%	263.40	28.51%	144.25	23.84%	248.25	76.62%	722.25
Black Stork	50.94%	26.5	36.49%	19.75	15.22%	31.00	76.63%	111.5
Booted Eagle	19.85%	25.04	22.50%	7.25	20.00%	18.50	84.00%	67.00
Common Crane	0.00%	0.00	5.88%	3.00	100.00%	9.00	100%	9.00
Common Kestrel	79.69%	84.00	63.64%	28.0	69.39%	42.67	100%	65.67
Eastern Imperial Eagle	5.26%	1.00	0.00%	0.00	11.11%	5.00	44.44%	10.00
Egyptian Vulture	12.07%	7.5	33.33%	10.25	10.00%	8.00	86.00%	68.33
Eurasian Sparrowhawk	16.67%	5.5	9.84%	2.75	51.16%	20.00	90.70%	45.67
Honey Buzzard	8.77%	96.3	5.44%	14.0	9.11%	36.00	78.83%	180.00
Great White Pelican	73.67%	74.5	68.72%	11.0	53.87%	77.00	100%	142.50
Greater Spotted Eagle	4.76%	1.0	0.00%	0.00	0.00%	1.00	66.67%	6.00
Lesser Spotted Eagle	8.09%	8.51	2.56%	1.5	14.07%	20.50	74.81%	108.00
Lanner Falcon	0.00%	0.00	0.00%	0.00	0.00%	0.00	100%	8.00
Levant Sparrowhawk	0.00%	0.00	13.22%	0.75	0.00%	0.00	100%	6.50
Long-legged Buzzard	14.09%	13.75	31.67%	6.0	16.98%	7.50	75.47%	57.0
Montagu's Harrier	80.00%	7.00	100.00%	3.5	83.33%	19.83	100%	27.5
Osprey	33.33%	2.00	100.00%	0.75	50.00%	6.00	75%	11.00
Pallid Harrier	50.00%	13.00	100.00%	4.75	100.00%	20.50	100%	23.00
Red-footed Falcon	0.00%	0.00	100.00%	0.5	0.00%	0.00	100%	1.00
Short-toed Snake Eagle	16.83%	60.58	13.64%	24.0	19.46%	75.00	70.14%	195.5
Steppe Buzzard	14.79%	358.81	17.13%	209.5	20.86%	184.83	71.85%	804.33
Steppe Eagle	14.65%	159.07	13.12%	67.5	8.34%	91.00	45.64%	356.58
Sooty Falcon	100.00%	1.00	0.00%	0.00	0.00%	0.00	0.00%	0.00
Western Marsh Harrier	75.00%	14.00	77.14%	29.75	60.00%	23.17	92.50%	37.50
White Stork	28.84%	313.54	64.93%	217.5	12.19%	177.33	86.31%	559.5
TOTALS	**30.68%**		**50.01%**		**15.17%**		**39.59%**	

Table 60: Observational data from the VP surveys used to derive bird density inputs for the autumn CRM analysis.

Species	2020	Time120 (min.)	2020 (120m)	Time120 (min.)	2021 (200 m)	Time200 (min.)
Black Kite	74.19%	45.00	32.89%	20.25	86.84%	50.25
Black Stork	0.00%	0.00	100%	0.25	100.00%	1.00
Booted Eagle	60.00%	2.5	0.00%	0.00	100%	0.25
Common Crane	0.00%	0.00	100.00%	1.00	100.00%	3.00
Common Kestrel	86.11%	27.1	53.57%	17.00	89.29%	26.75
Eastern Imperial Eagle	0.00%	0.00	0.00%	0.00	0.00%	0.00
Egyptian Vulture	0.00%	0.00	0.00%	0.00	33.33%	0.25
Eurasian Sparrowhawk	50.00%	2.00	66.67%	2.00	66.67%	3.00
Honey Buzzard	22.27%	162.4	6.77%	37.25	84.81%	441.50
Great White Pelican	83.57%	22.00	64.67%	24.25	100%	37.5
Greater Spotted Eagle	0.00%	0.00	0.00%	0.00	0.00%	0.00
Lesser Spotted Eagle	0.00%	0.00	0.00%	0.00	0.00%	0.00
Lanner Falcon	0.00%	0.00	0.00%	0.00	0.00%	0.00
Levant Sparrowhawk	0.00%	0.00	0.00%	1.25	100.00%	4.5
Long-legged Buzzard	0.00%	0.00	0.00%	0.00	0.00%	0.00
Montagu's Harrier	86.21%	22.54	86.67%	20.25	100.00%	25.75
Osprey	100%	1.00	0.00%	0.00	0.00%	0.00
Pallid Harrier	58.82%	10.00	60.00%	8.00	100%	14.5
Red-footed Falcon	0.00%	0.00	13.64%	1.50	100%	6.5
Short-toed Snake Eagle	50.00%	1.00	0.00%	0.00	0.00%	0.00
Steppe Buzzard	35.29%	5.00	22.22%	8.00	61.11%	26.25
Steppe Eagle	0.00%	0.00	0.00%	0.00	0.00%	0.00
Sooty Falcon	50.00%	0.5	83.33%	4.25	83.33%	4.25
Western Marsh Harrier	82.86%	54.00	48.48%	30.25	95.45%	74.75
White Stork	90.34%	126.00	55.59%	21.00	98.03%	58.5

The above table shows one important point. There is not a single CRM as each year has its own CRM due to the following:

- Variations in the numbers of flights at risk between years and
- Different times spent at risk for each year.

Thus, CRM is not a fixed rule, and may change between seasons affected by the numbers of birds

at risk and their associated times. We have demonstrated in "Section 7.5.4" that flights occur randomly over the site every year, so this results support such random passing and the lack of a single collision risk.

Association between risk and non-risk numbers

There is a common agreement that numbers of birds and risk versus non risk are associated, so the proportion at risk is a measure of the threat to a species-specific population. However, this point has never been explored using the migration data. We have used the total species and year counts for all of the spring and autumn seasons, and we have listed the number of birds at risk vs. non risk height at 120 m. We have compared these numbers as follows:

- We tabulated the number of birds of one species in two columns at risk and non-risk height 120 m for each year, as follows:

OBSERVED White Storks 120 m		
year	**risk**	**non risk**
2020	36,805	90,802
2021	72,330	39,066
2022	8,148	58,682

- A Chi-square test measures if the numbers at risk and non-risk are associated across the different years (because of more flights there is more chance of risk). When the test (Chi-square result) shows values close to zero, then there is no association between risk and non-risk. However, this test does not allow us to know how strong this association is. For this, we went into a second step,
- We calculated the Cramer's V, which is a measure of association between two nominal variables. It allows us to interpret how the association between the variables is despite the significance of the test. It varies from 0 (corresponding to no association between the variables) to 1 (complete association) and can reach 1 only when each variable is completely determined by the other. The Cramer`s V effect size is considered as follows:

Effect Size(ES) ≤ 0.2	Weak association despite the Chi-square test being significant.
0.2 < ES ≤ 0.6	Moderate association,
ES > 0.6	Strong association.

- For many species with less than five individuals, comparisons were not possible. Thus, they do not appear in the following Tables.

Species	SPRING 120m		AUTUMN 120	
	Chi-sq	**Cramer**	**Chi-sq**	**Cramer**
Black Kite	40.58	0.04	28.89	0.41
Black Stork	254.03	0.24	-	-
Booted Eagle	0.13	0.02	-	-
Common Crane	-	-	-	-
Common Kestrel	-	-	-	-
Eastern Imperial Eagle	-	-	-	-
Egyptian Vulture	7.01	0.23	-	-
Eurasian Sparrowhawk	-	-	-	-
European Honey Buzzard	29.21	0.05	935.06	0.22
Great White Pelican	227.38	0.10	60.45	0.21
Greater Spotted Eagle	-	-	-	-

Lesser Spotted Eagle	-	-	-	-
Levant Sparrowhawk	-	-	-	-
Long-legged Buzzard	-	-	-	-
Montagu's Harrier	-	-	-	-
Osprey	-	-	-	-
Pallid Harrier	-	-	20.50	0.22
Red-footed Falcon	-	-	-	-
Short-toed Snake Eagle	2.19	0.05	-	-
Steppe Buzzard	262.3	0.06	1.16	0.12
Steppe Eagle	30.2	0.05	17.90	0.36
Sooty Falcon	-	-	-	-
Western Marsh Harrier	-	-	-	-
White Stork	57,509.26	0.43	19,22.88	0.39

These species highlighted showed a Chi-square test showing high significant differences (red: $p < 0.001$, orange: $p < 0.05$) which means there is association between the risk and non-risk flights. However, there is none for the Booted and Short-toed snake eagles (no significance of the Chi-square test) in spring and the Steppe Buzzard in autumn.

In addition, when considering the effect size of such association through the Cramer's V, eight out of ten species in spring –all except the two storks- had Cramer V values lower than 2, indicating weak association, and only the two mentioned (Black and White Storks) showed moderate association (0.24 and 0.43). The situation was different for the autumn, with moderate values for all species except the Steppe Buzzard.

This will entail that we should consider with caution the following analyses, as the CRM considers the % of flights at risk height, as one of the inputs for the model.

Outcomes of the CRM for the spring and autumn seasons

The tables below show the results of the CRM analysis to assess risk at two rotor heights - 120m 180m - representing the original design (120m max. blade tip height) and a revised design (180m max. blade tip height). The flying height 'bands' were adjusted in autumn 2021 to allow an assessment of the larger turbine design. It was not possible to use flight activity data collected in the previous seasons to assess the larger turbine size.

Table 61: Spring migration collision risk estimates (birds/spring migration season) assuming avoidance rates of 95%, 98% and 99.5%) for the Amunet wind farm for two scenarios (max. blade tip 120m and 180m) for the spring seasons 2020-2022 and applying for large array correction.

Species	Spring 2020 (120m)			Spring 2021 (120m)			Spring 2022 (120m)			Spring Average (120m) 2020-22			Spring 2022 (180m)[7]		
	95%	98%	99.5%	95%	98%	99.5%	95%	98%	99.5%	95%	98%	99.5%	95%	98%	99.5%
Black Kite	3	1	0	1	0	0	8	3	1	4	2	0	36	14	4
Black Stork	1	0	0	7	3	1	0	0	0	3	1	0	3	1	1

[7] Collision risk assessment for turbines with max blade tip height of 180m was calculated using data in all flying height bands <200m

Booted Eagle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Kestrel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Imperial Eagle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Egyptian Vulture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eurasian Sparrowhawk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
European Honey-buzzard	0	0	0	0	0	0	0	0	0	0	0	0	9	4	1
Great White Pelican	168	67	17	1	0	0	1	0	0	57	23	6	10	4	1
Greater Spotted Eagle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lesser Spotted Eagle	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Lanner Falcon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Levant Sparrowhawk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Long-legged Buzzard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Montagu's Harrier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Osprey	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pallid Harrier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red-footed Falcon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Short-toed Snake Eagle	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Steppe Buzzard	5	2	0	0	0	0	13	5	1	6	2	0	49	20	5
Steppe Eagle	1	0	0	0	0	0	0	0	0	0	0	0	2	1	0
Sooty Falcon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Marsh Harrier	1	0	0	2	1	0	13	5	1	5	2	0	8	3	1
White Stork	206	82	21	97	39	10	170	68	17	158	63	16	345	138	35

Coloured cells in the table are illustrative to highlight lower and higher spring migration fatality rate estimates assuming avoidance rates recommended in (Scottish Natural Heritage 2018) i.e. 98% for all species except Egyptian Vulture which is assigned a precautionary avoidance rate of 95% to align with other vulture species (based on studies of a similar species with a similar risk profile to vultures - White-tailed Sea-eagle (May et. al. 2011). (Colour key: blue = 0, green = <10, orange = 11-50, red = >50 spring migration fatalities)

Table 62 Autumn season collision risk estimates (birds/autumn migration season) assuming avoidance rates of 95%, 98% and 99.5%) for the Amunet wind farm for two scenarios (max. blade tip 120m and 180m) for the autumn seasons 2020-2021 and applying for large array correction.

Species	Autumn 2020 (120m)			Autumn 2021 (120m)			Autumn Average (120m) 2020-21			Autumn 2022 (180m)[7]		
	95%	98%	99.5 %	95%	98%	99.5 %	95%	98%	99.5 %	95%	98%	99.5%
Black Kite	0	0	0	0	0	0	0	0	0	0	0	0
Black Stork	0	0	0	0	0	0	0	0	0	0	0	0
Booted Eagle	0	0	0	0	0	0	0	0	0	0	0	0
Common Crane	0	0	0	0	0	0	0	0	0	0	0	0
Common Kestrel	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Imperial Eagle	0	0	0	0	0	0	0	0	0	0	0	0
Egyptian Vulture	0	0	0	0	0	0	0	0	0	0	0	0
Eurasian Sparrowhawk	0	0	0	0	0	0	0	0	0	0	0	0
European Honey-buzzard	3	1	0	1	0	0	2	1	0	35	14	4
Great White Pelican	11	4	1	0	0	0	6	2	1	3	1	0

Greater Spotted Eagle	0	0	0	0	0	0	0	0	0	0	0	0
Lesser Spotted Eagle	0	0	0	0	0	0	0	0	0	0	0	0
Lanner Falcon	0	0	0	0	0	0	0	0	0	0	0	0
Levant Sparrowhawk	0	0	0	0	0	0	0	0	0	1	0	0
Long-legged Buzzard	0	0	0	0	0	0	0	0	0	0	0	0
Montagu's Harrier	0	0	0	0	0	0	0	0	0	0	0	0
Osprey	0	0	0	0	0	0	0	0	0	0	0	0
Pallid Harrier	0	0	0	0	0	0	0	0	0	0	0	0
Red-footed Falcon	0	0	0	0	0	0	0	0	0	0	0	0
Short-toed Snake Eagle	0	0	0	0	0	0	0	0	0	0	0	0
Steppe Buzzard	0	0	0	0	0	0	0	0	0	0	0	0
Steppe Eagle	-	-	-	-	-	-	-	-	-	-	-	-
Sooty Falcon	0	0	0	0	0	0	0	0	0	0	0	0
Western Marsh Harrier	0	0	0	0	0	0	0	0	0	0	0	0
White Stork	83	33	8	41	16	4	62	25	6	18	7	2

Coloured cells in the table are illustrative to highlight lower and higher spring migration fatality rate estimates assuming avoidance rates recommended in (Scottish Natural Heritage 2018) i.e. 98% for all species except Egyptian Vulture which is assigned a precautionary avoidance rate of 95% to align with other vulture species (based on studies of a similar species with a similar risk profile to vultures - White-tailed Sea-eagle (May et. al. 2011). (Colour key: blue = 0, green = <10, orange = 11-50, red = >50 spring migration fatalities)

Table 63 **Annual collision risk estimates** for two maximum blade tip height scenarios 120m and 180m. Results are the sum of the spring and autumn migration collision risk estimates for each year where data was available for both seasons The average annual collision risk estimate is the average of the annual rates for 2020 and 2021

Species	Annual 2020 (120m)			Annual 2021 (120m)			Average Annual 2020-21 (120m)			Annual 2022 (180m)[7]		
	95%	98%	99.5%	95%	98%	99.5%	95%	98%	99.5%	95%	98%	99.5%
Black Kite	3	1	0	1	0	0	2	1	0	36	14	4
Black Stork	1	0	0	7	3	1	4	2	1	3	1	1
Booted Eagle	0	0	0	0	0	0	0	0	0	0	0	0
Common Crane	0	0	0	0	0	0	0	0	0	0	0	0
Common Kestrel	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Imperial Eagle	0	0	0	0	0	0	0	0	0	0	0	0
Egyptian Vulture	0	0	0	0	0	0	0	0	0	0	0	0
Eurasian Sparrowhawk	0	0	0	0	0	0	0	0	0	0	0	0
European Honey-buzzard	3	1	0	1	0	0	2	1	0	44	18	5
Great White Pelican	179	72	18	1	0	0	90	36	9	13	5	1
Greater Spotted Eagle	0	0	0	0	0	0	0	0	0	0	0	0
Lesser Spotted Eagle	0	0	0	0	0	0	0	0	0	1	0	0
Lanner Falcon	0	0	0	0	0	0	0	0	0	0	0	0
Levant Sparrowhawk	0	0	0	0	0	0	0	0	0	1	0	0
Long-legged Buzzard	0	0	0	0	0	0	0	0	0	0	0	0
Montagu's Harrier	0	0	0	0	0	0	0	0	0	0	0	0
Osprey	0	0	0	0	0	0	0	0	0	0	0	0
Pallid Harrier	0	0	0	0	0	0	0	0	0	0	0	0
Red-footed Falcon	0	0	0	0	0	0	0	0	0	0	0	0
Short-toed Snake Eagle	0	0	0	1	0	0	1	0	0	0	0	0

Steppe Buzzard	5	2	0	0	0	0	3	1	0	49	20	5
Steppe Eagle	1	0	0	0	0	0	1	0	0	2	1	0
Sooty Falcon	0	0	0	0	0	0	0	0	0	0	0	0
Western Marsh Harrier	1	0	0	2	1	0	2	1	0	8	3	1
White Stork	289	116	29	138	55	14	214	85	22	363	145	37

Coloured cells in the table are illustrative to highlight lower and higher spring migration fatality rate estimates assuming avoidance rates recommended in (Scottish Natural Heritage 2018) i.e. 98% for all species except Egyptian Vulture which is assigned a precautionary avoidance rate of 95% to align with other vulture species (based on studies of a similar species with a similar risk profile to vultures - White-tailed Sea-eagle (May et. al. 2011). (Colour key: blue = 0, green = <10, orange = 11-50, red = >50 spring migration fatalities)

Findings of the collision risk model analysis and assessment of potential impact during the operational phase

The collision risk model (CRM) assessment data in the tables above are helpful for assessing impacts. The results suggest:

- The collision risk to all species except for European Honey-buzzard is lower in the autumn compared with the spring migration period
- For the majority of MSBs passing through the project site airspace during spring and autumn migration, the risk of collision is low or zero
- Most raptor species had low or zero predicted collision rates when assessed either seasonally or annually. Three raptors had higher CRM estimates (Steppe Buzzard, European Honey-buzzard, Black Kite). All the higher values for these species related to the autumn 2021 and spring 2022 180m blade tip analysis which may suggest that the that the increased blade tip height will result in higher collision rates. This is unsurprising and aligns with turbine collision studies comparing smaller with larger turbines (e.g Rasran *et.al. 2017,* Shimada *2021*)
- Based on the predicted seasonal and annual collision rate estimates two species have the potential to be substantially impacted by the project: White Stork and Great White Pelican. The impacts for both species are likely to be greatest during spring migration with average estimates of 63 White Storks and 23 Great White Pelican fatalities predicted without mitigation. In the autumn season Great White Pelican is predicted to have a lower risk with <5 fatalities predicted per autumn season but impacts on White Stork are relatively high compared with all other MSBs with a 2-season average of 25 fatalities predicted for the autumn migration.
- Four globally threatened MSBs pass through the project airspace. These are Steppe Eagle and Egyptian Vulture (IUCN - Endangered) and Eastern Imperial Eagle, Greater Spotted Eagle and Sooty Falcon (IUCN -Vulnerable). Additionally, Pallid Harrier (IUCN-Near Threatened) was also recorded during baseline flight activity monitoring. Of these only Steppe Eagle had a predicted collision rate exceeding zero. The predicted collision rate for Steppe Eagle was zero for two of the three seasons that it was present (the species only migrates through the site in spring). In spring 2022 the 180m CRM analysis predicted 1 Steppe Eagle fatality.
- CRM estimates for the maximum blade tip height of 180m using autumn 2021 and spring 2022 flight activity data suggest that the results for the original 120m blade tip analysis may underestimate risk, i.e. most species with at least 1 predicted fatality had higher rates for the increased blade tip height analysis in both autumn 2021 and spring 2022. The 180m tip analysis used flight activity data from all height bands up to 200m, so there is also potential for this analysis to have slightly higher predicted fatality rates than those for a 180m blade tip. In the field it is difficult to assess flying height to within 20m without height-defined reference points in the landscape, it is not clear if these were available to survey teams so it is probably reasonable to accept the 180m blade tip analysis as a approximate CRM estimate value.

