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

Final ESIA Report – Deliverable D4 – Rev 12

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Prepared by:
ECO Consult – Jude Centre, Salem Al-Hindawi Street, Shmeisani,
P.O. Box 941400, Amman 11194 Jordan
Tel: 962 6 569 9769
Fax: 962 6 5697264
E-mail: info@ecoconsult.jo

and

EcoConServ Environmental Solutions as a subcontractor to ECO Consult:
Tel: + (202) 2735 9078/2736 4818
Fax: + (202) 2736 5397
12 El-Saleh Ayoub St., Zamalek
Cairo, Egypt 11211

Prepared for:
RCREEE - Regional Centre for Renewable Energies and Energy Efficiency
Hydro Power Building, Floor 7
Block 11, Piece 15, Melsa District
Ard el Golf, Nasr City, Cairo
Arab Republic of Egypt

On behalf of:

Red Sea Wind Energy (RSWE).

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ABBREVIATIONS

- above sea level (A.S.L)
- Alternating Current (AC)
- Build, Own and Operate (BOO)
- Carbon Dioxide (CO2)
- Carbon Monoxide (CO)
- Central Agency for Public Mobilization and Statistics (CAPMAS)
- Community Based Organisations (CBOs)
- Community Integration Plan (CIP)
- Competent Administrative Authorities (CAAs)
- Consultant (ECO Consult and EcoConServ)
- Corporate Social Responsibility (CSR)
- decibels (dB)
- Direct Current (DC)
- Directorate of Health Affairs (DHA)
- Double-Circuit Transmission Towers (DCT)
- Egyptian Electricity Transmission Company (EETC)
- Egyptian Environmental Affairs Agency (EEAA)
- Egyptian pound (EGP)
- Electric and magnetic fields (EMF)
- ENGIE Energy Services S.A (ENGIE)
- Engineering, Procurement, and Construction (EPC)
- Environment, Health, and safety (EHS)
- Environmental and Social (E&S)
- Environmental and Social Impact Assessment (ESIA)
- Environmental and Social Management Plan (ESMP)
- Environmental and Social Standards (ESS)
- Environmental Impact Assessment (EIA)
- environmental management (EM)
- Environmental Management Unit (EMU)
- Environmental, Health & Safety (EHS)
- Environmental, Social, Health and Safety Management System (ESHS-MS)
- Equator Principle Financial Institutions (EPFIs)
- European Bank for Reconstruction and Development (EBRD)
- European Investment Bank (EIB)
- European Union (EU)
- Eurus Energy Holdings Corporation (EEH)
- Gigawatt hours (GWh)
- Government of Egypt (GoE)
- Green Economy Transition (GET)
- greenhouse gas (GHG)
- Gross Domestic Product (GDP)
- Gulf of Suez (GoS)
- Important Bird Areas (IBAs)
- Integrated Sustainable Energy Strategy (ISES)
- International Commission on Non-Ionizing Radiation Protection (ICNIRP)
- International Finance Corporation (IFC)
- International Financial Institutions (IFIs)
- International Organization for Standardization (ISO)
- International Union for Conservation of Nature (IUCN)
- Japan International Cooperation Agency (JICA)
- Kilowatt Hour (kWh)
- Line of Sight (LoS)

- Local Government Unit (LGU)
- Material Safety Data Sheet (MSDS)
- Medium Voltage (MV)
- Megawatt (MW)
- Migratory Soaring Birds (MSB)
- Minutes of Meeting (MoM)
- National Authority for Remote Sensing and Space Sciences (NARSS)
- National Institute of Environmental Health Sciences (NIEHS)
- New and Renewable Energy Authority (NREA)
- Nitrogen Dioxide (NO_2)
- Noise Pressure Levels (NPL)
- Noise Sensitive Receiver locations (NSR)
- Non-governmental Organisations (NGOs)
- Non-Technical Summary (NTS)
- Occupational Health and Safety Plan (OHSP)
- Oil and Gas (O&G)
- Operation and Maintenance (O&M)
- Orascom Construction S.A.E (OC)
- Overhead Transmission Line (OHTL)
- Particulate Matter (PM)
- Particulate Matter smaller than 10.0 microns in diameter (PM10)
- parts per million (ppm)
- Performance Requirements (PRs)
- Performance Standards (PSs)
- photovoltaic (PV)
- Planning Policy Statement 22 (PPS22)
- Power Purchase Agreement (PPA)
- Regional Centre for Renewable Energy and Energy Efficiency (RCREEE)
- Right of Way (RoW)
- Shuttle Radar Topography Mission (SRTM)
- Stakeholder Engagement Plan (SEP)
- Strategic and Cumulative Environmental and Social Assessment (SESA)
- Sulphur Dioxide (SO_2)
- Supervisory Control and Data Acquisition (SCADA)
- Tool Box Talks (TBT)
- Total Suspended Particulate (TSP)
- Toyota Tsusho Corporation (TTC)
- United Kingdom (UK)
- Wastewater Treatment Plant (WWTP)
- Water Resources Research Institute (WRRI)
- wind turbine generators (WTG)
- World Bank (WB)

1 NON-TECHNICAL SUMMARY

Background to the Project

1. 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.

2. In that respect, the Renewable Energy Law (Decree Law 203/2014) was issued 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 in which private investors are invited to submit their offers for solar and wind development projects.

3. Through the BOO mechanism, the Consortium that is incorporating Red Sea Wind Energy (RSWE) (hereafter referred to as 'the Developer'), has been selected for the development of a 500MW Wind Power Project in the GOS (hereafter referred to as 'the GOSII Project').

4. This executive summary presents the main outcomes of the Environmental and Social Impact Assessment (ESIA) that was undertaken for the Project. The ESIA was prepared in accordance with the Egyptian Environmental Affairs Agency's (EEAA) requirements as stipulated by the "Law No. 4 of 1994". In addition, the ESIA meets international best practice requirements to include the most comprehensive requirements of the International Finance Corporation (IFC).

Project Description

(i) Project Location

5. The Project is located in the Red Sea Governorate of Egypt, around 200km to the southeast of the capital city of Cairo. More specifically, the Project is located near the Red Sea shoreline and within the Ras Ghareb Local Governmental Unit of the Red Sea Governorate, where the closest villages include Ras Ghareb (located 40km to the southeast) and Zaafarana (45km to the north). Refer to figure below.

6. The Project is located within an 284km^2 area that has been allocated by the Government of Egypt to the New and Renewable Energy Authority (NREA) for development of wind farms. Within this, a land area of approximately 90km^2 has been allocated to the Developer by NREA for the development of this Project.

Figure 1-1: Project Location

(ii) Project Components

7. The key component of the Project includes the wind turbines. There will be 84 wind turbines spread over the Project site, each with a 6MW capacity. The turbine model has a hub height of 97.5m, rotor diameter of 165m and thus a tip height of 180m.

8. Other Project components include the following:

- Electrical Equipment: Project will feed electricity directly into the National Grid for end users. There is several electrical equipment which is required to convert the electricity produced from the turbines in a form that is appropriate for connection with the national grid. This includes transformers, inverters, and connection cables; and
- Infrastructure and Utilities: those include (i) offices used for normal daily operational related work and a warehouse for storage of equipment and machinery, (ii) road network for access to the site and turbines; (iii) substation which collects electricity generated from the turbines.

(iii) Project Phases

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

- Planning and Construction: this mainly includes preparing a detailed design for the Project, transportation of the various Project components to the site, and site preparation activities for installation of the wind turbines and various other components. Site preparation will include excavations and land clearing activities.
- Operation: such a Project requires limited operational activities which mainly include maintenance of the turbines and the various electrical equipment. This includes for example, turbine and rotor maintenance, lubrication of parts, washing of blades, maintenance of electrical components, etc.;
- Decommissioning: based on the signed agreement, the Project is expected to be operational for 25 years after which the Project could be decommissioned which will involve removing the tower and

blades by crane, disassembly into components for final disposal or possibly for reuse or refurbishment.

10. According to the current timeline information available, construction of the Project is anticipated to commence around the end of December 2022, and will require approximately 32 months for construction and commissioning (i.e., till end August 2025). Operation of the Project is therefore anticipated to commence in September 2025 for a period of 25 years.

The Environmental and Social Impact Assessment of the Project

11. The Project will result in crucial positive environmental and economic impacts on the strategic and national level. Such positive impacts are important to consider and take into account and include the following:

- The Project 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;
- The Project will contribute to increasing energy security through reliance on an indigenous, inexhaustible and mostly import-independent energy resource. The expected electricity generation from the Project 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).
- The clean energy produced is expected to reduce consumption of conventional petroleum products used at thermal power plants for electricity generation. This will help in reducing greenhouse gas emissions as well as air pollutant emissions – the Project is expected to offset 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.

12. On the other hand, the Project will result in certain negative environmental impacts. Nevertheless, the ESIA in general concludes that such impacts do not pose any key or major issues of concern, and through the implementation of the appropriate mitigation and monitoring requirements they are considered not significant. Such mitigation and monitoring measures are presented in detail within the Environmental and Social Mitigation and Monitoring Plan (ESMMP) in the ESIA document.

13. The table below provides an overview and summary of the key findings of the ESIA.

Table 1-1: Summary of E&S Issues

E&S Attribute	E&S Baseline Assessment	Further Requirements and Actions
Landscape and Visual	No key issues of concern noted. No sensitive visual receptors which could be impacted during construction or operation have been identified within the Project area and relevant radius surrounding the site (up to 15km).	▪ No detailed landscape and visual model required to assess impacts ▪ Routine mitigation and management measures are identified within the ESMMP
Land Use	No key issues of concern noted. Only land use activities within the Project area include the following: ▪ Petroleum storage facility and 1 oil rig operated by the General Petroleum Company ▪ Bedouin Groups (Ma'aza tribe) although they have no physical or economical activities within the site, the area is under their "Ghafra System" which entails involving such Bedouin groups in the Project (through jobs, services, etc.) for their support and providing security and protection for the Project.	▪ At planning stage, Developer to establish coordination via NREA/EETC with the relevant entity on the Project specific level to agree on any specific requirements to be taken into account as part of the detailed design for existing facilities such as the petroleum storage facility and oil rig, amongst other requirements. ▪ At planning stage, Developer to establish coordination with the Bedouin Groups for inclusion and engagement in employment and procurement opportunities during construction and operation.
Geology, Hydrology, Hydrogeology	No key issues of concern noted and based on preliminary assessment no flood risks are anticipated within the Project site.	▪ Routine mitigation and management measures for waste management are identified in ESMMP for construction and operation
Biodiversity	No key issues of concern noted. Project site is considered of low ecological significance due to its natural setting that is located in an arid environment with low vegetation cover and diversity (except for birds which is discussed further below).	▪ Routine mitigation and management measures for biodiversity are identified in ESMMP for construction and operation
Birds	▪ The results of the two-year monitoring revealed substantial differences in the bird numbers; this is not only for spring 2020 and 2021 but also autumn seasons 2019 and 2020. ▪ During both spring and autumn, birds pass randomly with no preference in any way for any specific areas or sites within the Project. ▪ Migration patterns in general are like those established by Shirihai et al. (2000) with minor differences. ▪ 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. ▪ 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 ▪ The numbers of birds at risk height per species differ significantly between the various years providing opposite results, and therefore data should not be used to estimate collision for one year as it could differ significantly during the second year. In addition, time spent at collision height in both similar seasons significantly differed for all the species. ▪ There are no key, important or significant habitats for roosting or breeding sites.	▪ Implement during the operation phase the following: (i) avi-Fauna Monitoring and Active Turbine Management Program (ATMP) (Shutdown On-Demand Program (SOD); (ii) Fatality Monitoring Program (FMP) (carcass Search Surveys and carcass Removal and Searcher Efficiency Bias Trials)
Bats	No key issues of concern noted. Site is of low significance and based on site survey and monitoring no bat activity was recorded within the Project site due to arid nature and low vegetation coverage.	▪ Fatality Monitoring Program (FMP) to be undertaken to include bats in particular. Based on the outcomes should it indicate any potential impacts on bats, mitigation and monitoring measures should be revised.
Archaeology	No key issues of concern noted. No site-specific archaeology or cultural heritage remains have been identified.	▪ Routine requirements for chance find procedures included in ESMMP for implementation during construction

Air Quality and Noise	No key issues of concern noted. Air quality and noise monitoring baseline indicates that all measurements are within allowable legal limits.	▪ Routine mitigation and management measures for dust and noise control during construction are identified in ESMMP
Infrastructure and Utilities	No key issues of concern noted. Key infrastructure and utility elements recorded onsite include: ▪ Telecommunication tower for General Petroleum company ▪ Five met masts onsite that are owned by the Developer ▪ Petroleum storage facility and oil rig (as discussed earlier) ▪ Electricity line and 4 pylons ▪ Existing road networks that are used by the General Petroleum Company	▪ At planning stage, Developer to establish coordination via NREA/EETC with the relevant entity on the Project specific level to agree on final requirements to be taken into account as part of the detailed design to include any requirements for telecommunication tower, road networks, and existing facilities located onsite. ▪ At planning stage, Developer to establish coordination with relevant entity to determine any specific requirements to be taken into account as part of the design for the onsite electricity networks. ▪ At planning stage, Developer to obtain non-objection for Project from relevant entities that govern telecommunication matters as well as civil/military aviation (if not undertaken already).
Occupational H&S	Baseline assessment considered irrelevant.	▪ Routine requirements for construction and operation included in ESMMP
Public Health and Safety	Closest 'potential' noise sensitive receptor is an Air Force Defence Unit located 3.4km to the east. Preliminary noise model indicates no key impacts. Model also took into account cumulative impacts to include nearby Lekela wind farm. Cumulative noise model indicates that cumulatively there will be likely noise impacts on the Unit. However, such receptors can be declassified as a noise sensitive receptor given that it includes offices, training grounds, radar system, and barracks for soldiers that is likely to include sleeping arrangements on a rotational basis, and is unlikely to include permanent residences.	▪ No detailed noise baseline and impact assessment model is required ▪ No additional mitigation or monitoring measures are required
	No impacts are anticipated in relation to shadow flicker.	▪ No additional mitigation or monitoring measures are required.
	In general, appropriate blade throw setback distance are implemented between turbines and populated areas. Key receptors onsite (petroleum storage facility, oil rig, road) not considered populated areas.	▪ At planning stage, Developer to establish coordination via NREA/EETC with relevant entity on requirements to be considered as part of the detailed design to include setback distances from onsite receptors.
	Other	▪ Routine requirements identified in ESMMP for other minor public health and safety impacts such as worker influx, public access to site, etc.
Socio-economics	No key issues of concern noted.	▪ Recommendations to enhance positive impacts identified in ESMMP to include development of a Community Integration Plan (CIP) for local job and procurement opportunities for local communities and Bedouin groups.

Key Additional Requirements for Planning and Micro-Siting of Project

14. Based on the outcomes of the ESIA, as summarized in the table above, this section identifies the key additional requirements to be taken into account by the Developer as part of the planning and micro-siting phase of the Project. This includes the following:

- Establish coordination with the Bedouin Groups for inclusion and engagement in employment and procurement opportunities during construction and operation.

- Establish coordination via NREA/EETC with the relevant entity on the Project specific level to: (i) determine any requirements to be taken into account as part of the detailed design for receptors noted onsite that are operated by the General Petroleum Company (such as the storage facility, oil rig, road network and telecommunication tower) which could include buffer distances; (ii) provide detailed design once available to include turbine locations, cables, roads, etc.; (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 throughout the Project's construction and operation phase (e.g. drilling and survey activities), and (v) any other issues as applicable.

- Establish coordination with relevant entity to provide information on the Project (to include location and specification of turbines as well as substation and overhead power line) to identify any specific requirement to be considered as part of the detailed design to include setback distance if required from electricity network and pylons located onsite.

- Establish coordination (if not already undertaken by NREA) with the relevant entity to provide information on the Project (to include location and specifications of turbines in specific) to identify 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.).

- Establish coordination (if not already undertaken by NREA) with the relevant entity to provide information on the Project (to include location and specifications of turbines in specific) and identify 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 Line-of-Sight connections).

2 INTRODUCTION

2.1 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, the Red Sea Wind Energy (RSWE) which is being incorporated by the consortium composed of Toyota Tsusho Corporation (TTC), Eurus Energy Holdings Corporation (EEH), ENGIE Energie Services S.A (ENGIE) and Orascom Construction S.A.E (OC) (hereafter referred to as 'the Developer'), has been selected for the development of a 500-Megawatt (MW) Wind Power Project (hereafter referred to as 'the GOSII Project'). The Project is located in the GoS on a land area of approximately 90km^2 provided by NREA.

2.2 Project Location and Components

The Project is located in the Red Sea Governorate of Egypt, around 200km to the southeast of the capital city of Cairo. More specifically, the Project is located near the Red Sea shoreline and within the Ras Ghareb Local Governmental Unit of the Red Sea Governorate, where the closest residential areas include Ras Ghareb city (located 40km to the southeast) and Zaafarana village (45km to the north).

The Project is located within a 284km^2 area that has been allocated by the GoE to NREA for development of wind farms (presented in green in Figure 2-3 below). Within this, a land area of approximately 90km^2 (presented in red in Figure 2-3 below) has been allocated to the Developer by NREA for the development of this Project.

Figure 2-1: Project Site in Relation to the Capital City of Egypt

Figure 2-2: Project Site and Closest Villages

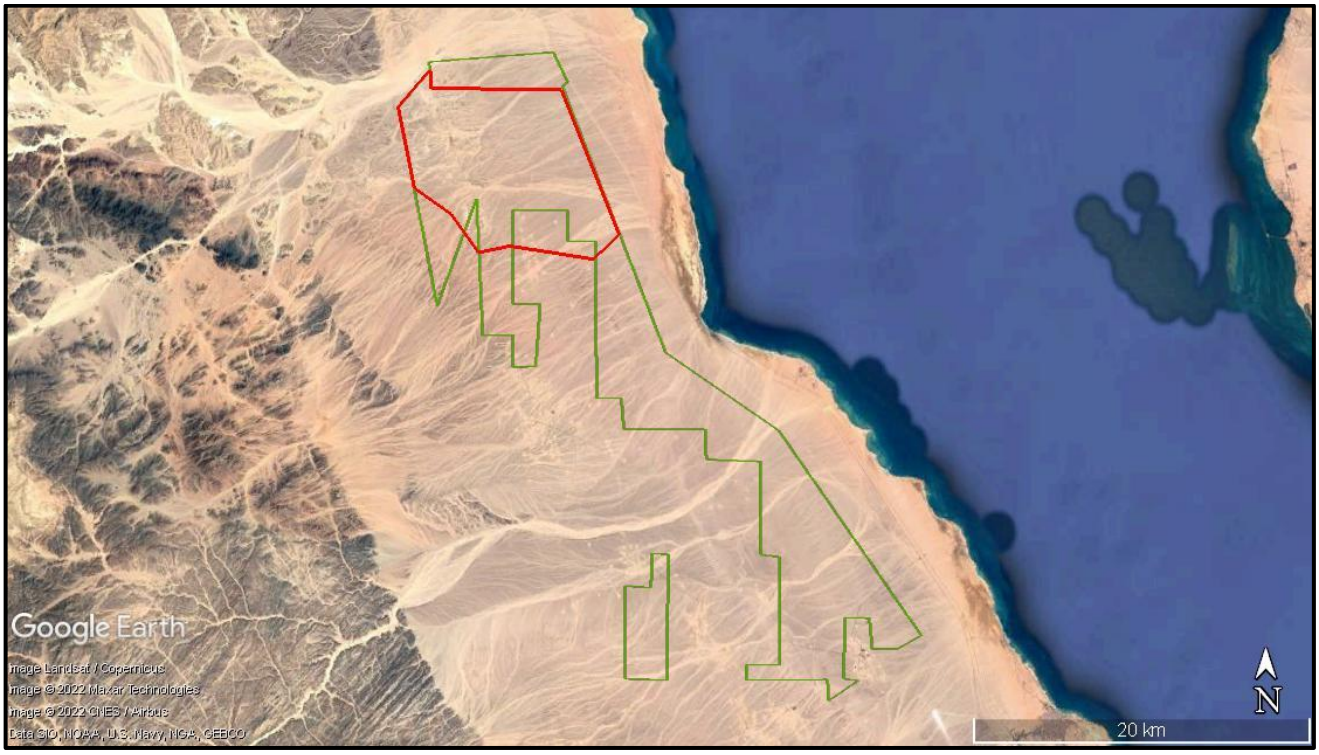

Figure 2-3: Project Site (Red) as Part of the 284km2 Area Allocated for Wind Farm Developments

2.3 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 Developer will be seeking financing for the Project from prospective lenders, including International Financial Institutions (IFIs). Therefore, the Developer wishes to design and manage the project in accordance with good international industry practice.

The IFI providing financing for the GOSII Project has not been identified yet. For the purpose of the ESIA, the following IFIs are considered:

- European Bank for Reconstruction and Development (EBRD)
- World Bank (WB)
- Japan International Cooperation Agency (JICA)
- European Investment Bank (EIB)
- International Finance Corporation (IFC)

IFC requirements have become the de facto international environmental and social performance benchmark for project financing and are considered the most comprehensive requirements related to Environmental and Social (E&S) assessments for wind projects. In general, other IFI institutions consider assessments undertaken according to IFC E&S requirements comprehensive and sufficient. For this reason, this ESIA follows the requirements of the IFC.

ECO Consult was commissioned by the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) on behalf of the Developer to prepare the ESIA for the Project in order to apply for the necessary environmental permit. ECO Consult subcontracted EcoConServ, which is a leading national environmental consultancy firm, as the local partner for undertaking the ESIA and responsible for undertaking the baseline studies, stakeholder consultation, and providing local context within this ESIA.

This report is the ESIA report to be submitted by the ESIA Practitioner (ECO Consult and its local partner) to the EEAA. This ESIA is undertaken in accordance with the "Law No. 4 of 1994" and its amendments, and the IFC requirements as set out in its Performance Standards (PSs) of Social and Environmental Sustainability E&S requirements and guidelines identified in Chapter 6.

2.4 Document Structure

The following table provides an overview of the Chapters within this ESIA document.

Table 2-1: ESIA Document Structure

Chapter	Description of Content
Chapter 3 – 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 4 – ESIA Approach and Methodology	Presents the methodology and approach that was adopted for the ESIA study.
Chapter 5 – Project Stakeholders and Consultations	Discusses in detail 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 6 – Policy, Legal, and Administrative Framework	Provides an overview of the environmental and social regulatory and policy framework applicable to the Project.
Chapter 7 – 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 8 – 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 8.1), Land Use (section 8.2), Geology/Hydrology/Hydrogeology (section 8.3), Biodiversity (section 8.4), Birds (section 8.5), Bats (section 8.6), Archaeology and Cultural Heritage (section 8.7), Air Quality and Noise (section 8.8), Infrastructure and Utilities (section 8.9), Occupational Health and Safety (section 8.10), Public Health and Safety (section 8.11), and Socio-economics (section 8.12).
Chapter 9 – 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 9.1), Landscape and Visual (section 9.2), Land Use (section 9.3), Geology/Hydrology/Hydrogeology (section 9.4), Biodiversity (section 9.5), Birds (section 9.6), Bats (section 9.7), Archaeology and Cultural Heritage (section 9.8), Air Quality and Noise (section 9.9), Infrastructure and Utilities (section 9.10), Occupational Health and Safety (section 9.11), Public Health and Safety (section 9.12), Socio-economics (section 9.13), Summary of Anticipated Impacts (section 9.14), and Assessment of Cumulative Impacts (section 9.15).
Chapter 10 – 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.
Chapter 11 – E&S Assessment for Project Substation	Presents the anticipated E&S impacts in specific for the Project's substation along with required mitigation and monitoring measures to be implemented.

2.5 Key Involved Entities

Different entities are involved in the planning and implementation of the Project. The responsibilities of each key entity which is of relevance to the ESIA are listed in the text below along with a general description of their roles.

- *Red Sea Wind Energy (RSWE) which consists of a consortium of ENGIE, Toyota Tsusho Corporation (TTC), Eurus Energy Holdings (EEH), and Orascom Construction (OC) (the Developer):* is the Project proponent and developer and will be the owner of the Project;
- *Regional Centre for Renewable Energy and Energy Efficiency (RCREEE):* is responsible for managing certain aspects of the overall development process on behalf of the Developer. This includes in specific the overall management of the ESIA process with the Consultant including review of deliverables and submissions including conducting an ornithological survey at the GoS (about 90km^2 area) in autumn 2019 and spring 2020 for the wind power project with the capacity of 500 MW under BOO scheme;
- *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 ESIA and making sure it complies with the "Environmental Protection Law No. 4 of 1994" and granting the environmental clearance for the Project;
- *National Renewable Energy Authority (NREA*): is the entity responsible for qualification of bids and selection of the Developer for this Project. In addition, they are also responsible for allocation of the land for the development of the Project;
- *Egyptian Electricity Transmission Company (EETC):* will be of the off taker of electricity and the responsible entity for signing 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 to the existing national grid.
- *Wind Farm Engineering, Procurement, and Construction (EPC) Contractors:* responsible for the development of the Project on a turnkey basis. Responsibilities include the preparation of the detailed design of the Project; supply of the material and equipment (turbines, cables, transformers, inverters, etc.); and construction of the Project and its various components (turbines, internal access roads, building infrastructure, connections, etc.). The EPC Contractors for this Project will be Orascom Construction for the construction and commissioning of the civil and electrical works, while Xinjiang Goldwind Science & Technology Co., Ltd. (Goldwind) will be responsible for the supply, erection and commissioning of the turbines;
- *Wind Farm Project Operator:* will be responsible for Operation and Maintenance (O&M) of the Project. The Owner will operate the wind farm for the duration of the PPA with the support of Goldwind for the wind turbine scope under a Long-Term Service Agreement (LTSA); and
- *Consultant (ECO Consult & EcoConServ):* hereafter referred to as the 'ESIA Team' who is the ESIA Practitioner and the consultant commissioned by RCREEE to prepare the ESIA for the Project in accordance with the requirements of the "Law No. 4 of 1994" as well as the IFI E&S requirements.

3 PROJECT DESCRIPTION

3.1 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 (Figure 3-1 below). Red Sea Governorate's total area is around 120,000 km2, 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 (refer to Figure 3-1 and Figure 3-2). 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 town (located 40km to the southeast) and Zaafarana village (45km 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 approximately 90km^2 has been allocated to the Developer by NREA for the development of this Project.

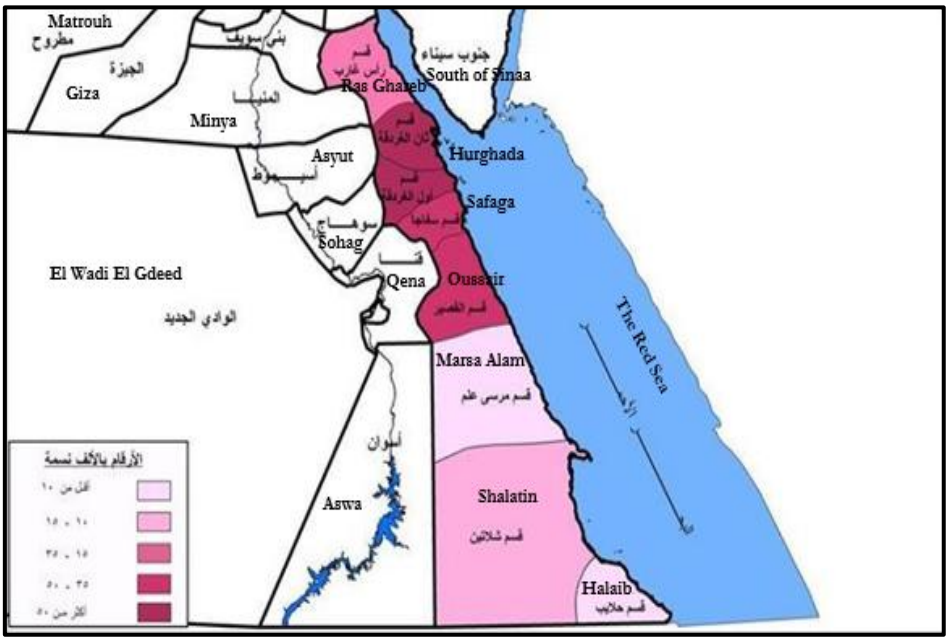

Figure 3-1: Administrative Borders of the Red Sea Governorate

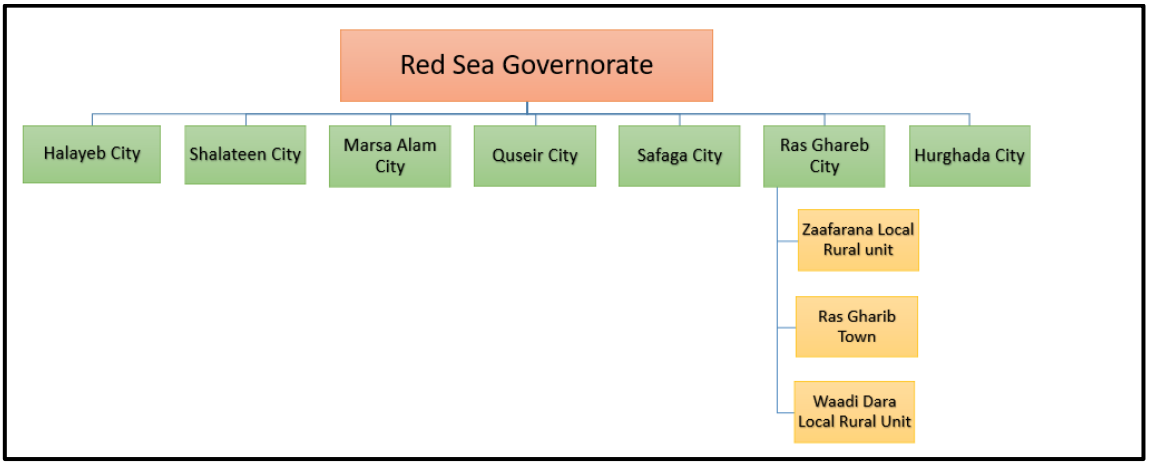

Figure 3-2: Administrative Division of Red Sea Governorate

Figure 3-3: Project Site and Closest Villages

3.2 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 blade begins to rotate which then spins a shaft that is connected to a generator thereby converting wind energy to electricity.