Although collision risk estimates will vary between years due to spatial variation in the intensity of migration flight activity within this part of the flyway, the CRM does provide 3 seasons of spring, and 2 of autumn data, and therefore likely provides a reasonable assessment of the scale of species-specific impacts likely. Specifically, the CRM provides robust evidence that White Stork, and Great White Pelican have the potential to be substantially impacted from collision with project turbines. The CRM also provides evidence that European Honey-buzzard are likely to be impacted during their autumn migration. The risk to most other raptor species and all globally threatened and near-threatened species appears to be low.

White Stork and Great White Pelican are assessed to have a high vulnerability to collision with turbines based on their body mass, flight style and behaviour and documented collision (see 'Species Vulnerability Index' section in Allinson 2017). This corroborates the potential for impacts on these two species. The same study assigns a high vulnerability to collision for large raptors, indicating that this group of species is especially susceptible to collision with turbines and that safeguarding of these species should always be a priority.

(i) Sensitivity of the Project Site

The baseline assessments have recorded high numbers of migratory soaring birds over the Project site and its vicinity. Some of those recorded species have an important status on the international or national levels. The baseline assessment concludes that the site is considered within a highly sensitive area in terms of avi-fauna. Additionally, the Project site is considered to be located along an intensive migration route. Taking all of the above into account, the receiving environment is considered of high sensitivity.

(ii) Magnitude of the Impact

The collision risk model (CRM) assessment data in the tables above are helpful for assessing impacts. The results suggest:

- The collision risk to all species except for European Honey-buzzard is lower in the autumn compared with the spring migration period.
- For the majority of MSBs passing through the project site airspace during spring and autumn migration, the risk of collision is low or zero.
- Most raptor species had low or zero predicted collision rates when assessed either seasonally or annually. Three raptors had higher CRM estimates (Steppe Buzzard, European Honey-buzzard, Black Kite). All the higher values for these species related to the autumn 2021 and spring 2022 180m blade tip analysis which may suggest that the increased blade tip height will result in higher collision rates. This is unsurprising and aligns with turbine collision studies comparing smaller with larger turbines (e.g. Rasran 2017, Shimada 2021).
- Based on the predicted seasonal and annual collision rate estimates, two species have the potential to be substantially impacted by the project: White Stork and Great White Pelican. The impacts for both species are likely to be greatest during spring migration with average estimates of 63 White Storks and 23 Great White Pelican fatalities predicted without mitigation. In the autumn season, Great White Pelican is predicted to have a lower risk with <5 fatalities predicted but impacts on White Stork remain relatively high compared with all other MSBs with a 2-season average of 25 fatalities predicted.
- Four globally threatened MSBs pass through the project airspace. These are Steppe Eagle and Egyptian Vulture (IUCN - Endangered), Eastern Imperial Eagle, Greater Spotted Eagle and Sooty Falcon (IUCN -Vulnerable). Additionally, Pallid Harrier (IUCN-Near Threatened) was also recorded during baseline flight activity monitoring. Of these, only Steppe Eagle had a predicted collision rate exceeding zero. The predicted collision rate for Steppe Eagle was zero for two of the three seasons that it was present (the species only migrates through the site in spring). In spring 2022 the 180m CRM analysis predicted one fatality for this species.
- CRM estimates for the current turbine maximum blade tip height of 180m (autumn 2021 and spring 2022 flight activity data) suggest that the results for the 120m blade tip analysis may underestimate risk, i.e. most species with at least 1 predicted fatality had higher rates for the increased blade tip height analysis in both autumn 2021 and spring 2022. The 180m tip analysis used flight activity data from all height bands up to 200m, so

there is also the potential that the predicted fatality rates could be slightly higher than those for a 180m blade tip.

Although collision risk estimates will vary between years due to spatial variation in the intensity of migration flight activity within this part of the flyway, the CRM does provide 3 seasons of spring data and 2 of autumn and therefore likely provides a reasonable assessment of the scale of species-specific impacts. Specifically, the CRM provides robust evidence that White Stork, and Great White Pelican have the potential to be substantially impacted from collision with project turbines. The CRM also provides evidence that European Honey-buzzard is likely to be impacted during their autumn migration. The risk to most other raptor species and all globally threatened and near-threatened species appears to be low.

White Stork and Great White Pelican are assessed to have a high vulnerability to collision with turbines based on their body mass, flight style and behaviour and documented collision (see 'Species Vulnerability Index' section in Allinson 2017). This corroborates the potential for impacts on these two species. The same study assigns a high vulnerability to collision for large raptors, so although the CRM did not generally predict many fatalities for this group, future migration periods with higher numbers of birds flying at turbine height will increase the CRM rate for these species, some of which are globally threatened.

Summarizing, the fatality rates for species recorded at the Amunet project will vary between years and it is likely that the number of fatalities could be higher than the assessment provided here. The CRM estimates indicate that for most MSB species including those globally threatened or near-threatened the impacts are likely to be low, however uncertainty relating to migration activity between years may mean that impacts could be higher and in some cases reach or exceed acceptable thresholds. For White Stork, Great White Pelican and European Honey-buzzard annual fatality rates are moderate to high. However, these species are all abundant with stable or increasing populations and assigned IUCN Least Concern status and therefore are better able to sustain some loss compared with globally threatened raptors using the project area. Overall, there is potential for a noticeable change to occur and acceptable limits are likely to be breached for non-threatened species but not for the majority of MSBs, therefore the assessment concludes medium magnitude of impact

Based on the above, the impact significance for the Amunet wind power project is assessed as Moderate, based on a high receptor sensitivity and a medium magnitude of effect.

Residual Impacts

The project will need to implement comprehensive turbine shutdown on demand and associated flight activity monitoring programs to mitigate turbine collision risk and identify and respond to emerging risks. The shutdown program will need to have the capacity to implement extended shutdown in response to predicted high migration intensity and/or environmental conditions that may lead to elevated risk situations. This type of shutdown will need to be implemented until the high collision risk situation has abated. Comprehensive and systematic fatality monitoring around turbines will be required to provide feedback on shutdown efficacy and as a trigger for adjusting the scale of shutdown required. Provided these measures are implemented to Good International Industry standards, evidence from operational wind projects in the Gulf of Suez operating this level of mitigation suggests that the significance of residual impact can be reduced to not significant

The following identifies the mitigation and monitoring measures to be applied during operation phase. Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Mitigation and Monitoring Measures

(i) Barrier Effect Study

It is recommended that RCREEE undertake at the cumulative level for all wind farms within the GoS region a barrier effect study. The study should assess potential impacts of wind farms as disruptive barriers to the migration route at the cumulative level within the GoS region and identify any additional mitigation measures to be considered. This could include for example spacing/buffer requirements between wind farms. The study should take into account the Project and all surrounding wind farms and the variations in the turbine heights of such projects. The study should be undertaken once all wind farms have confirmed their turbine specifications – please refer to "Section 8.15" for full list of wind farm projects within the GoS region.

(ii) Avi-Fauna Monitoring and On-Demand Turbine Shutdown

Good International Industry Practice standard shutdown on demand and bird monitoring study protocol will be designed and implemented by the Project informed by baseline bird data and the results of similar monitoring at GoS wind projects.

Monitoring during the operation of the wind farm must be completed in order to inform the actual impact caused by the wind farm on resident and migratory birds. The monitoring must be undertaken with the primary objective of collision avoidance but also secondary for migration monitoring behavior.

Monitoring will be undertaken during the migration seasons. The start and end of the monitoring period will be agreed with the ATMP Technical Committee[8] prior to commencement of each migration season. Based on current information, monitoring must take place during the spring migration season (from 20 February until 15 May) and autumn migration season (from 10 August till 15 November). Throughout these periods, monitoring must take place continuously on a daily basis. Detailed protocols for the ATMP including shutdown on demand is provided as an Annex

(iii) Avi-Fauna Carcass Search during Operation

A Good International Industry Practice standard post-construction fatality monitoring (PCFM) program (including bias correction trials) will be designed and implemented. A detailed protocol for this program is provided as an Annex.

The PCFM program will assess the effectiveness of shutdown mitigation measures and allow the annual number of bird turbine collision fatalities to be estimated.

PCFM reporting, including fatality rate estimate analysis will be 6-monthy, Additionally, a comparative assessment between the fatality monitoring results and the outcomes of the pre-construction ESIA CRM will be provided annually.

8.7 Bats

This Section identifies the anticipated impacts on bats from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

8.7.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the wind turbines and the various Project components to include substation, transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

[8] This includes members from RCREEE, EEAA, and EETC

Such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal. Nevertheless, such activities would likely result in the alteration of the site's habitat and thus potentially impacts bats; particularly through loss of hunting habitats for bats as well as roosting sites.

However, such impacts on bats created during the construction phase would of a long-term duration as they would result in a permanent change in the natural biodiversity of the site. However, such impacts are expected to be of negative nature, low magnitude, and low sensitivity and therefore not significant due to the reasons provided below.

- Based on literature review all bat species that are expected within the Project area are considered of Least Concern according to IUCN Red List of Threatened Species.
- The Project site being a feeding ground for bats (which in turn relates to bat activity) is expected to be minimal and insignificant given that the very low nocturnal insect activity due to the arid nature of the Project site and very low vegetation coverage.
- Based on preliminary visits of the Project area it does not seem to support any roosting sites for bats.

Taking the above into account, no mitigation measures are expected to be required

8.7.2 Potential Impacts during the Operation Phase

The potential impacts from the Project during operation are mainly related to risk of bat strikes and collisions with rotors of the operating wind turbines.

Many reports have corroborated the findings of bat collisions with wind turbines; this includes reports in Germany (Dürr 2001; Trapp *et al.* 2002; Dürr & Bach 2004), Sweden (Ahlén, 2002) and Spain (Alcalde, 2003). Evidences that turbines do not only kill bats from local populations but also from populations at far distance were established (Voigt *et al*., 2012).

In addition, in reference to EUROBATS Guidelines for Considerations on Bats in Wind Farm Projects (Rodrigues et al, 2014), some of the species that are listed to have their distribution range in the Project area and its vicinity are documented to be vulnerable to collisions with wind turbines. For instance, *Pipistrellus spp.* are known to be at high risk of collision from wind turbines. The literature shows that two species of the genus have their distribution range in the area; *Pipstrellus kuhlii* and *P. rueppellii*. Also, *Eptesicus spp.* of which *Eptesicus bottae* is documented to be recorded in the area, are known to be of medium risk to collision with wind turbines. None of the species listed in the literature review are known to have low risk of collision with wind turbines. In fact, all remaining seven species' vulnerability to collision with wind turbines is unknown.

Such impacts are anticipated to be of a long-term duration as negative nature, medium magnitude, and low sensitivity and therefore of minor significance due to the reasons provided below.

- Risk of collision of bats could potentially entail impacts on population on the species during specific periods of the year, mainly in spring season. However, based on literature review all bat species that are expected within the Project area are considered of Least Concern according to IUCN Red List of Threatened Species.
- The Project site being a feeding ground for bats (which in turn relates to bat activity) is expected to be minimal and insignificant given that the very low nocturnal insect activity due to the arid nature of the Project site and very low vegetation coverage.
- Based on preliminary visits of the Project area it does not seem to support any roosting sites for bats.

Mitigation and Monitoring Measures

To verify the outcomes above, as part of the Carcass Search Surveys and program to be undertaken (refer to "Section 8.6.2" earlier), this should cover bats as well. Based on the outcomes of the program above, if the results present any key outcomes then additional management measures should be determined as appropriate and based on the outcomes of the carcass search survey program.

8.8 Archaeology and Cultural Heritage

This Section identifies the anticipated impacts on archaeology and cultural heritage from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

It is important to note that there are no anticipated impacts during the operational phase of the Project.

8.8.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the wind turbines and the various Project components to include substation, transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

Although such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal, if such activities are improperly managed, they could damage or disturb archaeological remains present on the surface of the Project site. However, the archaeological baseline assessment discussed earlier concludes that there are no archaeological sites or remains within the Project site. Therefore, there are no anticipated impacts from the Project on surface archaeological remains within the Project site.

In addition, there is a chance that throughout such construction activities, archaeological remains buried in the ground are discovered. Improper management (if such sites are discovered) could potentially disturb or damage such sites which could potentially be of importance. Such potential impacts are of a short-term duration as they are limited to the construction phase, and are irreversible as should sites be discovered then inappropriate management could result in disturbance and/or damage, in which such an impact would be of medium magnitude. The impacts will be of a negative nature and low sensitivity given that the likelihood of such impacts is considered low. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase and which include:

- As required by the SCA (refer to Figure 74), during excavation activities, SCA must be notified to check if they will provide any observers to oversee the process and ensure that no underground archaeological remains of importance are unearthed and/or disturbed.
- Throughout the construction phase, and as the case with any Project development that entails such construction activities, there is a chance that potential archaeological remains in the ground might be discovered. It is expected that chance find procedures are implemented. Those mainly require that construction activities be halted and the area fenced along with proper signage, while immediately notifying the Ministry of Tourism and Antiquities/Red Sea and Suez Antiquities Inspection Office. No additional work will be allowed before the Ministry/Inspection Office assesses the found potential archaeological site and grants a clearance to resume the work. Construction activities can continue at other parts of the site if no potential archaeological remains were found. If found, same procedures above apply.

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Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the Wind Farm EPC Contractors during the construction phase and which include:

- Submission of formal letter of communication with SCA; and
- For chance find procedure, inspection of actions taken in case of new discoveries, including fencing, limiting access to site, and contacting the Ministry of Tourism and Antiquities/ Red Sea and Suez Antiquities Inspection Office. Report should be prepared and submitted to the Ministry in such a case which details the above.

8.9 Air Quality and Noise

This Section identifies the anticipated impacts on air quality and noise from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

8.9.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the wind turbines and the various Project components to include substation, transmission cables, access roads and internal road network, buildings, etc. are expected to include land clearing activities, levelling, excavation, grading, etc.

Although such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal. Nevertheless, such activities will likely result in an increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact ambient air quality. If improperly managed, there is a risk of nuisance and health effects to construction workers onsite and to a lesser extent to the nearby surrounding receptors from windblown dust (such as nearby petroleum activities). In addition, construction activities will likely entail the use of vehicles, machinery and equipment (such as generators, compressors, etc.) which are expected to be a source of other pollutant emissions (such as SO_2, NO_2, etc.) which would also have minimal direct impacts on ambient air quality.

In addition, all the above activities will likely include the use of machinery and equipment such as generators, hammers, compressors, etc. and which are expected to be a source of noise and vibration generation within the Project site and its surroundings. If improperly managed, there is risk of nuisance and health affects to construction workers onsite and to a lesser extent to the nearby surrounding receptors (such as nearby petroleum activities).

The above impacts are anticipated to be temporary and of short-term nature as they are limited to the construction period only. Such impacts are of a negative nature, and will be noticeable and therefore of medium magnitude. However, the impacts will be dispersed and are reversible as air quality would revert back to baseline conditions after construction works is completed and thus the receiving environment is considered of low sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase:

- Based on inspections and visual monitoring undertaken, if dust or pollutant emissions were found to be excessive due to construction activities, the source of such emissions should be identified and adequate control measures must be implemented;
- Comply with the Occupational Safety and Health Administration (OSHA) requirements and the Egyptian Codes to ensure that for activities associated with high dust and noise levels, workers are equipped with proper Personal Protective Equipment (e.g. masks, eye goggles, breathing masks, ear muffs, etc.);
- Apply basic dust control and suppression measures which could include:
  - Regular watering of roads for dust suppression;
  - Proper planning of dust causing activities to take place simultaneously in order to reduce the dust incidents over the construction period.
  - Proper management of stockpiles and excavated material (e.g. watering, containment, covering, bundling).
  - Proper covering of trucks transporting aggregates and fine materials (e.g. through the use of tarpaulin).
  - Adhering to a speed limit of 15km/h for trucks on the construction site.
- Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issue to avoid unnecessary pollutant and noise emissions.
- Based on inspections and visual monitoring undertaken, if noise levels were found to be excessive from construction activities, the source of such excessive noise levels should be identified and adequate control measures must be implemented; and
- Apply adequate general noise suppressing measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level, etc.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Inspection and visual monitoring of the works should be carried out at all times. In addition, periodic inspections should be conducted at nearby sites (e.g. such as nearby petroleum activities) to determine whether harmful levels of dust and noise from construction activities exist; and
- Reporting of any excessive levels of pollutants/dust or noise and the measures taken to minimize the impact and prevent it from occurring again.

8.9.2 Potential Impacts during the Operation Phase

The main foreseen impacts during the operation phase is that related to the noise generated from the operating wind turbines and its potential impact on the health and safety of the nearby surrounding receptors. Given that such impacts are directly related to public health and safety, such impacts have been discussed in details in "Section 8.12" along with other relevant impacts such as shadow flicker.

8.10 Infrastructure and Utilities

This Section identifies the anticipated impacts on infrastructure and utilities from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

8.10.1 Potential Impacts on Road Networks during the Planning and Construction Phase

Wind turbines are manufactured in factories and transported to the installation site where they are assembled. Wind turbine components have big dimensions and weight and their transport poses a challenge to the existing roads and infrastructure. The Project's wind turbine blades will have a length of around 57m and are usually transported in one piece. Tower components can have a transport height of up to 5m. Nacelles are also usually transported in one piece and can have a weight of more than 70 tonnes.

Components for wind energy projects are usually transported by sea from the manufacturing country to the country of installation and are then loaded in existing ports to trucks which manoeuvre their way through existing roads to the installation site.

Given the increasing size, weight, and length of components of the wind turbines, proper transportation and logistical solutions could be required for managing the heavy-load long-haul requirements. If improperly planned and managed, the trucks hauling the various heavy Project components may damage the existing roads, highways and bridges, utility lines (e.g. electricity lines), and could also be a public safety concern for other vehicles on the road.

Taking all of the above into account, the anticipated impacts on road networks are considered of short-term duration during the Project construction phase. Such impacts are of a negative nature, and if such impacts are improperly managed, then they are expected to be of high magnitude and medium sensitivity. Given the above impact is considered of moderate significance.

Mitigation Measures

It is recommended that EPC Contractor develop a Traffic and Transport Plan before commencement of any transportation activities to ensure that the transportation process is properly and adequately managed and does not pose a risk of damage to the existing roads, highways, overpasses whilst ensuring public safety. The Plan must analyse and study the entire route for transportation of the Project components from the port till the Project site. The assessment must take into account worst case scenarios for transportation of Project components for blade lengths, tower sections, etc. The study must investigate any constraints which need to be considered along the highways leading to the Project site such as bridges, overhead utility cables, slants in roads, etc. and identify accommodations which need to be taken into account (bypasses, adjustments to roads, etc.)

The Plan must take into account the following:

- The Plan must be developed in accordance with relevant local traffic and transportation legislations related to traffic loads and weights, dimensions, speed limits, etc.
- The plan must consider, to the extent possible, the proper planning of generated trips of trucks to ensure they are spread over the course of a work day and hours of day, and which also take into account peak and non-peak commute hours on the highway;
- As part of the Plan, the EPC Contractor must establish coordination with relevant entity to take into account any specific requirements that should be considered and ensure they are aware of the transportation requirements and details related to the Project.

In addition, the following identifies the mitigation measures that are to be implemented by the EPC Contractor as part of the planning phase of the Project:

- As noted earlier in "Section 8.3" formal communications must be established with the General Petroleum Company for a "Work Coordination Agreement". As part of such meetings, formal communication must also aim to discuss and determine any specific requirements to be taken into account for the established road networks within the Project site (e.g. avoidance of such areas, buffer distances to be considered, etc.)

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Submission of Traffic and Transport Plan with proof of coordination with the authorities discussed above for works required as part of the Study.
- Submission of proof of coordination with relevant entities

8.10.2 Potential Impacts on Electricity Lines during the Planning and Construction Phase

As noted earlier, an electricity line runs along the eastern border of the project area at a distance of around 600m. The electricity line is under the responsibility of the Egyptian Electricity Transmission Company (EETC).

Inappropriate management of planning activities (e.g. siting of turbines) and construction activities (e.g. excavations) could damage and/or disturb such electricity lines.

Taking all of the above into account, the anticipated impacts on electricity networks are considered of short-term duration during the Project construction phase. Such impacts are of a negative nature, and if such impacts are improperly managed, then they are expected to be of medium magnitude and medium sensitivity due to their distance from the Project site. Given the above impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase:

- Establish coordination with EETC with to discuss and determine any specific requirements to be taken into account for the established electricity networks within the Wind Farm (e.g. avoidance of such areas, buffer distances to be considered, etc.)
-

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Submission of proof of coordination with relevant entities

8.10.3 Potential Impacts on the Petroleum Pipeline during Construction

As noted earlier, there are some petroleum pipelines that pass close to the Project area at the south direction.

Inappropriate management of planning activities (e.g. siting of turbines) and construction activities (e.g. excavations) could damage and/or disturb such pipelines.

Taking all of the above into account, the anticipated impacts on petroleum pipeline are considered of short-term duration during the Project construction phase. Such impacts are of a negative nature, and if such impacts are improperly managed, then they are expected to be of medium magnitude and medium sensitivity due to their distance from the Project site. Given the above impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase:

- Establish coordination with relevant entity to discuss and determine any specific requirements to be taken into account for the pipeline (e.g. avoidance of such areas, buffer distances to be considered, etc.)

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Submission of proof of coordination with relevant entities

8.10.4 Potential Impacts on Water Resources during Construction and Operation

It is expected that the Project throughout the construction and operation phase will require water for potable usage (drinking, showering, etc.) and non-potable usage (e.g. cleaning of machinery and vehicles).

The Project is expected to require around 80,000m^3 throughout the construction phase (for a total duration of 28 months) – equivalent to around 75m^3/day. This will include around 60,000m^3 for construction requirements (concrete works, minimize dust, cleaning of requirements, etc.) as well as 20,000m^3 as potable water requirements (drinking, washing, etc.).

Similarly, during the operation phase, water will mainly be required for potable use of onsite staff at the Wind farm. Nevertheless, such requirements are expected to be minimal and insignificant.

As discussed earlier, based on consultations with Ras Ghareb Water Company there are no existing or planned water connections to the Project area. Water will be supplied through water trucks and tankers from Ras Ghareb and stored onsite through water tanks.

Based on the above it is clear that the water requirements for the Project during construction and operation are unlikely to entail any constraints on the existing users. However, the involved entities are required to coordinate with Ras Ghareb Water Company to secure water requirements for the Project most likely through tankers.

Taking all of the above into account, the anticipated impacts on the local water resources and utilities are considered of short-term duration during the Project construction phase and of long-term duration during the Operation phase. Such impacts are of a negative nature, and are expected to be of low magnitude and of low sensitivity given the temporary nature of such impacts during construction and minimal water requirements of the Project during operation. To this extent, the impact is considered not significant.

Additional Requirements

The following identifies additional requirements to be applied by the EPC Contractor during the construction phase and Project Operator during the operation phase respectively and which include:

- Coordinate with the Ras Ghareb Water Company to sector the water requirements of the Project.

8.10.5 Potential Impacts on Waste Utilities during Construction and Operation

The Project is expected to generate the following waste streams during the construction and operation phases:

- Wastewater during construction and operation to include black water (sewage water from toilets and sanitation facilities) and grey water (from sinks, showers, etc.). Wastewater during the construction phase from the Wind Farm can be assumed by taking into account an 80% wastewater generation factor for potable water requirements which will amount to around 16,000m^3 throughout the construction phase. Wastewater generated from the Wind Farm during operation is expected to be minimal and insignificant. Wastewater will be stored onsite though enclosed septic tanks and collected by tankers from the Project to the closest WWTP.
- Solid waste during construction and operation from the Wind Farm will include construction waste (mainly during construction to include dirt, rocks, debris, etc.) as well as general municipal waste (such as food, paper, glass, bottles, plastic, etc.). Solid waste quantities generated are not expected to be significant and are likely to be easily handled by closest landfill facility.
- Hazardous waste during construction and operation from the Wind Farm will include routine waste generated from such activities to include spent oil, lubricants, paint cans, solvents, etc. Hazardous waste quantities generated are not expected to be significant and are likely to be easily handled by closest authorized facility.

Taking all of the above into account, the anticipated impacts on waste utilities are considered of short-term duration during the Project construction phase and of long-term duration during the Operation phase. Such impacts are of a negative nature, and are expected to be of low magnitude and of low sensitivity given the relatively minimal quantities generated and easy of management by relevant authorities. Given the above impact is considered not significant.

Additional Requirements

The following identifies the additional requirements to be applied by the EPC Contractor during the construction phase and Project Operator during the operation phase respectively and which include:

- Coordinate with the Ras Ghareb Water Company and obtain list of authorized contractors for collection of wastewaters from the site to the Ras Ghareb WWTP.
- Coordinate with the Ras Gharib City Council to hire a competent private contractor for the collection of solid waste from the site to the closest approved sanitary landfill site.
- Coordinate with Environmental Management at Ras Ghareb City Council to obtain list of authorized contractors for collection of hazardous waste from the site to the closest approved facility for final disposal.

8.10.6 Potential Impacts on Aviation, Telecommunication and Television & Radio Links during the Planning and Construction Phase

Improper planning and site selection of the Project could impact and affect infrastructure elements related to aviation, telecommunication and television & radio links in the surrounding area. Those are discussed in further details below.

(i) Aviation

Any tall structure could impact aircraft safety if located near airports or known flight paths. In addition, such structures could potentially interfere with certain electromagnetic transmissions associated with air transport, for example primary radar and secondary surveillance radar. Wind turbines have the potential to impact the surveillance systems used to detect and identify aircraft approaching, overlying or leaving Egyptian airspace and for which a Recognized Air Picture (RAP) is produced.

Such issues are generally managed through appropriate setback distances (if applicable) and in addition, regulatory authorities generally include requirements for wind farm developments related to visibility of turbines to include navigational lights and blade paintings.

Nevertheless, if such issues are improperly managed and not taken into account as part of the planning phase, they could affect aircraft safety. Therefore, such impacts are considered of long-term duration, of negative nature, and of low magnitude given impact is related to inappropriate management of activities, however given its importance it is considered if high sensitivity. Given all of the above, the impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the Developer during the planning phase and which include:

- Establish coordination via NREA/EETC with the relevant entity to provide information on the Project (to include location and specifications of turbines in specific) and include any specific requirements to be considered as part of the detailed design to include setback distances if required (e.g. from radar systems if applicable) and navigational safety requirements (e.g. navigational lights, blade paintings, etc.)

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the Developer during the planning phase and which include:

- Submission of formal non-objection letters from relevant entities

(ii) Telecommunication, TV and Radio Links

Wind turbines during the construction and operation phase could impact telecommunication, TV and Radio infrastructure. For example, construction activities could damage/disturb underground communication cables (if present within the area), while rotating turbines during operation could disrupt Line of Sight (LoS) connections between telecommunication transmission towers.

Such issues are generally managed through appropriate setback distances (if applicable) from such infrastructure elements. Nevertheless, if such issues are improperly managed and not taken into account as part of the planning phase, they could affect such elements. Therefore, such impacts are considered of long-term duration, of negative nature, and of low magnitude given impact is related to inappropriate management of activities, however given its importance it is considered if high sensitivity. Given all of the above, the impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the Developer during the planning phase and which include:

- Establish coordination via NREA/EETC with the relevant entity (given that a telecommunication tower is noted onsite), and other applicable local agencies to provide information on the Project (to include location and specifications of turbines in specific) and include any specific requirements to be considered as part of the detailed design to include

setback distances if required for telecommunication, radio and TV infrastructure (e.g. from LoS connections)

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the Developer during the planning phase and which include:

- Submission of formal non-objection letters relevant entities

8.10.7 Potential Impacts on Water Dams during Construction

As noted earlier, there are three key water dams located just outside of the Project site to the west.

Inappropriate management of planning activities (e.g. siting of turbines) and construction activities (e.g. excavations) could damage and/or disturb such dams.

Taking all of the above into account, the anticipated impacts on the dams are considered of short-term duration during the Project construction phase. Such impacts are of a negative nature, and if such impacts are improperly managed, then they are expected to be of medium magnitude and medium sensitivity due to their distance from the Project site. Given the above impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase:

- Establish coordination with relevant entity to discuss and determine any specific requirements to be taken into account for the pipeline (e.g. avoidance of such areas, buffer distances to be considered, etc.)

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Submission of proof of coordination with relevant entities

8.11 Occupational Health and Safety and Worker Accommodation

This Section identifies the anticipated impacts from the Project throughout its various phases on occupational health and safety. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

This section presents the assessment of potential impacts on occupational health and safety collectively during the construction and operation phase for the wind farm, given that they are similar in nature during both phases.

Throughout the construction and operation phase there will be generic occupational health and safety risks to workers, as working onsite increases the risk of injury or death due to accidents. The following risks are generally associated with wind farm development projects:

- Slips and falls;
- Working at heights;
- Working with powered and hand-held tools;
- Struck-by objects;
- Moving machineries;
- Working in confined spaces and excavations;
- Exposure to chemicals, hazardous or flammable materials;
- Working in sunny conditions and high temperatures;
- Exposure to electric shocks and burns when touching live components;
- Exposure to noise and vibration
- OHS risks from work with nearby operations to include in specific the oil rigs and petroleum storage facilities

Such impacts are considered of short-term duration during the construction phase and of long-term duration throughout the Project operation phase, of a negative nature, and are expected to be of medium magnitude and medium sensitivity as in extreme cases they could entail permanent impacts (e.g. permanent disability). Nevertheless, such impacts are generally controlled through the implementation of general best practice. Given the above such an impact is considered of minor significance.

Mitigation Measures

The EPC Contractor is expected to prepare an Occupational Health and Safety Plan (OHSP) for their construction, installation and commissioning works as well as the general construction site operations. In addition, the Operator is expected to develop an OHSP tailored to the Project's operation phase.

The objective of the OHSP is to ensure the health and safety of all personnel in order to concur and maintain a smooth and proper progress of work at the site and prevent accident which may injure personnel or damage property contractor and all involved sub-contractors, as well as the Project Operators

The OHSP for the construction and operation phase should be Project and site specific and must take into account the national requirements mainly the Law 4/1994 and Law 12/2003 on Labour and Workforce Safety and Book V on Occupational Safety and Health (OSH) and assurance of the adequacy of the working environment. In addition, it must also be compliant with IFC PS2 (Labour and Working Conditions including Guidelines on OHS for noise and vibration) and EBRD PR 4 (Health and Safety) which recognize the importance of avoiding or mitigating adverse health and safety impacts on workers and require the development of a project-specific health and safety plan that is in accordance with Good International Practice (GIP).

In general, the OHSP should address the following components:

- Identify roles and responsibilities of the personnel involved within the Project to include the EHS manager, construction manager, supervisor, and other sub-contractor's responsibilities;
- Identify in details information in relation to formulation of safety committees, communication protocols, first aid personnel and facilities, first aid training programs, occupational health and safety culture, emergency preparedness and response, quality system, reporting requirements, competence and job safety training, safety inspections, recruitment procedures, safety audits, risk assessment, etc.;
- Identify in details the hazards which may be associated with various activities to take place and the various measures to be implemented to reduce such risks including the requirements for Personal Protective Equipment (PPE). This includes for example hand tools, access equipment, lifting equipment, mobile working equipment, etc.
- Identify in detail the fire control systems to include fire risk assessment, fire alarm system, fire risk management, and others; and

- Establish training requirements for workers to comply with health and safety procedures and protective equipment.
- Establish OHS and communications measures for working with nearby operations of the General Petroleum Company which has oil rigs and petroleum storage facilities within the Project area.

EPC Contractor and Project Operator are expected to adopt and implement the provisions of the OHSP throughout the Project construction and operation phase.

In relation to workers accommodation, the EPC Contractor has not been selected yet (nor any other sub-contractor which might be involved in the Project). Therefore, it is not clear at this point whether there will be any onsite accommodation for workers, or whether they will be accommodated at closest villages (i.e. Ras Gharib). However, should this be the case, an assessment on accommodating migrant workforce within Ras Ghareb should be undertaken.

Nevertheless, the EPC Contractor must prepare a worker accommodation plan, which must provide details on accommodation requirements of the workforce to include location, facilities, transportation requirements, etc. The Plan must ensure that workers are provided with a decent accommodation which meets the basic worker's needs. In addition, workers accommodation must be compliant with good international industry practices – mainly the "Workers' accommodation: process and standards" (EBRD/IFC Guidance Note, 2009). The document provides guidance notes on general living facilities, room facilities, medical facilities, management of accommodation units, etc.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor and Project Operator.

- Inspection to ensure the implementation of the provisions of the Occupational Health and Safety Plan and assess compliance with its requirements;
- Regular Reporting on the health and safety performance onsite in addition to reporting of any accidents, incidents and/or emergencies and the measures undertaken in such cases to control the situation and prevent it from occurring again; and
- Inspection on workers accommodation to ensure its compliance with EBRD/IFC's Guidance Note – Workers' accommodation: process and standards".

8.12 Public Health and Safety

This section identifies and assesses the anticipated impacts from the Project activities on public health and safety during the various phases to include planning and construction phase and operation phase. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

8.12.1 Potential Impacts from Noise from Wind Turbines during Operation

Wind turbines produce noise during operation from mechanical and aerodynamic sources. Mechanical noises are mainly limited from the machinery in the nacelle of the turbine (gearbox, generator, auxiliary equipment, etc.) while aerodynamic noise is generated from the movement of air around the turbine blades and tower.

Propagation of the sound from a turbine is primarily a function of distance, but it can also be affected by the placement of the turbine, surrounding terrain, and atmospheric conditions. In addition, noise levels depend greatly on the level of operation of the turbines (percentage of rated power). Nevertheless, in some cases, background/ambient sound already exceeds the sound produced by any wind turbine (e.g. high wind speeds, surrounding activities, etc.). In this case, the sound from the wind turbine blends into the background sound, simply becoming part of the present soundscape without the notice of residences.

As required by the IFC EHS Guideline for Wind Energy, the following is noted in relation to noise assessment for wind farms:

- Receptors should be chosen according to their environmental sensitivity (human, livestock, or wildlife).
- Preliminary modelling should be carried out to determine whether more detailed investigation is warranted. The preliminary modelling can be as simple as assuming hemispherical propagation (i.e., the radiation of sound, in all directions, from a source point). Preliminary modelling should focus on sensitive receptors within 2,000 meters (m) of any of the turbines in a wind energy facility.
- If the preliminary model suggests that turbine noise at all sensitive receptors is likely to be below an LA90 of 35 decibels (dB) (A) at a wind speed of 10 meters/second (m/s) at 10 m height during day and night times, then this preliminary modelling is likely to be sufficient to assess noise impact; otherwise, it is recommended that more detailed modelling be carried out, which may include background ambient noise measurements.

The IFC EHS Guideline for Wind Energy is based on the on "the Assessment and Rating of Noise from Wind Farms" (ETSU-R-97). ETSU can be regarded as relevant guidance on good practice, it contains a methodology for generating noise limits for a wind turbine and wind farms. ETSU-R-97 is referenced by the United Kingdom (UK) Government as a best practice guide for UK Legislation. The assessment procedure of ETSU-R-97 consists of the following steps for the screening assessment:

- Determine a study area;
- Identify potentially affected properties;
- Predict noise levels from all turbines (existing and proposed) and determine a noise contour boundary of 35dB(A);
- Identify if any noise sensitive receptors are within this boundary.

Taking the above requirements into account, a screening assessment was undertaken for the Project based on the following:

- Noise prediction calculations using SoundPLAN 8.2 software according to the International Organization for Standardization (ISO) 9613 'Acoustics − Attenuation of Sound During Propagation Outdoors' (International Organization for Standardization -ISO, 1996). ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources
- ISO 9613-2 calculates predicted noise levels with the major assumption that the sources are located upwind from the Noise Sensitive Receiver locations (NSR) as this is the worst-case scenario. Therefore, directivity and attenuation due to metrological factors such as wind speed and wind direction upwind from a source are not taken into account
- Screening was based on a worst-case noise scenario (W_{10} = 10m/s) as required by the guidelines. Since the proposed wind turbines for the Project operate at a constant maximum sound power output of 110.1 dB(A) between 10 m/s and 14 m/s, worst cases would be defined as operation within wind speeds which exceed 10 m/s.
- A 2 dB corrections for uncertainty have been applied in accordance with the turbine manufacturer

- Determining the extent of the 35 dB(A) contour boundary emitted from the wind turbine generators (WTG)
- Determining if there are any noise sensitive receptors within the calculated contour boundary;
- Model calculation and parameter setting to include the following:

Table 63: Model Calculation and Parameter Setting

Model Parameter	Parameter Setting / Standard							
Calculation Standard	(ISO) 9613 'Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Calculation Method' (ISO, 1996) Application as per IOA GPG							
Wind Speed	10 m/s							
Ground Absorption Coefficient	0.5							
Receiver Height	10 m							
Meteorological Data	Humidity 70% Air Pressure 1013.3 mbar T = 25°C							
Atmospheric Attenuation Coefficients (dB / km)	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
	0.1	0.3	1.1	2.8	5.0	9.0	22.9	76.6

The study is based on the following information:

- General arrangement and layout drawings of the wind farm, including topography.
- Wind turbine supplier data (vendor noise data) as provided by the Developer is as follows:
  - The sound power levels for the turbines during standard operation mode ranges from 99.8 dB(A) at low revolutions per minute (rpm) to 110.1 dB(A) at full rated power output (high rpm). In accordance with IEC 61400-14 'Wind Turbines – Part 14: Declaration of apparent sound power level and tonality values', the turbine manufacturer provides a performance guarantee of a maximum sound power output of 110.1 dB(A).
- Noise Sensitive Receiver locations (NSR) as identified in "Section 7.10" earlier. Review of identified receptors indicate that the nearest NSR is Ras Ghareb City located 9km to the southeast. As discussed within the land use section (refer to "Section 7.2") it was concluded that the Project site in particular is uninhabited and vacant with no indication or evidence of any physical or economical land use activities. There are several ongoing petroleum activities within the surrounding areas (to include 4-5km radius from the site in particular). Based on consultations, it was indicated that there are no lodging facilities within such receptors and it only include employees during normal working hours. *Therefore, such receptors are not considered key sensitive receptors*.