Wind turbines produce Direct Current (DC) electricity from wind, which can be used for grid connected power generation. However, electricity at the grid is usually in a different form (known as Alternating Current (AC)) and thus inverters are used to convert DC current to AC current. In addition, 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 panels to a higher voltage that matches the grid.

3.3 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. It is important to note that the information included throughout this section is based on preliminary information provided by the Developer to date.

Table 3-1: Summary of Key Project Components

Component	Description
Project Generation Capacity (MW)	504
Technology Type	Wind Power
Number of Wind Turbines	84
Rated Power per Turbine (MW)	6
Rotor Diameter (m)	165m
Hub Height (m)	97.5m
Tip height (m)	180m
Project area to be covered	+/- 90 km^2
Infrastructure and Utilities	This includes: (i) internal road network; (ii) underground cables; (iii) warehouse and offices; (iii) substation; and (iv) associated facilities such as the high voltage overhead transmission line.

Note

In 2020 a previous ESIA study was submitted by the ESIA Consultant to EEAA and IFIs that included different turbine characteristics and a layout than that presented in the table above and throughout this section. The previous turbine characteristics included a total of 173 turbines with a rated power of 2.9MW and a tip height of 120m.

In July 2022 new governmental approvals have been issued allowing an increase in tip height up until 220m, where previously due to various governmental restrictions the allowed tip height was set at 120m (as noted above). Based on that, all wind farm developers within the GoS are currently assessing installing such bigger turbines (including the RSWE).

Therefore, the Developer has opted at this point for the selection of such new turbine characteristics as well as layout for technical and economical/financial reasons. This issue is discussed in further details in "Section 7.3".

3.3.1 Wind Turbines

Generally, a wind turbine consists of a foundation, tower, nacelle, rotor blades, a rotor hub, and a transformer. 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 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 20.5m diameter and a depth of 5m. 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 detail below). Each turbine will also be equipped with an inverter that will convert electricity from the turbine from DC current to AC current.

The Developer is currently undergoing a selection process for the EPC Contractor whom will be supplying the wind turbines and is preparing the detailed design of the Project; which as discussed earlier will most likely be Orascom Construction and Xinjiang Goldwind Science & Technology Co., Ltd. (Goldwind). Currently, detailed information is available on the turbine specifications. Based on such information there

will be 84 turbines, each with a rated power of 6MW (for a total installed generation capacity of around 504MW). Each turbine will have a hub-height of 97.5m, rotor diameter of 165m and therefore a tip height of 180m.

The potential EPC Contractors will also be preparing the detailed design for the Project which presents the layout of the wind turbines within the Project site. The preliminary design mainly takes into account technical criteria (wind resources in the specific Project site, spacing between the turbines to minimize wake effects which could lead to a decreased wind energy production, accessibility to the turbines, etc.). Any E&S constraints or considerations (based on the outcomes of the ESIA as identified throughout this document) will also be taken into account as part of the preliminary designs and the detailed design that will be prepared at a later stage. The turbine layout is presented in the figure below.

Figure 3-4: Project Turbine Layout

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3.3.2 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 the substation. The connection between the turbines and the substation will be made using underground transmission cables buried in ground by 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 is a high voltage transformer substation that collects and converts 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). One substation will be located within the Project area. A typical 220 kV substation is presented in Figure 3-6.
- **Project Electricity Transmission Line:** electricity generated from the Project will be connected from the substation to the National Grid through an Overhead Transmission Line (OHTL) and will be developed by EETC. *It is important to note that the Overhead Transmission Line (OHTL) that will connect from the substation to the national grid (to be developed by EETC) is not included in this ESIA. A separate standalone ESIA was performed and completed for the 220 kV EETC OHTL.*
- Other infrastructure and utilities in the Project site will include the following:
  - **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 and a warehouse for storage of equipment and machinery such as spare parts, oil cartridges, fuel, lubricants, etc.;
  - **A crane pad** next to each wind turbine 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, each crane pad has an area of around 1,500m^2.
  - **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.

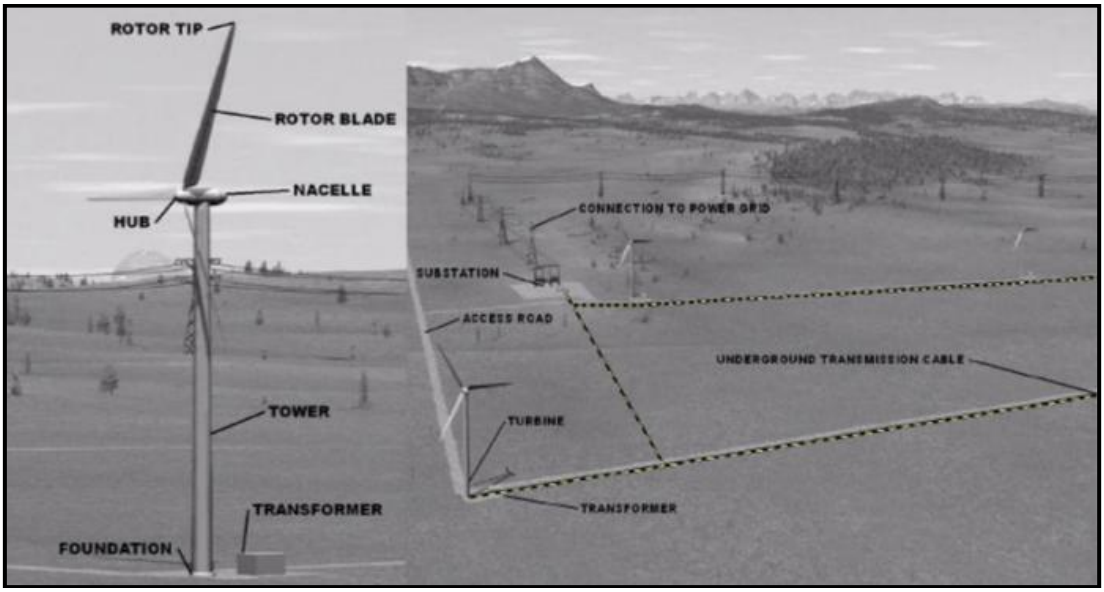


Figure 3-5: (a) Typical Structural Components of a Wind Turbine, (b) Typical Components of a Wind Farm (Source: EHS Guidelines for Wind Energy, IFC)

Figure 3-6: Typical 33/220kV Substation

3.4 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 around 90km^2).

Table 3-2: Footprint of the Project Components

Component	Footprint	Description
Turbines	0.15km^2	This includes the footprint for the foundation and the crane pad area for each of the 84 turbines. 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	0.07 km^2	Typically, footprint for substation and building facilities is around 0.07km^2.
Trenches for MV cables and communication cables	0.0825 km^2	This includes trenches with a calculated length of around 75km and a width of 1m.
Road networks	0.49 km^2	This includes the road network with a total length of 75km and a width of 6m.
Total Project Footprint	0.6km^2	
Total Project site Area	90km^2	Project footprint is around 1,5% of the total surface of the Project area.

3.5 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 summarised below.

3.5.1 Wind Farm

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 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 bolting of the tower to the foundation;
- Installation of turbine components to include tower assembly, hub, rotor, and nacelle lift and rotor assembly which most likely will occur through onsite mobile cranes;
- In addition to the erection of each turbine, there is additional construction work (which could include excavations, land clearing activities, electrical work, etc.) that must be conducted to connect each turbine to the power grid, this could include the installation and laying of transmission and communication cables, installation of substations, and installation of project transmission line; and
- Other construction works (which could include excavations, land clearing activities, etc.) for the potential access road construction or upgrade and for the building infrastructure (warehouse and offices).

Operation Phase

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

- 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;

- 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.

Decommissioning Phase

According to the PPA agreement, the Project is expected to be operational for 25 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.

3.5.2 Project Schedule

According to the current timeline information available by the Developer, construction of the Project is anticipated to commence around Q4 2022 and will require approximately 32 months for construction and commissioning. Operation of the Project is therefore anticipated to commence in Q3 2025 for a period of 25 years based on the PPA signed.

3.6 Workforce and Training

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

- Around 1,600 job opportunities at peak during the construction phase for a duration of approximately 32 months. This will mainly include around 300 skilled job opportunities (to include engineers, technicians, consultants, surveyors, etc.) and 1,300 unskilled job opportunities (mainly labourers but will also include a number of security personnel).
- Around 40 job opportunities during the operation phase for a duration of 25 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 detail in 'Section 8.12'.

4 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 and trans-boundary effects; and
- Approach for development of an ESMP.

4.1 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); (ii) EBRD Performance Requirement 1; and (iii) WB Environmental and Social Standard 1.

Environmental and social considerations have been part of the planning of the Project and a core element of the decision-making process. The analysis of alternatives is presented in "Chapter 7". 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.

4.2 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 WB/IFC/EBRD. The previous and future stakeholder consultation and engagement for the Project are summarized below and discussed in detail in "Chapter 5".

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, local businesses, as well as citizens and Bedouins in the area. This has been undertaken through bi-lateral meetings, e-mail communication, phone communication, formal letters, and other. In addition, a public disclosure session has been undertaken with stakeholders to present the findings and recommendations proposed within the ESIA. "Chapter 5" identifies in detail the stakeholder groups, objective and method of engagement, and key outcomes and how they have been taken into account as part of the ESIA study.

"Chapter 5" 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.

4.3 Delineation of Study Boundaries and Scope of Assessment

4.3.1 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 Figure 4-1 below. This includes the Wind Farm Project Site with a total area of approximately 90km^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.

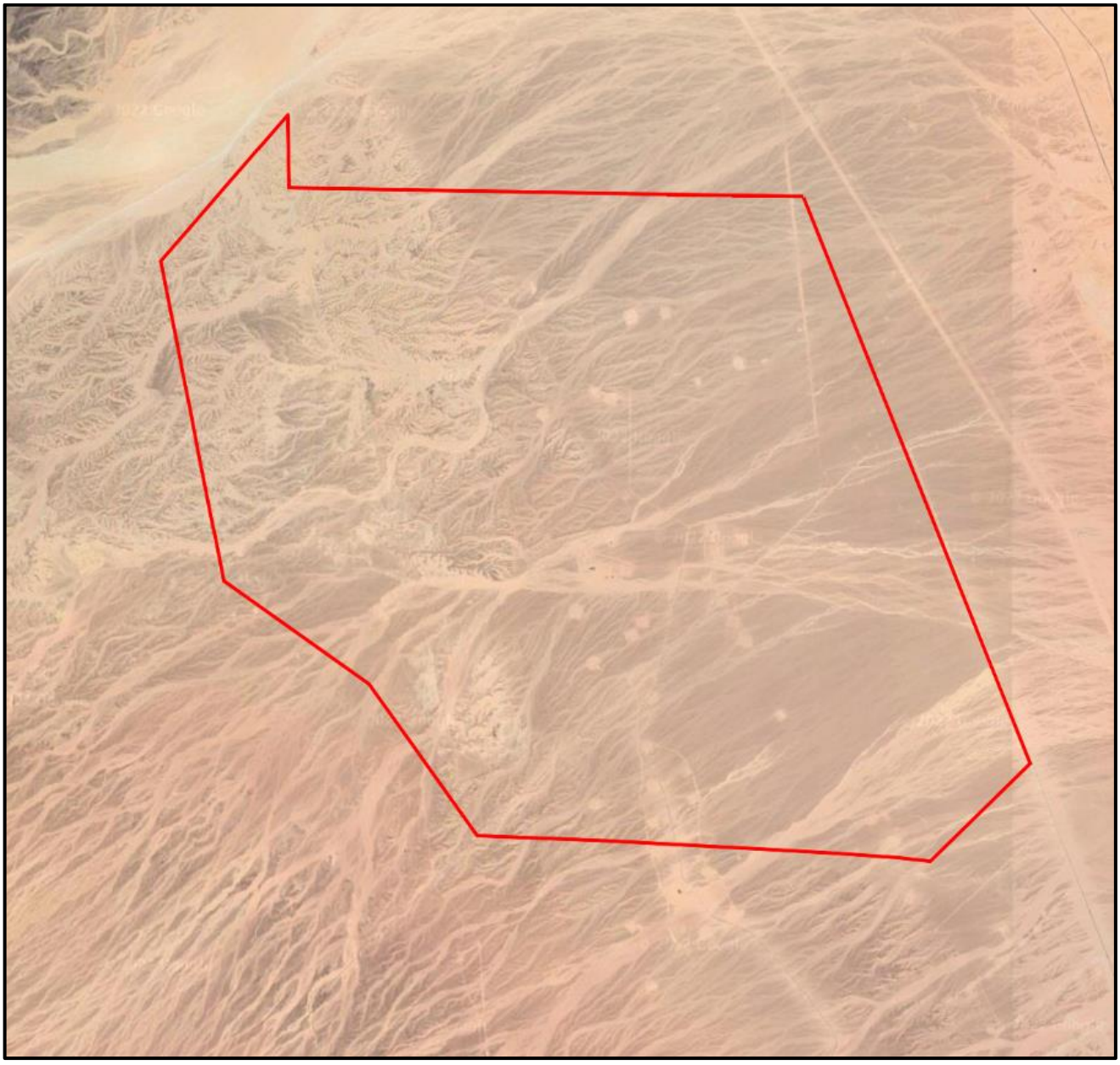


Figure 4-1: Study Area

4.3.2 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 Wind Farm EPC Contractors under the guidance of the Project Owner. 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 Wind Farm 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.

4.4 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 8” 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.

4.5 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 9.1”.

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 9.2” to “Section 9.13”. The following section provides a description of the approach, methodology and process adopted for the impact assessment presented within this ESIA.

4.5.1 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.

4.5.2 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.

4.5.3 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.

4.5.4 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 4-1: 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 extensively by consulting expertise in the areas of the identified impacts to design needed mitigation and environmental management measures. Moreover, conducting specific studies and assessments to some of the key issues identified;

- *Moderate significance*: requires reasonable investigation in the ESIA. These impacts have been studied by expertise in the areas of the identified impacts 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'.

4.5.5 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.

4.5.6 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 9.14".

4.6 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 9.15”.

4.7 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.

4.8 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.

The route for the OHTL is provided in the figure below. However, it is important to note that the ESIA did not include the OHTL given that key official information was not available or provided at the time of undertaking of the associated surveys and assessments as part of the ESIA (e.g., route, specifications number of towers, etc.). Therefore, a standalone ESIA for the OHTL was undertaken and provided.

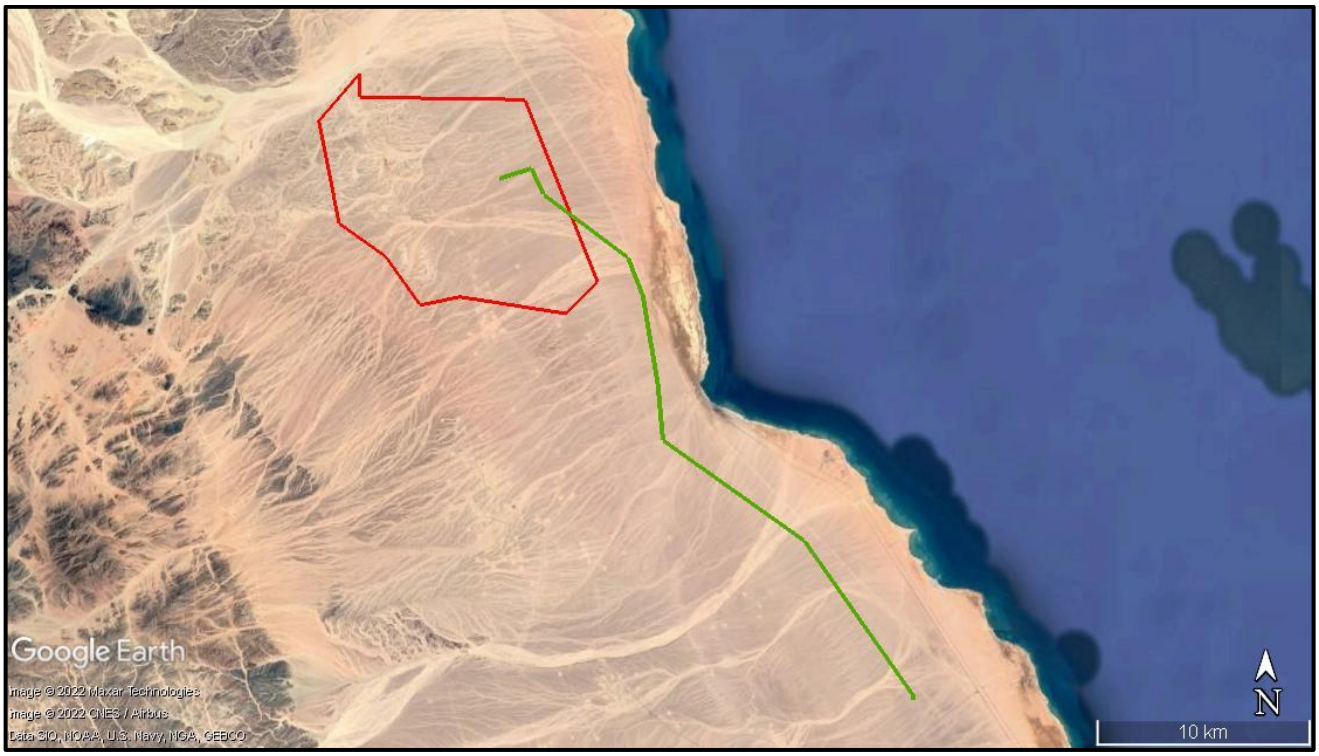


Figure 4-2: OHTL Route for the Project

5 PROJECT STAKEHOLDERS AND CONSULTATIONS

This Chapter discusses in detail 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.

5.1 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/EBRD/WB 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 August 2019.

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.

5.2 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.

5.3 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 5.5" below for additional details). In addition, the public consultation is required to include the following entities (refer to "Section 5.6" below for additional details):

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

EEAA guidelines methodology

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

The IFIs providing financing for the GOSII Project have not been identified yet. Nevertheless, stakeholder engagement activities undertaken as part of the ESIA meets international best practice requirements to include the relevant environmental and social requirements of IFIs as follows:

- International Finance Corporation (IFC):
  - Performance Standards (PS) (2012) to include PS 1: Assessment and Management of Environmental and Social Risks and Impacts; PS 2: Labour and Working Conditions; and PS 4: Community Health, Safety and Security
  - EHS Guidelines to include: General EHS Guidelines (2007); EHS Guidelines for Wind Energy (2015); and EHS Guidelines for Electric Power Transmission and Distribution (2007)
- European Bank for Reconstruction and Development (EBRD) Performance Requirements (PR) to include:
  - PR 1: Assessment and Management of Environmental and Social Impacts and Issues; PR 2: Labour and Working Conditions; PR 4: Health and Safety; and PR 10: Information Disclosure and Stakeholder Engagement
- World Bank Environmental and Social Standards (ESS) to include:

- ESS1 Assessment and Management of Environmental and Social Risks and Impacts; ESS2 Labour and Working Conditions; ESS4: Community Health and Safety, ESS5: Land Acquisition; Restrictions on Land Use and Involuntary Resettlement; and ESS10: Stakeholder Engagement and Information Disclosure

- Japan International Cooperation Agency (JICA) Guidelines for Environmental and Social Considerations (2010)

- EIB Environmental and Social Standards grouped across 10 thematic areas to include: Standard 1: Assessment and management of environmental and social impacts and risks; Standard 6: Involuntary resettlement; Standard 7: Rights and interests of vulnerable groups; Standard 8: Labour standards; Standard 9: Occupational and public health, safety and security; and Standard 10: Stakeholder engagement.

IFC requirements have become the de facto international environmental and social performance benchmark for project financing and are considered the most comprehensive requirements related to E&S assessments for wind projects. In general, other IFI institutions consider assessments undertaken according to IFC E&S requirements comprehensive and sufficient. For this reason, the SEP follows the requirements of the IFC in relation to stakeholder engagement process and activities.

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.

5.4 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 5-1: Identified Groups of Stakeholders

Level of Stakeholder interest in/involvement to the Project

1. Stakeholders who may be directly or indirectly affected by the Project

- Nearby local community from Ras Ghareb and Zaafarana to include:

Community people	- 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
Community Leaders	- 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.
Business Community (Local Large-Scale Contractors)	- Responsible for performing some contracting works on-site. - Responsible for providing workers with food and amenities.

- 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.

2. Secondary Interested Parties/Stakeholders

Stakeholders who may participate in implementation of the Project

- Regional Centre for Renewable Energy & Energy Efficiency (RCREEE): RCREEE acts on behalf of the Consortium in developing, managing, and implementing the site-specific Environmental and Social Impact Assessment (ESIA) and the Active Turbine Management Program (ATMP).
- IFIs, and investors

National Government & Permitting Authorities

- 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.

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
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 in some parts of the Project area and adjacent areas 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 Secure and support the Project
Red Sea Governorate	The main role of the governorate is supporting the Project by providing the various permissions needed, and infrastructure maps in case if needed.
Ras Gharib City Council	Give permits for any construction Provide maps of the floods in the area Supervision and follow-up from the Environmental Department in Ras Ghareb City Council during the construction phase. Coordinate with them to solid waste disposal through the construction contractors (In the case of contracting with them)
Media: Newspaper, Television, Internet	They disclose information about the Project.
Water and wastewater Company in Ras Ghareb	Provide the Project needs of water and wastewater disposal during the construction phase; through the construction contractors (In the case of contracting with them)
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: Labour Office in Red Sea Governorate	Data of the labour force in Suez Governorate and complaints of workers Monitor labour recruitment standards during construction
Roads Directorate in Red Sea Governorate	Services and development of external roads in the governorate Issuing permits for any construction work on the external roads

	Ministry of Interior	MI is responsible for national and local security, as well as approving emergency response and firefighting plans for establishments/projects

Local Government

- Red Sea Governorate and Local Unit in Ras Gharib: The main role of the Governorate is to support the Project by providing the various permissions needed, as well as infrastructure maps, if required.

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

Further to the above, a PRELIMINARY STAKEHOLDER ANALYSIS is undertaken below to clarify stakeholders' interest in the Project and their ability to impact the Project's development. Accordingly, a priority contact list is identified.

High rating for priority contact list indicates importance of continuous and regular consultation and engagement. On the other hand, medium rating for priority contact list does not reduce the importance of the entity as a stakeholder but indicates that their engagement is required at specific stages or milestones of the Project (i.e., when the involvement of these entities is triggered for a specific purpose such as obtaining a specific service).

Table 5-2: Preliminary Stakeholder Analysis and Priority Contact List for the Project

#	Stakeholder Group	Level of Interest			Ability to Impact			Priority		
		Low	Medium	High	Low	Medium	High	Low	Medium	High
1.	**Stakeholders who may be directly or indirectly affected by the Project**									
	▪ Nearby local community from Ras Ghareb and Zaafarana			√			√			√
	▪ Bedouin groups in the general area where the Project is located			√			√			√
2.	**Secondary Interested Parties/Stakeholders**									
	▪ Regional Centre for Renewable Energy & Energy Efficiency (RCREEE)			√			√			√
	▪ IFIs, and investors		√			√			√	
	▪ National Government & Permitting Authorities									
	- Ministry of Environment –Egyptian Environmental Affairs Agency (EEAA)			√			√			√
	- Environmental Office within the Governorate			√		√			√	
	- Egyptian Electricity Transmission Company (EETC)		√			√			√	
	- New & Renewable Energy Authority (NREA)		√			√			√	
	- General Petroleum Company		√		√				√	

#	Stakeholder Group	Level of Interest			Ability to Impact			Priority		
		Low	Medium	High	Low	Medium	High	Low	Medium	High
	- Ministry of Defence: Army Intelligence force, Border guards		√				√		√	
	- Red Sea Governorate		√				√		√	
	- Ras Gharib City Council		√			√			√	
	- Media: Newspaper, Television, Internet		√			√			√	
	- Water and wastewater Company in Ras Ghareb	√				√			√	
	- Civil Aviation	√				√			√	
	- public health: Directorate of Health in Red Sea Governorate, Ras Ghareb General Hospital	√			√			√		
	- Education providers (in particular technical / vocational training institutes)		√			√			√	
	- Manpower Directorate: Labour Office in Red Sea Governorate			√		√			√	
	- Roads Directorate in Red Sea Governorate	√			√			√		
	- Ministry of Interior	√			√			√		
	▪ Non-governmental Organisations (NGOs) and Community Based Organisations (CBOs)			√		√			√	
	▪ Academia and research		√			√			√	
	▪ Other community members at the national level	√			√			√		

5.5 Stakeholder Consultation and Engagement To-Date

5.5.1 Scoping Process Stakeholder Consultation and Engagement

The table below provides a summary of the key stakeholders that were previously consulted and engaged throughout the Project to date. The table provides a summary of the stakeholder groups that were engaged, date of engagement, and the main objective and outcome.

As noted earlier, the Egyptian ESIA includes requirement for stakeholder engagement under the scoping process. The table below identified the stakeholder groups that were consulted as part of the scoping process in addition to other stakeholders that were engaged by the Developer.

Table 5-3: Summary of Previous and Recent Stakeholder Engagement Activities

Stakeholder	Phase / Entity	Method of Engagement	Objective of Consultation
Red Sea Governorate Ras Gharib City Council	ESIA / Consultant	Bilateral Interviews	In general, such entities acknowledged the importance of the Project and were much in favour of energy developments and showed their willingness to support the Project as required. In addition, such entities stressed on the importance of the Project. They also emphasized on the importance of taking into account the views and concerns of local communities as well as providing job opportunities and service provisions, as well as engaging in social investment initiatives that benefit the local communities. In addition, throughout such meetings the following was investigated and discussed: ▪ Key and critical visual receptors in the area (refer to Section 8) ▪ Formal and informal land use planning for the Project site (refer to Section 8.2) ▪ Potential for flood risks within the Project site (refer to Section 8.3) ▪ Infrastructure and utility elements related to waste/wastewater/hazardous waste disposal (refer to Section 8.9) ▪ Other views, issues of concern and requirements for the Project site
Red Sea	ESIA /	Bilateral	Throughout such meetings the following was investigated and discussed:

Archaeology and Cultural Heritage Inspectorates	Consultant	Interviews	▪ Secondary data on any available archaeology and cultural heritage in the Project site (refer to Section 8.7) ▪ Discuss outcomes of site survey undertaken and identify any additional requirements or issues of concern to be taken into account (refer to Section 8.7).
Head of Bedouin Groups	ESIA / Consultant	Bilateral Interviews	The key Bedouin groups that are known within the Project area include El-Ma'aza tribe. Meetings undertaken investigated and discussed the following: ▪ Land use activities and details that are undertaken in the area (refer to Section 8.2) ▪ Obtain socio-economic information on such Bedouin groups (refer to Section 8.12) ▪ Other views, issues of concern and requirements for the Project site
	Initial Planning / Developer	Bilateral Interviews	Initial discussions and agreements were undertaken between the Developer and such Bedouin groups for integration in the Project to include in specific provision of security arrangements at this stage.
General Petroleum Company	ESIA / Consultant	Bilateral Interviews	The Project site is located within a concession area for oil exploration and an area with extensive petrolatum activities. In general, the company stressed their keenness to cooperate and provide services as applicable to the Project. In addition, throughout such meetings the following was investigated and discussed: ▪ Formal and informal land use planning for the Project site (refer to Section 8.2) ▪ Infrastructure and utility elements in the Project site (refer to Section 8.9) ▪ Potential for flood risks within the Project site (refer to Section 8.3) ▪ Other views, issues of concern and requirements for the Project site
	Initial Planning / NREA and Developer	NREA and Developer	NREA signed a coordination of work agreement with the General Petroleum Company which identifies obligations on both entities for use of lands and undertaking of activities within a 700km2 area (in which the Project site is located).
Ras Ghareb Water Company	ESIA / Consultant	Bilateral Interviews	Meetings undertaken investigated and discussed the following: ▪ Water supply to the project (refer to Section 8.9) ▪ Any water related infrastructure and utility elements in the Project area (refer to Section 8.9) ▪ Other views, issues of concern and requirements for the Project site
Ras Ghareb Electricity Company	ESIA / Consultant	Bilateral Interviews	Meetings undertaken investigated and discussed the following: ▪ Any electricity related infrastructure and utility elements in the Project area (refer to Section 8.9) ▪ Other views, issues of concern and requirements for the Project site

5.5.2 Public Disclosure Session

Once the Draft ESIA has been completed, a public consultation session was held in GoS in Ras Gharib City, Red Sea Governorate (Orchidia Hall) on 24th February 2020. The objective of the session included the following:

- Introduce the Project to stakeholders;

- Identify the key anticipated impacts;
- Present the methodology for the ESIA study;
- Present key outcomes and conclusions; and
- Allow interested stakeholders to comment on the scope of work undertaken, key issues identified and any other issues of concern they might have.