  The table below identifies the distance of the residential dwelling in Ras Ghareb that is closest to a proposed wind turbine in the Project site.

Table 64: Noise Sensitive Receptors

Noise Sensitive Receptor	Coordinates		Nearest WTG	Distance to Nearest WTG (km)
	mE	mN		
Ras Ghareb Residential Dwelling	505220	3136493	WTG 77	8.4

A noise contour map for the worst-case noise scenario has been calculated and is presented in the figure below. The map shows both contour lines and noise propagation level areas or 'zones'. The significance of the noise contour map is to allow for an overview of noise levels over a geographic area and therefore allows a quick basic analysis of the noise propagation for identification of the specific NSR.

Table 65: Noise Contour Map Setup Specification

Parameter Description	Noise Map Parameter
Wind Speed (W10)	10 m/s
WTG Operation	Worst Case – All WTGs operating
Mapping Grid Resolution	25 x 25 m

Mapping Result Range	35 - 70 dB(A)

As noted in the figures below, the nearest NSR (Ras Ghareb City) is outside of the LA90 of 35 decibels (dB) (A) at a wind speed of 10 meters/second (m/s) at 10 m as required by the Guidelines. In fact, the expected noise levels at the NSR are significantly lower than such limits.

Taking the above into account, such impacts are considered irrelevant and no detailed noise assessment is required.

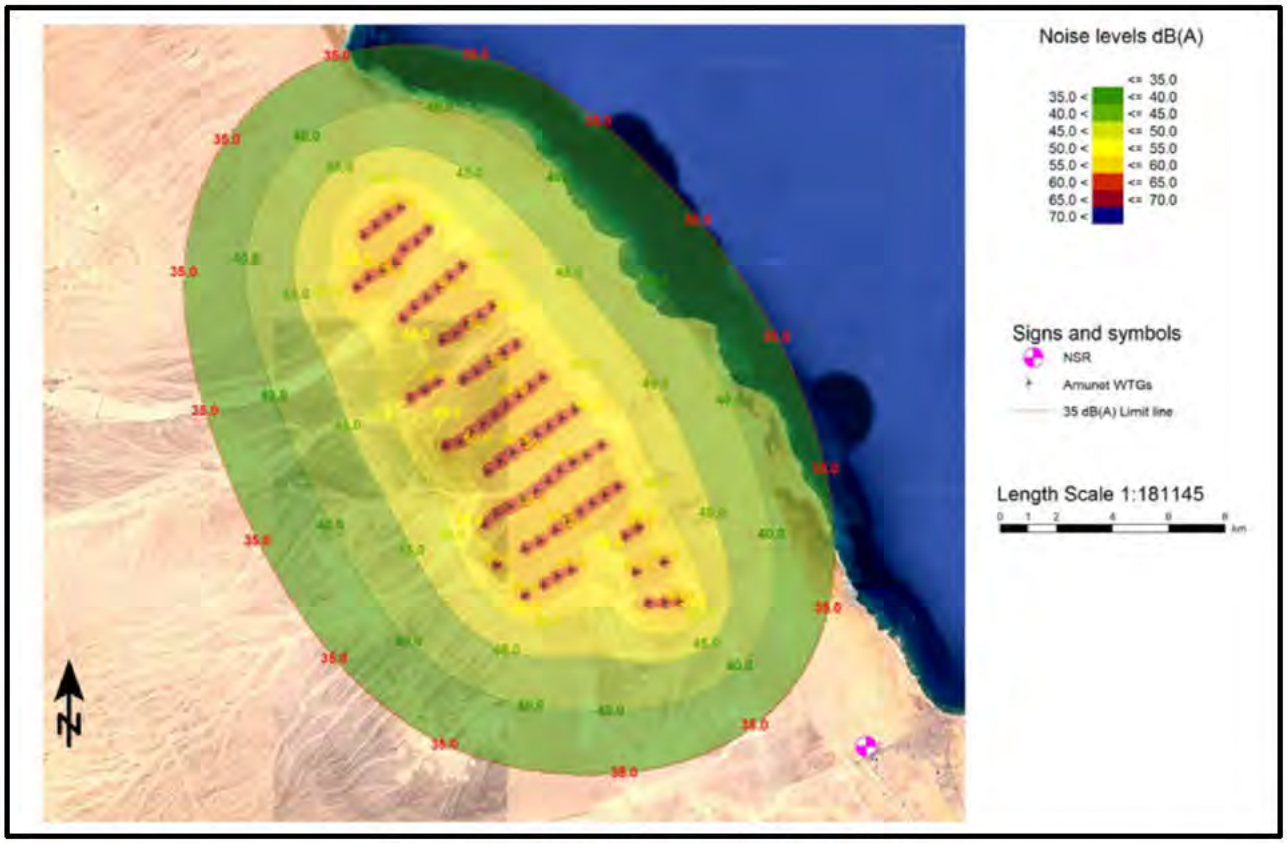

Figure 89: Noise Contour Map for Layout

Table 66: Predicted Contribution Noise Levels at NSR from Amunet Wind Farm (W10)

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10m/s Wind Speed (W10) – dB(A)
Ras Ghareb Residential Dwelling	**27.9**

8.12.2Potential Impacts from Shadow Flicker from Wind Turbines during Operation

Shadow flicker occurs when the sun passes behind the wind turbine and casts a shadow several hundred meters away from the turbine's location. As the rotor blades rotate, shadows pass over the same point causing an effect known as 'shadow flicker'. Shadow flicker only occurs under specific environmental conditions which must also align for flicker to occur which include position and height of the sun, wind speed, direction, cloudiness, and position of the turbine to a sensitive receptor.

Excessive shadow flicker can be a source of nuisance and could create a disturbing indoor environment to the occupants of those buildings especially when casted through windows of buildings that directly face the turbine with no obstructions in sight (trees, hills, etc.).

A companion guide to Planning Policy Statement 22 (PPS22) (2004) and BERR (2007) indicates that shadow flicker is typically limited to occurring within approximately 10 rotor diameters of a wind turbine; at distances beyond 10 rotor diameters shadow flicker effects are essentially

undetectable. Beyond this distance, the shadow is diffused such that the variation in light levels is not likely to be sufficient to cause annoyance. This is also acknowledged in the Queensland Wind Farm Planning Guidelines, which state that the first step in performing a shadow flicker assessment is to determine the extent of shadows from turbines and suggest a distance equivalent to 265 maximum blade chords (the thickest part of the blade) as an appropriate limit. This limit corresponds to around 800 m to 1,325 m for modern wind turbines, which typically have maximum blade chord lengths of 3 m to 5 m (AECOM, 2016). The rotor diameter that will be considered for the Project is 171m – therefore shadow flicker effects are likely to occur within 1,800m radius.

The IFC EHS Guideline for Wind Energy states that *where there are nearby receptors*, commercially available software can be used to model shadow flicker in order to identify the distance to which potential shadow flicker effects may extend.

Based on the above and the fact that the closest proposed sensitive receptor is located 9km from the Project; such impacts are considered irrelevant and no detailed shadow flicker modelling is required.

8.12.3 Potential Impacts from Trespassing of Unauthorised Personnel

Such impact is mainly related to public access of unauthorized personnel to the various Project components. Such access could result in safety issues such as unauthorized climbing of the turbine, safety hazards from substations (electric shock, thermal burn hazards, exposure to chemicals and hazardous materials, etc.), unauthorized climbing of the transmission tower and others.

Such impacts are considered of long-term duration throughout the Project operation phase, of a negative nature, and are expected to be of medium magnitude and high sensitivity given that it entails potential public safety concerns which in extreme cases they could entail permanent impacts (e.g. death or permanent disability). Given the above such an impact is considered of moderate significance.

Mitigation Measures

The following presents the mitigation measures that are to be implemented by the Project Operator during the operation phase of the Project and which include:

- A Security Risk Assessment should be developed for the Wind Farm Project and which takes into account the following:
  - Each turbine to be fitted with locked doors to prevent unauthorized access to the turbines;
  - Substation area to be completely fenced with concrete walls to prevent unauthorized access;
  - Onsite guards within the entire Project site at all times to ensure the safety and security of the Project as well as preventing unauthorized access to any of the Project components. However, it must be ensured that all onsite guards are adequately trained to deal with unauthorized trespassing incidents.
  - Post informative signs on the turbines and substation about public safety hazards and emergency contact information. Signs, especially warnings need to be pictorial as well as written to ensure they are understood by those unable to read

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to *not significant.*

Monitoring and Reporting Requirements

The following presents the mitigation measures that are to be implemented by the Project Operator during the operation phase of the Project and which include:

- Submission of Security Risk Assessment

8.12.4 Potential Impacts from Worker Influx during Construction

During construction the Project a relatively significant number of workers will be expected onsite (around 1,500 workers) for duration of approximately 28 months. However, as discussed earlier, at this point it is still unclear how many of these workers will be expatriates, Egyptians and/or from local communities and it is still unclear where accommodation of these works will take place. However, an estimate is likely to be around 15-20% from the total number of workforce at peak.

Nevertheless, the influx of workforce to the area could result in certain community health, safety and security impacts which are discussed below.

Risk of Diseases

Influx of workers may introduce new reservoirs of diseases such as vector-related diseases, water-borne diseases, etc. In addition, there is also a risk of spreading communicable diseases, included sexually transmitted ones. The risk of catching or exchanging communicable diseases (e.g., Virus B, Virus C, and HIV/AIDS) and the lack of awareness on transmission disease can represent a high risk to workers and community health and safety. This could also include in particular risk from COVID-19.

Inappropriate Code of Conduct

Other risks from worker influx include inappropriate code of conduct by workers towards local communities which might result in hostilities and resentment. Such inappropriate conduct could include also disrespecting the traditional culture and social norms of the area and local communities.

Increase in Social Vices

Population influx could result in an increase of social vices including alcoholism, drug abuse, and other.

Such impacts are considered of short-term duration during the construction phase, of a negative nature, and are expected to be of medium magnitude and medium sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

The EPC Contractor is expected to prepare a worker influx plan to be implemented for the construction phase of the Project. The plan must take into account the following:

- Medical examination program. All workers must be subject to a preliminary medical examination before commencement of any job tasks in accordance with local applicable requirements. In addition, routine medical examination for workers (bi-annually) must be undertaken. Such medical examinations must be undertaken at certified centres. Copies of medical examination results of all workers must be retained onsite.
- Details and procedures for ensuring and maintaining hygienic conditions onsite at all times specifically related to toilet and washing facilities, eating areas, etc.
- Development of a code of conduct for workers which takes into account appropriate behaviour by workers at all times, religious customs, traditional cultures and social norms in the area. In addition, it must include specifically requirements for social vices including gender-based violence, sexual harassment, alcoholism, drug abuse, etc.
- Induction training and awareness raising sessions on risks associated to the most common contagious diseases (e.g. influenza virus), communicable diseases, general measures for hygiene, code of conduct expected to be implemented and other as appropriate.
- COVID-19 procedures to be implemented onsite for the workforce (e.g. masks, disinfectants, etc.)

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor:

- Submission of the Worker Influx Plan

8.12.5 Potential Impacts from Security Personnel

Inappropriate management of security issues and incidents by security personnel towards local communities could result in resentment, distrust and escalation of events. Such impacts are considered of short-term duration during the construction phase and long-term duration during the Project operation phase, of a negative nature, and are expected to be of medium magnitude and medium sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

The EPC Contractor and Project Operator are expected to prepare a Security Management Plan to be implemented for the construction and operation phase of the Project.

The plan must identify appropriate measures for hiring, rules of conduct, training, equipping, and monitoring of security personnel to control and manage such issues. The plan must adhere to: (i) IFC PS 4 (Community Health, Safety and Security); and (ii) EBRD PR 2 (Labour and Working Conditions), all of which identify requirements for security personnel. This includes in specific requirements to ensure security personnel are guided by the Voluntary Principles on Security and Human Rights in terms of hiring, rules of conduct, training, equipping and monitoring of such personnel. They also require reasonable inquiries that those providing security measures are not implicated in past abuses, will ensure they are trained adequately in the use of force (and firearms if applicable) and appropriate conduct towards the workers and the local community. Force should only be used when strictly necessary, and to an extent proportional to the threat.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor and Project Operator:

- Submission of the Security Management Plan

8.12.6 Potential Impacts from Blade and Tower Glint of Wind Turbines during Operation

Blade or tower glint occurs when the sun strikes a rotor blade or the tower at a particular orientation. This can impact a community, as the reflection of sunlight off the rotor blade may be angled toward nearby residences.

However, as discussed previously, there are no key sensitive receptors located within the surrounding area of the wind farm which could potentially be impacted by blade and tower glint. In addition, according to the IFC EHS Guidelines on Wind Energy (IFC, 2007), blade glint is a temporary phenomenon for new turbines only, and typically disappears when blades have been soiled after a few months of operation.

Taking all of the above into account, such impacts are considered of short-term duration as they will occur only temporary throughout the operation phase of the Project and of a negative nature. However, given that there are no sensitive receptors located within the surrounding areas and

the only temporary occurrence (if occurring at all) such an impact is considered of low magnitude and low sensitivity. Given the above, such an impact is considered of not significant.

Mitigation Measures

The following presents the mitigation measures that are to be implemented by the Project Operator during the operation phase of the Project and which include:

- Consideration should be given to the use of non-reflective finishes to ensure potential impacts are not significant.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to *not significant*

Monitoring and Reporting Requirements

The following presents the mitigation measures that are to be implemented by the Project Operator during the construction phase of the Project and which include:

- Inspections and visual monitoring to ensure that non-reflective finishes have been used.

8.12.7 Potential Impacts from Blade/Ice Throws from Turbines during Operation

There are potential impacts from blade throws and ice throws from the wind turbines, where if such incidents occur, they could affect the public safety of nearby receptors.

According to the IFC EHS Guidelines on Wind Energy (IFC, 2015), a failure in the rotor blade can result in the 'throwing' of a rotor blade – however the overall risk of such an event is extremely low. In addition, if ice accretion occurs in blades, which can happen in certain weather conditions in cold climates, then pieces of ice can be thrown from the rotor during operation, or dropped if the turbine is idling. Ice throws are considered irrelevant given that in general the area does not experience any snow events.

The IFC EHS Guidelines on Wind Energy (IFC, 2015) states a setback distance should be applied between turbines and *populated locations*. The minimum setback distance is 1.5 x turbine height (tower + rotor radius), although modelling suggests that the theoretical blade throw distance can vary with the size, shape, weight, and speed of the blades, and the height of the turbine. Although the Guideline specifies such a setback distance from populated location (which are not applicable for the Project given that there are none), it is still important to consider such requirements for existing onsite and nearby facilities (such as the petroleum facilities).

Taking all of the above into account, such impacts are considered of long-term duration as they will occur throughout the operation phase of the Project and of a negative nature. However, given that there are no sensitive receptors located within the surrounding areas and given that the risk is extremely low such an impact is considered of low magnitude and low sensitivity. Given the above, such an impact is considered of not significant.

Additional Requirements

As noted earlier in "Section 8.3", formal communications must be established with the General Petroleum Company for a "Work Coordination Agreement". As part of such meetings, formal communication must also aim to discuss and determine any specific requirements to be taken into account for the established setback distances from existing onsite facilities which could be based on the IFC setback distance requirements. This could include in particular the following receptors as discussed in "Section 7.2"/ Table 15 and Figure 18 but which their uses and potential plans can be verified as part of such communications: (i) receptor 5 (substation location with offices), receptor 6 (petroleum field with offices), receptor 7 (parking and offices) and receptor 6 (entrance gate with office); (ii) receptor 13 is only a storage area and therefore could be potentially excluded.

8.13 Socio-economics

This Section identifies the potential impacts in relation to socio-economic during the various Project phases. For each impact, a set of mitigation measures and monitoring requirements are identified.

Given the generic nature of the impacts on socio-economic development for both phases of the Wind Farm Project (construction and operation) those have been identified collectively throughout this section.

During the construction and operation phases of the Wind Farm, the Project is expected to create the following job opportunities:

- Around 1,500 job opportunities at peak during the construction phase for a duration of approximately 30 months. This will mainly include skilled job opportunities (to include engineers, technicians, consultants, surveyors, etc.) and unskilled job opportunities (mainly labourers but will also include a number of security personnel).
- Around 60 job opportunities during the operation phase for a duration of 20 years. This will include skilled job opportunities (such as engineers, technicians, administrative employees, etc.) and unskilled job opportunities (such as security personnel, drivers, etc.).

However, the contractors and operators have not been selected at this stage, and therefore there are no details available on the number of job opportunities targeted to local communities, type of jobs, duration, etc. In addition to the above, the local communities could also be engaged in procurement opportunities along different segments of the value chain such as local contractors, local supply of equipment and machinery, cleaning services, etc.

Taking the above into account, the Developer is committed to ensuring that priority for job opportunities and procurement activities where relevant are targeted to the local communities. The above could also entail other indirect positive benefits to the local community from increase in demand for local services, supplies, and businesses. This could include for example possible engagements for supplies and service providers (accommodation services, food, etc.). Such demands could improve the existing local economic activities and impact certain sectors, such as wholesale/retail trade.

Taking all of the above into account, this to some extent could contribute to enhancing the living environment for its inhabitants. The creation of job and procurement opportunities in specific is of crucial importance. However, it is understood that the socio-economic development of the area is not hinged on a single project but rather on implementing collective and coordinated actions, including other development projects and investment within the area.

Nevertheless, proper planning and local community engagement from the start is crucial to understand issues and opportunities which in turn would enable the Project build true sustainable links which will bring maximum benefits to the local communities. Given the above, such impacts are anticipated to be *positive*.

Recommendations and Required Action

As the impacts discussed are mainly positive, no mitigation measures have been identified. This section provides recommendations which aim to enhance such positive impacts anticipated from the Project throughout the construction and operation phases to the greatest extent possible.

- Local Recruitment Procedure: the EPC Contractor under supervision from the Developer should develop a Local Recruitment Procedure that must identify the number of job opportunities targeted for local communities to include skilled and unskilled workers. Such job opportunities shall also take into account employment of local communities in the area around the project to include fresh graduate engineers, technicians, labourers, etc. In addition, the procedure must include details on how job opportunities will be announced as well as a selection process that is fair and transparent and provides equal opportunities for all including females. The Procedure should investigate the potential for implementation through a joint collaboration between the Developer/EPC Contractors and the other wind farm developers in

the area. Prioritising employment from the community is considered a key issue and this should be reflected in the EPC Contract and subsequent subcontracts.

- Local Procurement Procedure: the EPC Contractor under supervision from the Developer should develop a Local Procurement Procedure that must identify the procurement opportunities targeted for local communities to include for example local subcontractors, local supplies and services, cleaning services, etc. In addition, the procedure must include details on how procurement opportunities will be announced as well as a selection process that is fair and transparent and provides equal opportunities for all. The Procedure should investigate the potential for implementation through a joint collaboration between the Developer/EPC Contractors and the other wind farm developers in the area. Prioritising procurement opportunities from the community is considered a key issue and this should be reflected in the EPC Contract and subsequent subcontracts.
- Social Responsibility Program: it is recommended that the Developer implement a social responsibility program which aims to benefit the local communities to the greatest extent possible. In this case, a structured approach must be developed which must identify priority development projects which could benefit local communities (e.g. based on a needs assessment if available). Based on that the social responsibility program can prioritise projects for local communities based on available budget, vision, timeline for implementation and other factors.

8.14 Summary of Anticipated Impacts

The tables below present a summary of the anticipated impacts during the planning and construction and operation phase of the Project. The information in the tables includes:

- Key and generic environmental attributes (e.g. air quality, noise);
- Impact (textual description);
- Nature of impact (negative or positive);
- Duration (long-term or short-term);
- Reversibility (reversible or irreversible);
- Magnitude (high, medium, or low);
- Sensitivity (high, medium, or low);
- Significance (major, moderate, minor, or not significant);
- Management action – generally management actions describe whether an impact can be mitigated or not. Management actions include: (i) mitigation measures; (ii) compensation measures; (iii) additional requirements which must be implemented at a later stage and which could be required by a governmental entity; (iv) for positive impacts recommendations have been provided which aim to enhance the impact; and
- Residual significance after management actions are implemented (major, moderate, minor, or not significant).

Table 67: Summary of Anticipated Impacts during Planning and Construction

Attribute / Issue	Likely Impact – Planning and Construction Phase	Impact Assessment							
		Nature	Duration	Reversibility	Magnitude	Sensitivity	Significance	Management Action	Residual Significance
Landscape and Visual	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	Negative	Short – Term	Reversible	Medium	Low	Minor	Mitigation Available	Not Significant
Land Use	Project could conflict the formal assigned land sues set by the various governmental entities.	There are no anticipated impacts.						No additional requirements	Not relevant
	There are several land uses onsite which if improperly managed could result in potential conflicts and disputes. This includes the Ghafra system of the Bedouin groups and existing nearby petroleum facilities.	Negative	Long – Term	Reversible	Medium	High	Moderate	Mitigation Available	Not Significant
Geology, Hydrology and hydrogeology	Potential for flood risks on the Project area.	There are no anticipated impacts.						No additional requirements	Not relevant
	Risk of soil and groundwater contamination during the various construction activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater.	Negative	Long – Term	Could be irreversible	Medium	Low	Minor	Mitigation available	Not Significant
Biodiversity	Improper management of construction activities could disturb/damage habitats and fauna.	Negative	Long – Term	Could be irreversible	Medium	Low	Minor	Mitigation Available/ Additional Studies	Not Significant
Avi-Fauna (Birds)	Improper management of construction activities could disturb breeding birds and damage relevant habitats	Negative	Short – Term	Could be irreversible	Low	Medium	Minor	Mitigation Available/ Additional Studies	Not Significant
Bats	Improper management of construction activities could damage habitats and disturb species.	Negative	Long – Term	Could be irreversible	Low	Low	Not Significant	No Mitigation Required	Not Significant
Archaeology	Improper management of construction activities could disturb/damage archaeological remains which could be buried in the ground (if any).	Negative	Short – Term	Could be irreversible	Medium	Low	Minor	Mitigation Available	Not Significant
Air Quality and Noise	Construction activities will likely result in an increased level of dust, particulate matter and pollutant emissions which in turn will directly impact ambient air quality.	Negative	Short - Term	Reversible	Medium	Low	Minor	Mitigation Available	Not Significant
	Possible noise emissions to the environment from the construction activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Negative	Short - Term	Reversible	Medium	Low	Minor	Mitigation Available	Not Significant
Infrastructure and Utilities	Road Networks – if transportation activities of the various project components to the site are not properly managed beforehand, they could entail risk of damage to the existing roads and could be of public safety concerns to other users on the road. In addition, if planning activities are not well managed it could damage/disturb existing onsite road networks.	Negative	Short - Term	Reversible	High	Medium	Moderate	Mitigation Available	Not Significant
	Electricity network – if planning activities are not well managed onsite it could damage/disturb existing onsite electricity network and pylons.	Negative	Short – Term	Reversible	Medium	Medium	Minor	Mitigation Available	Not Significant
	Petroleum Pipeline – if planning activities are not well managed onsite it could damage/disturb existing pipeline	Negative	Short – Term	Reversible	Medium	Medium	Minor	Mitigation Available	Not Significant
	Water Resources – water requirements of the Project could entail constraints on the existing resources and users.	Negative	Short - Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of waste, wastewater and hazardous generated from the Project during the construction phase.	Negative	Short - Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Aviation, Telecommunication, and TV & Radio Links – Improper planning and site selection of the Project could impact aircraft safety and/or could potentially interfere with certain electromagnetic transmissions associated with air transport, telecommunications, and radio/television systems in the area.	Negative	Long-Term	Reversible	Low	High	Minor	Additional Requirements	Not Significant
	Water Dams – if planning activities are not well managed onsite it could damage/disturb existing dams.	Negative	Short – Term	Reversible	Medium	Medium	Minor	Mitigation Available	Not Significant
Occupational Health and Safety	There will be some generic risks to workers health and safety from working on construction sites, as it increases the risk of injury or death due to accidents.	Negative	Short – Term	Could be Irreversible	Medium	Medium	Minor	Mitigation Available	Not Significant
Public Health and Safety	Public access of unauthorized personnel to the various Project components (turbines, substation) could results in various public safety hazards.	Negative	Long – term	Could be Irreversible	Medium	High	Moderate	Mitigation Available	Not Significant
	Worker influx could result in certain community health, safety and security impacts to include risk of diseases, inappropriate code of conduct by workers towards locals, increase in social vices, etc.	Negative	Short-term	Reversible	Medium	Medium	Minor	Mitigation Available	Not Significant
	Inappropriate conduct of security personnel towards local communities could result in resentment, distrust and escalation of events	Negative	Short-term	Reversible	Medium	Medium	Minor	Mitigation Available	Not Significant
Socio-economic Development	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to	Positive	Not applicable.						

	local communities.		

Table 68: Summary of Anticipated Impacts during Operation

Attribute / Issue	Likely Impact – Operation Phase	Impact Assessment							
		Nature	Duration	Reversibility	Magnitude	Sensitivity	Significance	Management Action	Residual Significance
Landscape and Visual	Visual impacts concern the turbines themselves (e.g. colour, height, and number of turbines) relating to their interaction with the character of the surrounding landscape.	Could be Negative or Positive	Long – Term	Reversible	Medium	Low	Minor	No mitigation required	Minor
Geology, Hydrology and Hydrogeology	Risk of soil and groundwater contamination during the various operational activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater.	Negative	Long – Term	Could be irreversible	Medium	Low	Minor	Mitigation available	Not significant
Biodiversity	Improper management of operation activities could disturb/damage habitats and fauna.	Negative	Long – Term	Could be irreversible	Medium	Low	Minor	Mitigation Available	Not Significant
Avi-Fauna (Birds)	Wind turbines are associated with impacts on birds from risks of strikes and collision on both migratory and resident soaring birds. Such impacts depend on several factors but could affect the population levels of certain species especially those with international/national critical conservation status.	Negative	Long – Term	Could be irreversible	Low – High	Medium	Moderate	Mitigation Available	Not Significant
Bats	The potential impacts from the Project during operation are mainly related to risk of bat strikes and collisions with rotors of the operating wind turbines.	Negative	Long – Term	Could be irreversible	Low	Low	Not Significant	Mitigation Available / Additional Studies	Not Significant
Infrastructure and Utilities	Water Resources – water requirements of the Project could entail constraints on the existing resources and users.	Negative	Short - Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
	Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of waste, wastewater and hazardous generated from the Project during the construction phase.	Negative	Long – Term	Reversible	Low	Low	Not significant	Additional Requirements	Not Significant
Occupational Health and Safety	There will be some risks to workers health and safety during the operation and maintenance activities of the Project.	Negative	Long – Term	Could be irreversible	Medium	Medium	Minor	Mitigation Available	Not Significant
Public Health and Safety	Operating wind turbines will produce noise from mechanical and aerodynamic effects. This could be a source of disturbance and nuisance to the receptors and could create a disturbing indoor environment.	There are no anticipated impacts.						No additional requirements	Not relevant
	Operating wind turbines will produce shadow flicker which could be a source of disturbance and nuisance to the receptors and could create a disturbing indoor environment.	There are no anticipated impacts.						No additional requirements.	Not relevant
	Public access of unauthorized personnel to the various Project components (turbines, substation) could results in various public safety hazards.	Negative	Long – term	Could be Irreversible	Medium	High	Moderate	Mitigation Available	Not Significant
	Inappropriate conduct of security personnel towards local communities could result in resentment, distrust and escalation of events	Negative	Short-term	Reversible	Medium	Medium	Minor	Mitigation Available	Not Significant
	Blade or tower glint can impact sensitive receptors as the reflection of sunlight off the rotor blade may be angled toward nearby receptors.	Negative	Short – Term	Reversible	Low	Low	Not Significant	Mitigation available	Not Significant
	Failure in rotor blade can result in the 'throwing' of the blade. Although overall risk of such events is extremely low, it could affect the public safety of nearby receptors.	Negative	Long – term	Could be Irreversible	Low	Low	Not Significant	Mitigation Available	Not Significant
Socio-economic Development	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to local communities.	Positive	Not applicable						

8.15 Assessment of Cumulative Impacts

As discussed earlier, currently an area of around 284km^2 in the GoS is being developed for multiple wind farm projects (in which the Project site is located). A Strategic and Cumulative Environmental and Social Assessment (SESA) was undertaken for the 284km^2 area. One of the objectives of the SESA was to investigate the cumulative impacts of the wind farm developments and identify constraints to be taken into account by the various developers.

This section provides an assessment of cumulative impacts mainly based on the outcomes of the SESA. The table below provides the key outcomes of the SESA for each attribute, key outcomes of the project-specific ESIA and key additional requirements to be considered.

Table 69: Assessment of Cumulative Impacts

E&S Attributes	Outcomes of SESA	Outcomes of Project Specific ESIA	Additional Requirements
Landscape and Visual	Key outcome of SESA is related to visibility of the turbines during operation. SESA concludes that due to absence of people living in the area where visual impacts are relevant and given that the key receptors to be impacted include several petroleum facilities and passengers on main highways such issues are not considered key. No additional requirements have been identified in the SESA.	Key impact is related to visibility of the turbines during operation. No key issues of concern given that no key sensitive visual receptors which are anticipated to be impacted from the Project during operation were identified.	Site-specific mitigation and monitoring requirement. Refer to "Section 8.2"
Land Use	Key outcome is that SESA area is uninhabited and unutilized; therefore there are no land use impacts related to physical or economical displacement. No additional requirements have been identified in the SESA.	Key outcome is that in general Project site is uninhabited and vacant and does not include any physical or economical land use activities. In addition, Bedouin Groups in general implement the Ghafra system in such land areas to include the Project site.	Site-specific mitigation and monitoring requirement. Refer to "Section 8.3".
Geology, Hydrology, Hydrogeology	Key outcome of SESA is recommendation to avoid placing turbines within the beds of large wadi systems where there could be flood risks. In addition, if infrastructure and utility elements for wind farm developers are required within such areas (e.g. roads) then appropriate engineering measures are required (e.g. culverts). SESA requires project-specific ESIA's to investigate flood risks further. In addition, SESA identifies routine measures for waste management during construction and operation.	No key site-specific issues of concern noted and based on preliminary assessment, there are no flood risks anticipated at the Project site. There are routine impacts during construction and operation from improper waste management.	Site-specific mitigation and monitoring requirement for waste management. Refer to "Section 8.4".
Biodiversity	No major issues identified by SESA since the habitats of the area are considered	No floral species were identified at the project site to be of high concern. Faunal species, including three	Site-specific mitigation and monitoring

	to be of low or no importance. However, it is required to investigate at specific project locations avoidance of wadis for turbine erection to avoid direct damage to plants and habitats. Fauna could be affected by construction activities but are not believed to be impacted during the operations of the wind farms.	mammal species and one reptiles require consideration since literature has shown that the project site is located in their distribution range.	requirement. Refer to "Section 8.5".
Birds (avi-fauna)	Significant considerations were provided with the SESA regarding impacts on avifauna, specifically during spring migration season while autumn migration was considered to be of low significance since species recorded were of least concern and were relatively low.	The project is conducting a Cumulative Effects Assessment (CEA) to identify species at highest risk from cumulative effects. This is expected to identify a suite of migratory soaring birds (MSBs) as priority biodiversity values. Biologically/demographically derived thresholds will be determined for all priority bird species	Site-specific mitigation and monitoring requirements. Refer to "Section 8.6".
Bats	Bats were not considered specifically by the SESA	The project is conducting a Cumulative Effects Assessment (CEA) to identify species at highest risk from cumulative effects. This will include an assessment for bats.	Site-specific mitigation and monitoring requirements. Refer to "Section 8.7".
Archaeology and Cultural Heritage	There are no archaeological and cultural heritage sites within the SESA studied area. No additional requirements have been identified for site-specific ESIA's or for developers.	There are no site-specific archaeology or cultural heritage remains. Therefore, there are no anticipated impacts during construction and operation. There is routine chance find impacts related to the construction phase.	Site-specific mitigation and monitoring requirement. Refer to "Section 8.8".
Air Quality and Noise	Key outcome is that there are no key issues of concern identified within SESA studied area due to absence of sensitive receptors which could be affected by air quality and dust during construction phase. SESA identified routine air quality and noise mitigation measures for construction phase. *Note: impacts from noise during operation of turbines are assessed as part of the public health and safety section below.*	No key issues of concern identified. Routine impacts on air quality and noise from construction activities on several receptors. *Note: impacts from noise during operation of turbines are assessed as part of the public health and safety section below.*	Site-specific mitigation and monitoring requirement. Refer to "Section 8.9".
Infrastructure and Utilities	No key issues of concern identified. Several infrastructure and utility elements were noted within the SESA studied area to include roads, electricity lines, oil exploitation facilities, and other. SESA concludes there are no impacts on such infrastructure and utility elements and SESA does	No key issues of concern identified. Several site-specific infrastructure and utility elements were noted within the area and surrounding to include a roads, telecommunication tower, electricity network, pipeline, and other which could be impacted during the construction and operation phase if improperly managed.	Site-specific mitigation and monitoring requirement. Refer to "Section 8.10".

	not identify any additional requirements.		
Occupational Health and Safety	No key issues of concern are noted. There are routine impacts during construction and operation on occupational health and safety and SESA identifies additional route measures to control such impacts.	No key issues of concern are noted. There are routine impacts during construction and operation on occupational health and safety.	Site-specific mitigation and monitoring requirement. Refer to "Section 8.11".
Public Health and Safety	Key issues include noise and shadow flicker. SESA concludes that due to large distance from any nearby settlement, there are no impacts related to noise and shadow flicker during operation of turbines. No additional requirements are identified in the SESA	Key issues include noise and shadow flicker during operation of turbines. Site specific assessment indicates that there are no anticipated impacts on nearby sensitive receptors. However, as part of the site-specific ESIA, a cumulative noise model was undertaken which takes into account the closest wind farms to the Project site. Results are discussed in further details below. In addition, it is important to note that there are no cumulative impacts in relation to shadow flicker given that project impacts are limited to 1800m where no sensitive receptors are located within such areas.	Site-specific mitigation and monitoring requirement for other public health and safety concerns. Refer to "Section 8.12".
Socio-economics	Impacts anticipated are positive in nature.	Impacts anticipated are positive in nature.	Project specific recommendations to enhance positive impacts have been provided. Refer to "Section 8.13".

Cumulative Noise Assessment

Similar to the noise screening assessment undertaken in "Section 8.12.1", a similar methodology and analysis was undertaken taking into account the nearby wind farm developments for a cumulative screening assessment.

There are four (4) existing/proposed wind farms present in the surrounding area of the proposed Project location. Therefore, the noise screening assessment should consider all wind turbine noise emissions that have the potential to increase noise levels at NSR. These wind farms include the following which are also presented in the figure that follows with respect to the proposed Project in both layout.

The key wind farms that could result in cumulative impacts are summarized below.

Lekela Wind Farm

This project consists of 96 wind turbine generators, each of which also houses a Gamesa SG 2.6-114 IA wind turbine. The table below details the basic specifications.

Table 70: Lekela Wind Farm - Gamesa SG 2.6-114 CS Wind Turbine Generator Specification

Manufacturer	GAMESA
Model Type	2.6-114
Rated Power	2,625 kW
Rotor Diameter	114 m
Hub Height	63 m

RGWE 250MW Wind Farm

This project consists of 125 wind turbine generators, each of which houses a G97- 2.1 MW max power wind turbine. The table below details the basic specifications.

Table 71: RGWE 250MW Wind Farm - G97- 2.1MW MaxPower Wind Turbine Generator Specification

Manufacturer	GAMESA
Model Type	G97-2.1
Rated Power	2,100 kW
Rotor Diameter	97 m
Hub Height	71.5 m

RSWE 500MW Wind Farm

This project consists of 191 wind turbine generators, each of which houses a Gamesa SG 2.6-114 IA wind turbine. The table below details the basic specifications.

Table 72: RSWE 500MW Wind Farm - Gamesa SG 2.6-114 Wind Turbine Generator Specification

Manufacturer	GAMESA
Model Type	2.6-114
Rated Power	2,625 kW
Rotor Diameter	114 m
Hub Height	63 m

NIAT Wind Farm

This proposed project consists of 173 wind turbine generators, each of which will house one 3.05 MW Wind Turbine. The table below details the basic specifications.

Table 73: NIAT Wind Farm - Gamesa SG 2.6-114 Wind Turbine Generator Specification

Manufacturer	GAMESA
Model Type	2.6-114 (AM+4, 3.05MW)
Rated Power	3,050 kW
Rotor Diameter	114 m
Hub Height	63 m

Results of Cumulative Noise Effect from All Wind Farms in the Region

Noise contour maps for the worst-case noise scenario have been calculated for the cumulative assessments and is presented in the figure below. The map shows noise contour lines as well as the noise contour limit line of 35 dB(A).

As noted in the figure below, cumulatively the results of the preliminary model undertaken indicate that the nearest NSR (Ras Ghareb City) exceeds the limit of LA90 of 35 decibels (dB) (A) at a wind speed of 10 meters/second (m/s) at 10 m. Based on the results of the noise contour map the predicted contribution noise level cumulatively at 10 m/s has been estimated at 38.0 dB(A).

However, as discussed earlier, the IFC EHS Guidelines on Wind Energy recommends that modelling should focus on sensitive receptors within 2 km of the nearest wind turbine. The nearest NSR is located 6 km from nearest wind farm (that being NIAT wind farm). The NSR is located in the suburbs of Ras Ghareb, adjacent to Highway 65.

Taking the above into account, noise from the wind turbines cumulatively is unlikely to be audible above the background noise level at this location. In addition, as discussed in "Section 8.12.1" it was concluded that noise levels from the AMUNET Wind Farm are not contributing to the

cumulative noise levels at the NSR. Therefore, there are no additional requirements for the AMUNET Wind Farm Project in specific.

However, other wind farms that are contributing to the noise exceedance will be required to undertake a 24-hour baseline noise survey to verify that background noise levels at this NSR are high enough to screen potential wind turbine noise.