Note: the disclosure session was undertaken in 2020. As discussed in "Section 3.2" earlier, at that time the turbine layout and specifications (a total of 173 turbines with a rated power of 2.9MW per turbine and a tip height of 120m) included different turbine characteristics and a layout than the final turbine specifications and layout presented in "Section 3.2" (a total of 84 turbines with a rated power of 6MW and a tip height of 180m). However, EEAA does not require that an updated disclosure session is undertaken for the new turbine layout and characteristics.

The list of invitees was identified jointly between RCREEE in coordination with the ESIA consultant and included EEAA Headquarter and regional branch, New and Renewable Energy Authority (NREA), environmental office of the Governorate, other governmental entities, local community representatives and other. In coordination with the ESIA Consultant, invitees were informed of the date and location of the Public Consultation. Participants were invited through:

- Invitations sent by the ESIA consultant to governorate stakeholders by fax
- Invitations sent by RCREEE via e-mails
- Telephone communication by the ESIA Consultant
- An advertisement in an official daily newspaper as presented in the figure below (Gomhoryia Newspaper).

In total, seventy-five (75) people attended the public disclosure session to include around 63% males and 37% females. The table below, provides a summary of the entities that attended the session. A non-technical executive summary of the ESIA was prepared and distributed to the attendees. Sample photos of the session are presented in the figure that follows.

Table 5-4: Distribution of Participants

Entity	No.	Percentage
EEAA	3	3
EEAA - Red Sea	4	6
EETC	1	1
RCREEE	3	4
NREA	3	4
Ras Ghareb City Council	7	9
Local Community representatives	48	65
Red Sea Wind Energy Company	4	5
ESIA Consultant	2	3
Total	75	100

Figure 5-1: Newspaper Advertisement

Figure 5-2: Selected Photos of the Session

The session was moderated by the following key entities: (i) Red Sea Wind Energy Company Representatives (as the Developer); (ii) RCREEE representatives; and (iii) ESIA consultants (ECO Consult and EcoConServ).

The public consultation began with a welcoming speech by Mr. Ahmed Khalil (RCREEE representative). Following that, Mr. Amr Syed (Developer representative) presented the project in detail (to include location, key components, phases, etc.) and also discussed the company's social responsibility program aimed and its keenness to contribute in the field of vocational education and training. Finally, the ESIA consultant (ECO Consult & EcoConServ) presented in detail the ESIA study to include methodology

adopted, outcomes of E&S baseline surveys, key impacts anticipated and outcomes of the impact assessment, key mitigations and monitoring requirements to be implemented, and other as appropriate.

After the presentations above, 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 construction as well as the response on such comments.

Table 5-5: Key Outcomes and Responses of the Public Disclosure Session

Issue	Questions and comments	Responses
Avi-fauna and Birds	*Dr. Osama Al Jabali* *Director of the Migratory Soaring Birds Project, the Ministry of Environment.* He emphasized the strategic importance of the project site as one of the main passages for bird migration in the Red Sea region and stated that the project is located within the second most important paths for migratory birds. He further explained that the layout* indicated that the distribution of the turbines irregularly in rows at the project site would hinder the avi-fauna monitoring and turbine shutdown during operation when required. In addition, he stated that there must be escape corridors for the birds between the turbines as required in the SESA. *It is important to note that the comment raised above was related to a previous layout that was considered and included within the ESIA and presented in the disclosure session and which is presented in Figure 7-5 in 'Section 7.3' (and not the current and final layout presented throughout the document and in Figure 3-4).	It was explained that as part of the ESIA an avi-fauna survey has been undertaken during the fall season (fall 2019). It was further explained that additional avi-fauna surveys are being undertaken for 3 additional seasons (spring 2020, fall 2020 and spring 2021) and results will be studied and appropriate mitigations will be identified (as discussed in Section 8.5). It was further explained that the distribution of turbines differs from the western region of the project and the eastern region due to the topographical nature of the land in the western area. Nevertheless, the layout takes into account the recommendations of the SESA which identifies 'migration corridors' as space between wind farms in the area to enable large soaring birds to safely migrate over the coastal desert plains and continue migration during spring and autumn time and seasons. Such 'migration corridors' have been avoided and no turbines were placed within such area (refer to Section 7.3 for additional details). *It is important to note that the response provided above is related to a previous layout that was considered and included within the ESIA and presented in the disclosure session and which is presented in Figure 7-5 in 'Section 7.3' (and not the current and final layout presented throughout the document and in Figure 3-4).
	Why was the third plot of land designated for the project not included in the distribution of the turbines?	The Developer agreed that redistributing the turbines on the three plots will be better, however, the wind energy in the third plot is weak, which increases the loss of electricity. Therefore, the third plot of land was not used to reduce the loss of produced electricity, although the bird's corridors was taken into account in the two plots of land plans to be used as discussed above.
	The cumulative impact of wind energy projects in the region should be taken into consideration	It was explained that cumulative impacts of wind energy project in the region have been considered as part of the SESA. The key outcomes and recommendations of the SESA in relation to cumulative impacts from wind farm developments have been taken into account and reiterated within the ESIA study.
Socio-economics	*Mahmoud Hussein Baghdadi* *Chairman of the Board of the Educational Administration in Ras Gharib City*	It was explained that the project is expected to provide at least job opportunities for local communities, which in turn may contribute to

Issue	Questions and comments	Responses
	He stressed the importance of the project to open new fields of investment in the area to contribute of solving the unemployment problem in the city	improving the standard of living. However, it was also stressed 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 within the area. More importantly, it was explained that the ESIA (as discussed in 'Section 9.13) recommends that the Developer adopt and implement an action plan with the local community that addresses the following: - Managing expectations so that the local communities close to the project site have priority in obtaining job opportunities from the project according to the project's employment needs, - Determine the number of job opportunities for skilled and unskilled workers that target the local community during the construction and employment stages, - Provide transparent recruitment procedures to the local community. Such measures must provide equal opportunities for all, - Provide details of additional areas that local community members can participate in, as well as job opportunities for those with the required skills and experience (for example hiring local contractors) - Consider implementing a social responsibility program.
	Khaled Abu AlHajjaj *General Administration of Environmental Affairs in the governorate* The jobs required for the project must be announced in a clear place for the people of Ras Gharib, so that they can know about it	
Occupational Health and Safety	*Ras Gharib community members* stressed in their comments on the importance of maintaining occupational safety and health for workers because it can affect community health and safety	It was explained that during the construction and operation phase, there will be a possibility of general occupational health and safety hazards for workers that may increase the risk of injury resulting from accidents. This includes risks of working at altitudes, electric shocks and burns, movement of machinery, etc. In addition, it was further explained that the ESIA (as discussed in 'Section 8.10') study requires that the EPC Contractors and Project Operator prepare a detailed project and site-specific occupational health and safety plan for the construction and operation phase. The objective of the plan is to ensure the health and safety of all workers and prevent to the greatest extent possible any incidents or accidents onsite.
Energy Supply	*Adel Abdul Hamid* *Director of Administrative Affairs Department, Ras Gharib City Council* Will the city of Ras Ghareb benefit from the energy produced from the project?	It was explained that the project allows for more sustainable development, and shows the government's commitment to achieving its energy strategy and meeting the goals set for renewable energy sources. The project will contribute to increasing energy security by relying on inexhaustible natural energy resources, and most importantly, they are independent sources. More importantly, it was explained that such benefits are not limited to Ras Gharib only, but it covers the

Issue	Questions and comments	Responses
		entire region.
Flood Risks	*Adel Abdul Hamid* *Director of Administrative Affairs Department, Ras Gharib City Council* Did the ESIA study focus on flood risk onsite?	It was explained that as part of the ESIA study, a preliminary flood risk assessment was undertaken that included review of secondary data, field investigations as well as consulting with the concerned departments of Ras Gharib City Authority to find out the current map of the flood paths in the project area. The assessment concludes that there are no flood risks onsite.
Associated facilities	*Mohamad Akmal* *New and Renewable Energy Authority NREA* Who is responsible for conducting the ESIA of the OHTLs from the project, to study in particular the impact of these lines on the bird's migration	It was explained that the ESIA did not include the OHTL given that key official information was not available or provided at the time of undertaking of the associated surveys and assessments as part of the ESIA (e.g., route, specifications number of towers, etc.). Therefore, a standalone ESIA was completed and provided.
Biodiversity	*Al Matwli Shahat* *Environmental Affairs Agency, the regional branch of the Red Sea* It is important to take into account the fauna and flora in the area and if there are any sensitive or important habitats, before starting construction work, especially with fluctuating rains	It was explained that as part of the ESIA, a biodiversity baseline assessment was undertaken (to include flora and fauna) based on desktop review and site survey. Results indicate that the project site is of low ecological importance and no major or sensitive habitats were observed and all recorded flora and fauna were in general considered common and typical for such habitats. In addition, it was further explained that another biodiversity survey will be undertaken in spring 2020 and results will be updated within the "Analysis and Assessment of the Potential Risks and Impacts on Habitats and the Biodiversity" report to be submitted at a later stage. Refer to Section 8.4 for additional details.
Land Use	*Al Matwli Shahat* *Environmental Affairs Agency, the regional branch of the Red Sea* The main roads should be taken into account in anticipation of future expansion plans for the area.	It was explained that the official plans for the Project area have been studied as part of the ESIA, and the results indicate that the official plans in the local unit in Ras Ghareb stipulate that the area has been allocated to the New and Renewable Energy Authority NREA to develop wind energy projects. The project does not conflict with any formal plan that has been prepared for the use of land by various government agencies, so the project will not have impacts on the official use of land. In addition, the ESIA identified some infrastructure and utility elements onsite and the ESIA also identified additional measures to be taken into account which include mainly that the Developer coordinate through NREA and EEAA with the concerned authorities to take into account within the design appropriate requirements to prevent impacts on the infrastructure elements recorded in the area. Refer to Section 8.2 for additional details.

As required by EEAA, in addition to the above session, the ESIA Consultant also communicated with the following key stakeholder groups in specific and provided them with a Non-Technical Summary (NTS) on

the ESIA and its outcomes. The objective was to also obtain any concerns, inquires or comments on the ESIA and the Project from such stakeholder groups in specific.

Table 5-6: Stakeholder Response for Additional Consultations Undertaken

Entity	Response
Ras Gharib City Council	No specific concerns, inquiries or comments were provided to date
Ras Ghareb Water and Wastewater Company	No specific concerns, inquiries or comments were provided to date
Environmental Management Unit – Ras Ghareb City Council	Stated that after review of all documentation provided, there are no comments or concerns to be taken into account as part of the ESIA study.
General Petroleum Company – Ras Gharib Office	Stated that after review of all documentation provided, there are no comments or concerns to be taken into account as part of the ESIA study.
Roads Management Unit – Ras Gharib City Council	No specific concerns, inquiries or comments were provided to date
Armed Forces – Ras Gharib	No specific concerns, inquiries or comments were provided to date
CBO representatives / Environmental Protection Association at Ras Ghareb	Stated that after review of all documentation provided, there are no comments or concerns to be taken into account as part of the ESIA study. However, stated that Project should consider social responsibility programs for Ras Ghareb city. This has been taken into account – refer to "Section 9.13" for additional details.

5.6 Future Stakeholder Engagement and Consultation

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.

In addition to the above, the Developer discloses on his website the ESIA, SEP and NTS at the link below:

ESIA DISCLOSURES - Red Sea Wind Energy S.A.E. (rswe.co)

6 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This chapter first provides an overview of the environmental clearance process for the Project as governed by the environmental legal requirements of the Egyptian Environmental Law 4 of 1994 amended by Law 9/2009 and its executive regulations No. 338 of 1995 modified by Prime Minister Decree no. 1741/ 2005, modified in 2011/2012 and 2015 as well as the EEAA Guidelines for Environmental Impact Assessment (EIA) issued 2009.

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.

6.1 Regulatory and Policy Framework at the National Level

6.1.1 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).

Other related national government & permitting authorities

Table 6-1: Other Related National Government & Permitting Authorities

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
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 in some parts of the project area and adjacent areas 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 Secure and support the project
Red Sea Governorate	The main role of the governorate is supporting the project by providing the various permissions needed, and infrastructure maps in case if needed.
Ras Gharib City Council	Give permits for any construction Provide maps of the floods in the area Supervision and follow-up from the Environmental Department in Ras Ghareb City Council during the construction phase. Coordinate with them to solid waste disposal through the construction contractors (In the case of contracting with them)
Water and wastewater Company in Ras Ghareb	Provide the project needs of water and wastewater disposal during the construction phase; through the construction contractors (In the case of contracting with them)
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
Manpower Directorate: Labour Office in Red Sea Governorate	Data of the labour force in Suez Governorate and complaints of workers Monitor labour recruitment standards during construction
Roads Directorate in Red Sea Governorate	Services and development of external roads in the governorate Issuing permits for any construction work on the external roads
Ministry of Interior	MI is responsible for national and local security, as well as approving emergency response and

	firefighting plans for establishments/projects
EEAA	Issues the Environmental approval for the project Monitors the compliance with the conditions of approval
Ministry of Electricity and Renewable Energy	The ministry of electricity is the responsible entity for the generation, transmission and distribution of electricity in Egypt, under which operates NREA, Egyptian Electricity Holding company and EETC
Ministry of Environment	The ministry of Environment is the entity responsible for the formulation of environmental policies. The preparation of necessary plans for environmental protection and environmental development projects and following up on the implementation of all of the above. Under the ministry, the EEAA and the Nature protection bureau operate.
Ministry of petroleum and mineral resources	The ministry of petroleum is the entity responsible for the supervision of the exploration, production, marketing and distribution of oil, gas and other natural resources
Ministry of Antiquities	The ministry of antiquities is the entity responsible for the preservation and protection of the heritage and ancient history of Egypt, under which operates all inspector offices in the governorates
Red Sea Governorate antiquities inspector offices	First contact in case of any chance finds during construction Responsible for protecting and managing antiquities in the area

6.1.2 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 including public scoping and consultation activities, in addition to a public disclosure with an Arabic executive summary.

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.

Upon submission of the ESIA report by the ESIA Practitioner to the CAA in charge of issuing licences, sends the EIA 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.

Furthermore, it is important to mention that specific legal requirements for wind park construction are defined in the Law No. 101/1996, Building Construction and Decree No. 326/1997.

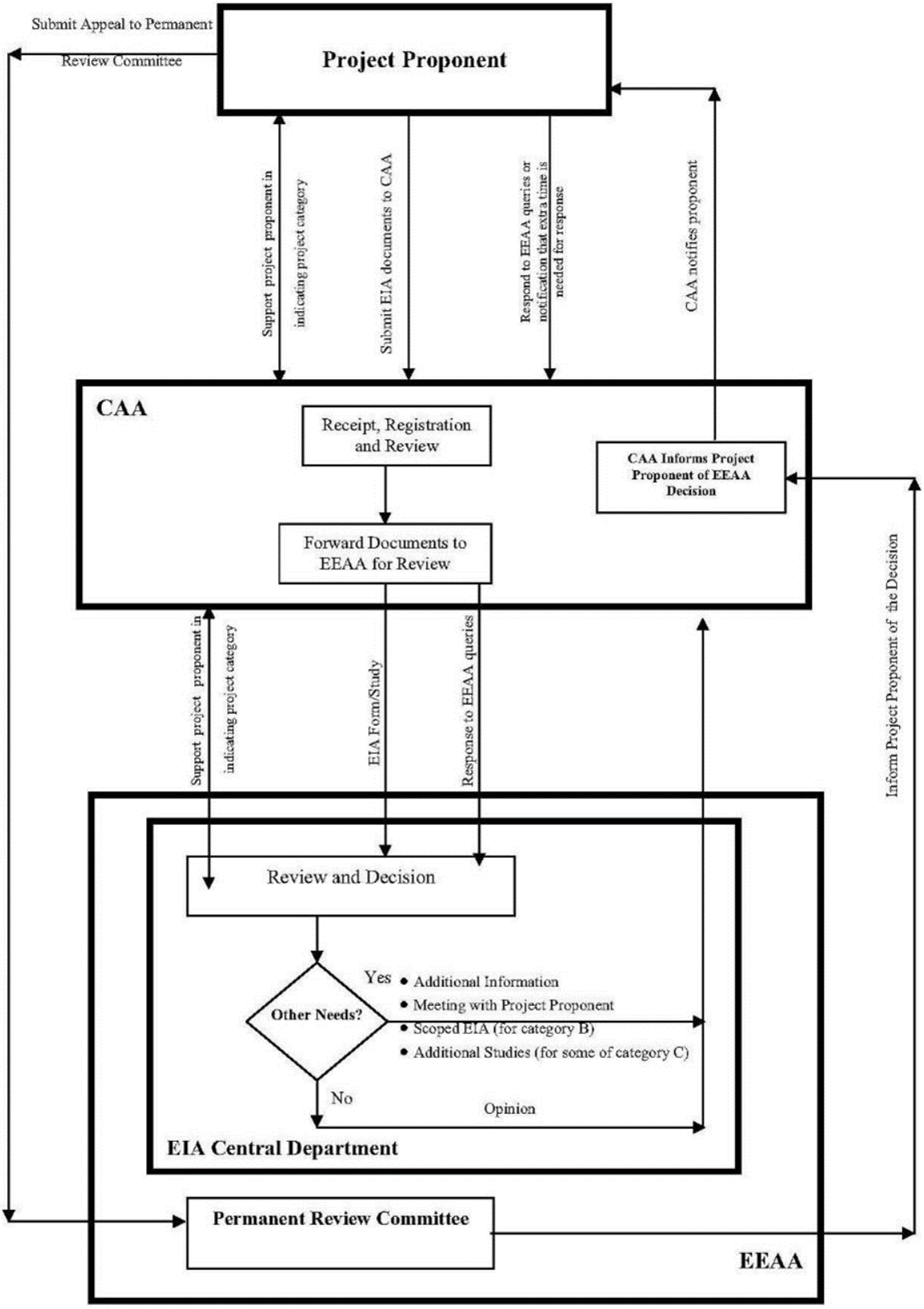


Figure 6-1: ESIA Process Followed for Development Projects in Egypt, (EEAA EIA Guidelines, 2010)

6.1.3 Egyptian Environmental and Social 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 6-2: 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 Regulations	▪ The establishment should maintain an environmental register in accordance with Annex 3 of the Executive 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 the conservation of Migratory Soaring Birds (MSB)	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.
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 and ER 710/2012	Article 42 of Law 4/1994 amended by Law 9/2009 Article 44 of ER 710/2012	▪ Maximum allowable limits for ambient noise intensity and maximum exposure duration
	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 air quality, noise, heat stress, and the provision of protective measures to workers.	▪ 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) ▪ 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.

6.1.4 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 6-3: Relevant international Conventions and agreements to which Egypt is a signatory

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

6.2 Requirements for Project Financing

6.2.1 Summary of Different IFI Environmental and Social Requirements

The IFI providing financing for the GOSII Project has not been identified yet. The ESIA Practitioner considered different IFIs and reviewed their environmental and social requirements. Summary of findings is provided in the table below.

Table 6-4: Summary of Different IFI Environmental and Social Requirements

European Bank for Reconstruction and Development (EBRD)
▪ In accordance with EBRD's 2014 Environmental and Social Policy, EBRD 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. ▪ 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 applicable EU Directives for this project are: - EU EIA Directive (Directive 2014/52/EU) - The Birds Directive (Directive 2009/147/EC) - The Habitats Directive (Directive 92/43/EC) - The Bern Convention (June 1979) - The Aarhus Convention (June 1998) ▪ The EBRD Performance Requirements applicable to this project are: - PR 1: Assessment and Management of Environmental and Social Impacts and Issues - PR 2: Labour and Working Conditions - PR 3: Resource Efficiency and Pollution Prevention and Control - PR 4: Health & Safety - PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement - PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources - PR 8: Cultural Heritage - PR 10: Information Disclosure and Stakeholder Engagement ▪ The EBRD developed a greenhouse gas (GHG) assessment methodology through which the GHG impact of any project is estimated. The principal objectives are to estimate the change in GHG impact that each project will have, and to demonstrate climate change mitigation benefits that a number of EBRD projects are designed to achieve. The environmental and social policy of the bank directs all clients to collect and report the data for GHG assessment of projects whose emissions might exceed 25 Kiloton of CO_2 equivalent/year. Projects that are expected to reduce GHG emission by less than 25 Kiloton of CO_2 equivalent/year may also be subject to a GHG assessment. (ref: EBRD protocol for assessment of greenhouse gas emissions) ▪ EBRD has also established The Green Economy Transition (GET) approach in 2015. The key goal of EBRD is to preserve and improve the environment, the GET approach seeks to increase the volume of green financing. The GET approach broadens the environmental dimension, emphasises innovation and makes selective use of public delivery channels to maximize. GET supports a wider range of projects whose purpose is to prevent pollution and mitigate the damage to ECO systems. The table below presents the main topics and environmental benefits of GET projects. (ref: https://www.ebrd.com/cs/Satellite?c=Content&cid=1395250237163&d=Mobile&pagename=EBRD%2FContent%2FContentLayout
World Bank (WB)
▪ The World Bank Environmental and Social Framework sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards that are designed to support Borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity. ▪ The World Bank Environmental and Social Policy for Investment Project Financing sets out the requirements that the Bank must follow regarding projects it supports through Investment Project Financing ▪ The Environmental and Social Standards set out the requirements for Borrowers relating to the identification and assessment of environmental and social risks and impacts associated with projects supported by the Bank through Investment Project Financing. ▪ The ten Environmental and Social Standards establish the standards that the Borrower and the project will meet through the project life cycle, as follows:

- Environmental and Social Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Environmental and Social Standard 2: Labour and Working Conditions;
- Environmental and Social Standard 3: Resource Efficiency and Pollution Prevention and Management;
- Environmental and Social Standard 4: Community Health and Safety;
- Environmental and Social Standard 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Environmental and Social Standard 8: Cultural Heritage; and
- Environmental and Social Standard 10: Stakeholder Engagement and Information Disclosure.

Japan International Cooperation Agency (JICA)

- JICA is an independent governmental agency that implements Official Development Assistance of Japan.
- JICA assists the economic and social growth of developing countries and promotes international cooperation through schemes including Technical Cooperation, Loan Aid, Grant Aid, Volunteer Programmes, and Emergency Disaster Relief.
- In 2010 JICA adopted a new set of guidelines for Environmental and Social Considerations (ESC Guidelines) to ensure that its assistance will lead to sustainable development.
- The basic principles behind the ESC Guidelines include the following:
  - ESC is a prerequisite for JICA's assistance
  - Respect human rights for inclusive development
  - Avoid adverse impacts
- The essential points of the ESC Guidelines include the following:
  - A wide range of impacts must be addressed including impacts on the environmental and on the society.
  - Participation of local stakeholders is crucial
  - Information on ESC must be disclosed to the public
- Standards and references
  - Host country's laws, standards, policies and plans
  - The World Bank's Safeguard Policies
  - Internationally accepted standards

European Investment Bank (EIB)

- EIB operates within and outside Europe as the financial arm of the EU. The bulk of its lending is directed towards projects in the Member States but projects elsewhere get considered so long as they align with the EU external cooperation policies, EU Sustainable Development Strategy, the Cotonou Agreement and the European Consensus on Development.
- EIB operations conform to the standards and principles defined by the EU E&S aspects.
- The EIB has adopted and developed an Environmental Statement in an effort to address its Corporate Responsibility by outlining the environmental and social requirements applied to the projects it finances.
- The Environmental Statement is the reference upon which projects are assessed and judged.
- These requirements are stipulated in the "EIB Environmental and Social Handbook", which covers the following:
  - Assessment and Management of Environmental and Social Impacts and Risks,
  - Pollution Prevention and Abatement,
  - EIB Standards on Biodiversity and Ecosystems,
  - EIB Climate-Related Standards,
  - Cultural Heritage,
  - Involuntary Resettlement,
  - Rights and Interests of Vulnerable Groups,
  - Labour Standards,
  - Occupational and Public Health, Safety and Security, and
  - Stakeholder Engagement.

International Finance Corporation (IFC)

- IFC requirements have become the de facto international environmental and social performance benchmark for project financing and are considered the most comprehensive requirements related to E&S assessments for wind projects.
- In general, other IFI institutions consider assessments undertaken according to IFC E&S requirements comprehensive and sufficient.
- For this reason, this ESIA follows the requirements of the IFC. Details about IFC stipulations are included below.

6.2.2 International Finance Corporation (IFC) Requirements and Performance Standards

ECO Consult was commissioned to prepare the ESIA for the Project in order to apply for the necessary environmental permit. This report is the ESIA report to be submitted to the EEAA. This ESIA is undertaken in accordance with the "Law No. 4 of 1994" and its amendments as well as other related national legislations.

In addition to national requirements, the international standards which are applicable to the Project include the "International Finance Corporation Policy on Social and Environmental Sustainability" (IFC, 2012) including the IFC Performance Standards (PS) and the Environmental, Health & Safety (EHS) Guidelines.

The "IFC Policy on Social and Environmental Sustainability" (IFC, 2012) sets out the environmental, health & safety and community requirements for projects financed by IFC. Through the implementation of the Equator Principles, IFC requirements have become the de facto international environmental and social performance benchmark for project financing.

IFC requirements are set out in its Performance Standards (PSs) of Social and Environmental Sustainability, which are summarized in the table below.

Table 6-5: Overview of IFC Performance Standards of Social and Environmental Sustainability

IFC Performance Standard	Key Points Relevant to the Project
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 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.

IFC Performance Standard	Key Points Relevant to the Project
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.

In addition, IFC has produced a comprehensive range of Environment, Health & Safety (EHS) Guidelines. Not only is there a General EHS Guideline document, but there is also sector-specific EHS guideline document for Wind Energy.

This EHS guidance document provides detailed management and technical recommendations with regards to Industry-Specific Impacts and Management (Environmental performance; Occupational health and safety; and Community health and safety) and Performance Indicators and Monitoring (Environmental performance; and Occupational health and safety). A summary of the relevant guidelines to this project includes the following:

- *General EHS Guidelines (IFC, 2007)*: Provide common guidance's and information to users on EHS issues that are potentially applicable to all industry sectors; and
- *EHS Guidelines for Wind Energy (IFC, 2015):* Provide guidance's and information to users on EHS issues related to onshore and offshore wind energy facilities. The Guideline provides a summary of EHS impacts associated with wind energy facilities along with recommendations for their management as well as performance indicators and monitoring programs for environmental, occupational health and safety and community health and safety. Where relevant, the requirements of this guideline are reiterated clearly in subsequent chapters that discuss the environmental attributes they relate to where national legislations are not available.
- *EHS Guidelines for Electric Power Transmission and Distribution (2007):* Provides information relevant to power transmission between a generation facility (Wind Farm in this case) and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas. The Guideline provides a summary of EHS impacts associated with the OHTL connecting the Wind farm with the closest substation and recommendations for their management as well as performance indicators and monitoring programs for environmental, occupational health and safety and community health and safety. Where relevant, the requirements of this guideline are reiterated clearly in subsequent chapters that discuss the environmental attributes they relate to where national legislations are not available.

Where the IFC are investors in a project, as part of their review of environmental and social risks and impacts of a proposed investment, they use a process of environmental and social categorisation. The same categorisation is also applied under Equator Principles (EP) III (June 2013) by Equator Principle Financial Institutions (EPFIs). The category also specifies IFC's institutional requirements for disclosure in accordance with IFC's Access to Information Policy.

7 ANALYSIS OF ALTERNATIVES

7.1 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 with only sparse vegetation being considered to be of limited ecological relevance;
- 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.