Figure 90: Proposed and Existing Wind Farms

Taking the above into account, such impacts are considered irrelevant and no detailed noise assessment is required.

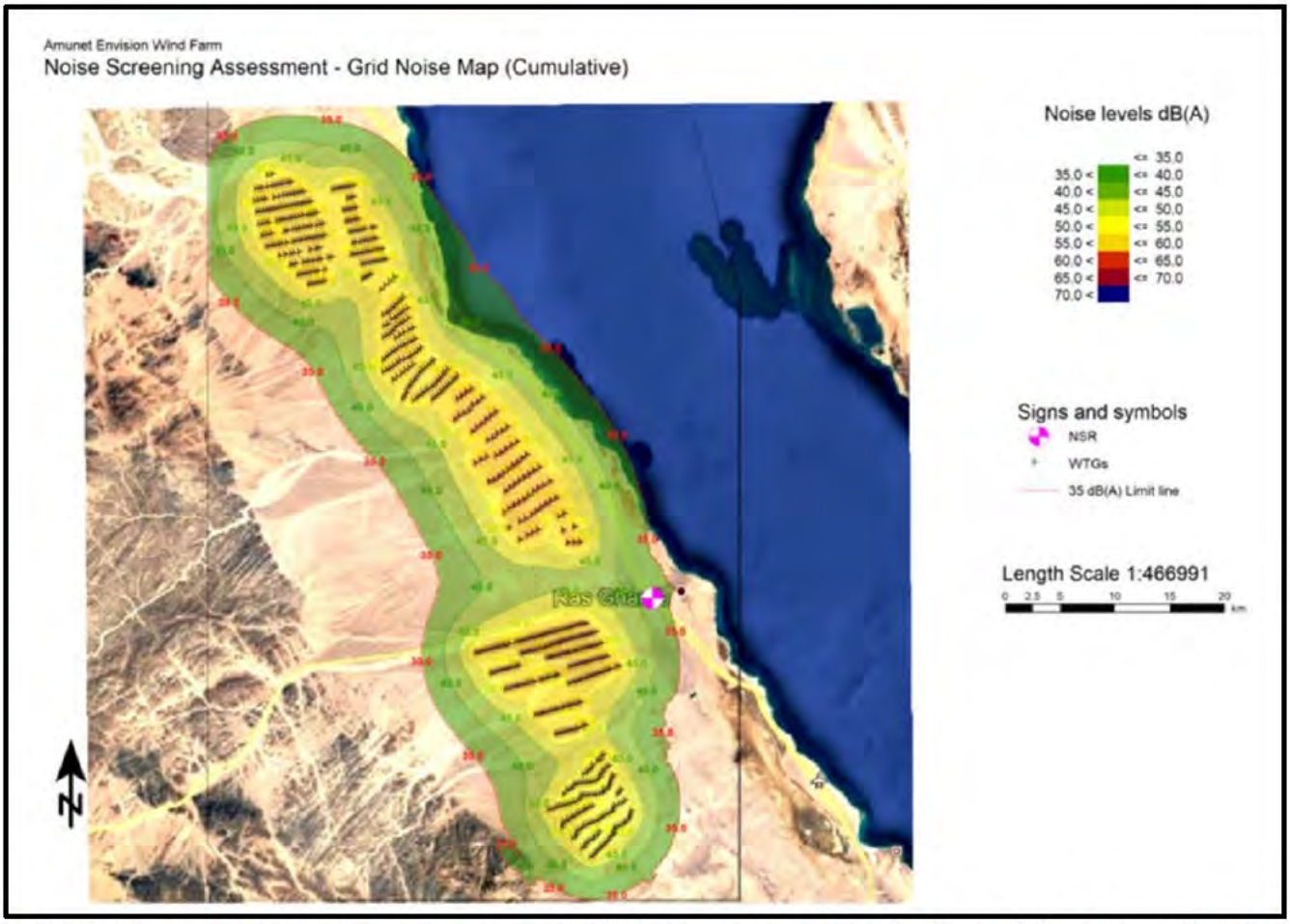

Figure 91: Noise Contour Map for Amunet Wind Farm - W10: 10 m/s [Cumulative Assessment]

Table 74: Predicted contribution noise levels at NSR from Amunet and Adjacent Wind Farms (W10)

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10m/s Wind Speed (W10) – dB(A)	
	Isolation	Cumulative
Ras Ghareb Residential Dwelling	27.9	38.0

9. Environmental and Social Management Plan (ESMP)

9.1 Institutional Framework and Procedure Arrangements for ESMP Implementation

Generally, two main pillars govern the successful implementation of any Environmental and Social Mitigation and Monitoring Plan (ESMP) as well as the Environmental, Social, Health and Safety Management System (ESHS-MS) for the project that will be developed at a later stage (as discussed in further details ow). These pillars include:

1. Proper identification of roles and responsibilities for the entities involved; and

2. Effective control of the process.

All management practices are interlinked, and this section describes how these two pillar criteria could be fulfilled, which in turn helps ensure that the overall objectives are met.

Staffing Requirements

Defining roles and responsibilities of the involved entities identifies where and when each entity should be engaged, their degree of involvement, and the tasks expected of the entity. This in turn eliminates any overlap of jurisdiction or authority and ensures proper communication and effective management of ESMP and ESHS-MS components.

The table below identifies the staffing requirements that are expected for the Project. This should be expanded further in the Environment, Health, and safety (EHS) Manual that is required as part of the ESHS-MS (as discussed in further details below). This should include an organisational structure that identifies the lines of authority and roles and responsibilities of all involved entities.

Table 75: Roles and Responsibilities of Entities Involved in ESMP

Project Role	Entity	Responsibilities	Staffing Requirements
Project Owner and Developer	Amunet	▪ Selection of EPC Contractor and Project Operator; ▪ Implement mitigation and monitoring requirements as applicable for such entity as detailed in the ESMP; and ▪ Ensure overall compliance of EPC Contractor and Project Operator with the requirements of the ESMP and ESHS MS.	Appoint competent HSE Manager or as part of Third-Party Employer representative (e.g. Owner's Engineer) Appoint a Community Liaison Officer (CLO) and Social Specialist
EPC Contractor	TBD	▪ Appoint a competent HSE team. ▪ Implement mitigation and monitoring requirements as detailed in the ESMP and ESHS MS requirements;	For Project nature and duration, this is expected to include at a minimum full-time and onsite HSE Manager and 5 HSE officers as well as a Social Specialist and 5 social officers.
Project Operator	TBD	▪ Appoint a competent HSE team. ▪ Implement mitigation and monitoring requirements as detailed in the ESMP and ESHS MS requirements;	For Project nature and duration, this is expected to include HSE Manager (which is required to be full-time onsite at all times) as well as Social Specialist.
EEAA	Granting environmental clearance to the Project	▪ Undertake compliance monitoring	N/A

Training and Awareness

An EHS training plan must be developed and maintained onsite which identifies the type of training that is required for each worker onsite. In addition, signed attendance sheets and training material must be maintained onsite at all times. This should be completed by the EPC Contractor and Project Operator as applicable.

Training should include the following as applicable and as highlighted in the table that follows.

- Basic visitor HSE induction training
- Worker HSE induction training for all workers onsite to include for example EPC Contractor and subcontractor crew
- Emergency response training for all workers onsite to include for example EPC Contractor and subcontractor crew
- Specialized training: there are other specific training requirements that must be adhered to and which are related to specific topics as applicable. This includes for example specific training for Occupational Health and Safety (OHS) issues such as working at height, electrical works, etc.
- Tool Box Talks (TBT): regular TBT meetings must be undertaken with for example EPC Contractors respective crews and subcontractor crew. Topics and frequency are developed and distributed regularly.

Training	EPC Contractor	Project Operator
Basic visitor HSE induction training	✓	✓
Worker HSE induction training	✓	✓
Emergency response training	✓	✓
Specialized training	✓	✓
Tool Box Talks (TBT)	✓	✓

Inspection and Monitoring

EHS inspection and monitoring must be undertaken to ensure compliance of involved entities with the mitigation and monitoring requirements as detailed in the ESMP and ESHS-MS requirements. This should be completed by the Developer, EPC Contractor, and Project Operator as applicable.

Inspection and monitoring should include the following as applicable and as highlighted in the table that follows.

- Daily HSE inspection and monitoring at the site and preparation of a daily observation report stating therein the corrective measures on observed safety deficiencies, unsafe acts and conditions.
- Weekly site inspections to be carried out using the weekly site inspection checklists template based on requirements of the ESMP and EHSS-MS
- HSE Audits to be undertaken by Developer on EPC Contractor to ensure compliance with ESMP requirement and EHSS-MS. HSE audits should be undertaken monthly during the construction phase and quarterly during the operation phase

Inspection and Monitoring	Developer	EPC Contractor	Project Operator
Daily HSE Inspection and Monitoring		✓	
Weekly Site Inspections		✓	✓
HSE Audits	✓		

Meetings

Regular EHS meeting must be undertaken to discuss EHS performance onsite, outstanding issues, key issues of concern and other as applicable. Signed attendance sheets and Minutes of

Meeting (MoM) must be maintained onsite at all times. This should be completed by the Developer, EPC Contractor, and Project Operator as applicable.

Meetings should include the following as applicable and as highlighted in the table that follows.

- Weekly HSE meetings
- Monthly HSE meeting
- Quarterly management HSE reviews

Meetings	Developer	EPC Contractor	Project Operator
Weekly HSE Meetings		✓	✓
Monthly HSE Meeting	✓	✓	✓
Quarterly Management HSE reviews	✓	✓	✓

Reporting

HSE reporting will be required to summarize the following:

- Progress in implementing the ESMP and EHSS MS plans as required
- Findings of the monitoring programs, with emphasis on any breaches of the control standards, action levels or standards of general site management
- Outstanding incident report forms
- Relevant changes or possible changes in legislation, regulations and international practices
- Reporting on Key Performance Indicators (KPI).
- Grievances
- Security incidents

Reporting should be submitted to the Developer as applicable by the relevant entities as identified below.

Reporting	EPC Contractor	Project Operator
Reporting	Monthly	Monthly

9.2 Environmental, Health, Safety and Social Management System (EHSS-MS)

The ESIA is considered a key document in assessing and managing environmental and social risks related to the Project. The key output of the ESIA is the ESMP which aims to provide high level mitigations and requirements for managing the environmental and social risks anticipated from the Project.

Throughout the Project's construction and operation phase an Environmental, Health, Safety and Social Management System (EHSS-MS) must be implemented by all relevant parties (i.e. Developer, EPC Contractor and Project Operator). The EHSS-MS must be project and site specific and must build on and take into account the requirements of the ESMP. The development and implementation of an EHSS-MS is considered a key requirement under IFC PS1, in addition the EHSS-MS must also be in line with the IFC PSs.

Summarised below is the overall framework, structure and key requirements for the EHSS-MS for the key entities involved in the Project.

Developer

- HSE Manual that should include: (i) HSE Policy; (ii) Human Resources Policy and Procedures; (iii) HSE Organisational Structure and Responsibilities; and (iv) HSE Training, Monitoring and Reporting Plan

- Stakeholder Engagement Plan;
- Community Grievance Mechanism
- Active Turbine Management Plan (ATMP)

EPC Contractor

- HSE Manual (in line with Developer) that should include: (i) HSE Policy; (ii) Human Resources Policy and Procedures; (iii) HSE Organizational Structure and Responsibilities; (iv) HSE Training, Monitoring and Reporting Plan
- Water Management Plan
- Waste and Wastewater Management Plan
- Soil and groundwater Management Plan
- Air Quality and Noise Management Plan
- Traffic and Transport Management Plan
- Training Management Plan
- Community H&S and Worker Influx Plan
- Occupational Health and Safety Plan
- Emergency Preparedness and Response Plan
- Hazardous Material Management Plan
- Biodiversity Management Plan
- Security Management Plan
- Archaeological and Cultural Heritage Chance Find Procedures
- Worker Grievance Mechanism
- Human Resources Management Plan
- Gender Equality Management Plan
- Employment and Procurement Management Plan
- Worker Accommodation Plan

Project Operator

- HSE Manual (in line with Developer) that should include: (i) HSE Policy; (ii) Human Resources Policy and Procedures; (iii) HSE Organizational Structure and Responsibilities; (iv) HSE Training, Monitoring and Reporting Plan
- Water Management Plan
- Waste and Wastewater Management Plan
- Air Quality and Noise Management Plan
- Occupational Health and Safety Plan
- Emergency Preparedness and Response Plan
- Security Management Plan
- Recruitment and Procurement Procedure
- Hazardous Material Management Plan
- Biodiversity Management Plan
- Gender Equality Management Plan
- Employment and Procurement Management Plan
- Training Management Plan

9.3 Compilation of Environmental and Social Management Plan (ESMP)

The tables below present the ESMP for the: (i) planning and construction, and (ii) operation phase respectively and which include the following:

- The environmental attribute (e.g. air quality) that is likely to be impacted;
- A summary of the potential impact and/or likely issue;
- The identified management measures that aim to eliminate and/or reduce the potential impact to acceptable levels. Management measures include mitigation actions, further requirements, additional studies, etc.;
- Monitoring actions to ensure that the identified mitigation measures are implemented. Monitoring actions include: inspections, review of reports/plans, reporting, etc.;
- The frequency for implementing the monitoring actions, which include: once, continuously throughout the construction/operation period (depending on the mitigation measure identified this could include daily, weekly, or monthly), or upon occurrence of a certain issue;
- Parameters and location of monitoring actions as identified and applicable; and
- Responsible entity for implementing the mitigation measures and monitoring actions identified.

Table 76: ESMP for the Planning and Construction Phase

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
Landscape and Visual	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	Ensure proper general housekeeping and personnel management measures are implemented which could include: (i) ensure the construction site is left in an orderly state at the end of each work day; (ii) to the greatest extent possible construction machinery, equipment, and vehicles that are not in use should be removed in a timely manner and kept in locations to reduce visual impacts to the area.	Mitigation	Visual inspections	At construction active areas	Daily / Weekly	EPC Contractor
Land Use	There are several informal land uses onsite which if improperly managed could result in potential conflicts and disputes. This includes the Ghafra system of the Bedouin groups and existing petroleum facilities within the area.	Establish coordination with the Bedouin Groups for inclusion and engagement in employment and procurement opportunities	Additional requirement	Submit agreement with Bedouin groups	Not applicable	Once before commencement of construction	Developer
		Establish coordination via NREA/EETC with the General Petroleum Company and other relevant entities as applicable on the Project specific level to: (i) agree on final requirements to be taken into account as part of the detailed design based on the "Work Coordination Agreement"; (ii) present and provide detailed design to include turbine locations, cables, roads, etc. along with key requirements identified under point earlier; (iii) further identify access to land requirements, conditions and communication protocol for the Project; (iv) demonstrate safety compliance of all Project components based on excepted activities that could be undertaken by the General Petroleum Company (e.g. drilling and survey activities), and (v) any other issues as applicable.	Additional requirement	Submit formal communication letter (or similar) with relevant entity	Not applicable	Once before commencement of construction	Developer
		Undertake consultations through RCREEE with the Technical Committee which includes representatives from EEAA and EETC to discuss the preliminary layout and identify any additional requirements which should be taken into account in relation to avi-fauna migration (if any) and its location in relation to Gabal El Zeit IBA.	Additional requirement	Submit formal communication letter (or similar) with relevant entity	Not applicable	Once before commencement of construction	RCREEE
Geology, Hydrology and hydrogeology	Solid waste management	Coordinate with Ras Gharib City Council for the collection of solid waste from the site to the municipal approved sanitary landfill (	Mitigation	Submit contract	Not applicable	Once before commencement of construction	EPC Contractor
		Prohibit fly-dumping of any solid waste to the land	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste	Mitigation	Visual inspections	At construction active areas	Once before commencement of construction	
		Distribute a sufficient number of properly contained containers clearly marked as "Construction Waste" for the dumping and disposal of construction waste	Mitigation	Visual inspections	At construction active areas	Once before commencement of construction	

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
		Implement proper housekeeping practices on the construction site at all times	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill	Mitigation	Submit manifests	Not applicable	Throughout construction period	
	Wastewater management	Coordinate with Ras Gharib Water Company to hire a private contractor for the collection of wastewater from the site to the closest WWTP. Undertake a due diligence assessment is to be undertaken to ensure discharges are within allowable parameters as per WBG EHS Guidelines	Mitigation	Submit contract	Not applicable	Once before commencement of construction	EPC Contractor
		Prohibit illegal disposal of wastewater to the land	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Ensure that constructed septic tanks during construction and those to be used during operation are well contained and impermeable to prevent leakage of wastewater into soil	Mitigation	Visual inspections	At applicable area	Once before commencement of construction	
		Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing	Mitigation	Visual inspection	At applicable area	Daily/weekly	
		Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the WWTP	Mitigation	Submit manifests	Not applicable	Throughout construction period	
	Hazardous Waste Management	Hire approved private contractor for the collection of hazardous waste from the site to the approved hazardous waste disposal facilities	Mitigation	Submit contract	Not applicable	Once before commencement of construction	EPC Contractor
		Ensure that hazardous waste is disposed in a dedicated area that is enclosed, of hard surface, with proper signage and suitable containers as per hazardous waste classifications and that they are labelled for each type of hazardous waste	Mitigation	Visual inspections	At applicable area	Once before commencement of construction	
		Ensure hazardous waste storage area is equipped with spill kit, fire extinguisher and anti-spillage trays and a hazardous waste inventory is available	Mitigation	Visual inspections	At applicable area	Daily / weekly	
		Prohibit illegal disposal of hazardous waste to the land	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Possibly contaminated water (e.g. runoff from paved areas) must be drained into appropriate facilities (such as sumps and pits). Contaminated drainage must be orderly disposed of as hazardous waste	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the hazardous waste disposal facilities	Mitigation	Submit manifests	Not applicable	Throughout construction period	

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
	Hazardous material management	Ensure that hazardous materials are stored in an area that is of hard impermeable surface, flame-proof, accessible to authorized personnel only, locked when not in use, and prevents incompatible materials from coming in contact with one another	Mitigation	Visual inspections	At applicable area	Once before commencement of construction	EPC Contractor
		Maintain a register of all hazardous materials used and accompanying MSDS must present at all times. Spilled material should be tracked and accounted for	Mitigation	Visual inspections	At applicable area	Daily / weekly	
		Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.)	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refuelling) must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Ensure that general-purpose spill absorbent is available at hazardous material storage facility. This should be dependent on the largest storage tank onsite or truck that brings hazardous materials to the site (i.e. largest conceivable spill);	Mitigation	Visual inspections	At applicable area	Daily / weekly	
All hydrocarbons to be stored within hardstanding within secondary containment bunds capable of retaining 110% of the contents of the largest vessel or 25% of the inventory (if more than one vessel), whichever is the greatest. Ensure the integrity of the secondary bund and Oil/water separators to be used to discharge rainwater after visual inspection to ensure no oil contamination of rainwater.	Mitigation	Visual inspections	At applicable area	Daily / weekly			
		If spillage on soil occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste	Mitigation	Visual inspection	At applicable area	Upon occurrence	
	Erosion and runoff management	Avoid executing excavation works under aggressive weather conditions	Mitigation	Visual inspections	At construction active areas	Upon occurrence	EPC Contractor
		Place clear markers indicating stockpiling area of excavated materials to restrict equipment and personnel movement, thus limiting the physical disturbance to land and soils in adjacent areas	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Erect erosion control barriers around work site during site preparation and construction to prevent silt runoff where applicable	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Return surfaces disturbed during construction to their original (or better)	Mitigation	Visual inspections	At construction active areas	Upon occurrence	

Environmental Attribute		Potential Impact			Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)			Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
					condition to the greatest extent possible							
Biodiversity	Construction activities would disturb existing habitats (flora and fauna). In addition, other impacts could be from improper management of the site (e.g. improper conduct and housekeeping practices).	No turbines or Project activities (road, quarries, batching plants, etc.) will be permitted to occur within the 1km2 overlap with the IBA	Mitigation	Review of detailed design	N/A	Once	Developer					
					Implement proper housekeeping practices on the construction site at all times			Mitigation	Visual inspections	At construction active areas	Daily / weekly	
					Undertake a detailed Egyptian Dabb Lizard survey by a biodiversity expert. The survey should focus on all construction activities areas and in particular the Wadi systems where such a species is likely to be located. Should burrows and/or records of this species be identified, relocation activities The expert should have an educational background in a related field (bachelor degree at a minimum) (e.g. biology, biodiversity or similar) with demonstrated work experience and track record in planning and implementing biodiversity assessments, surveys and studies in the region including reptiles in particularshould be undertaken to nearby similar habitats.			Additional Survey	Submission of agreed survey method and relocation strategy.	Prior to construction	Once; before construction	EPC Contractor
Birds (avi-fauna)		Construction activities could disturb existing habitats of birds breeding and/or nesting within the Project site.			Implement proper housekeeping practices on the construction site at all times including prohibiting hunting.			Mitigation	Visual inspections	At construction active areas	Daily / weekly	EPC Contractor
		Develop a protocol to swiftly report and dispose of any dead wildlife or animals recorded onsite.	Mitigation	Submission of protocol	N/A	Once	EPC Contractor					
Archaeology and Cultural Heritage		Improper management of construction activities could disturb/damage archaeological remains which could be buried in the ground (if any).			As required by the SCA, during excavation activities, SCA must be notified to check if they will provide any observers to oversee the process and ensure that no underground archaeological remains of importance are unearthed and/or disturbed			Mitigation	Submission of evidence of communication with SCA	Not applicable	Prior to construction	EPC Contractor
					If potential archaeological remains in the ground are discovered, appropriate measures for such chance find procedures are implemented. Those mainly require that construction activities be halted and the area fenced along with proper signage, while immediately notifying the Ministry of Tourism and Antiquities/Red Sea and Suez Antiquities Inspection Office. No additional work will be allowed before the Ministry/Inspection Office assesses the found potential archaeological site			Mitigation	Visual inspections and submittal of chance find report	At applicable area	Upon occurrence	EPC Contractor

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
		and grants a clearance to resume the work. Construction activities can continue at other parts of the site if no potential archaeological remains were found. If found, same procedures above apply					
Air Quality and Noise	Construction activities will likely result in an increased level of dust, particulate matter and pollutant emissions as well as noise which in turn will directly impact ambient air quality and noise levels.	If dust or pollutant emissions were found to be excessive due to construction activities, the source of such emissions should be identified and adequate control measures must be implemented (as identified below)	Mitigation	Visual inspections	At construction active areas and other receptors to include nearby petroleum activities and internal road networks	Upon occurrence	EPC Contractor
		Comply with the Occupational Safety and Health Administration (OSHA) requirements and the Egyptian Codes to ensure that for activities associated with high dust and noise levels, workers are equipped with proper Personal Protective Equipment	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Apply basic dust control and suppression measures which could include: (i) regular watering of roads for dust suppression; (ii) proper planning of dust causing activities to take place simultaneously in order to reduce the dust incidents over the construction period; (iii) proper management of stockpiles and excavated material (e.g. watering, containment, covering, bundling); (iv) proper covering of trucks transporting aggregates and fine materials (e.g. through the use of tarpaulin); and (v) adhering to a speed limit of 15km/h for trucks on the construction site.	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issue to avoid unnecessary pollutant and noise emissions	Mitigation	Submission of maintenance program	Not applicable	Monthly	
		If noise levels were found to be excessive from construction activities, the source of such excessive noise levels should be identified and adequate control measures must be implemented	Mitigation	Visual inspections	At construction active areas and other receptors to include petroleum storage facilities	Upon occurrence	
		Apply adequate general noise suppressing measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level, etc.	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
Infrastructure and Utilities	Traffic and transport management	Develop a Traffic and Transport Plan to ensure transportation process of turbine components does not pose a risk of damage to the existing roads,	Additional study	Submission of Traffic and Transport Plan and approval from	Not applicable	Once before commencement of construction	EPC Contractor

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
		highways, overpasses whilst ensuring public safety. The Plan must analyse and study the entire route for transportation of the Project components from the port till the Project site. The study must investigate any constraints which need to be considered along the highways leading to the Project site such as bridges, overhead utility cables, slants in roads, etc. and identify accommodations which need to be taken into account.		local authorities			
		Establish coordination via NREA/EETC with General Petroleum Company to discuss and determine any specific requirements to be taken into account for the established road networks within the Wind Farm (e.g. avoidance of such areas, buffer distances to be considered, etc.)	Additional requirement	Submit formal communication letter (or similar) with relevant entity	Not applicable	Once before commencement of construction	Developer
	Improper planning and design of project could affect electricity lines and pylons within Project area.	Establish coordination with EETC to discuss and determine any specific requirements to be taken into account for the established electricity networks (e.g. avoidance of such areas, buffer distances to be considered, etc.)	Additional requirement	Submit formal communication letter (or similar) with relevant entity	Not applicable	Once before commencement of construction	Developer
	Improper planning and design of project could affect petroleum pipelines	Establish coordination via NREA/EETC with General Petroleum Company to discuss and determine any specific requirements to be taken into account for the pipeline (e.g. avoidance of such areas, buffer distances to be considered, etc.)	Additional requirement	Submit formal communication letter (or similar) with relevant entity	Not applicable	Once before commencement of construction	Developer
	Water resources management	Coordinate with the Ras Ghareb Water Company to sector the water requirements of the Project	Additional requirement	Submit formal communication letter (or similar) with Ras Ghareb Water Company	Not applicable	Once before commencement of construction	EPC Contractor
	Waste utilities	Undertake the following: (i) coordinate with the Ras Ghareb Water Company and obtain list of authorized contractors for collection of wastewater from the site; (ii) coordinate with the Ras Gharib City Council to hire a competent private contractor for the collection of solid waste from the site; and (iii) obtain list of authorized contractors for collection of hazardous waste from the site	Additional requirement	Submit formal communication letter with relevant entities	Not applicable	Once before commencement of construction	EPC Contractor
	Aviation, telecommunication and TV/Radio management	Establish coordination via NREA/EETC with the relevant entity to provide information on the Project (to include location and specifications of turbines in specific) and include any specific requirements to be considered as part of the detailed design to include setback distances if required (e.g. from radar systems if applicable) and navigational safety requirements (e.g. navigational lights, blade paintings, etc.)	Additional requirement	Submit formal communication letter with relevant entities	Not applicable	Once before commencement of construction	Developer
		Establish coordination via NREA/EETC with relevant entity and other applicable local agencies to provide information on	Additional requirement	Submit formal communication letter with	Not applicable	Once before commencement of construction	Developer

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
		the Project (to include location and specifications of turbines in specific) and include any specific requirements to be considered as part of the detailed design to include setback distances if required for telecommunication, radio and TV infrastructure (e.g. from LoS connections)		relevant entities			
	Improper planning and design of project could affect nearby dams.	Establish coordination via NREA/EETC with relevant entity to discuss and determine any specific requirements to be taken into account for the dams (e.g. buffer distances to be considered, etc.)	Additional requirement	Submit formal communication letter (or similar) with relevant entity	Not applicable	Once before commencement of construction	Developer
Occupational Health and Safety	There will be some generic risks to workers health and safety from working on construction sites, as it increases the risk of injury or death due to accidents.	Develop and submit an Occupational Health and Safety Plan (OHSP) that is project and site specific to ensure the health and safety of all personnel in order to concur and maintain a smooth and proper progress of work at the site and prevent accident which may injure personnel or damage property.	Additional study	Submit OHSP plan	Not applicable	Once before commencement of construction	EPC Contractor
Public health and safety	Relatively large worker influx could result in H&S issues such as risk of diseases, inappropriate code of conduct, social vices, etc.	Submit a worker influx plan which takes into account the following: (i) medical examination program for workers; (ii) procedures to maintain hygienic conditions onsite; (iii) code of conduct for workers; (iv) induction training and awareness requirements for risk of diseases, etc.	Additional study	Submit worker influx plan	Not applicable	Once before commencement of construction	EPC Contractor
	Inappropriate management of security issues and incidents by security personnel towards local communities could result in resentment, distrust and escalation of events	Prepare a Security Management Plan that identifies appropriate measures for hiring, rules of conduct, training, equipping, and monitoring of security personnel to control and manage such issues	Additional study	Submit security management plan	Not applicable	Once before commencement of construction	EPC Contractor
	Potential impacts from blade throw which could affect the public safety of nearby receptors.	Establish coordination via NREA/EETC with the General Petroleum Company to discuss and determine any specific requirements to be taken into account for the established setback distances from any existing or nearby onsite facilities which could be based on the IFC setback distance requirements.	Additional requirement	Submit formal communication letter (or similar) with General Petroleum Company	Not applicable	Once before commencement of construction	Developer
Socio-economics	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity	- Local Recruitment Procedure: the procedure must identify the number of job opportunities targeted for local communities to include skilled and unskilled workers. Such job opportunities shall also take into account employment of local communities in the area around the project to include fresh graduate engineers, technicians, labourers, etc. In addition, the procedure must include details on how job opportunities will be announced as well as a selection process that is fair and transparent and provides equal opportunities for all including females. - Local Procurement Procedure:	Recommendation	Regular reporting on outcomes of Program implementation	Not applicable	Continuous	Project Developer/EPC Contractors

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
		the procedure must identify the procurement opportunities targeted for local communities to include for example local subcontractors, local supplies and services, cleaning services, etc. In addition, the procedure must include details on how procurement opportunities will be announced as well as a selection process that is fair and transparent and provides equal opportunities for all. - Social Responsibility Program: it is recommended that the Developer implement a social responsibility program which aims to benefit the local communities to the greatest extent possible. In this case, a structured approach must be developed which must identify priority development projects which could benefit local communities (e.g. based on a needs assessment if available). Based on that the social responsibility program can prioritise projects for local communities based on available budget, company vision, timeline for implementation as well as other factors.					

Table 77: ESMP for the Operation Phase

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
Geology, Hydrology and hydrogeology	Solid waste management	Coordinate with Ras Gharib City Council for the collection of solid waste from the site to the municipal approved sanitary landfill	Mitigation	Submit contract	Not applicable	Once before commencement of operation	Project Operator
		Prohibit fly-dumping of any solid waste to the land	Mitigation	Visual inspections	At operational active areas	Daily / weekly	
		Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste	Mitigation	Visual inspections	At operational active areas	Once before commencement of operation	
		Implement proper housekeeping practices onsite at all times	Mitigation	Visual inspections	At operational active areas	Daily / weekly	
		Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill	Mitigation	Submit manifests	Not applicable	Throughout operational period	
	Wastewater management	Coordinate with Ras Gharib Water Company to hire a private contractor for the collection of wastewater from the site to the closest WWTP. Undertake a due diligence assessment is to be undertaken to ensure discharges are within allowable parameters as per WBG EHS Guidelines	Mitigation	Submit contract	Not applicable	Once before commencement of operation	Project Operator
		Prohibit illegal disposal of wastewater to the land	Mitigation	Visual inspections	At operational active areas	Daily / weekly	
		Ensure that septic tanks are emptied and collected by	Mitigation	Visual	At applicable	Daily/weekly	

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
		wastewater contractor at appropriate intervals to avoid overflowing		inspection	area		
		Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the WWTP	Mitigation	Submit manifests	Not applicable	Throughout operational period	
	Hazardous waste management	Hire approved private contractor for the collection of hazardous waste from the site to the approved hazardous waste disposal facilities	Mitigation	Submit contract	Not applicable	Once before commencement of operation	Project Operator
		Ensure that hazardous waste is disposed in a dedicated area that is enclosed, of hard surface, with proper signage and suitable containers as per hazardous waste classifications and that they are labelled for each type of hazardous waste	Mitigation	Visual inspections	At applicable area	Once before commencement of operation	
		Ensure hazardous waste storage area is equipped with spill kit, fire extinguisher and anti-spillage trays and a hazardous waste inventory is available	Mitigation	Visual inspections	At applicable area	Daily / weekly	
		Prohibit illegal disposal of hazardous waste to the land	Mitigation	Visual inspections	At operational active areas	Daily / weekly	
		Possibly contaminated water (e.g. runoff from paved areas) must be drained into appropriate facilities (such as sumps and pits). Contaminated drainage must be orderly disposed of as hazardous waste	Mitigation	Visual inspections	At operational active areas	Daily / weekly	
		Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing	Mitigation	Visual inspections	At operational active areas	Daily / weekly	
		Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the hazardous waste disposal facilities	Mitigation	Submit manifests	Not applicable	Throughout operational period	
	Hazardous material management	Ensure that hazardous materials are stored in an area that is of hard impermeable surface, flame-proof, accessible to authorized personnel only, locked when not in use, and prevents incompatible materials from coming in contact with one another	Mitigation	Visual inspections	At applicable area	Once before commencement of operation	Project Operator
		Maintain a register of all hazardous materials used and accompanying MSDS must present at all times. Spilled material should be tracked and accounted for	Mitigation	Visual inspections	At applicable area	Daily / weekly	
		Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.)	Mitigation	Visual inspections	At operational active areas	Daily / weekly	
		Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refuelling) must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material	Mitigation	Visual inspections	At operational active areas	Daily / weekly	
		Ensure that general-purpose spill absorbent is available at hazardous material storage facility. This should be dependent on the largest storage tank onsite or truck that brings hazardous materials to the site (i.e. largest conceivable spill);	Mitigation	Visual inspections	At applicable area	Daily / weekly	
	All hydrocarbons to be stored within hardstanding within secondary containment bunds capable of retaining 110% of the contents of the largest vessel or 25% of the inventory (if more than one vessel), whichever is the greatest. Ensure the integrity of the secondary bund and Oil/water separators to be used to discharge rainwater after visual inspection to	Mitigation	Visual inspections	At applicable area	Daily / weekly		

Environmental Attribute		Potential Impact		Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)				Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
	ensure no oil contamination of rainwater.											
				If spillage on soil occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste				Mitigation	Visual inspection	At applicable area	Upon occurrence	
Biodiversity		Improper management of the site could disturb existing habitats (e.g. improper conduct and housekeeping practices).		Implement proper management measures to prevent damage to the biodiversity of the site.				Mitigation	Inspection	At applicable area	Continuous	Project Operator
Birds (avi-fauna)	Wind turbines are associated with impacts on birds from risks of strikes and collision on both migratory soaring birds and resident soaring birds in the area. Generally, such impacts depend on several factors but could affect the population levels of certain species especially those with international/national critical conservation status.	It is recommended that RCREEE undertake at the cumulative level for all wind farms within the GoS region a barrier effect study. The study should assess potential impacts of wind farms as disruptive barriers to the migration route at the cumulative level within the GoS region and identify any additional mitigation measures to be considered. This could include for example spacing/buffer requirements between wind farms. The study should take into account the Project and all surrounding wind farms and the variations in the turbine heights of such projects. The study should be undertaken once all wind farms have confirmed their turbine specifications – please refer to "Section 8.15" for full list of wind farm projects within the GoS region.	Additional requirement	Submission of study	GOS region	Once before commencement of operation	RCREEE					
				In-flight monitoring during spring and autumn 2022 migration seasons				Additional requirement	Submission of survey reports for each season to be added as addendum to ESIA	At operational active areas	Before commencement of operation	Consultant
				Avi-Fauna Monitoring and On-Demand Turbine Shutdown				Mitigation	Submission of 6-monthly reports + priority bird fatality reports	At operational active areas	Continuous	
				Bird and bat collision fatality monitoring surveys Carcass Search during Operation				Additional requirement	Submission of 6-monthly reports + priority bird fatality reports	At operational active areas	Continuous	

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
		Develop a protocol to swiftly report and dispose of any dead wildlife or animals recorded onsite.	Additional requirement	submission of protocol	N/A	Once	
Bats	The potential impacts from the Project during operation are mainly related to risk of bat strikes and collisions with rotors of the operating wind turbines.	Bird and bat collision fatality monitoring surveys	Additional requirement	Submission of report	At operational active areas	Continuous	Consultant
Infrastructure and Utilities	Water resources management	Coordinate with the Ras Ghareb Water Company to sector the water requirements of the Project.	Additional requirement	Submit formal communication letter (or similar) with Ras Ghareb Water Company	Not applicable	Once before commencement of construction	Project Operator
	Waste utilities	Undertake the following: (i) coordinate with the Ras Ghareb Water Company and obtain list of authorized contractors for collection of wastewater from the site; (ii) coordinate with the Ras Gharib City Council to hire a competent private contractor for the collection of solid waste from the site; and (iii) obtain list of authorized contractors for collection of hazardous waste from the site	Additional requirement	Submit formal communication letter with relevant entities	Not applicable	Once before commencement of construction	Project Operator
Occupational Health and Safety	There will be some generic risks to workers health and safety from working on construction sites, as it increases the risk of injury or death due to accidents.	Develop and submit an Occupational Health and Safety Plan (OHSP) that is project and site specific to ensure the health and safety of all personnel in order to concur and maintain a smooth and proper progress of work at the site and prevent accident which may injure personnel or damage property.	Additional study	Submit OHSP plan	Not applicable	Once before commencement of operation	Project Operator
Public Health and Safety	Public access of unauthorized personnel to the various Project components.	A Security Risk Assessment should be developed for the Wind Farm Project and which takes into account the following: (i) each turbine to be fitted with locked doors to prevent unauthorized access to the turbines; (ii) substation area to be completely fenced with concrete walls to prevent unauthorized access; (iii) onsite guards; (iv) post informative signs on the turbines and substation about public safety hazards and emergency contact information, and other as applicable	Additional study	Submit Security Risk Assessment	Not applicable	Once before commencement of operation	Project Operator
	Inappropriate management of security issues and incidents by security personnel towards local communities could result in resentment, distrust and escalation of events	Prepare a Security Management Plan that identifies appropriate measures for hiring, rules of conduct, training, equipping, and monitoring of security personnel to control and manage such issues	Additional study	Submit security management plan	Not applicable	Once before commencement of operation	Project Operator
	Blade or tower glint can impact nearby receptors in the area	Consideration should be given to the use of non-reflective finishes to ensure potential impacts are not significant	Mitigation	Visual inspection	Turbines	Once before commencement of operation	Project Operator
Socio-economics	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity	- Local Recruitment Procedure: the procedure must identify the number of job opportunities targeted for local communities to include skilled and unskilled workers. Such job opportunities shall also take into account employment of local communities in the area around the project to include fresh graduate engineers, technicians, labourers, etc. In addition, the procedure must include details on how job opportunities will be announced as well as a selection process that is fair and transparent and provides equal opportunities for all including females. - Local Procurement Procedure: the procedure must identify the procurement opportunities targeted for local communities to include for example local subcontractors, local supplies and services, cleaning services, etc. In addition, the procedure must include details on how	Recommendation	Regular reporting on outcomes of Program implementation	Not applicable	Continuous	Project Developer/ Operator

Environmental Attribute	Potential Impact	Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.)	Type of Action	Monitoring Action	Parameters to be monitored / location	Frequency	Responsible Entity
		procurement opportunities will be announced as well as a selection process that is fair and transparent and provides equal opportunities for all. - - Social Responsibility Program: it is recommended that the Developer implement a social responsibility program which aims to benefit the local communities to the greatest extent possible. In this case, a structured approach must be developed which must identify priority development projects which could benefit local communities (e.g. based on a needs assessment if available). Based on that the social responsibility program can prioritise projects for local communities based on available budget, company vision, timeline for implementation as well as other factors.					