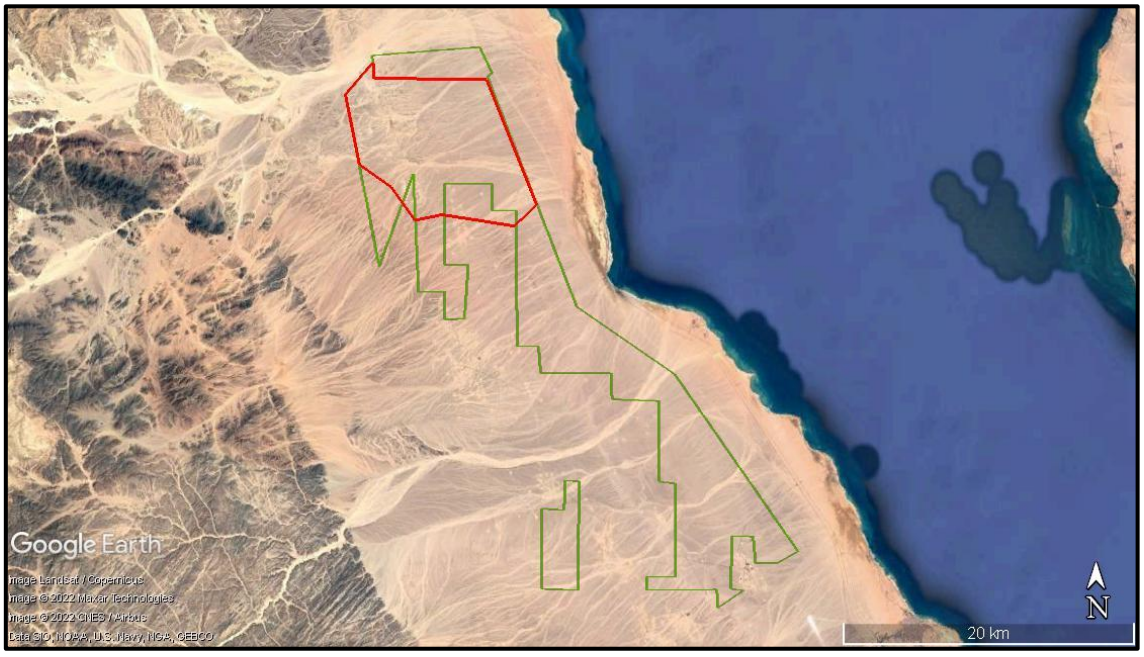


Figure 7-1: Project Site (Red) as Part of the 284km2 Area Allocated for Wind Farm Developments

7.2 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.

7.2.1 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 1,220km^2 in the GoS for wind development projects.

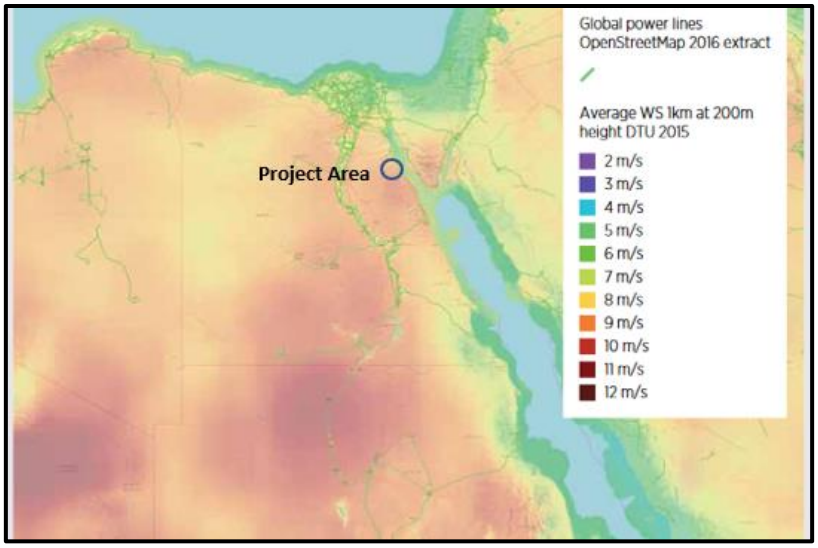


Figure 7-2: Egypt's Wind Atlas (Source: IRENA, 2018)

7.2.2 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.

7.3 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 with the exception of recommendation for birds as discussed in further detail below.

The SESA recommends that to efficiently reduce potential barrier effects of multiple wind farms in the 284km^2 area, sufficient space is maintained between wind farms to enable large soaring birds to safely migrate over the coastal desert plains and continue migration during spring and autumn time and seasons (known as bird corridors). Therefore, within the Project site, the SESA recommends avoiding installing turbines within the allocated areas presented in red in the figure below (where a buffer distance of at least 1.6km is maintained between each plot) and also requires that at least a 1km buffer is maintained between the rows of turbines within each plot.

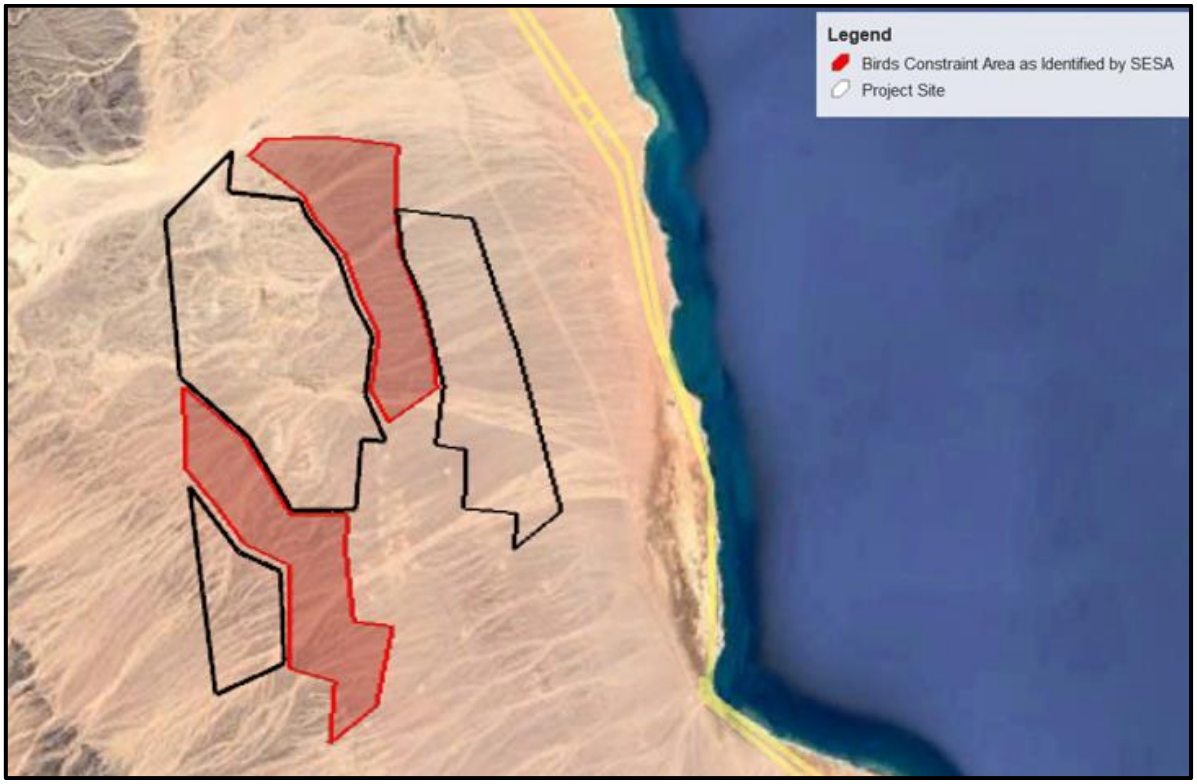


Figure 7-3: Bird Constraint Areas as Identified in the SESA

Note: the figure above presents the previous Project boundary in black. The current final boundary mainly includes the 2 plots to the east as presented in the figure below.

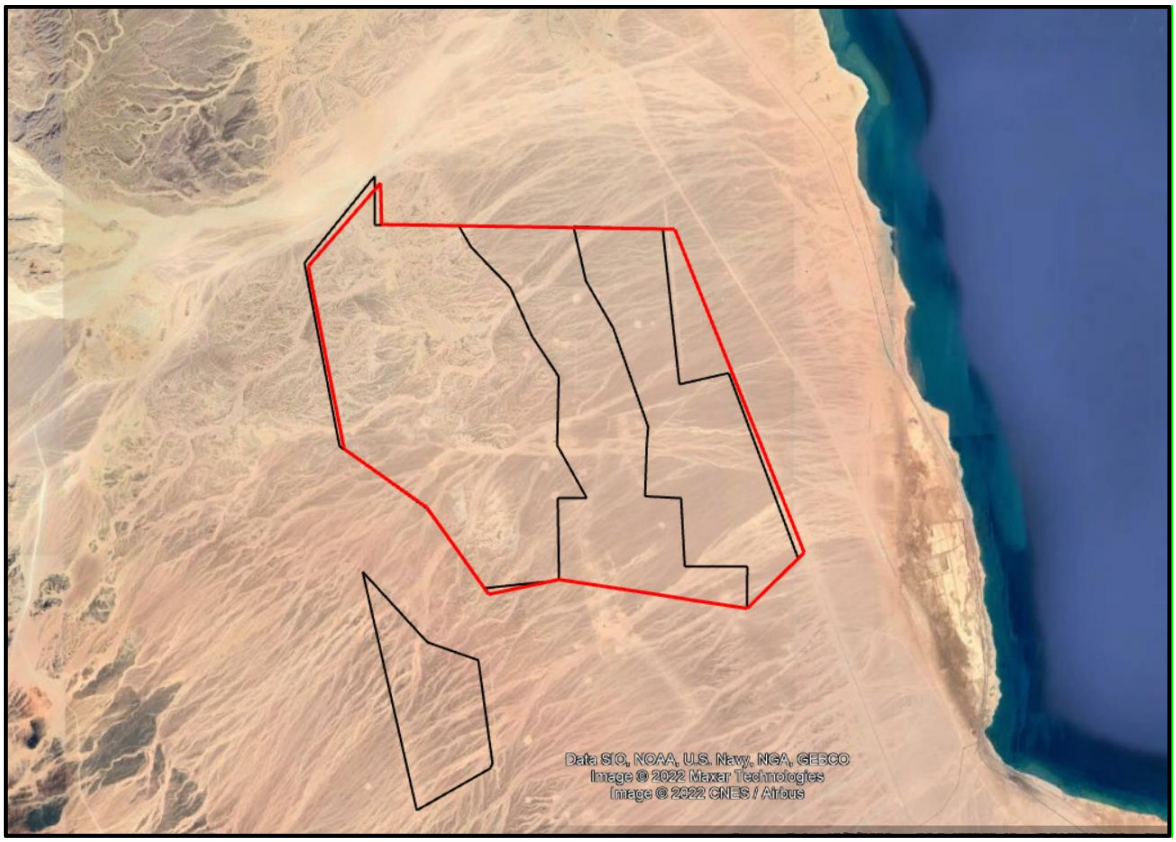


Figure 7-4: Previous and Current Project Boundary

However, throughout the public disclosure session (as discussed previously in 'Section 5.5.2'), EEAA raised a concern *on a previous layout for the Project* (which was the selected layout that was applicable at that time), stating that the turbines were not following straight lines and were not always laid out in parallel lines. This issue is believed to provides challenges which could raise the risk of collision of migratory soaring birds with turbines. Firstly, this could cause confusion for on-site observers who apply the shutdown-on-demand and could cause delays or even mistakes in shutdown orders which could eventually lead to shutdown of the wrong turbines and therefore could cause collisions of birds with operating turbines. Secondly, it could cause a higher rate of collision for migratory soaring birds as some of the turbines in the layout that are not located in the parallel lines could provide a physical barrier for the birds. Therefore, EEAA required that the layout be revised to take such challenges into account.

Based on the above, the Developer prepared another layout in 2020 which took such considerations into account. The layout met the SESA recommendations of: (i) avoiding installation of turbines within the allocated red areas and maintaining a buffer distance of at least 1.6km between each plot (where based on the adjusted layout the closest and minimal distance between the turbines in such buffer areas is 2km as provided in the figure below); and (ii) avoiding a buffer distance of 1km between the rows of turbines within each plot (where based on the adjusted layout the closest and minimal distance between the row of turbines is 1.3km as provided in the figure below). In addition, the layout also ensured that all turbines are following straight lines.

However, to accommodate the above, the Developer had to add a small triangular area when compared to the initial preliminary layout presented earlier (check triangle in red in figure below). The area still lies within and is considered part of the SESA 284km^2 area and this was agreed and approved by NREA and EETC. It is important to note that this area in specific was also included in all E&S baseline studies undertaken as noted earlier in "Section 4.3". The figure that follows presents the final layout along with the small area that was added which now presents the final project and turbine layout as presented earlier in "Chapter 3".

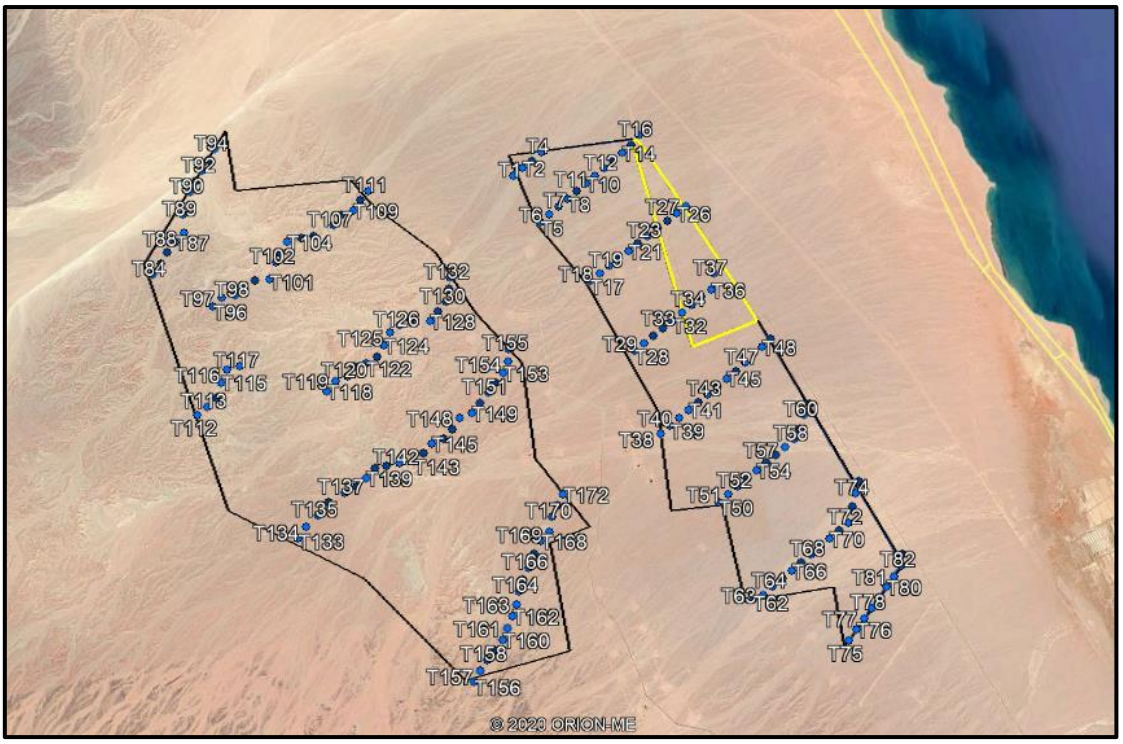


Figure 7-5: Project Layout used for the original Environmental Permit from 2020

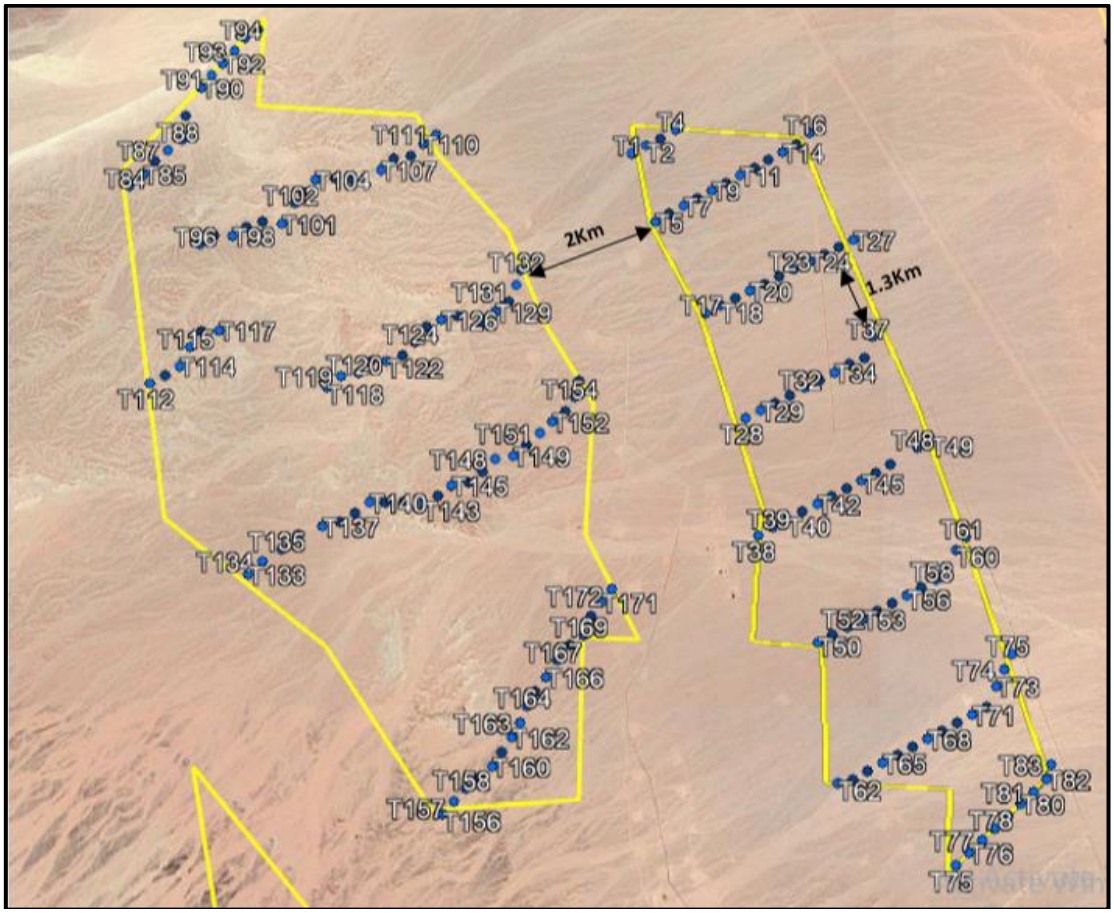


Figure 7-6: Previous Project Layout and SESA Requirements

Updates from 2020 to 2022

The above alternatives were considered in 2020 when at that time turbine specification and layout was different to the current one presented in "Section 3.2". In 2020, the turbines considered within the ESIA were a total of 173 turbines with a rated power of 2.9MW per turbine and a tip height of 120m. The layout considered is that presented above in Figure 7-4 and 7-5.

However, as noted earlier in "Section 3.2", in July 2022 new governmental approvals have been issued allowing an increase in tip height up until 220m, where previously due to various governmental restrictions the allowed tip height was set at 120m (as noted above). Based on that, all wind farm developers within the GoS are currently assessing installing such bigger turbines (including the RSWE).

Therefore, the Developer has opted at this point for the selection of new turbine characteristics (with a total of 84 turbines and a rated power of 6MW per turbine and a tip height of 180m) for technical and economical/financial reasons which include the following:

- The previously selected technology did not allow the Project to be financially viable or feasible, given in particular the reduction in the Power Purchase Agreement (PPA) tariff in 2020, and very strong increases in both the cost of the turbines and the cost of the financing over the course of 2020, 2021 and 2022.
- The increase in the tip height restriction from 120 to 220 meters in 2022 allowed for the selection of a new technology (as per specifications in *"Section 3.2"*). The higher tip height and higher unitary capacity allows for economies of scale to be unlocked, i.e., lower overall investment cost and lower overall operational costs. The new technology also allows for a significantly higher annual production.

In addition, the final layout developed by RSWE (as presented in *"Section 3.2"*) also places turbines within the SESA recommended areas to be avoided as bird corridors as presented in the figure below (the eastern

bird corridor only). The Developer has considered such an area mainly due to its higher wind speeds and a less complex topography than the western parts of the entire Project area which allows for a significant increase in the annual production and reduction of construction cost.

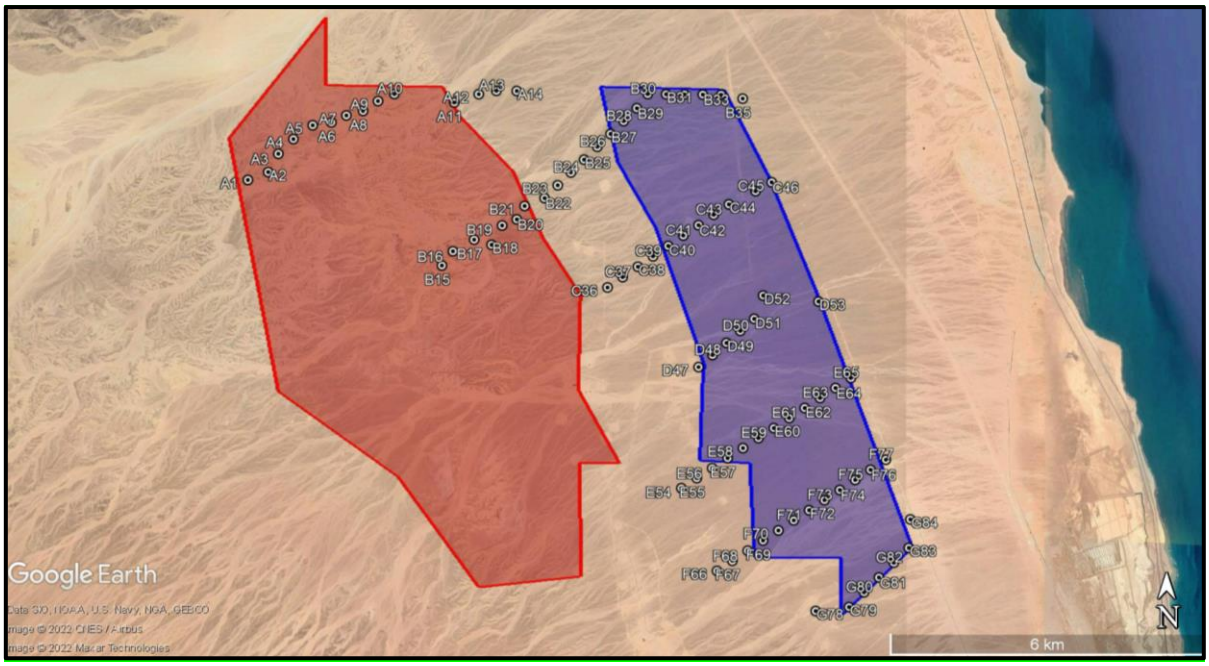


Figure 7-7: Final Layout which occupies Eastern Bird Corridor of SESA

To take into account such an issue, as part of the ESIA an analysis was undertaken for the potential effect of utilizing such bird corridor and its overall impacts on avifauna in specific. This analysis is presented in "Section 9.6.2".

Such as an assessment was also presented in detail through a workshop arranged by RCREEE and attended by EEAA, EETC and NREA. EEAA in principle approved such an analysis and the placement of turbines within the eastern bird corridor given that the new layout has fewer turbines that are concentrated within the eastern parts of the site (when compared to the previous layout). This allows for adding this eastern bird corridor to the western corridor (i.e., making it much wider and bigger which will give an advantage to the migrating birds to escape within the area).

The above is expected to be formally approved by EEAA once this updated ESIA is submitted for review and approval.

Apart from the above, no additional site-specific constraints have been identified in the SESA. 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.

7.4 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 10”. 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 realising 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 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.

8 EXISTING PHYSICAL, BIOLOGICAL, AND SOCIAL ENVIRONMENT

8.1 Landscape and Visual

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

8.1.1 Baseline Assessment Methodology

A site assessment was undertaken to characterize the general landscape and topography characteristics of the Project site. In addition, the site assessment also focused on identifying any key critical visual receptors within the Project site and a 2km radius from the area. Moreover, based on desktop review and consultations with relevant stakeholders (to include Ras Ghareb Local Governmental Unit 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.

Such distance (15km radius) was taken into account, given that 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 8-1: 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

8.1.2 Results

Landscape and Topography

Based on the site assessment, in terms of landscape and topography characteristics, the Project site can be divided into three (3) distinctive zones as presented in the figure below.

Zone 1 is can be classified as a desert area with soil that is formed from sand and rocks. In addition, this area is characterised of being composed of relatively small hills. Zone 2 can be classified as a desert area with higher rock coverage, larger flat areas, and larger Wadi systems and in addition hills located are also considered much bigger than those in Zone 1. Finally, Zone 3 is classified as a flat desert area with very small elevation differences.

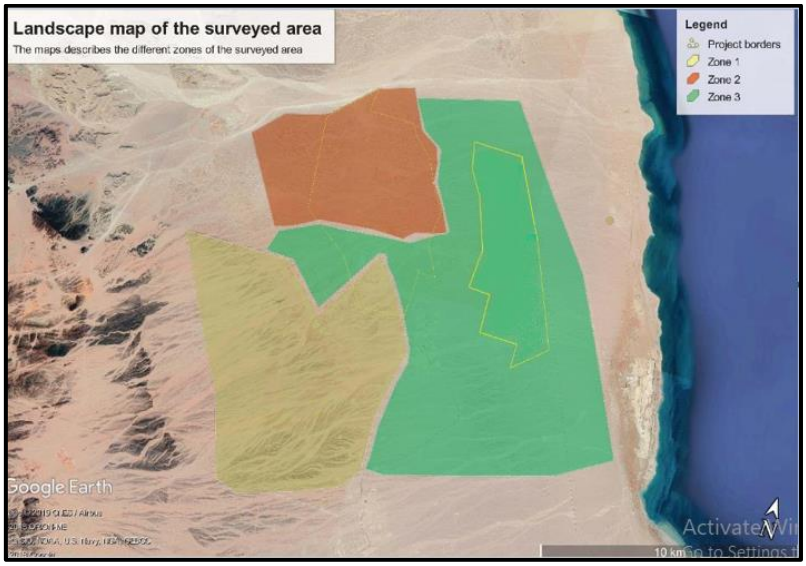


Figure 8-1: Landscape Characteristics of the Project Site

Figure 8-2: Typical Landscape of Zone 1

Figure 8-3: Typical Landscape of Zone 2

Figure 8-4: Typical Landscape of Zone 3

Visual

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 2km radius, no critical visual receptors were identified. The only facilities located include a petroleum storage facility as well as several oil rigs as discussed in further detail in "Section 8.2.3" below.

In addition, based on the literature review and consultations, no critical visual receptors were identified within the 15km radius. There are several receptors located within the 15km radius as identified further in "Section 8.2.3" however those do not classify as key visual receptors. This includes an Air Force Defence Unit, several petroleum facilities and oil rig stations, other wind farm development projects, etc.

Other key critical visual receptors are located at a distance from the Project area. This includes for example: (i) closest community settlement (Ras Ghareb town located 40km to the southeast and Zaafarana village located 45km to the north); (ii) closest key archaeology/cultural heritage site (Monastery of Paul located around 20km to north), (iii) key biodiversity areas (Gabal El Zeit Important Bird Area located 20 km to south); and (iv) a touristic resort located 17km to the north.

8.2 Land Use

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

8.2.1 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.

Understanding and characterising the informal or 'actual' land use of the Project site was mainly based on a detailed land use survey for the Project site and a 2km 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.). In addition, consultations were undertaken with relevant stakeholders to further understand any informal or 'actual' land use practices as identified throughout this Chapter.

8.2.2 Formal Land Use

(i) Formal Land Use Plan for Ras Ghareb

Consultations were undertaken with the Ras Ghareb Local Unit 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 current planning it has been allocated to NREA for the development of wind farm projects (as discussed earlier in "Section 7.1").

A land use plan has been prepared for the area based on available information through secondary data review. As noted in the figure below, the clusters (1-5) represent the wind farm plots that are being allocated to various developers by NREA (with Cluster 1 representing the Project site in specific). In addition, as noted there are petroleum mining blocks (represented in yellow) that are operated mostly by the General Petroleum Company. As discussed in further detail below, there has been a "Work Coordination Agreement" signed between NREA and the General Petroleum Company for the area.

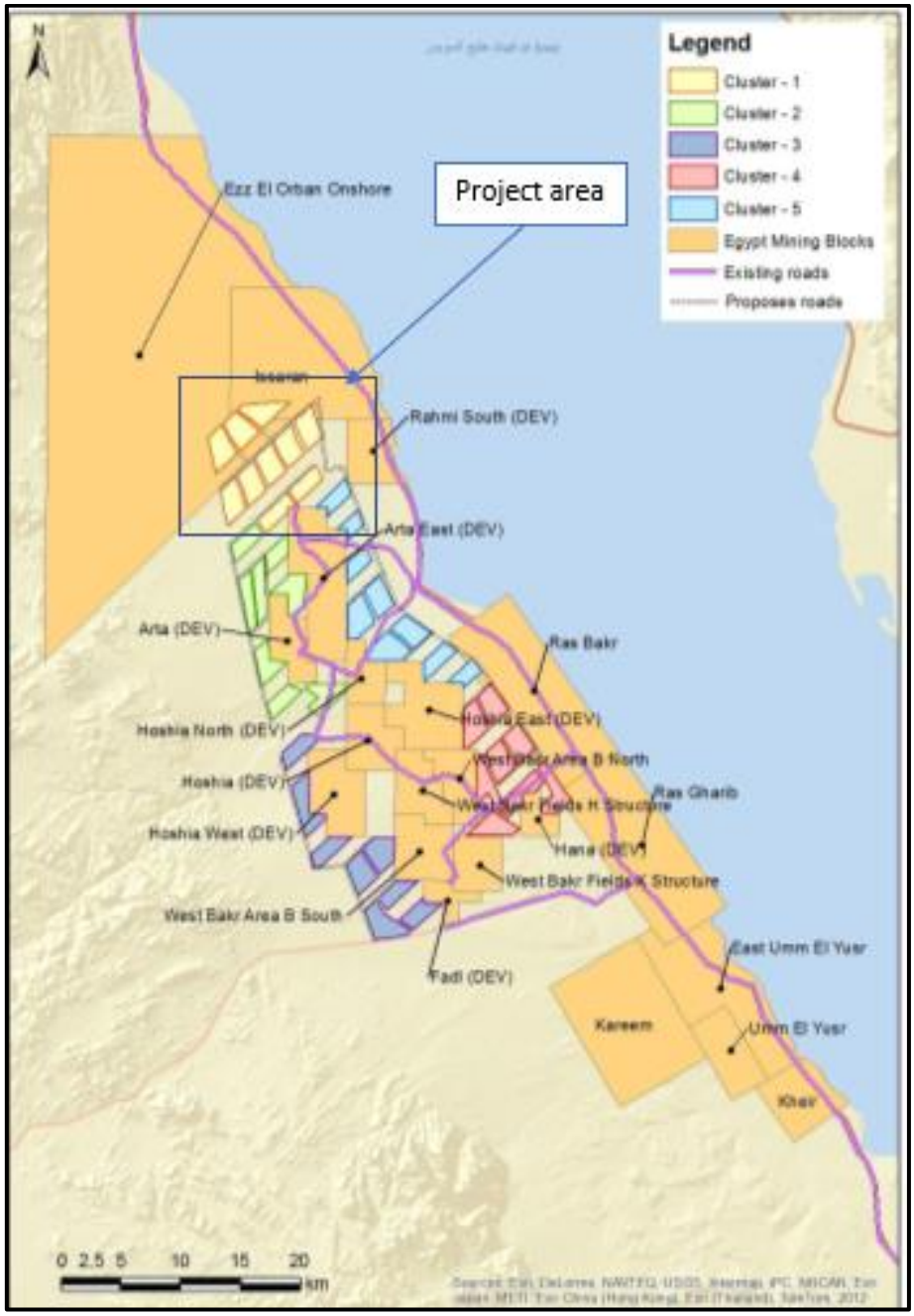


Figure 8-5: Land Use Plan Set for the Project Area

(ii) <u>Areas of Critical Environmental Concern</u>

Planning for areas of critical environmental concern is under the responsibility of the EEAA and this includes Important Bird Areas (IBAs) and natural protectorates.

The Project site is not located within or near any IBAs. 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 approximately 20 km away from the southernmost part of the site as presented in the figure below.

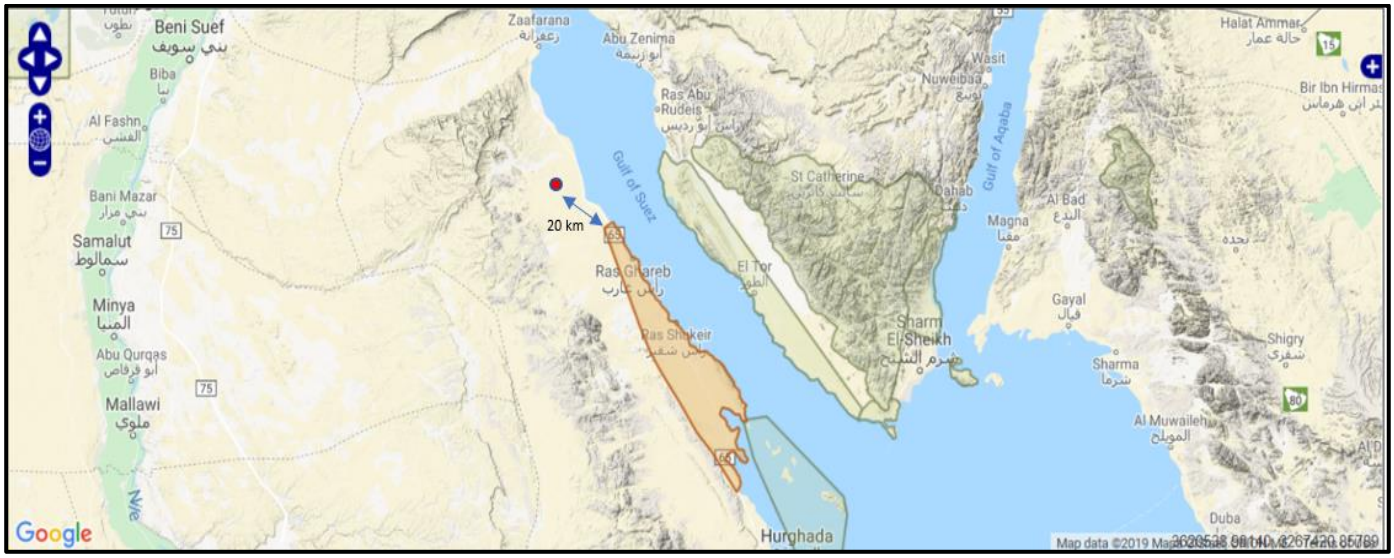


Figure 8-6: Gabal El Zeit IBA

In addition, the EEAA's nature protection team published in 2013 the map for all current and future natural protectorates, which is presented below. As noted, the Project location is not located within any existing or planned natural protectorates, where the closest is 80km away to include the planned natural protectorate at Ras Shukeir.

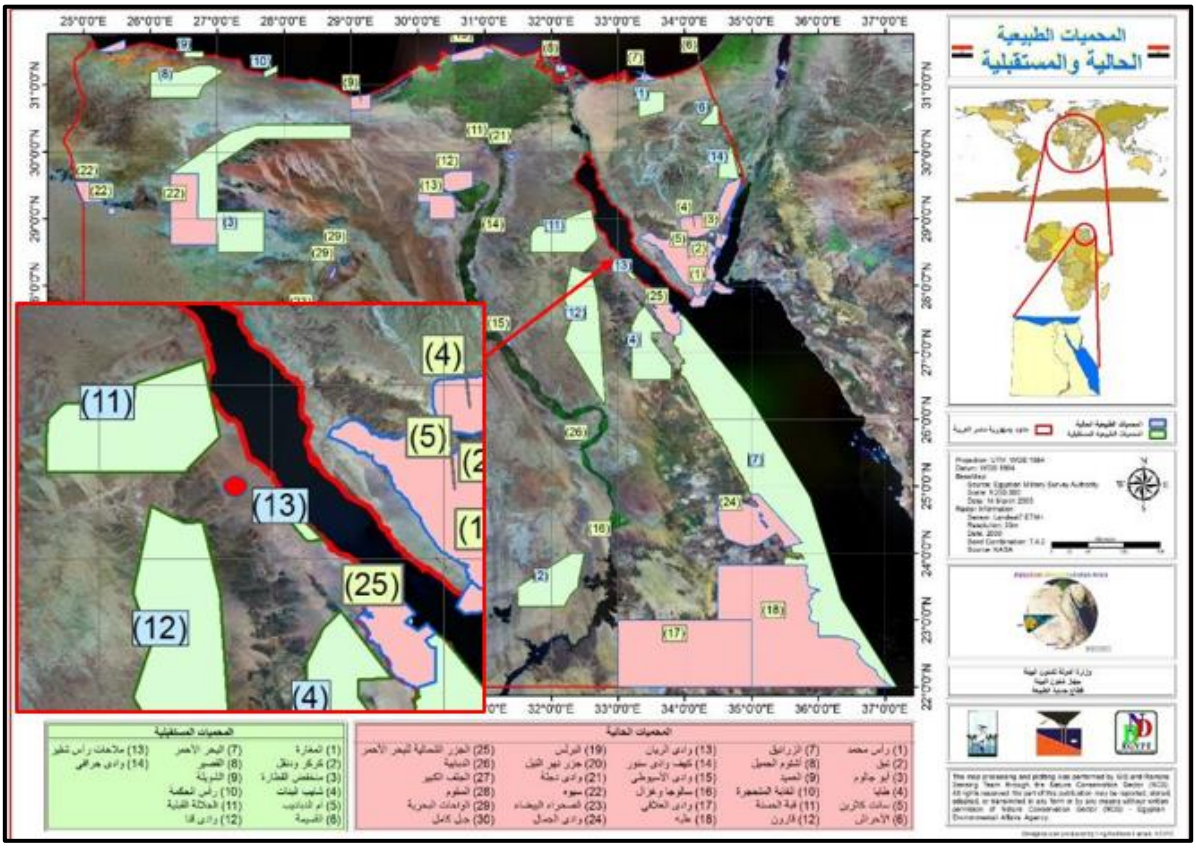


Figure 8-7: Map of EEAA Current and Future Natural Protectorates

8.2.3 Actual Land Use

As discussed earlier, a detailed land use survey was undertaken for the Project site and a 2km 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 above, the only land use activity noted within the Project site and 2km radius include the following which are also presented in the figure that follows:

- An existing petroleum storage facility located within the eastern part of the western plot of the Project site (refer to figure below). This facility includes: (i) 3 open and lined lagoons for petroleum and a pumping station; (ii) the pumping station supplies the petroleum to 5 storage tanks; (iii) tankers transport the petroleum to refineries located further away on the coast; and (iv) 1 caravan that is used when needed for rest by 4-6 workers that are onsite to fill up the tankers and monitor the storage tanks. The facility does not include any housing or accommodation structures. Another petroleum storage facility is also located around 2km south of the western plot of the Project site.
- 1 oil rig located within the eastern part of the western plot of the Project site (refer to figure below). In addition, there are around 4 oil rig stations that are located outside of the Project boundary between the western and eastern Project plots. These facilities do not include any offices or housing/accommodation structures and are mainly involved in pumping of petroleum.

Figure 8-8: Petroleum Storage Facility

Figure 8-9: Oil Rig

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 2km radius.

In addition, land use activities in the area in general were also investigated based on review of secondary data available. Key activities noted include the following as presented in the figure below:

- Air Force Defence Unit located around 3.4km to the east. 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.
- Several existing petroleum activities mainly located to the north and east, closest of which is around 4.6km to the north. These activities include oil storage, transportation and oil rigs.

- Other oil rig stations (around 5) located around 3.5km to the south.
- Touristic resort located at around 17km to the north
- Sand quarry sites located around 20km from the Project site to the west
- Other wind farm projects.

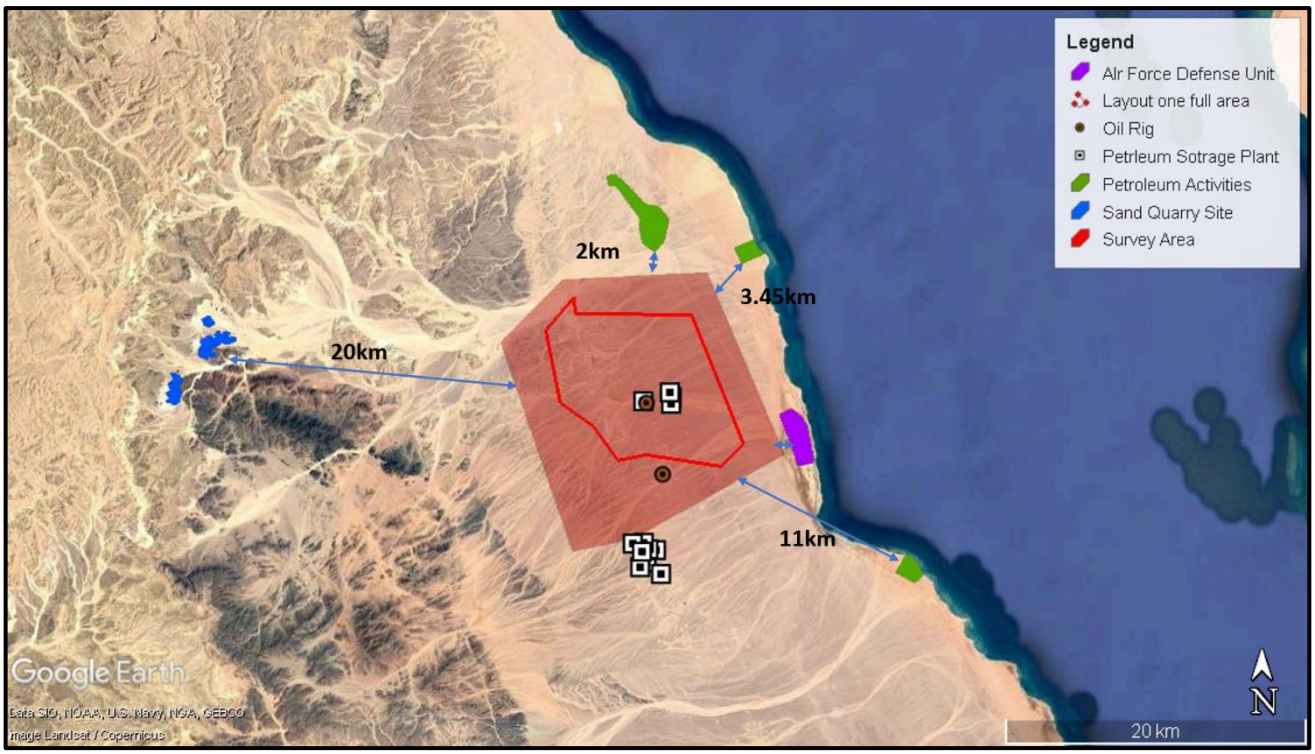


Figure 8-10: Land Use Activities within the Project Area and Surroundings

In addition, consultations were undertaken with key target groups and review of available secondary data to verify and further investigate any land use activities onsite.

Land Ownership

As discussed earlier, 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, this includes an area of 1,220 km^2 in the 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.

Ras Ghareb Local Unit and Red Sea Governorate

Based discussed earlier, consultations were undertaken with Ras Ghareb Local Unit and the Red Sea Governorate. Consultations indicated that as discussed earlier, the formal land use planning for the area includes wind farm developments through lands that have been allocated to NREA as well as oil exploration and production activities undertaken mostly by the General Petroleum Company. Based on such consultations there are no other formal or informal land use rights or activities in the Project area.

Consultation activities were conducted with the head of Ras Ghareb City Council, PR, and the Director of the Information Centre at the Ras Ghareb Local Unit and with the Director of the Investment Department, the General Secretary of the Governorate and the Director of the Engineering Department.

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 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.

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 considered illegal and which is 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 (EcoConServ Environmental Solutions, October 2018).

In order to avoid conflicts with Bedouins, companies involved in developmental projects over lands claimed by Bedouins always try to get into certain arrangements with the tribes. Therefore, they will need to be compensated by the project owner to satisfy their custom "**Ghafra system**" which involves paying an amount of money to the Bedouins in exchange for their support in implementing their projects and providing security and protection. 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) (EcoConServ Environmental Solutions, October 2018).

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

- Currently, there are no Bedouin families currently residing at or near the Project site. Such Bedouin families currently settle in Ras Gharib town, Zaafarana, Wadi Dara. In the past there were some Bedouin communities in the area that have left since the beginning of the oil exploration activities in the area since 1938.
- 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 Contractors and a representative of these Bedouin families.
- Bedouin tribes follow *Al-Ghafra* system when it comes to land ownership. Therefore, the positive or negative position of the Bedouin families depends on how aware the Project owner is of *Al-Ghafra* system, and other aspects of Bedouin culture. The project owner's understanding of Bedouin culture plays a major role in regulating the relationship between them and the tribes in the region.

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 (including the Project site). 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 agreement provides the allowed specifications and depths for foundations, cables, substation, roads, 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 following provisions will be ensured and met for any well drilling or survey activities: (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 info for all infrastructure elements above and underground (e.g., cables, roads, etc.)
- Identifies areas where no wind farm development projects are allowed
- NREA will inform the General Petroleum Company before commencement of any activity of any wind farm development in the area

8.3 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.

8.3.1 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.

8.3.2 Geology

The figure below presents the geological formation within the Project site and surrounding areas which are represented by various lithologic associations ranging in age from Late Palaeozoic to Quaternary.

As shown in the figure below, the rock units that could be exposed in the Project location are mainly Quaternary deposits. The Quaternary deposits cover almost all the area of the project site. These deposits are formed of sand, gravel, clay, aeolian sand sheets and sand accumulations. They are mainly composed of clastic sediments of different textures ranging from silt to boulder 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. As the exposed rocks in the north and north-west directions (the southern part of north Galala plateau) are sedimentary and mainly of carbonates rich in chert bands (Eocene limestone) and evaporates, their withered products are light in colour rich in lime mud, chert nodules, limestone and dolomite fragments. But in the southern direction with the occurrence of the igneous rocks of the Red Sea Mountain range in the far west, which consists

mainly of granitic rocks rich in feldspars reddish in colour. The soil cover in this region is predominantly reddish as it consists of the weathered products of and fragments of granites.

The Quaternary sediments are the main cover of the project area on which all construction works will be built. 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.

The soil covering most of the area of the project site is in the form of chains of alluvium terraces. The terraces differ in their height from the floor of the wadi in addition to the type and size of their components. The terraces near the highlands in the north and west are located at higher altitudes, and the components are very close to those in the source and are large in size.

In terms of subsurface geological formations, the subsurface layers covering the Project site consists of varying thickness of depositional cycles of conglomerates, sand, silts and clay. The size of the components determines the intensity of the sediment carrier (water flow) where the thickness of the layer indicates the period of the depositional storm. The subsurface layers are described as follows:

- Valley deposits: a layer of reddish brown, silty, sandy clay with some carbonate fragments and chert gravelly size. The layer extends from the ground surface down to a depth ranging between 0.5 and 2 m below the ground surface.
- Claystone: a reddish-brown claystone or claystone and sandstone layer with hard silty clay intercalations. The claystone contained a lens of silty sand with cemented sand pieces.
- Sandstone: a brown to reddish-brown or brown sandstone layer with cemented sand pieces and/or silty clay intercalations. The sandstone layer was encountered at a depth varying between 1.00 and 3.5 m below the ground surface.
- Conglomerate: this layer is almost present at the base of each cycle. It is composed of a mixture of coarse-grained gravels to bolder size fragments of the country rocks with chert nodules impeded in a matrix of fine grain sand and clay. These layers vary in thickness from 0.5 m to more than 3 m especially at the west.

Finally, there are no active faults in the area of the project. However, some faults with a North-West to South-East trend appear in the area between Quseir and Ras Ghareb.

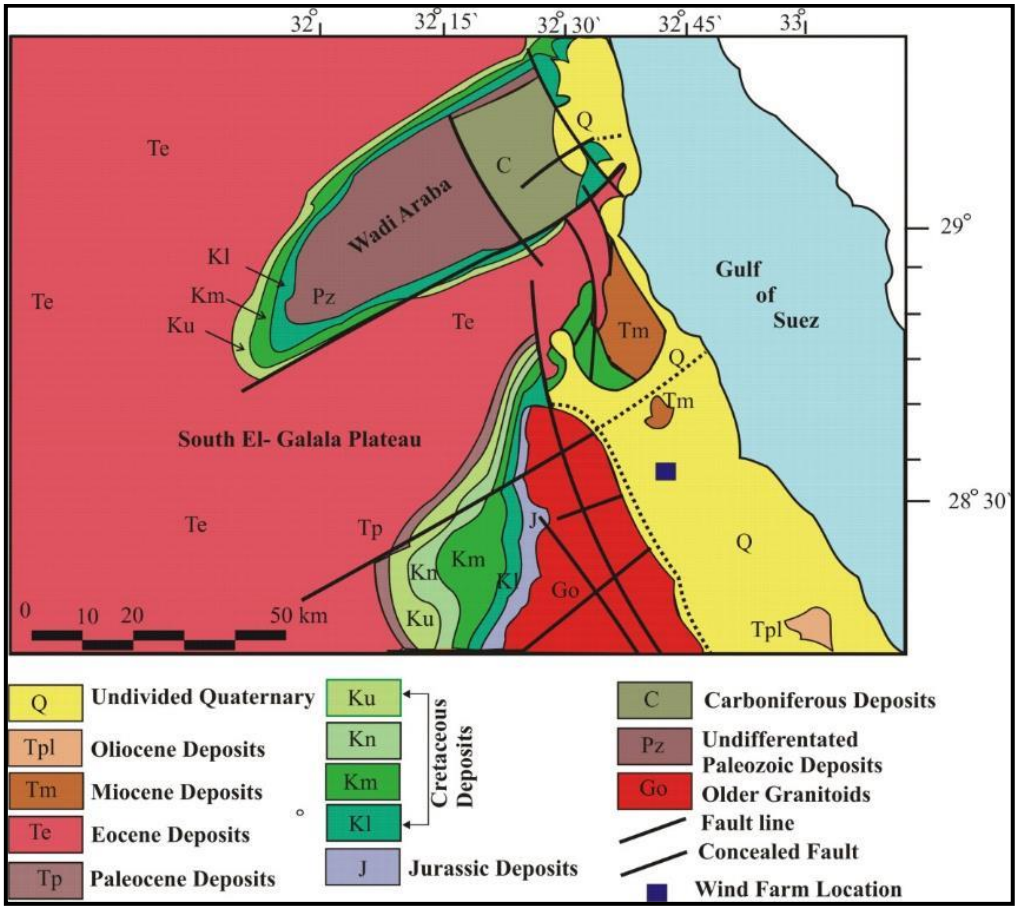


Figure 8-11: Regional Geologic Map of the Area (Modified from the Egyptian Geological Survey and Mining Authority, 1981)

8.3.3 Hydrology

The key major Wadi systems in the area include Wadi Aldahal located around 3km to the Project site and Wadi Hawashiya located around 12 km to the south of the Project site. The physiographic features of the area that includes the location of the wind farm and the surroundings could be differentiated into high, medium and low relief units as noted in the figure and described further below.

- Low Relief Unit (in which Project site is located). This unit consists of thick loose deposits and extends parallel to the shore line of the GoS. Elevation ranges from shoreline to about 350m above sea level (A.S.L) and extends from the hillslope towards the GoS at the east by a distance of about 30 km. This unit is characterised by gentle or very gentle slope toward the GoS with an average slope of about 1% traversed by numerous wide and shallow drainage lines.

  There are many different geomorphic features that characterize this coastal plain such as, numerous wide and shallow drainage lines, vague alluvial fans, sabkhas and beaches. The tidal channels are very shallow and have a straight pattern. The sabkhas lies in the low land area near the GoS and completely out of the Project site. The most important notes in this unit are the numerous traversed drainage lines with very wide and shallow courses with limited extension and malformation of the tributaries' alluvial fans. This means that the quantity of rain water drained toward south and southeast is too limited. This is because the regional slope of the south Galala plateau is towards the east-southeast, so the main direction of surface flow is toward Wadi Aldahal to the north of the site, which means that no strong surface flow and low elevation of the western and north-western highs leads to accumulation of big quantity of sediments downhill forming alluvial fans.

- Medium relief unit; this unit extends from the scarp of the plateau toward the Gulf in the east and southeast direction with a distance of about 10 km and a surface ranging from 350 to 800 m A.S.L. The unit is gently curving, or straight (rectilinear) part of a hillslope, possibly interrupted or replaced by

cliffs, composed of cretaceous rocks. This unit is characterized by the presence of many small, shallow and wide tributaries that drain the plateau scarp towards Wadi Aldahal and wadi Hawashiya to the north and south of the Project location, respectively. This unit is located away from the site borders by a distance from 10 to 15 km in the north, North-West and west directions. This unit is characterized by the presence of simple heights (low elevated hills) which are spaced from each other through dry and shallow wadies. The average slope gradient of this unit is about 2% toward the Gulf of Suez.

- High relief unit: is located in the northwest at a highly elevated plateau with slightly rough topography of resistant Eocene limestone (south Galala Plateau) and its southern scarp is facing the project from the northwest direction. The surface elevation of this unit is above 800 A.S.L. The average slope gradient of this unit is about 7.5%. This unit is located at a distance of more than 30 km from the northern and western borders of the site.

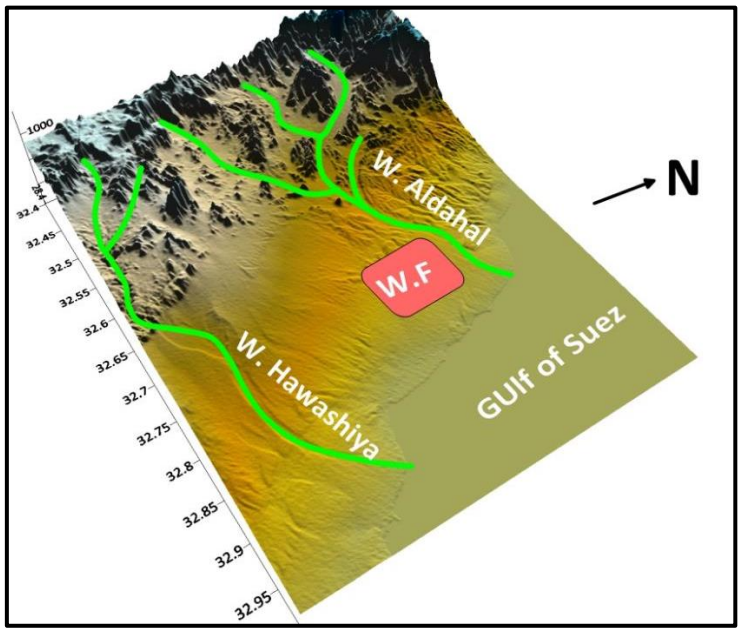


Figure 8-12: Key and Major Wadi Systems in the Area

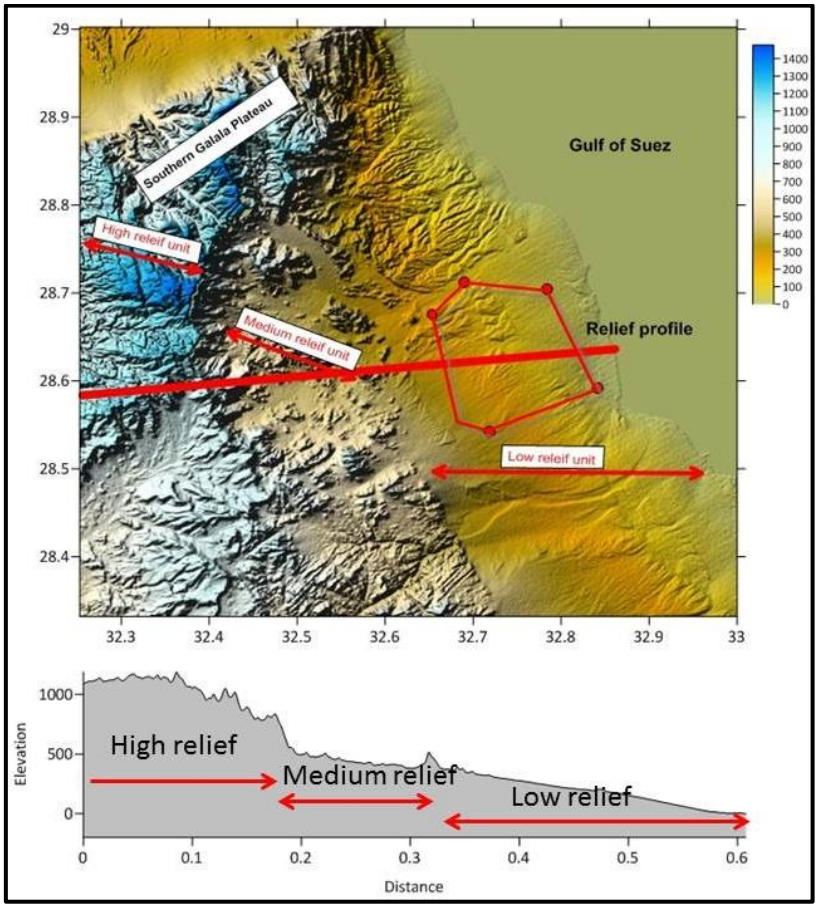


Figure 8-13: Relief Units of the Project Site and Surrounding Areas

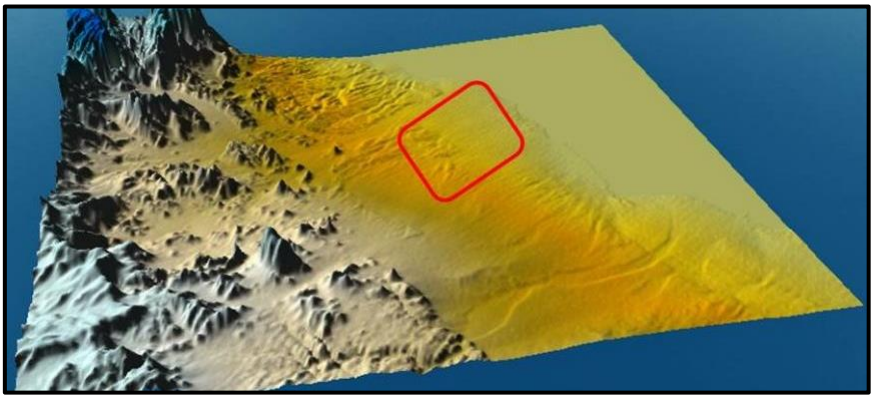


Figure 8-14: 3D Elevation Model of the Project Area and its Surrounding

Based on the above and investigating the Project site further through series of site visits, indicates that the area can be characterized as follows:

- 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.
- No drainage lines or tributaries originating from the south Galala plateau are crossing the Project site where the closest is Wadi Aldahal that runs completely out of the site at the north. In addition, the Project site is located outside of the other key drainage lines – Wadi Hawashiye located around 12km to the south
- The main drainage lines traversing the project site are very weak, shallow and the surface signs of their existence disappears towards the GoS (as presented in the figure below)

- A complete absence of strong and well-developed geomorphic features like deep wadis, depressions, steep slope scarps, conspicuous hill heights.