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11. Annexes

Annex 1 : Fatality Monitoring Methodology

Objectives of the fatality monitoring guidance

The proposed approach aims to provide:

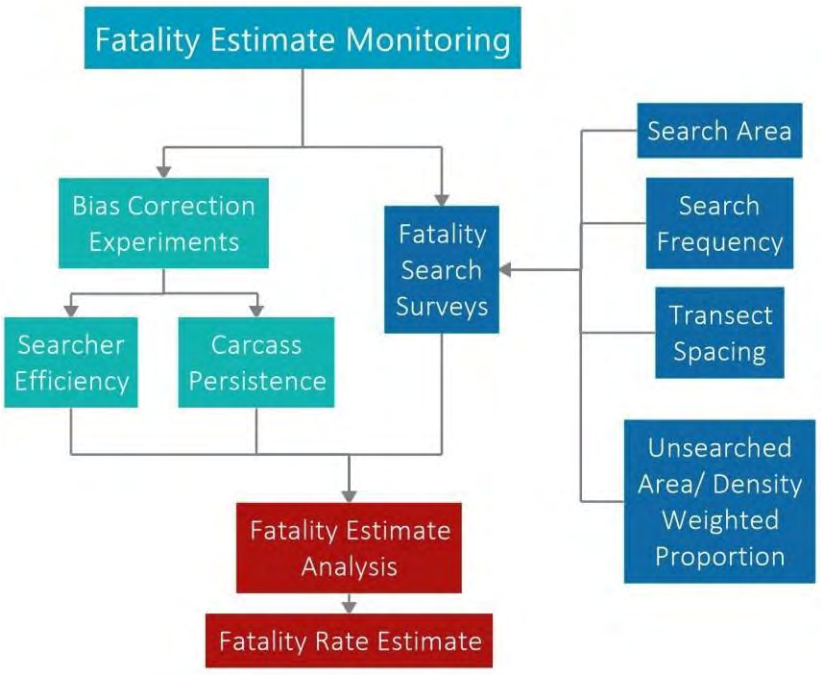
- an uncomplicated search survey design appropriate for assessing fatality rates at all WTGs as well as along transmission powerline
- project specific, accuracy optimized, unbiased fatality rate estimates for MSBs
- project specific unbiased fatality rate estimates for non- MSBs
- consistent and comparable fatality rate data across all WTGs and overhead transmission powerlines, to facilitate robust assessment of cumulative effects and with the potential to inform GoS adaptive management strategies for wind energy

Fatality monitoring program design

Obtaining unbiased fatality rates requires the following field activities to be conducted:

1. 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) (e.g. within a 200m radius around each turbine),
   - using defined transect spacing within the search area (e.g. 20m apart),
   - within the area defined as 'searchable' within the search plot.
2. Identify potential carcasses for the use in scavenger removal experiments
3. Searchable efficiency bias correction experiments to estimate the % of fatalities missed by searchers;
4. Carcass persistence bias correction experiments to estimate fatalities removed by scavengers between searches.

Fatality rate estimate monitoring requirement shows in the following flowchart.



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[2] IFC are currently developing wind energy fatality guidance based on the use of GenEst.

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:

1. **Carcass observations (CO)** – containing details of all found fatalities during search surveys,
2. **Search schedule (SS)** – containing dates when each turbine/powerline was searched,
3. **Searcher efficiency (SE)** – containing results of searcher attempts to find carcasses placed to test searcher efficiency,
4. **Carcass persistence (CP)** – containing results of the times when carcasses placed to test carcass persistence were last recorded present and first recorded absent,
5. **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.

Detailed information on the design and implementing of the suggested approach for ecological managers

The detailed guidance in section 6 provides:

- Suggested design components for the fatality search survey (6.1.1) at turbines along powerlines in the GoS with the reasoning for selecting each.
- Key points to consider when preparing the fatality search survey (6.1.2).
- Key points to consider when conducting fatality search surveys (6.1.3).
- Key points to relating to data entry for fatality surveys (6.1.4).
- Key points relating to the design of searcher efficiency experiments (6.2).
- Key points relating to the design of carcass persistence experiments (6.3).
- 'GenEst' analysis summary (7).
- 'GenEst' reporting summary (8).

Sample size

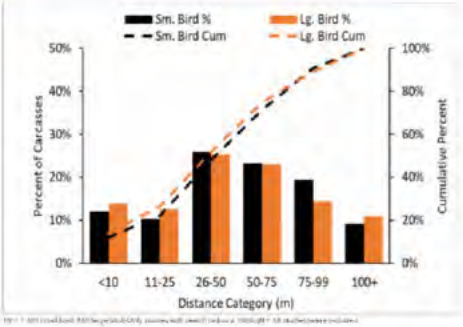
Suggested sample size	For turbines	All turbines
	For powerlines beside the WBWF boundary	Total length of the powerline over which the project has influence

- ***Reasoning.*** Searching all turbines and all powerlines over which the project has influence recognizes the potential for high conservation status and/or multiple fatalities to occur at any turbine and along any section of powerline. It acknowledges the value of using a design which allows all fatality search data to be formally analyzed within fatality rate estimate software. Compared to the studies at RGWE and KfW where 30- 40% of turbines were systematically searched,

the increased time require to systematic search all turbines is compensated for by the increased transect spacing (6.1.1.3 below) and reducing search frequency (6.1.1.4) suggested in this design.

Search area limits (search plot)

Suggested search plot size	For turbines	A square plot with each boundary from the turbine base + access roads to a distance of 200m from the turbine base
	For powerlines	Corridor extending 20m either side of center-line of powerline cables



- ***Reasoning.*** *The search plot around turbines and along powerlines needs to balance the objective of finding priority species fatalities (i.e.MSBs)with there sources available and the fact that search area increases with distance from a turbine. Studies examining the fall distances' of birds hit by turbines (e.g. (Hallingstad et al. 2018) indicates that approximately 80% of birds land within approximately 70- 80m from the turbine base beyond which search area per fatality increases. The recommended plot size for turbines in this design uses this information to define a plot size that optimizes search effort.*

For powerlines, there are few studies that have measured fall distances of birds. Of those that have; Murphy et al. (2009) found that approx. 70% of 28 Sandhill Crane fatalities Occurred within 20m of the powerline, Shaw et al. (2010) found 100% of approximately 65 Blue Crane fatalities occurred within 15m of the powerline, and Frost (2008) found 37% of Mute Swans were found within 20m -

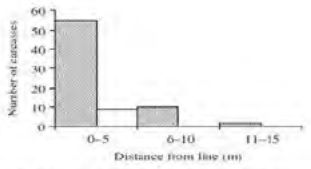
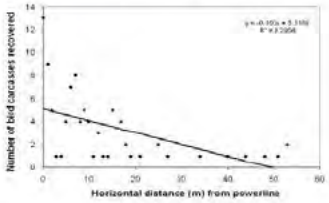
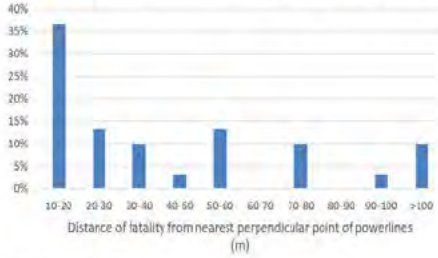


Figure 3. Distance of Blue Crane carcasses from the power line in open habitats, i.e. pasture and stubble (shaded), and closed habitats, i.e. mature cereal and veld (white).

Shaw *et. al.* 2010



Murphy *et. al.* 2029



Frost et. al. 2008

but highlighted the likelihood that some injured birds moved further away from the location where they first landed. Overall these studies suggest that a search area extending 20m either side of the powerline will likely be sufficient to detect an adequate proportion of the fatalities occurring along powerlines.

Searching along access roads

The suggested design requires a single transect to be searched beyond the main search plot along access roads out to a typical maximum distance that birds may land when they collide with turbines and associated powerlines. The purpose of this is to obtain some information (with minimum effort) about this outer area which is otherwise unsearched. Provided the search is conducted in the same way as the within the main plot (i.e. one transect walk scanning 10m either side of the walk route) this information can easily be incorporated in the analysis alongside the information from the main plot.

Transect spacing

Suggested transect spacing	For turbines	20m
	For powerlines	20m

- ***Reasoning.*** *Birdlife International (2015) guidance suggests a transect width of 20m (i.e. searching 10m either side of a transect line) for medium (buzzard size) raptors. Although reducing the spacing will increase the possibility of detecting*

smaller MSB species, it is expected that this transect spacing will be suitable for detecting and adequate proportion of MSB fatalities across all sizes in typically featureless desert landscapes where projects. Using a 20m transect spacing represents a considerable saving in survey time which is using in this design to allow a larger sample of turbines to be search systematically and a larger plot area to be searched around each turbine. Specific sites with more mountainous terrain, specifically the KfW WPP, will likely require narrower transect spacing to adequately detect an adequate proportion of fatalities, however even here this should be balanced with the increased number of turbines that can be searched systematically and included in formal fatality rate estimate analysis.

For powerlines the 20m spacing would require in 2 transects 10m either side of the centre line of the powerline. Importantly, searcher efficiency experiment results should be used to confirm the adequacy of transect spacing at all powerlines during the early implementing of this plan.

Search frequency

Suggested search frequency	For turbines	Weekly
	For powerlines	Weekly

Reasoning. *The principal role of fatality monitoring in this area is to assess risk and impacts to MSBs. The validity of focusing on these species is further validated by the negligible presence of bats and high priority small birds determined from the intensive fatality monitoring carried out in the early operational phase. Carcass persistence rates for raptors and other MSB species in recent literature (e.g.Urquhart, Hulka & Duffy 2015; Hallingstad et al. 2018) and from unpublished WPP carcass persistence studies, including those at KFW and RGWE WPPs, indicate that a weekly search interval would not substantially reduce the number of carcasses detected for these types of species. A weekly search interval for MSBs is also supported by relevant international guidance (see advice in Birdlife International 2015, P31).*

Preparing for fatality search surveys

Before fatality search surveys begin the ecological manager will require time to visit each turbine and each length of the powerline to:

1. Define the **limits (boundary) of each search plot/corridor**
2. Identify and **map the area to be searched within the search plot**, clearly marking any areas that are to be regarded as 'unsearchable' areas for the purpose of the survey
3. Identify and **map areas of differing ground visibility** ('visibility classes')

Additionally, field sheets may need to be developed, or if already in use, checked to ensure that they will collect the required data for use in the GenEst program.

Map the search plot and search transects and maximum fall radius

- For each turbine; the turbine location, hard standing, access roads, 200 x 200 search plots, maximum fall radius, should be determined from GIS/maps/satellite images, marked on field maps, with relevant locations entered into searchers' GPS devices before the start of the fieldwork program. Additionally 'unsearchable areas' within each search plot determined during initial field visits by the ecological manager should also be marked (see also 6.1.2.2)
- In the field, the use of markers to determine the plot boundaries and transect start/end points is essential if it is not feasible for each searcher to have a GPS, and may be useful even if they do.

Identifying and mapping 'unsearchable' areas

An 'unsearchable' area is an area within the search plot where either; a) the terrain or vegetation result in fatalities being very difficult to find and/or, b) the health/safety of the surveyor is likely

to be compromised. In the largely unvegetated areas along the GoS, unsearchable areas will likely relate to patches of ground where a transect walk is difficult because the terrain is steep/rocky. Importantly, this includes mounds of loose rock deposited around turbines and associated powerlines during construction at some sites. These will likely represent a small % of the total search plot, will have little impact on the final fatality rate estimates and should be excluded from the search to improve the overall efficiency of the survey. At many of the turbines and associated powerlines in the Gulf of Suez area there will be no unsearchable areas within search plots.

Identifying and mapping visibility classes within each search plot

For each turbine and powerline, the ecological manager will also need to map areas of differing ground surface characteristics to account for differences in fatality visibility. It is likely that one or two visibility classes will be needed. The described visibility classes below provide a guide

- high visibility areas - ≥90% level bare ground, vegetation ≤15cm (includes turbine hard standing and access roads)
- medium visibility areas - ≥25% level bare ground, vegetation ≤15cm
- low visibility areas - ≤25% level bare ground and/or ≤25% vegetation ≥15cm
- very low visibility areas - little or no level bare ground and/or vegetation ≥25% vegetation ≥15cm

Mapping of these areas will be needed to correctly conduct bias correction experiments and estimate fatality rate, but will not be needed by searchers in the field and therefore do not need to appear on the field maps described in 6.1.2.1 above. The following design illustrates turbine search design.

Conducting fatality search survey

Key points

- Focus searches only in the searchable areas within the 200 x 200 search plot, the access road area of 120m from the turbine and, the 40m powerline search corridor.
- All incidental finds of fatalities found either in a) the unsearched area between the edge of the 200 x 200m search plot and the 120m maximum fatality fall radius or b) in 'unsearchable' areas should be recorded in the same way as fatalities found in the search area.
- All found fatalities should be collected and stored frozen in a dedicated on-site freezer for use in future carcass persistence experiments, following good health and safety guidelines.

Data entry for fatality search surveys

Key points

- Each fatality record should provide:
    - a GPS location
    - species
    - turbine number,
    - powerline (voltage level 220 kV or 500 kV, section number)
    - age (where evident)
    - condition
    - date and time of discovery

- discarded or retained
- photographs showing head, body underparts, upper parts and wings (closed and outstretched) with scale to show size
- ID number corresponding to the number on storage bag

Bias correction experiments – searcher efficiency

The suggested design requires a maximum of two types of searcher efficiency experiments

1. Searcher efficiency experiment for walked transects
2. Searcher efficiency experiment for driven transects along powerlines

If powerlines are to be walked then only the walked transect experiment (1 above) is needed.

Key points relating to the design of searcher efficiency experiments

- Experiments are required. Ideally experiments are conducted as a small number of clustered events through each migration season
- Aligned with previous searcher efficiency experiments at RGWE and KfW WPPs decoys rather than actual carcasses should be used. Provided decoys reflect the visibility of fatalities that searchers are looking for decoys are a more practical solution compared with real carcasses. Principal advantages are; a sufficient sample size can readily be bought/made and stored, decoys can be reused, and in the field they are less likely to attract scavenging species which can lead to reduced fatality persistence rates and as a result reduced fatality rate accuracy.
- Searcher efficiency experiments should test all size classes potentially found: bats, small, medium and large birds. Although the focus of the fatality monitoring is MSBs which are mainly in the medium/large bird class, understanding the extent to which species in the smaller size class are being missed using the suggested design will allow fatality rate estimate for fatalities in all size classes to be calculated and allow the intensity of the suggested design to be evaluated at each site and if necessary adjusted.
- Good practice is to use a minimum of 10 decoys per covariate (i.e. size class x visibility class x season). For example, at many project sites in the GoS it is likely that there will be just two ground visibility classes, (high and moderate visibility). This situation would require (4 [size classes] x 2 [visibility classes] x 2 [seasons]) x10 = 160 decoys per year or 80 decoys per migration season.
- The ecological manager should place decoys within the search area to achieve a balanced sample within each covariate class
- Search teams should not be aware that decoys are being placed in the turbine and powerline search areas.
- The ecological manager should check that the decoys are still present after the search is conducted. Any searches where the decoys that are not present after the search should not be included in the analysis as these may have disappeared before the searcher reached the location.
- If feasible, 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. The GenEst program allows for this information to be entered and incorporated into the fatality rate analysis (See 13.1.4 columns S1,S2…)

Bias correction experiments – carcass persistence

Carcass persistence methods follow international wind energy good practice standards and the key points below reiterate these practices.

Key points relating to the design of carcass persistence experiments

- Conduct a carcass persistence experiment during each migration season.
- Conduct carcass persistence experiments using actual fatalities for MSBs and other migratory raptors. Raptor fatalities from other sources may be useable as surrogates if they can be sourced. Do not use chickens as surrogates as they are likely to have no value in correcting fatality estimates for raptors and MSBs and may lead to a general increase in the scavenging rate in the area.
- On carcass persistence recording forms give the species name for all experimental carcasses used (rather than just for generic size groupings e.g. medium sized bird or large bird). This will allow carcass persistence to be analyzed for species groups of particular interest, e.g. large raptors, large water birds which will help validate program design search frequency.
- Ensure that carcass persistence is tested at powerline locations as well as turbines. This is especially important if powerlines are not close the turbine array.
- At a minimum check carcass persistence on the following days after placement [1, 2, 3, 4, 5, 7, 10, 14, 20, 27, 34….] until the carcass has disappeared or would no longer be recorded as a fatality if it was found during fatality searches. For example, if 10 feathers or 2 or more primaries is the minimum criteria for evidence of a fatality the same criteria should be used for the carcass persistence experiment. If feasible for all globally threatened/near threatened species and all raptor species consider monitoring the experimental carcass more regularly to provide a more precise estimate of persistence.
- To improve sample size using actual fatalities one approach would be to test for statistical differences between carcass persistence rates in the same season in different years, between different seasons and between years. Where no statistical difference is found it may be valid to pool data to improve sample size and use this pooled data to obtain a more robust carcass persistence rate.

Options for improving carcass persistence sample size

Obtaining valid carcass persistence rates for MSBs and other migratory raptors is a major challenge due to the lack of adequate surrogates. Using actual fatalities is the most accurate measure. For the RCREEE wind development area a unique opportunity exists to implement consistent good practice carcass persistence experiments across all projects and establish a data sharing repository for carcass persistence data. Analysis of shared data will improve understanding of MSB/raptor carcass persistence in this area and could provide reference persistence rates for projects in the early stage of the operational phase where few fatalities have occurred.

Fatality rate analysis in GenEst

Data input

- Use separate MS Excel.csv or plain text.csv files to enter field derived data and then upload to the program using the buttons on the left side of the panel.
- Carcass Observations (CO), Search Schedule (SS), Searcher Efficiency, and Carcass Persistence (CP) files use data derived directly from the results of the field work.
- The Density Weighted Proportion (DWP) file gives turbine and powerline specific details of the percentage of fatalities arriving in the search area that were detectable, and requires the location of each fatality and a measure of the percentage of area searched within a distance bands out from the turbine and powerline. This needs to be calculated before it can be entered in the DWP data file. The GenEst team are currently developing functionality that will

help calculate DWP. Until this is available IFC can provide help with producing DWP files if needed.

Data analysis

- Based on the input data candidate models are created for searcher efficiency and carcass persistence and the 'best' model for each bias correction experiment selected by the user. Once these models are selected the fatality (mortality) rate estimate can be calculated.
- GenEst allows mortality rate to be split according to variables of interest. For example seasonal, species group differences in fatality rate can be directly compared.