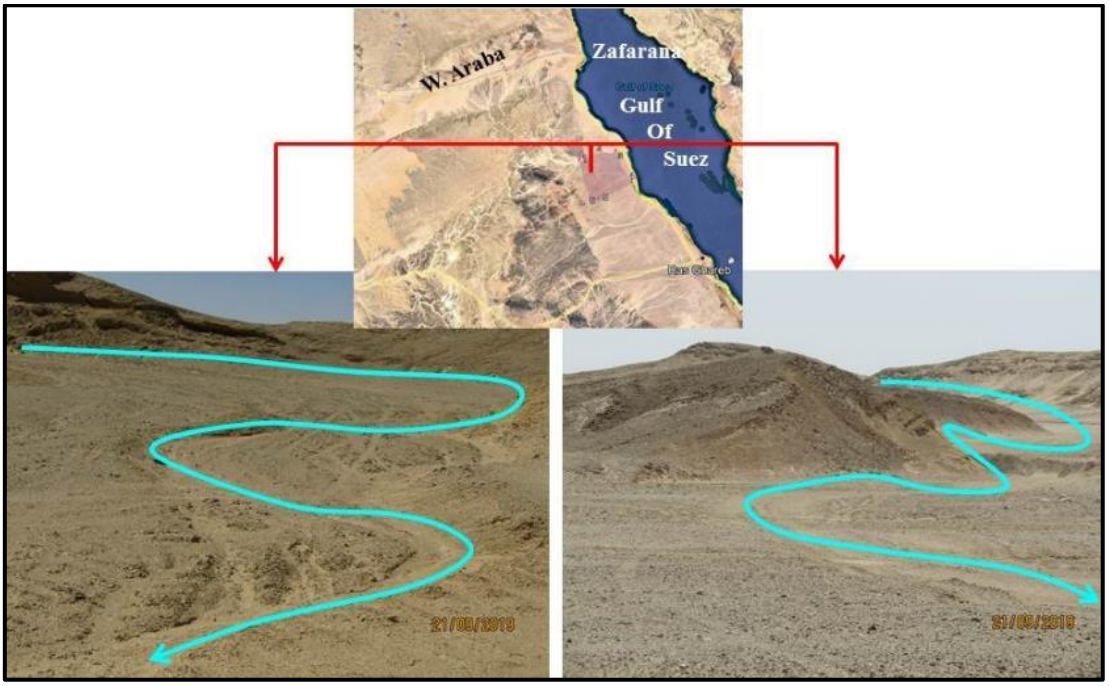


Figure 8-15: Shallow and gentle slope of drainage lines Typical in Project Site

8.3.4 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 (Fig. 36). 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 m^3/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.

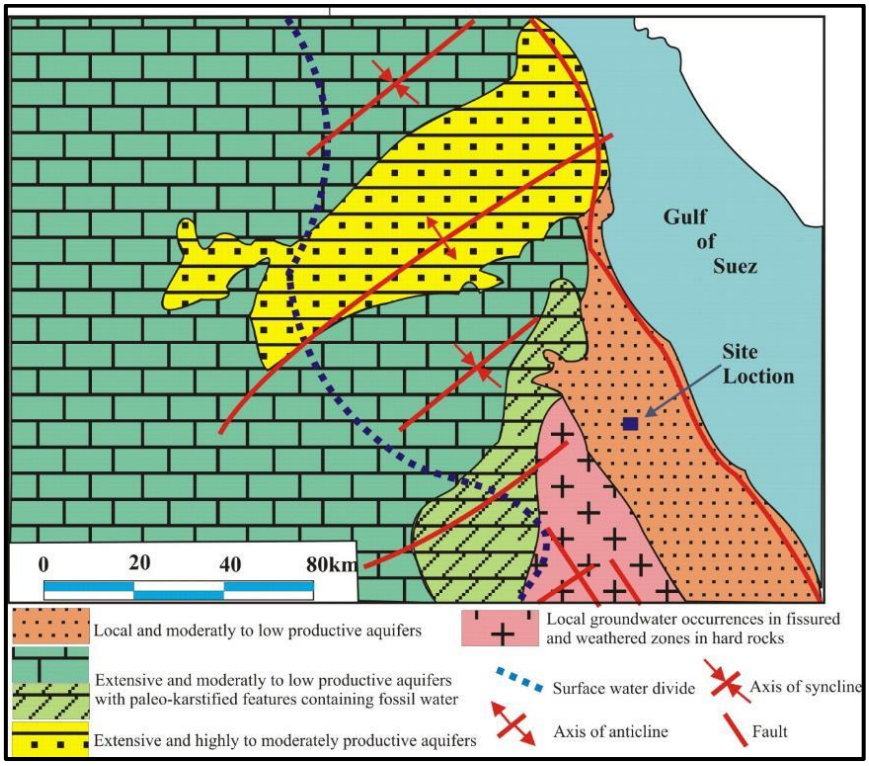


Figure 8-16: Hydrogeological Map of the Project Site and Surrounding Areas (Modified from Hydrogeological Map of Egypt of 1999, Research Institute for Groundwater (RIGW))

8.4 Biodiversity

This section provides an assessment of baseline conditions within the Project site and its surroundings 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 8.5" and "Section 8.6" respectively.

8.4.1 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 in detail below.

(i) *Literature Review*

This 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).

(ii) *Field Survey*

A field survey was undertaken at the Project site during the autumn of 2019 and spring 2020. The surveys in this sense cover the key seasons for assessing habitats and floral and faunal elements. 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 the following methods:

- Field observations: 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. The team carried out route-transects along the wadis searching for any of the above-mentioned signs of animal presence. 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.;
- Interviews with local people: local people of the area were interviewed and asked questions regarding well known fauna species that are likely to be present within the site.

(iii) Fauna and Flora Species status

All species recorded as part of the literature review or on-site during the field survey had their conservation status identified according to International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2019), which provides the global conservation status of evaluated species. Since Egypt does not have national Red Lists for most taxon, 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.

8.4.2 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 during site visits and field surveys 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 typically 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 proceeds in coincidence with the modification of 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.

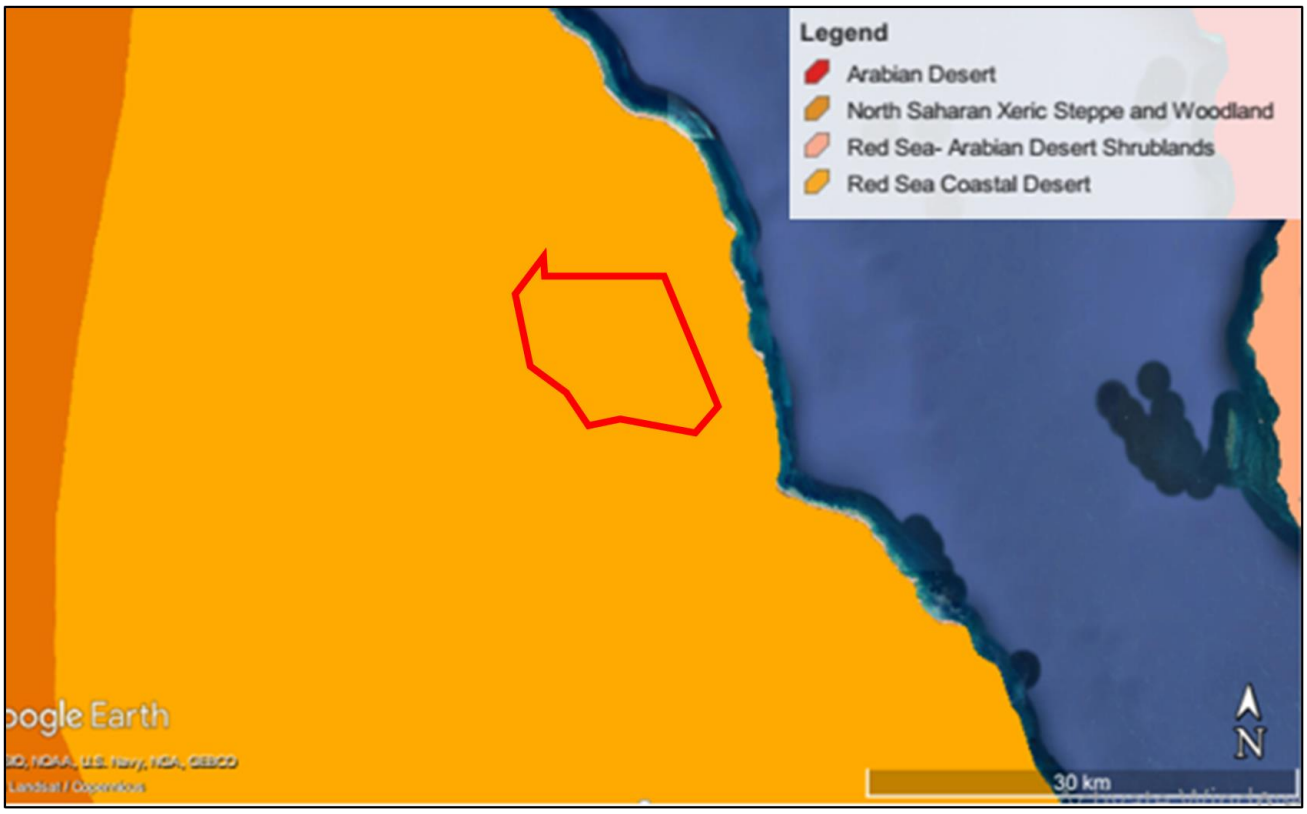


Figure 8-17: Location of Project in reference to Ecoregions of the world (TEOW) (Olson et al, 2001)

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 8-2. Only seven perennial species were recorded during the surveys.

Out of the 68 species documented to be recorded in the project area and its vicinity, 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 8-2: List of Plant Species Recorded during Field Visit and Literature Review

Family	Scientific name	IUCN Red List of Threatened Species	Notes
Ephedraceae	*Ephedra aphylla* Forssk.	Least Concern	Literature and field survey
Amaranthaceae	*Aerva javanica* (Burm. f.) Juss. ex Schult.	Not Evaluated	Literature
	Amaranthus viridis L.	Not Evaluated	Literature
Apocynaceae	*Calotropis procera* (Aiton) W.T. Aiton	Not Evaluated	Literature
	Leptadenia pyrotechnica (Forssk.) Decne.	Not Evaluated	Literature
	Pergularia tomentosa L.	Not Evaluated	Literature
Asteraceae	*Artemisia judaica* L.	Not Evaluated	Literature
	Centaurea calcitrapa L.	Not Evaluated	Literature
	Centaurea scoparia Sieber ex Spreng.	Not Evaluated	Literature
	Cotula cinerea Delile	Not Evaluated	Literature
	Echinops spinosus L.	Not Evaluated	Literature
	Ifloga spicata (Forssk.) Sch. Bip.	Not Evaluated	Literature
	Iphiona mucronata (Forssk.) Asch. et Schweinf.	Not Evaluated	Literature
	Launaea spinosa (Forssk.) Sch. Bip. ex Kuntze	Not Evaluated	Literature
	Limbarda crithmoides (L.) Dumort.	Not Evaluated	Literature
	Pluchea dioscoridis (L.) DC.	Least Concern	Literature
	Pulicaria incisa (Lam.) DC.	Not Evaluated	Literature

Family	Scientific name	IUCN Red List of Threatened Species	Notes
	Pulicaria undulata (L.) C.A. Mey.	Not Evaluated	Literature
	Reichardia tingitana (L.) Roth	Not Evaluated	Literature
	Senecio glaucus L.	Not Evaluated	Literature
	Sonchus oleraceus L.	Not Evaluated	Literature
Boraginaceae	*Heliotropium bacciferum* Forssk.	Not Evaluated	Literature
	Trichodesma africanum (L.) R. Br.	Not Evaluated	Literature
Brassicaceae	*Diplotaxis harra* (Forssk.) Boiss.	Least Concern (Europe)	Literature
	Farsetia aegyptia Turra	Not Evaluated	Literature
	Matthiola longipetala (Vent.) DC.	Not Evaluated	Literature
	Zilla spinosa (L.) Prantl	Not Evaluated	Literature and field survey
Capparaceae	*Capparis spinosa* L.	Not Evaluated	Literature
Caryophyllaceae	*Polycarpaea robbairea* (Kuntze) Greuter & Burdet	Not Evaluated	Literature
Chenopodiaceae	*Anabasis articulata* (Forssk.) Moq.	Not Evaluated	Literature and field survey
	Arthrocnemum macrostachyum (Moric.) K. Koch	Not Evaluated	Literature and field survey
	Atriplex halimus L.	Not Evaluated	Literature
	Chenopodium album L.	Not Evaluated	Literature
	Halocnemum strobilaceum (Pall.) M.Bieb.	Not Evaluated	Literature and field survey
	Halopeplis perfoliata (Forssk.) Bunge ex Asch.	Not Evaluated	Literature
	Haloxylon salicornicum (Moq.) Bunge ex Boiss.	Not Evaluated	Literature
	Salsola imbricata Forssk.	Not Evaluated	Literature
	Suaeda monoica Forssk. ex J.F. Gmel.	Not Evaluated	Literature
Cleomaceae	*Cleome amblyocarpa* Barratte &Murb.	Not Evaluated	Literature
	Cleome droserifolia (Forssk.) Delile	Not Evaluated	Literature
Convolvulaceae	*Convolvulus hystrix* Vahl	Not Evaluated	Literature
Euphorbiaceae	*Ricinus communis* L.	Not Evaluated	Literature
Fabaceae	*Acacia seyal* Delile	Not Evaluated	Literature
	Acacia tortilis (Forssk.) Hayne	Not Evaluated	Literature and field survey
	Alhagi graecorum Boiss.	Not Evaluated	Literature
	Lotus hebranicus Hochst. ex Brand	Not Evaluated	Literature
Fabaceae (cont.)	*Taverniera aegyptiaca* Boiss.	Not Evaluated	Literature
Frankeniaceae	*Frankenia hirsuta* L.	Not Evaluated	Literature
Geraniaceae	*Erodium glaucophyllum* (L.) L'Hér.	Not Evaluated	Literature
Nitrariaceae	*Nitraria retusa* (Forssk.) Asch.	Not Evaluated	Literature
Orobanchaceae	*Cistanche phelypaea* (L.) Cout.	Not Evaluated	Literature
Polygonaceae	*Calligonum polygonoides* L.	Not Evaluated	Literature
Resedaceae	*Ochradenus baccatus* Delile	Not Evaluated	Literature
	Reseda pruinosa Delile	Not Evaluated	Literature
Solanaceae	*Hyoscyamus muticus* L.	Not Evaluated	Literature
Tamaricaceae	*Reaumuria hirtella* Jaub. & Spach	Not Evaluated	Literature
	Tamarix nilotica (Ehrenb.) Bunge	Least Concern	Literature and field survey
	Tamarix tetragyna Ehrenb.	Not Evaluated	Literature
Urticaceae	*Forsskaolea tenacissima* L.	Not Evaluated	Literature
Zygophyllaceae	*Fagonia arabica* L.	Not Evaluated	Literature
	Fagonia bruguieri DC.	Not Evaluated	Literature
	Fagonia mollis Delile	Not Evaluated	Literature
	Zygophyllum album L.f.	Not Evaluated	Literature
	Zygophyllum coccineum L.	Not Evaluated	Literature
	Zygophyllum simplex L.	Not Evaluated	Literature
Juncaceae	*Juncus rigidus* Desf.	Not Evaluated	Literature
Poaceae	*Pennisetum setaceum* (Forssk.) Chiov.	Least Concern	Literature
	Phragmites australis (Cav.) Trin. ex Steud.	Least Concern	Literature

(ii) Fauna

The specific outcomes of the field survey in relation to faunal species are discussed below and which includes 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 8-3. 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 east 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 globally threatened Striped Hyaena (vulnerable), 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 onsite during the field survey undertaken.

Table 8-3: Mammal species (excluding bats) Recorded in Project Site and its Vicinity

Family	Scientific name	Common name	Global IUCN status
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 / Canis aureus	African Wolf / Golden Jackal	Least Concern
	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 (check table below). Due to the aridity of the area, no amphibian species are known to be present in the project area. 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*.

In addition, it is important to note that no mammals were recorded onsite during the field survey undertaken. However, during the spring survey potential burrows were recorded in two wadis in the southwestern area of the Project site as noted in the figure below.

Table 8-4: Reptilian Species Known to Occur within Study Area

Family	Scientific name	Common name	IUCN Red List of Threatened Species (2019)
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
	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

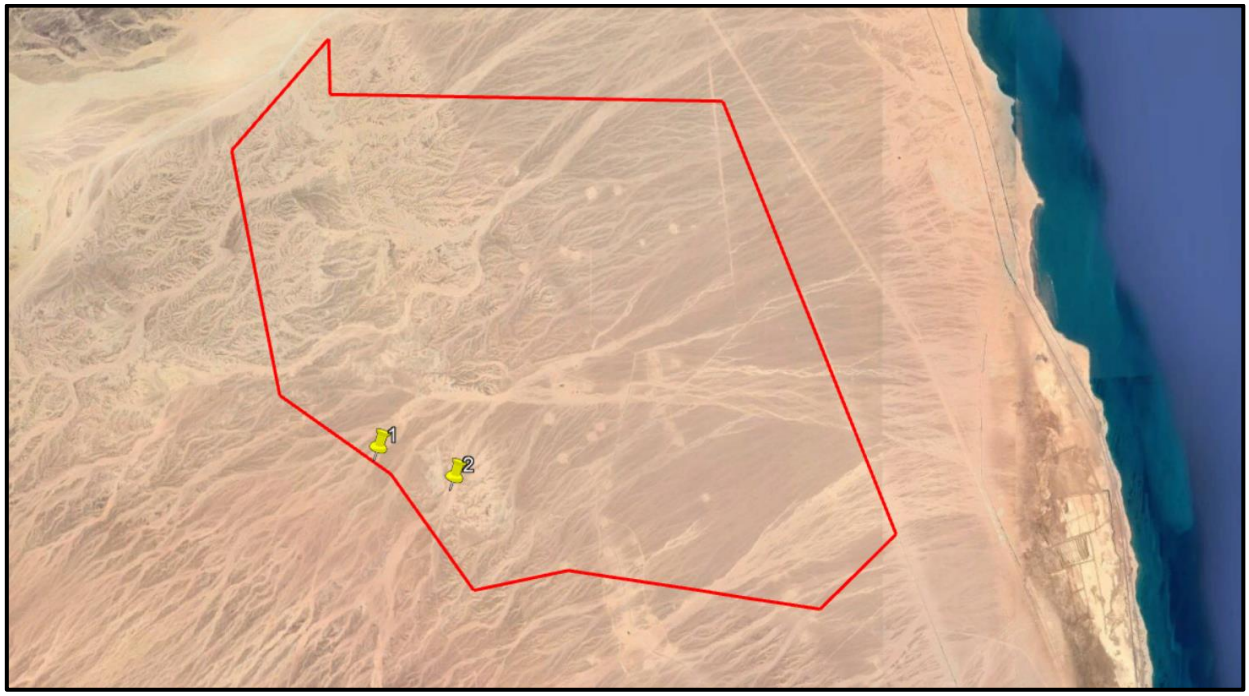


Figure 8-18: Locations of the wadis where Egyptian Dabb Lizard's potential burrows were recorded within the project study area

(iii) Summary

In summary, based on the survey and 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 number. 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. Finally, as discussed earlier in Section 8.2 (land use section), the Project site is not located within any current or planned natural protectorates.

8.5 Birds (Avi-Fauna)

This section provides an assessment of baseline conditions within the Project site and surroundings in relation to birds (avi-fauna).

8.5.1 Baseline Assessment Methodology

(i) Background

The methodology and scope of work designed followed the standard methodology for bird census being implemented using the Vantage Point (VP) (which are also known as 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 was 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.

(ii) History from 2020 to 2022

As discussed earlier in "Section 3.2", in 2020 a previous ESIA study was submitted by the ESIA Consultant to EEAA and IFIs that included different turbine characteristics and a layout than that presented in "Section 3.2". The previous turbine characteristics included a total of 173 turbines with a rated power of 2.9MW and a tip height of 120m.

In July 2022 new governmental approvals have been issued allowing an increase in tip height up until 220m, where previously due to various governmental restrictions the allowed tip height was set at 120m (as noted above). Based on that, all wind farm developers within the GoS are currently assessing installing such bigger turbines (including the RSWE).

Therefore, the Developer has opted at this point for the selection of such new turbine characteristics as well as layout presented in "Section 3.2", for technical and economical/financial reasons that include 84 turbines with a rated power per turbine of 6MW and a tip height of 180m.

The previous ESIA submitted in 2020 included 2 avifauna monitoring seasons (spring 2019 and autumn 2020). However, as presented throughout this section, this updated ESIA now includes 4 monitoring seasons (spring 2019, autumn 2020, spring 2020, autumn 2021).

In addition, as discussed in the methodology below, it is important to note that the monitoring data throughout all 4 monitoring seasons included various height bands that account for the previous and new turbine heights and specifications.

(iii) 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 were located at the top of a hill overlooking the surrounding area in a way that enabled 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.

Each VP covers a view of 360 degrees extending for a maximum of 2.5km as required. Also, this distance was 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.

Such VPs covered the entire Project area including the birds' corridors to the extent possible (eastern corridor is covered by VP 1 and VP 4 and western corridor is covered by VP 5 and VP 8).

Table 8-5: 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

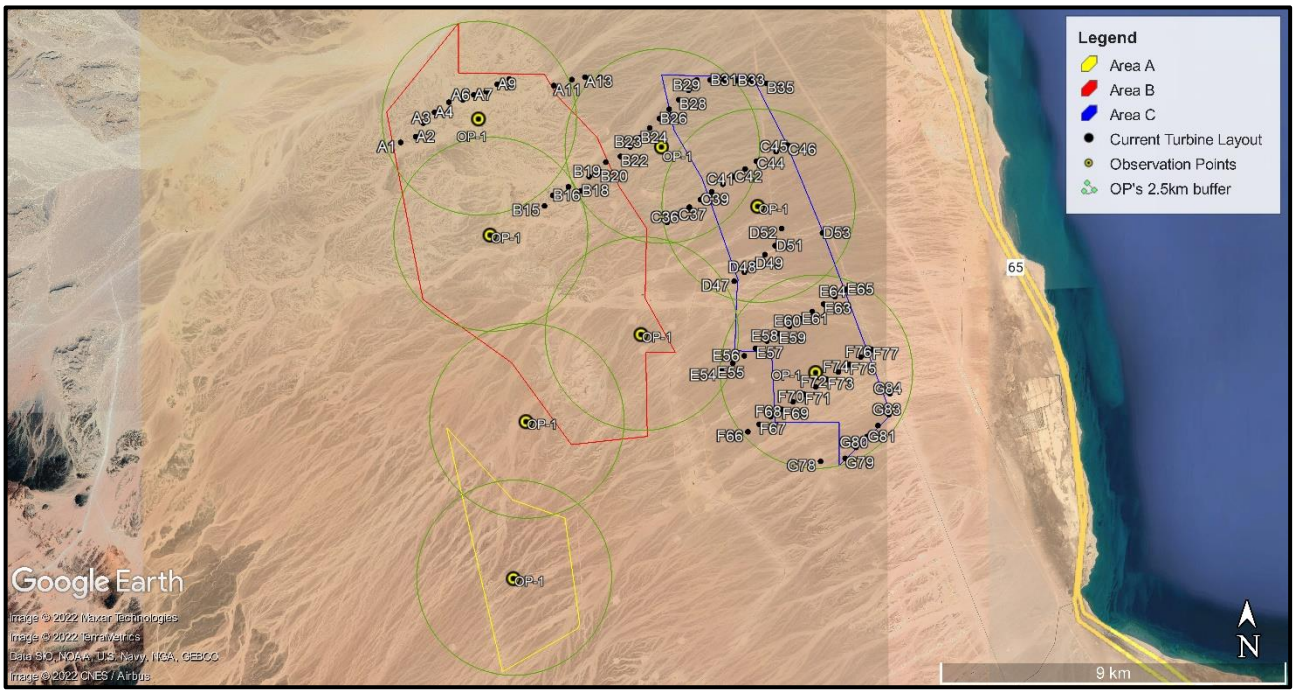


Figure 8-19: Location of Project VPs with the Current Turbine Layout

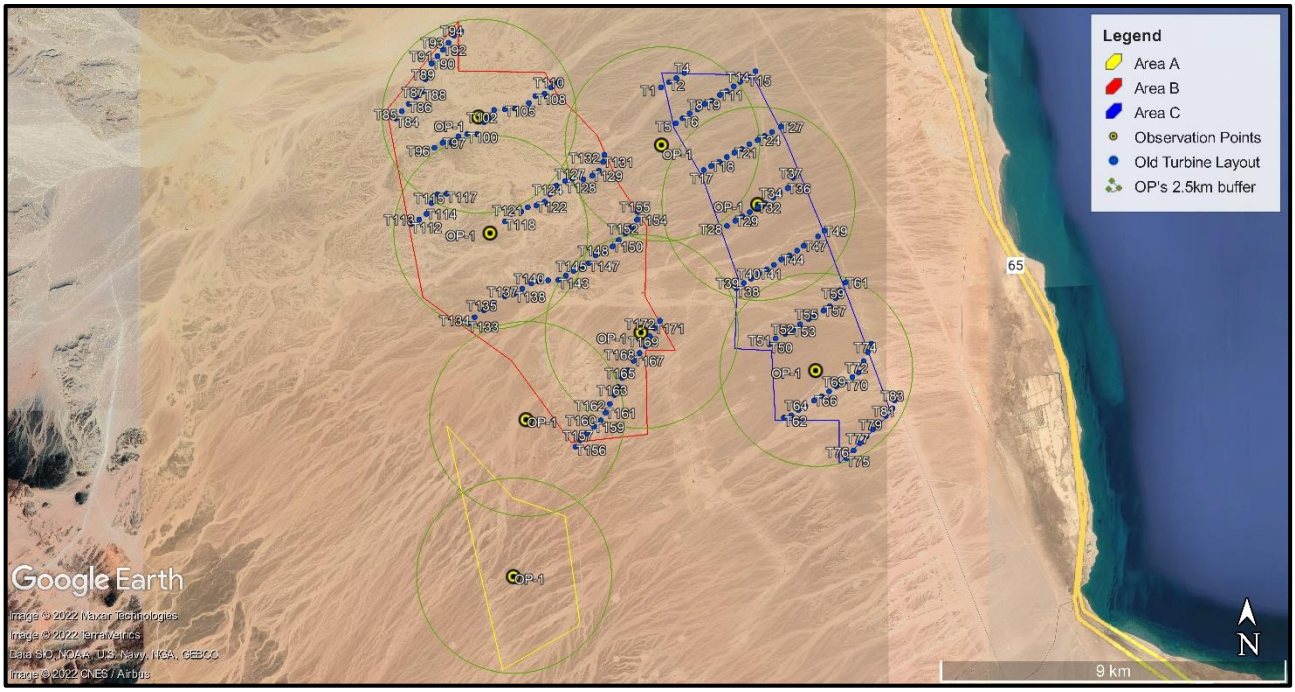


Figure 8-20: Location of Project VPs with the Previous (old) Turbine Layout

Please note that the figure above refers to the old site allocation as discussed previously in "Section 7.3".

(iv) <u>Monitoring/Sampling effort</u>

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

Table 8-6: Monitoring Dates

DATES	2020	2021
Spring	20 Feb to 19 May	20 Feb to 20 May
	1,897 hr. 51 min	2,535 hr. 52 min
	2019	**2020**
Autumn	20-Aug to 10 Nov	15 Aug to 10 Nov
	2,539 hr. 13 min.	2,673 hr 18 min.

(v) 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 migration period as outlined in the required guidelines.

As part of the capacity building program integrated into the assignment, 4 junior observers joined the qualified observers for a maximum of 30-35 days for each junior observer throughout the migration period.

Monitoring from VP's were 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 were 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.

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

The start and end of observation periods varied 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 were 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.

Information on bird flight activity was collected from each VP. The recording of observations followed the methods described by Band et al. (2007), which are summarized below.

Observers at VPs positioned themselves to minimize their effects on bird behaviour. A complete circle of 360 degrees was scanned using a combination of naked eye and 10x binoculars. If a target species was

detected, it will be followed until it ceased flying or was 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. Heights to be classified were based on existing turbine specifications at the time of the design of the survey and any expected changes in the future. This included four classes:
  - Band 1= (≤ 120 m)
  - Band 2= (> 120 – 200 m)
  - Band 3= (>200 – 500 m)
  - Band 4 = above 500 m

As a guidance to observers to define their area of survey before observations started, they were required to determine cardinal directions (North, South, East and West) and predefine several landmarks of reference in the field, if possible. Observers constantly scanned, using a combination of naked-eye and binoculars, the whole covered buffer of 360 degrees around, from each VP until a target species was 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 have bene 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 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 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 was recorded using the binominal (genus and species) scientific names (e.g., *Aquila nipalensis*). For unidentified birds it was referred to the nearest identifiable systematic position, e. g. two close species like "harriers", or to genus level, e.g., Aquila sp., if not possible to the

closest group e. g. Unidentified Raptor (UR). The survey area was scanned constantly until a target MSB species was detected in flight.

- Number – number of birds of the same species (mixed species flocks had one line and one key number for each species)
- Sex and Age when feasible- 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.
- Flying direction
- 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
- Any other noteworthy remarks noted.
- All units were collected for all recorded targeted species inside and outside the project area.
- None targeted species were recorded in a separate accidental datasheet, and mainly basic data of observation time, species, number of individuals, flying direction, etc.. No trajectories were mapped.

Weather Data

- This sheet was only filled by one of the senior observers assigned by the Team Leader.
- The following weather variables were 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)

(vi) Roosting & Resting of Birds

Porter (2006) should be referenced again on the issue related to **the concept of roosting/resting of birds** in any project proposed in the region. Porter states the following:" In *the case of birds of prey the vast majority will pass overhead and not stop unless to roost as most do not feed on migration. The species that do are mainly those which migrate on a broad front, notably the harriers and falcons (especially Lesser Kestrel and Red-footed Falcon), but these are not known to gather in any concentration at the bottleneck" and "Storks are known to gather to feed on migration if the habitat is suitable; similarly White Pelicans will congregate on lakes where fish are abundant*".

In addition to this, the bird`s exhaustion during migration is a key factor, especially for those species which cross the Red Sea through the open water between the Sinai Peninsula and the coast where projects like RSWE Wind Farm is planned. Birds leave the opposite coast at a time in the day that they consider appropriate for crossing, but these conditions may change over the route, making the crossing difficult. These flocks may arrive to the other side and need to rest for a while, or it might be just too late when arriving to continue the migration through such day.

Roosting and resting birds were identified within the project area or its surroundings through the following:

- Either the standard methodology of VP monitoring. During the watches, the visible ground area was scanned thoroughly for any birds, allowing quick spotting of roosting birds in and around the project site.
- Recording and mapping for any roosting birds in the Project Area, plus the 2 km buffer zone.
- Annotating any roosting bird observation during travelling time within the study area including travel time from-to Project Area, and switching between VPs.

As seen from the existing information from the RVRSF, whether some species roost or not, is well known for a long time now. Roosting is not a site-specific issue, and it may occur wherever in the Red Sea coast and adjacent areas, subject to species and weather-specific conditions.

(vii)Other Issues and Limitations

Typical to any bird survey, some limitations existed during the bird monitoring undertaken for the Project. Some of the key limitations and issues included the following:

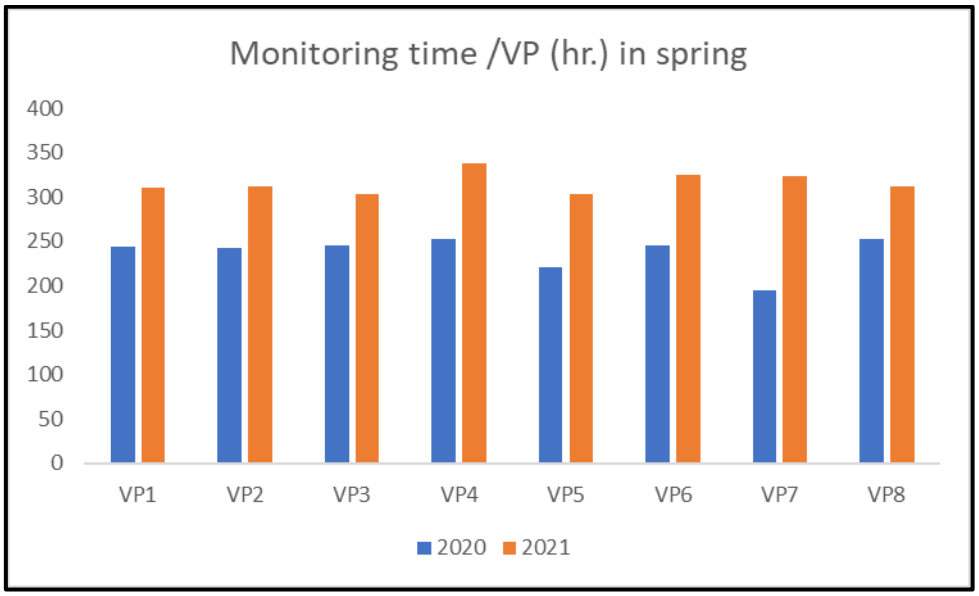
- The survey technique was based on visual observation, which limited the detectability of birds and getting accurate measurements of flight heights and trajectories.
- The wind farm has not yet been constructed. Without a reference, flying heights could entail some degree of uncertainty, especially in the very narrow bands at turbine level.
- Occasionally, and due to the location of the Project in a remote area, weak phone signals were experienced which caused some communication and coordination issues between field observers to some extent.
- In any avifauna migratory count, either related to wind farms assessments or not, **bird identification is challenging**. As Porter (2006) states: "*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." In addition, observers are generally not able to identify all the birds recorded. For the analysis, and so many species involved, these records must be excluded instead of assigning the unidentified birds to a specific species, as they could introduce biases in the overall results. The important point in any analysis is not the raw global count but rather the passing rates as explained above

8.5.2 Results

(i) Initial Note

The figures below present the distribution of monitoring hours in 2020 and 2021 among the 8 VPs in the spring season (first figure) and autumn season 2019 and 2020 (second figure). As noted, there is an uneven distribution of monitoring time within each season which resulted in different monitoring efforts per VP. These differences can be attributed to various factors such as: (i) sandstorms which would result in suspension of monitoring onsite, (ii) the holy month of Ramadan (where its timing differs from year to year and during this month monitoring hours are reduced for observer health and safety consideration), (iii) logistical arrangements for observers (e.g., emergency leaves for observers, changes in break periods, etc.), etc. The longer the monitoring time, the higher the chance of counting more birds.

As noted by Bildstein et al. (2007) in **Raptor Research and Management Techniques,** (Bird and Bildstein Eds.) Institute for Wildlife Research, National Wildlife Federation 2007: "*When examining seasonal or diurnal patterns of variation in flight magnitude within a given year, and in cases where variability in daily observation effort is significant within the period of interest, a more accurate picture may be derived by standardizing daily counts based on daily effort (e.g., counts per hour of observation).* ***Taking this into account, we worked with the passing bird rates (birds /hour rate) instead of raw bird numbers throughout the analyses undertaken throughout the subsequent sections, unless clearly stated otherwise.***



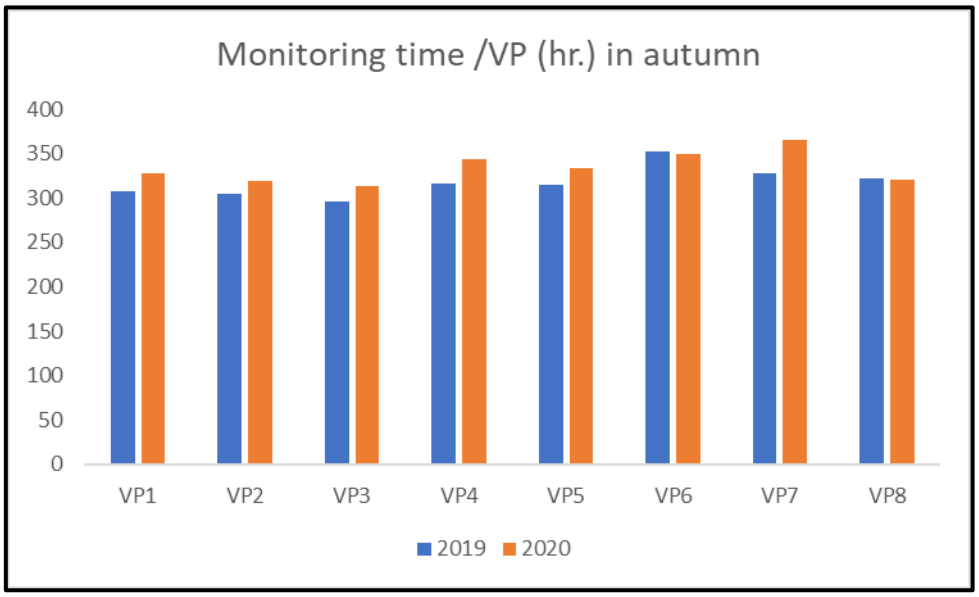


Figure 8-21: Distribution of Monitoring Hours for the VPs in spring and autumn seasons.

(ii) Spring Season

Data Analysis

In the spring season, and despite the increase in the monitoring time from 2020 to 2021, the number of records and birds decreased by 40% and 15% respectively. In 2020 a total of 8,100 records belonging to 309,330 birds were recorded whereas in 2021 a total of 4,899 records belonging to 263,184 birds were recorded.

A total of twenty-seven (27) species were recorded overall throughout both seasons. Note: a record of the Pink-backed Pelican was excluded because it was an observation of a single individual out of the species distribution range (Birdlife International 2022 http://datazone.birdlife.org/species/factsheet/pink-backed-pelican-pelecanus-rufescens).

Main differences between 2020 and 2021 included species which are quite scarce or may pass undetected by observers because of their small body sizes (Red-footed, and Peregrine falcons, Tawny and Spotted eagles). Additionally, other causes included that the species does not need to migrate every season through the Project area.

Six (6) species accounted for 88-90% of birds recorded in 2020 and 2021, including the Black Kite, Levant Sparrowhawk, Honey Buzzard, Steppe Buzzard, Steppe eagle, and White stork. All the remaining species had lower numbers representing less than 1% of the individuals each. However, still a 1% represents several thousand of a given species.

Also, another six (6) species had a higher conservation concern according to the IUCN Red List. This included Vulnerable (VU) (Eastern Imperial, Tawny and Spotted eagles, and the Sooty Falcon) or Endangered (EN) (Egyptian Vulture and the Steppe Eagle). A seventh could be considered of special interest being Near Threatened (NT), the Pallid Harrier.

The Table 8-7 lists the species found in spring 2020 and 2021, their number of records and individuals.

Table 8-7: Species Recorded during spring 2020 and 2021

Species	IUCN	Scientific name	Records 2020	# of Birds 2020	Records 2021	# of Birds 2021
Black Kite	LC	*Milvus migrans*	1,190	16,229	826	6,855
Black Stork	LC	*Ciconia nigra*	108	2,156	76	1,910
Booted Eagle	LC	*Aquila pennata*	431	858	153	205
Common crane	LC	*Grus grus*	3	8	4	21
Merlin	LC	*Falcocolumbarius*	2	2	0	0
Lanner Falcon	LC	*Falcobiarmicus*	2	2	0	0
Peregrine	LC	*Falco peregrinus*	0	0	1	1
Tawny Eagle	VU	*Aquila rapax*	1	1	0	0
Eastern Imperial Eagle	VU	*Aquila heliaca*	42	44	34	38
Egyptian Vulture	EN	*N. percnopterus*	213	395	63	99
Eurasian Sparrowhawk	LC	*Accipiter nisus*	63	108	39	56
European Honey Buzzard	LC	*Pernis apivorus*	259	21,626	115	8,645

Great White Pelican	LC	*Pelecanus onocrotalus*	12	936	9	499
Greater Spotted Eagle	VU	*Clanga clanga*	121	341	2	2
Lesser Spotted Eagle	LC	*Clanga pomarina*	329	1,705	350	5,016
Levant Sparrowhawk	LC	*Accipiter brevipes*	15	4,230	22	23,647
Long-legged Buzzard	LC	*Buteo rufinus*	298	548	62	72
Montagu's Harrier	LC	*Circus pygargus*	22	23	5	5
Osprey	LC	*Pandion haliaetus*	5	5	8	8
Pallid Harrier	NT	*Circus macrourus*	24	24	19	19
Red-footed Falcon	LC	*Falco vespertinus*	1	1	0	0
Short-toed Snake Eagle	LC	*Circateus gallicus*	732	1,563	336	746
Sooty Falcon	VU	*Falco concolor*	2	2	2	2
Steppe Buzzard	LC	*Buteo vulpinus*	2,140	86,740	1,546	73,523
Steppe Eagle	EN	*Aquila nipalensis*	1,746	17,152	833	5,628
Western Marsh Harrier	LC	*Circus aeruginosus*	59	67	45	58
White Stork	LC	*Ciconia ciconia*	261	154,545	180	135,819
Unidentified species	In addition to the above numbers, the totals below also include those unidentified species. However, those have been excluded from the detailed analysis provided throughout the subsequent section.					
TOTALS			**8,100**	**309,330**	**4,899**	**263,184**

Spatial Distribution

According to the above-mentioned methodology, median passing rates have been calculated globally and for each species per VP. The figures below present the global median passing rates (birds/hour) per VP in spring 2020 (first figure) and spring 2021 (second figure) for all species pooled together ± 25-75% percentiles. Figures exclude the so called "outlier ranges" for better visual presentation of the data and figure. An outlier is an observation that lies an abnormal distance from other values in a random sample from a population.

In 2020, the passing rates were the highest (an outlier) at VP5 (2,307.69 birds/hr), followed by VP7 (1,904.65), showing significant differences among vantage points (ANOVA F (7; 8092) =2.67 and p <0.01) However, in 2021, rates were nearly consistent with the same rate at all VPs (ANOVA F (7; 4894) =0.65 and p =0.71).

We can conclude that for some reason passing rates showed some preference in 2020 but not in 2021 among the VPs. 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 the same, however they are not. **Birds do not pass through the same VP every year with the same rates so passage is either random or affected by some factor(s).**

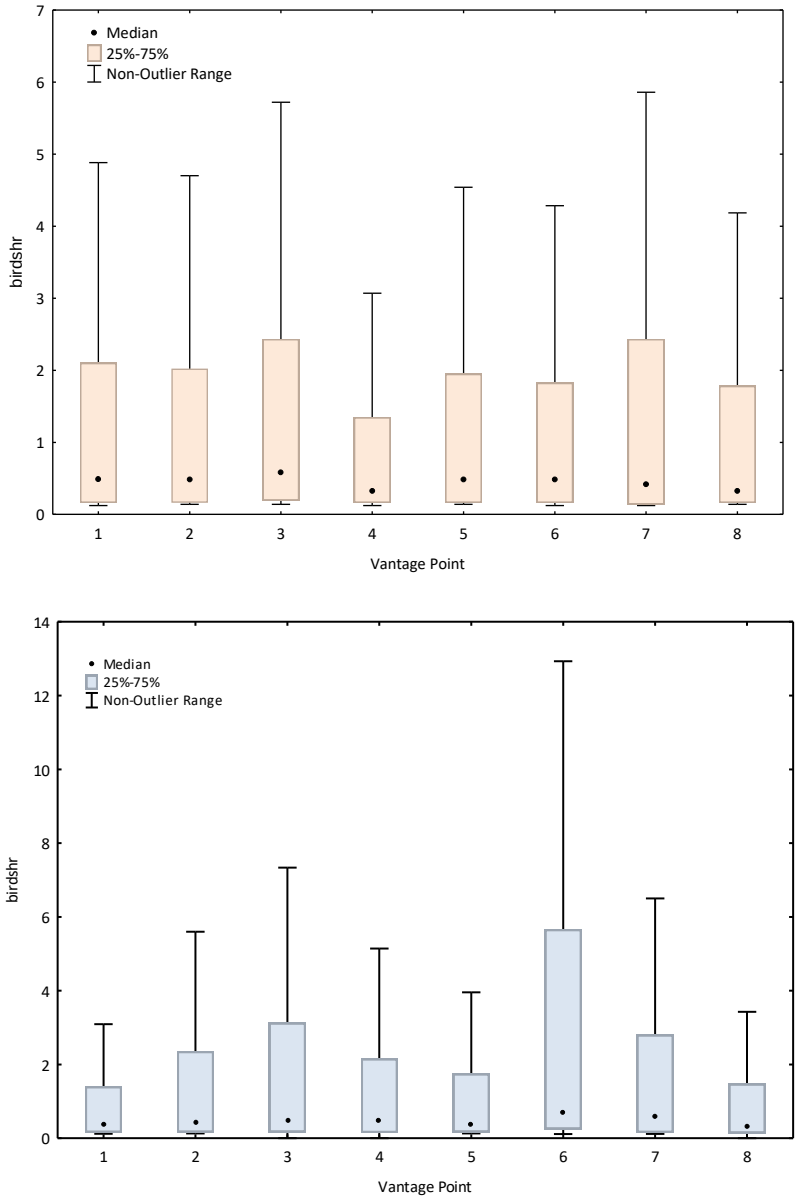


Figure 8-22: Median Passing Rates± 25-75% percentiles per VP in spring 2020 and 2021

The table below presents the median passing rates per species, and their 25 and 75 interquartile. There were eight (8) species forming flocks (gregarious). Two of them had either a lower detectability rate, like the Levant Sparrowhawk, or despite its size did 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 despite their large numbers; the cranes remain detectable because of the large size, but they are not true obligate soaring birds, and they do not pass every season and year in large numbers. The White Stork, Great White Pelican, Steppe, and Honey buzzards always appeared.

Table 8-8: Passing Rates for the Bird Species

Year	Species	N	Birds/hr Q25	Birds/hr Median	Birds/hr Q75	Percentile 5%	Percentile 95%
2020	Black Kite	1190	0.324	0.811	2.204	0.140	9.070
	Black Stork	108	0.261	0.973	5.270	0.162	17.514
	Booted Eagle	431	0.162	0.162	0.324	0.140	0.811
	Common Crane	3	0.122	0.486	0.558	0.122	0.558
	Steppe Buzzard	2140	0.367	1.535	6.177	0.140	30.793
	Egyptian Vulture	213	0.162	0.162	0.324	0.140	0.968

	Eleonora's Falcon	1	0.162	0.162	0.162	0.162	0.162
	Greater Spotted Eagle	121	0.162	0.162	0.324	0.140	0.811
	Griffon Vulture	8	0.150	0.162	0.162	0.140	0.162
	Honey Buzzard	259	0.486	1.714	5.513	0.162	81.081
	Imperial Eagle	42	0.162	0.162	0.162	0.140	0.279
	Lanner	2	0.139	0.151	0.162	0.140	0.162
	Lesser Kestrel	10	0.162	0.162	0.193	0.140	0.316
	Lesser Spotted Eagle	329	0.162	0.324	0.976	0.162	4.054
	Levant Sparrowhawk	15	0.162	0.162	0.324	0.122	425.806
	Long-legged Buzzard	298	0.139	0.162	0.324	0.122	0.698
	Marsh Harrier	59	0.162	0.162	0.162	0.140	0.324
	Merlin	1	0.139	0.140	0.139	0.140	0.140
	Montagu's Harrier	22	0.162	0.162	0.162	0.140	0.240
	Osprey	5	0.162	0.162	0.162	0.162	0.162
	Pallid Harrier	24	0.139	0.162	0.162	0.122	0.162
	Pink-backed Pelican	1	0.162	0.162	0.162	0.162	0.162
	Red-footed Falcon	1	0.122	0.122	0.122	0.122	0.122
	Short-toed Eagle	732	0.162	0.162	0.418	0.140	0.973
	Sooty Falcon	2	0.139	0.151	0.162	0.140	0.162
	Sparrowhawk	63	0.162	0.162	0.324	0.140	0.947
	Steppe Eagle	1746	0.162	0.486	1.297	0.140	5.721
	Tawny Eagle	1	0.139	0.140	0.139	0.140	0.140
	White Pelican	12	0.201	2.270	14.675	0.122	62.791
	White Stork	261	1.621	20.270	72.972	0.162	486.486
	Lesser Spotted Eagle	350	0.138	0.402	1.500	0.125	10.000
	Steppe Buzzard	1547	0.383	1.826	9.875	0.129	36.129
	Black Kite	826	0.250	0.506	1.319	0.126	5.265
	Pallid Harrier	19	0.128	0.132	0.154	0.119	0.444
	Short-Toed Eagle	337	0.130	0.158	0.264	0.122	0.875
	Egyptian Vulture	63	0.130	0.164	0.267	0.125	0.500
	Marsh Harrier	45	0.130	0.156	0.164	0.124	0.371
	Common Kestrel	126	0.126	0.132	0.164	0.122	0.329
	Sparrowhawk	39	0.156	0.164	0.171	0.124	0.470
	Eleonora‘s Falcon	1	0.176	0.176	0.176	0.176	0.176
2021	Honey Buzzard	115	0.329	2.938	12.308	0.156	69.307
	White Stork	180	2.623	20.372	99.180	0.133	620.260
	Lesser kestrel	4	0.130	0.131	0.148	0.129	0.164
	Sooty Falcon	2	0.161	0.162	0.163	0.161	0.163
	Steppe Eagle	834	0.132	0.277	0.796	0.125	3.391
	Long-legged Buzzard	62	0.130	0.137	0.164	0.124	0.381
	Black Stork	76	0.234	0.559	1.810	0.132	22.727
	Eleonora’s falcon	1	0.164	0.164	0.164	0.164	0.164
	Osprey	8	0.125	0.128	0.132	0.122	0.171
	Booted Eagle	153	0.129	0.154	0.250	0.122	0.468
	Common Crane	4	0.341	0.588	1.046	0.130	1.467

	Peregrine falcon	1	0.154	0.154	0.154	0.154	0.154
	Levant Sparrowhawk	22	0.590	50.171	195.652	0.163	821.918
	Montagu's Harrier	5	0.154	0.160	0.162	0.151	0.164
	Eastern I. Eagle	34	0.129	0.132	0.164	0.122	0.343
	Hobby Falcon	2	0.130	0.147	0.163	0.130	0.163
	White pelican	9	2.065	5.143	8.536	0.164	38.462
	Crested-Honey Buzzard	1	0.163	0.163	0.163	0.163	0.163
	Greater-spotted Eagle	2	0.156	0.156	0.157	0.156	0.157
	Griffon Vulture	6	0.130	0.143	0.171	0.130	0.171

Further statistical analysis was performed to confirm if there were preferred passing areas (vantage points) on a species-by-species level. If so, species would show similar trends through the same sites (VPs) both in 2020 and 2021. For this, analyses of variance for each species were performed.

The table below compares for significant differences in the passing rates (birds per hour) for each species among the 8 VPs for each year for all the species. The table provides the results of the test and the level of significance as per common standards in statistics. For species and year when comparisons are not possible, they have been noted as "n.a." (not available).

Table 8-9: Results of the Analyses (Analysis of Variance-ANOVA) for Vantage Point passing preferences on a species per species basis for each spring season 2020 and 2021

Species	2020	2021
Black Kite	F (7; 1182) =3.40 **p <0.01**	F(7;818) =2.89 **p <0.01**
European H. Buzzard	F (7; 251) =1.08 p =0.37	F (7;107) =0.48 p =0.84
Great W. Pelican	F (3;8)=0.32 p=0.81	F(5;3)=0.48 p=0.77
Western Marsh Harrier	F (7;51) =0.45 p =0.86	F (7;37) =0.73 p =0.64
Montagu's Harrier	F (7;14) =0.75 p =0.63	F(3;1)=18.42 p=0.16
Pallid Harrier	**F (7;16) =15.61** **p < 0.001**	F(6;12)=0.28 p=0.93
White Stork	F (7; 253) =1.18 p =0.31	F (7; 172) =0.70 p =0.66
Short-toed S. eagle	F (7; 724) =2.45 **p < 0.05**	F (7; 329) =1.11 p=0.35
Steppe Eagle	F (7;1738) =1.48 P=0.16	F (7; 826) =2.78 **p <0.001**
Lesser S. eagle	F (7; 321) =2.31 **p <0.05**	F (7;342) =3.72 **p <0.001**
Steppe Buzzard	H (7; 2132) =8.57 **p < 0.001**	F (7; 1538) =3.48 **p <0.001**
Long-legged Buzzard	F (7;290) =2.56 **p <0.05**	F (7;54) =0.63 p=0.53
Greater S. Eagle	H (7;113) =0.60 p =0.74	n.a.
Black Stork	F (7; 100) =1.30 p =0.25	H (7;68) =0.89 p=0.51
Egyptian vulture	F (7; 205) =1.33 P=0.23	F (7;55) =2.20 **p < 0 .05**
Booted Eagle	F (7; 423) =0.56 p =0.78	F (7; 145) =2.75 **p < 0.05**
Eastern I. eagle	F (7;34) =0.86 p =0.54	F (7;26) =1.43 p =0.23

Levant Sparrowhawk	F (4; 10)=20.8 p=0.15	F(5;16)=4.13 **p<0.05**
Common crane	F (1;1)=41.52 p=0.09	n.a.
Sparrowhawk	F (7;55) =0.85 p =0.54	F (7;31) =2.76 **p <0.05**
Lesser Kestrel	F (3;6)= 1.79 P=0.24	F(2;1)=3.13.65 **p<0.05**
Eleanora's Falcon	n.a.	n.a.
Common Kestrel	n.a.	F (7;118)=0.90 p=0.50
Osprey	n.a.	F (4;3)=172.24 **P<0.001**
Eurasian Griffon vulture	n.a.	F(3;2)=0.46 P=0.73
Tawny eagle	n.a.	-
Red-footed falcon	n.a.	-
Sooty Falcon	n.a.	-
Peregrine Falcon	-	n.a.
Hobby	-	n.a.
Merlin	n.a.	-
Lanner Falcon	n.a.	-

From the above the following can be concluded:

1. A total of 6 species (highlighted and which have p <0.05) presented significant differences among VPs in terms of passage rates in 2020 and 10 in 2021 (**i.e., they tended to pass in greater numbers through specific VPs compared to others).** However, when comparing the data for 2020 and 2021, only three exhibited such trend in both seasons (the Black Kite, Lesser Spotted eagle, and Steppe Buzzard). The Table only shows there are differences, but not where (observation points) such differences occur. These three have been represented in the following Tables 8-10 to 8-12. The abundances have been scaled for comparison between the two spring seasons for each species. **As seen in the Tables, the VPs which had higher passage rates were not the same in 2020 and 2021.**
2. Another 7 species showed no significant differences (i.e., p is higher than 0.05) either in 2020 and/or 2021 (i**.e., supports that they migrated throughout the site without any specific preference for any VP**). These include the Black and White storks, Great White Pelican, the Honey Buzzard and the Western Marsh and Montagu's harriers, and the Eastern Imperial Eagle.
3. As noted earlier, there is a final group which no further analysis can be performed because their data is too limited (marked in n.a.). This mostly comprises the "falcons" which are not true soaring birds. We must highlight that the Lesser Kestrel and the Common Crane are also night migrants, and there are no counts during darkness in the wind farms along the GoS, so their numbers might be unrepresented.
4. Among the species showing significant preferences only in 2021 but not in 2020, and because of their conservation concerns, we present the Steppe Eagle and the Egyptian Vulture, Table 8-13. For that year where differences were not significant the background colour of the cells has been kept white.
5. The **use of passing rates is recommended for any bird assessment** in which external factors like (i) sandstorms which limited and disrupted monitoring hours, (ii) the holy month of Ramadan (where its timing differs from year to year and during this month monitoring hours are reduced for observer health and safety consideration), and (iii) logistical arrangements for observers (e.g., emergency leaves for observers, changes in break periods, etc.) influence reducing the monitoring times. Analyses should take into account all these for proper conclusions being achieved.

The passing rates in the following tables have been scaled accordingly for the comparison between VPs and years for each species.

Table 8-10: Passing rates per VP for the Black Kite scaled between 2020 and 2021 (Index: High ≥ 1, Medium 1 < index ≥ 0.5, Low ≤ 0.5)

Vantage Point	Black Kite	
	2020	2021
VP-1	Low	Low
VP-2	High	Medium
VP-3	Medium	Low
VP-4	Medium	Medium
VP-5	Medium	Low
VP-6	Low	Low
VP-7	Medium	High
VP-8	Medium	Low

Table 8-11: Passing rates per VP for the Lesser Spotted Eagle (Index: High ≥ 1, Medium 1 < index ≥ 0.5, Low ≤ 0.5)

Vantage Point	L. Spotted Eagle	
	2020	2021
VP-1	Low	Low
VP-2	Medium	Medium
VP-3	Low	Low
VP-4	Low	Low
VP-5	Low	Medium
VP-6	Low	Medium
VP-7	Low	Low
VP-8	Low	Low

Table 8-12: Passing rates per VP for the Steppe Buzzard (Index: High ≥4-6, Medium 2-4, Low ≤ 2)*

Vantage Point	Steppe Buzzard	
	2020	2021
VP-1	Low	Low
VP-2	Medium	Low
VP-3	Medium	Low
VP-4	Low	Low
VP-5	Low	Medium
VP-6	Low	High
VP-7	Low	Low
VP-8	Low	Medium

*For the Steppe Buzzard the scaling has to be changed due to the very high bird numbers migrating, which outnumber most of the other species.

Table 8-13: Passing rates per VP for the Egyptian Vulture and Steppe Eagle (cells for 2020 are kept black because of the lack of significance of the tests)

Vantage Point	Egyptian Vulture		Steppe Eagle	
	2020	2021	2020	2021
VP-1	Low	Low	Medium	Low
VP-2	Low	Low	High	Medium
VP-3	Medium	Medium	High	Low
VP-4	Low	High	Low	Medium
VP-5	Medium	Low	Medium	Low
VP-6	Low	Low	Medium	High
VP-7	Low	Medium	Low	Medium
VP-8	Low	Medium	Medium	Low

The **use of the passing rates allowed solving the uneven sampling (monitoring)** throughout the spring migratory seasons. The results suggest there are differences between 2020 and 2021 in the bird rates, and this cannot be attributed or explained because of the numbers of birds counted. From the data and figures we conclude that the lack of preference for the same vantage points in the two seasons suggest birds do not use the same areas for passing through at a local scale (project footprint).

Overall, wind energy related and migratory studies use the term *Migratory Soaring Birds (MSBs*) but the inclusion of some species into that definition is rather arbitrary and not scientifically based. A Soaring species is a bird which relies exclusively on air updrafts for displacements. Soaring is grouped in two main forms: thermal and slope soaring. Thermals are columns of rising air that are formed on the ground through the warming of the land surface by sunlight, whilst the second forms when wind blows into the face of a hill/mountain and the airstream is deflected upward. Studies on raptor migration have demonstrated that "*some medium-sized raptors with intermediate morphology between obliged soarers and typical flappers, such as the Honey Buzzards, Black Kites, harriers, and ospreys, are capable of long non-stop flapping flights over water showing more or less fronts of migration and a more flexible flight strategy*" (Panuccio et al. 2021 and references therein)[1]. In addition, radar studies showed that migratory raptors are affected by weather conditions at local and regional scale (Shamoun-Baranes et al. 2017)[2].

Because of the aspects discussed above – i.e., bird morphology (which differs among the species migrating through the project) and the differences in atmospheric conditions between years, a common pattern at species specific level could not be established as to conclude there are precise areas at the RSWE project which the birds prefer to migrate through. These areas change from year to year accordingly and the findings for the spring seasons of 2020 and 2021 should be considered as a snapshot of those years.

Timing distribution

A) Migration Patterns: Monthly-weekly

In the following step, the timing of passage was analysed according to the day, month and week in the spring season. For each species a single figure showing the two passages in 2020 and 2021 was

[1] Panuccio, M., N. Agostini, U. Mellone (2021) *Raptors as models to Study Animal Migration.* Pp. 1-10 in Panuccio et al. 2021. Migration Strategies of Birds of Prey in Western Palearctic. CRC Press. Boca Ratón. Florida.

[2] Shamoun-Baranes, J., F. Lietchi, W.M.G. Vansteelant. 2017. Atmospheric conditions create freeways, detours, and tailbacks for migrating birds. *Journal of Comparative Physiology.* 203:509-529.

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).

There is low migration flux during mid-late February and first two week of March in both years. After that, there was a peak around end-March in 2020 and early April in 2021; then there was a great decrease in 2021 whilst numbers remain rather similar in 2020 until late April and early-May. On the contrary, there was another higher peak in 2021 by the end of April.

Overall, the passing time extended along fourteen (14) weeks however it is important to note that this was the period/time that was established to monitor the spring migration as described in the methodology.

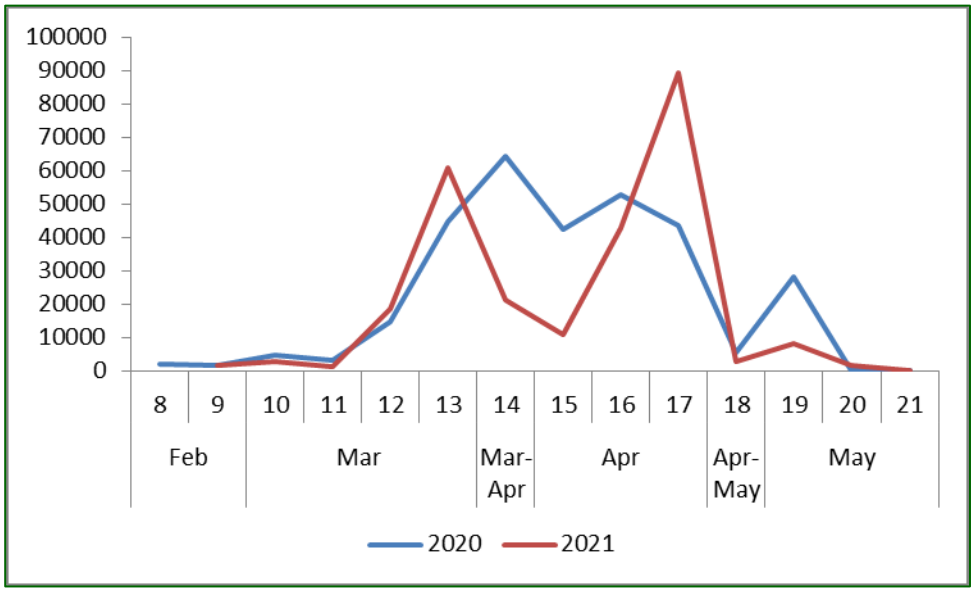


Figure 8-23: Overall Numbers of Birds per Week and Months in 2020 and 2021

A better view for understanding the number of birds passing is shown in the Figure 8-24. During the first weeks (mid-Feb to Mid-March, the bird numbers remain low both for 2020 and 2021 (1,000-3,000 individuals). The steady increase starts in mid-March till the last week of April; then the numbers vary from 10,000 to 90,000 individuals. By May almost all bird species have passed, except the Honey Buzzard. The trend in both years is similar with very slight variations between them.

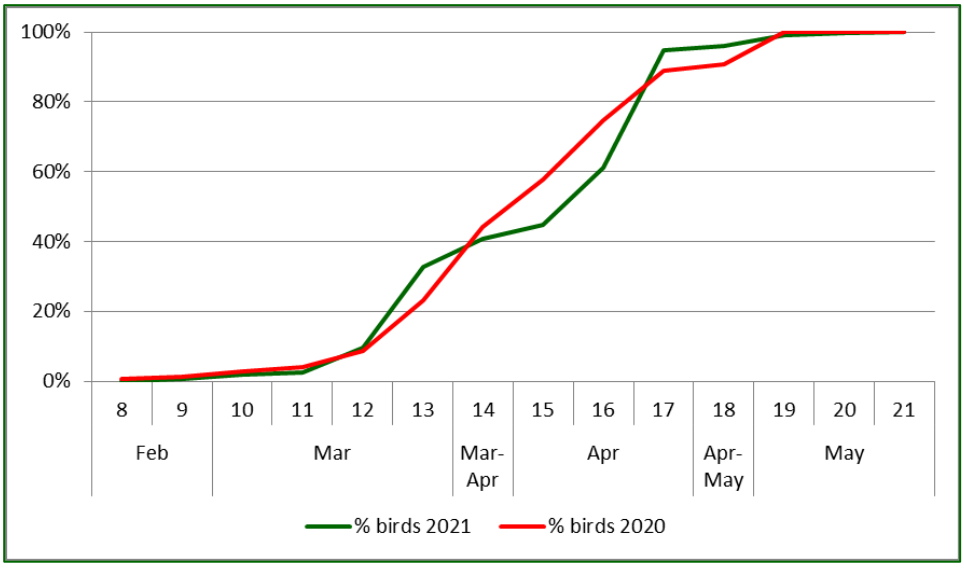


Figure 8-24 Percentages of birds per week and months in 2020 and 2021

To analyse the migration pattern of the species recorded those species with enough data, observations and individuals were selected. Despite wind energy being 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. Counts at the Gulf of Suez of migratory birds in both autumn and spring were 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 the Bosphorus. The assessment below compared the results with the Shirihai et al. (2000) study in order to understand the migratory patterns recorded within the Project site since it is more focused in the Middle East.

The following figures represent the number of individuals migrating per year. Due to the great differences in numbers between years for some species, results should be expressed in two axes. Notation to which axis belongs to what year appears in the legend of each figure.

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.

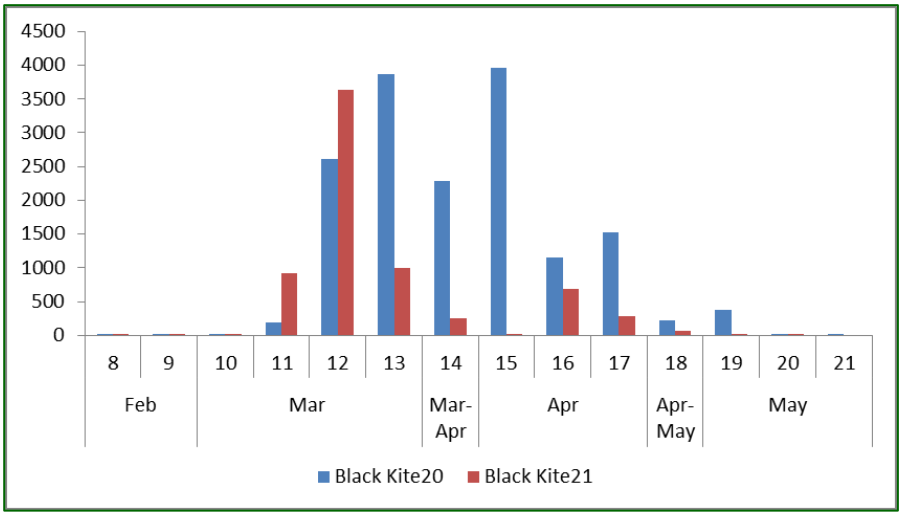


Figure 8-24: Migration pattern of the Black Kite among the weeks/months for 2020 and 2021

The figure below presents the migration pattern for the Black Stork, an irregular migrant in terms of bird numbers, which 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 in 2020 but rather compressed in one single week in 2021. For this species data was compared 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 here.

Despite being further north in the Flyway than the RSWE project, 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 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 2021 were quite high compared to 2020.

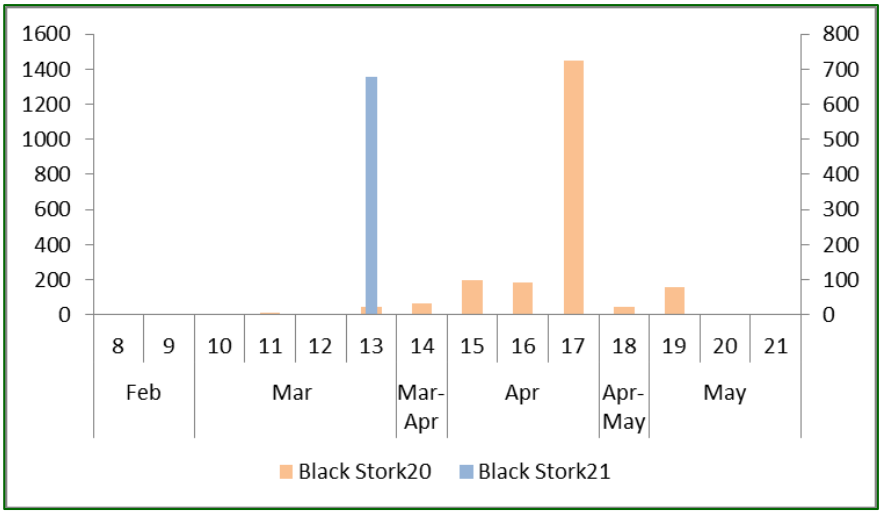


Figure 8-25: Migration pattern of the Black Stork Y-left 2021, Y-right 2020

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). As what has occurred with the Black Stork, more birds were recorded in 2020 compared to 2021.

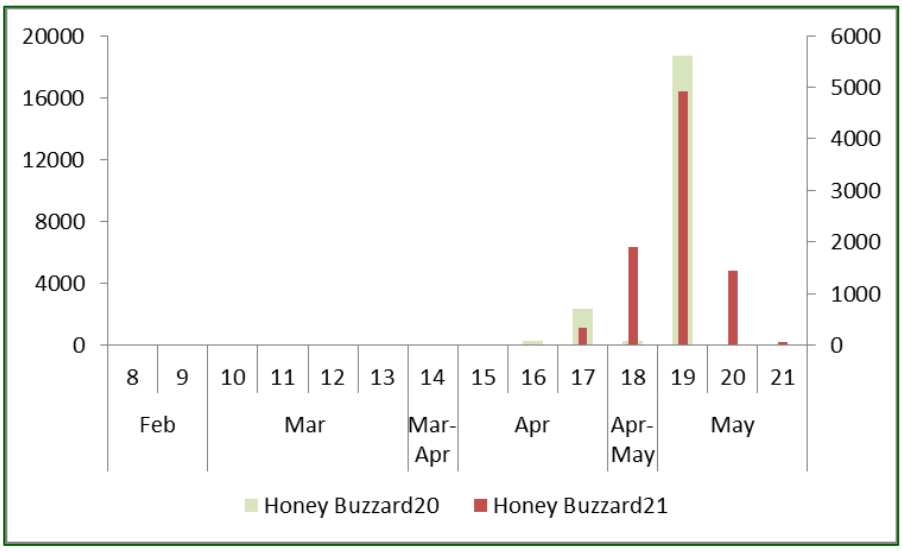


Figure 8-26: Migration pattern of the Eurasian Honey Buzzard Y-left 2020, Y-right 2021

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 extended over nine weeks, but counts in 2021 were with some delay compared to 2020 by around a week. For this species numbers in both years are rather similar. Shirihai et al. (2000) mentions that 90% of the total numbers passes between 22 March and 15 April. Results do not fully match this pattern in 2021 starting earlier and finishing later to such times, but does in 2020.

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.

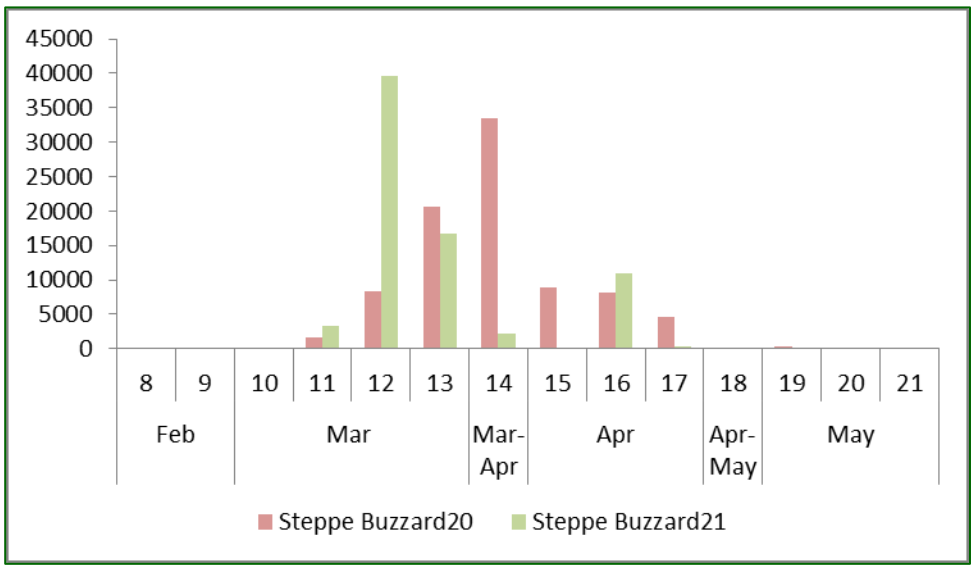


Figure 8-27: Migration pattern of the Steppe Buzzard

The figure below presents the migration pattern for the White Stork. This species has been recorded from March to May, with peaks in the first half of April in 2020 but later in 2021. For the study and comparison of the passage of the White Stork the work by Van den Bossche (2002) was relied on, 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, April, and May with flocks larger than 1,000 birds. 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.

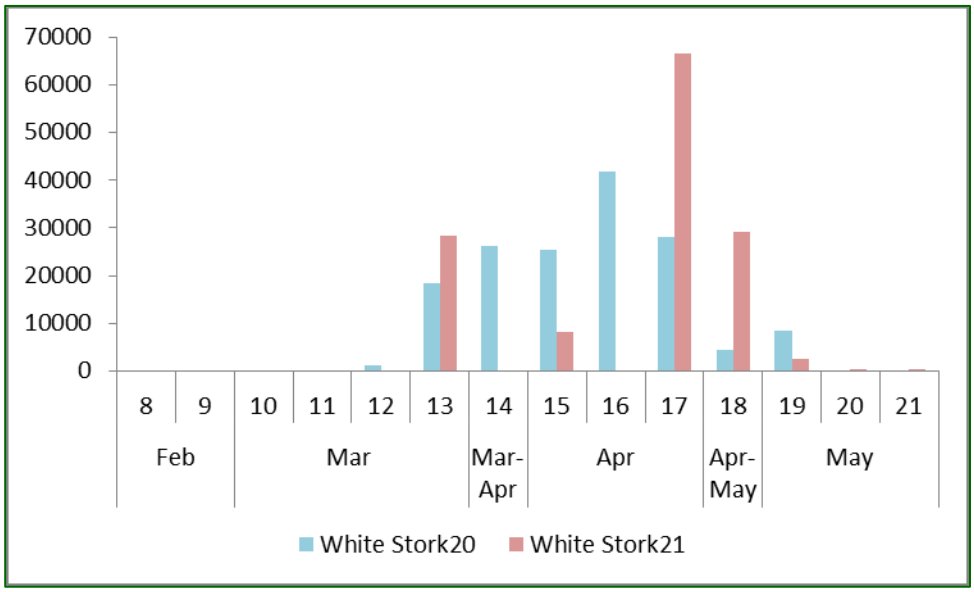


Figure 8-28: Migration pattern of the White Stork

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 2021 there was only one peak in March-April, whilst in 2020 the peak reaches February-March, with a more sustained pass till early 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.

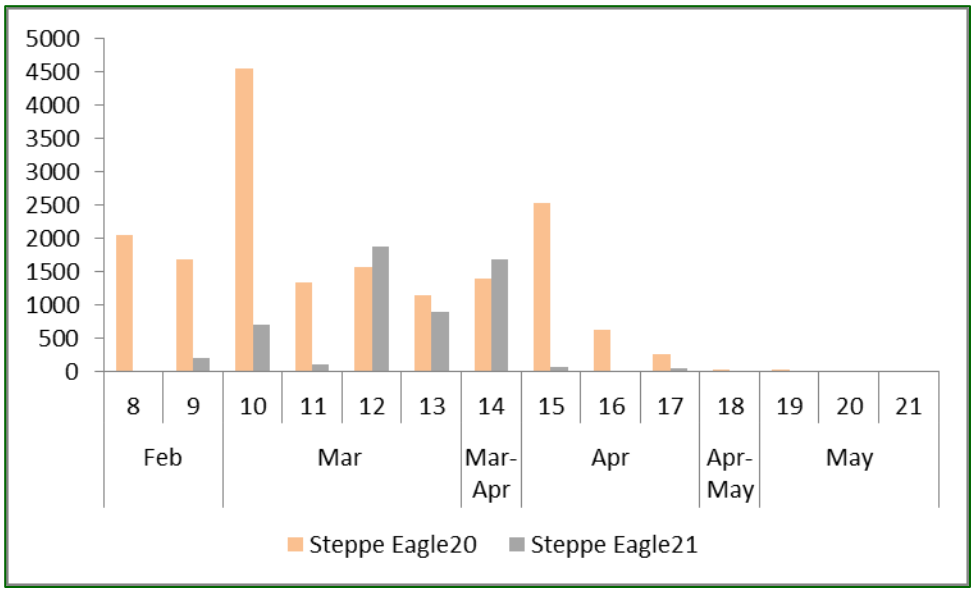


Figure 8-29: Migration pattern of the Steppe eagle

Finally, the Great White Pelican exhibits an erratic and asynchronous passage, with most birds crossing in mid-March in 2020 and late April and May in 2021.

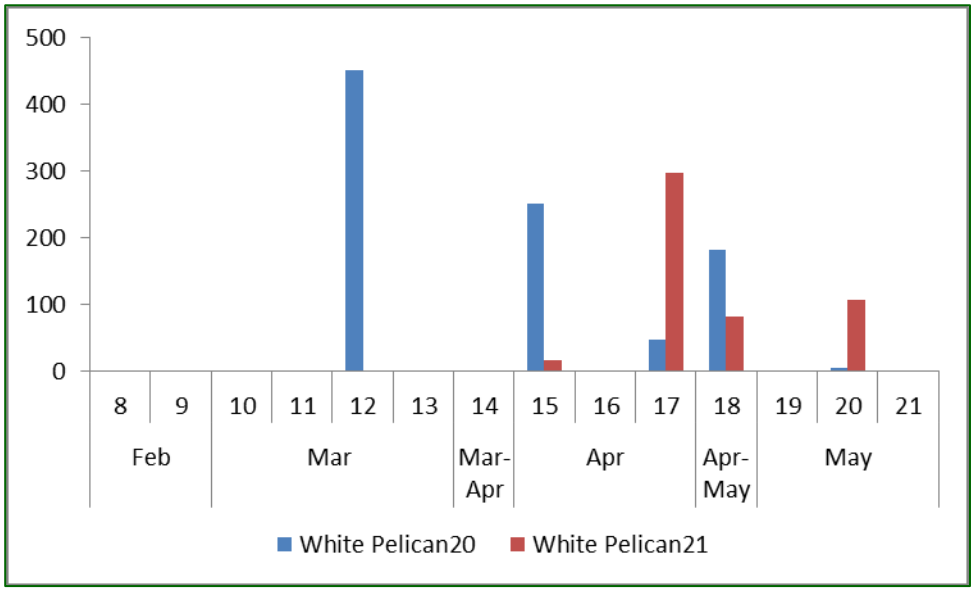


Figure 8-30: Migration pattern of the Great White Pelican

Finally, we present a Table with the average median date, date of first 5% and first 95% of passage, and length of central 90% of passage (days), as presented in other migration studies[3] in The Western Palearctic.

Table 14 Average median date of passage, first 5% and 95%, and length of passage in days for those with more than 50 individuals. For a given species, the first line represents spring 2020 and the second 2021.

Species	N	Median	Percentile 5%	Percentile 95%	Length passage (days)
Black Kite	1190	01-abr-20	15-mar-20	27-abr-20	43
	826	23-mar-21	17-mar-21	25-abr-21	39
Black Stork	108	21-abr-20	23-mar-20	04-may-20	42
	76	22-mar-21	21-mar-21	06-may-21	46
Booted Eagle	431	13-abr-20	19-mar-20	03-may-20	45
	153	03-abr-21	21-mar-21	28-abr-21	38
Common Crane	3	21-mar-20	15-mar-20	04-may-20	50
	4	21-mar-21	10-mar-21	26-mar-21	16
Egyptian Vulture	213	10-abr-20	05-mar-20	05-may-20	61
	63	31-mar-21	17-mar-21	01-may-21	45

[3] Verhelst,B, J. Jansen, W. Vansteelant. 2011. South West Georgia: an important bottleneck for raptor migration during autumn. ARDEA 99(2).
Onrubia. A. 2015. Spatial and temporal patterns of soaring birds migration through the Strait of Gibraltar. Ph. D. León University.

Greater Spotted Eagle	121	09-abr-20	17-mar-20	25-abr-20	39
	-	-	-	-	-
Honey Buzzard	259	24-abr-20	16-abr-20	05-may-20	19
	115	30-abr-21	18-abr-21	11-may-21	23
Imperial Eagle	42	12-abr-20	07-mar-20	23-abr-20	47
	34	25-mar-21	26-feb-21	19-abr-21	52
Lesser Spotted Eagle	329	11-abr-20	17-mar-20	05-may-20	49
	350	21-mar-21	25-feb-21	19-abr-21	53
Long-legged Buzzard	298	30-mar-20	05-mar-20	22-abr-20	48
	62	22-mar-21	04-mar-21	28-abr-21	55
Marsh Harrier	59	16-abr-20	05-mar-20	05-may-20	61
	45	18-abr-21	20-mar-21	02-may-21	43
Montagu's Harrier	22	16-abr-20	23-mar-20	26-abr-20	34
	5	19-abr-21	18-abr-21	26-abr-21	8
Pallid Harrier	24	30-mar-20	26-mar-20	27-abr-20	32
	19	25-mar-21	16-mar-21	26-abr-21	41
Short-toed Eagle	732	10-abr-20	03-mar-20	02-may-20	60
	337	25-mar-21	04-mar-21	29-abr-21	56
Steppe Buzzard	2140	31-mar-20	08-mar-20	25-abr-20	48
	1547	23-mar-21	14-mar-21	19-abr-21	36
Steppe Eagle	1746	24-mar-20	21-feb-20	22-abr-20	61
	834	21-mar-21	01-mar-21	10-abr-21	40
White Pelican	12	21-abr-20	16-mar-20	10-may-20	55
	9	25-abr-21	07-abr-21	15-may-21	38
White Stork	261	11-abr-20	24-mar-20	04-may-20	41
	180	18-abr-21	21-mar-21	08-may-21	48

The duration of the central 90% of migration varied between 16 and 61 days for the Egyptian Vulture and the Short-toed eagle. Among most of the species, the median passing date ranges between zero and eight days (one week) between 2020 and 2021, with only two species, the Lesser Spotted and the Short-toed eagles, for which the days were seventeen and fifteen days respectively.

B) Migration Patterns: Flocking behaviour

A second aspect of the migratory behaviour 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 to apply, as large flocks may cause a large number of fatalities in one single event compared to individuals flying singly.

The table below presents the average flock size (birds /flock) for all species, their confidence intervals ± 95%, the number of records, minimum and maximum values. By far, the Great White Pelican, Levant Sparrow Hawk and the White Stork form the largest flock sizes. However, notice that also the flock size changes between years for some of the species like the pelican itself, but also the common crane or the Levant Sparrowhawk. ***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 eight species do in large ones.***

Table 8-15: Average Flock Sizes for those species recorded both in 2020 and 2021

Species	Year	Mean	Conf. -95%	Conf. +95%	n obs.	Min.	Max.
Black Kite	2020	13.64	12.03	15.25	1190	1	339
	2021	8.30	7.32	9.28	826.00	1	147
Black Stork	2020	19.96	14.41	25.52	108	1	150
	2021	25.13	5.07	45.19	76.00	1	700
Booted Eagle	2020	1.99	1.26	2.72	431	1	160
	2021	1.34	1.21	1.47	153.00	1	6
Common Crane	2020	2.67		6.46	3	1	4
	2021	5.25		11.92	4.00	1	11
Egyptian Vulture	2020	1.85	1.58	2.13	213	1	21
	2021	1.57	1.34	1.81	63.00	1	5
Greater Spotted Eagle	2020	2.82	0.65	4.99	121	1	133
	2021	1.00			2.00	1	1
Griffon Vulture	2020	1.00			8	1	1
	2021	1.00			6.00	1	1
Honey Buzzard	2020	83.50	42.98	124.02	259	1	3200
	2021	75.17	49.12	101.23	115.00	1	850
Imperial Eagle	2020	1.05	0.98	1.11	42	1	2
	2021	1.12	1.00	1.23	34.00	1	2
Lesser Spotted Eagle	2020	5.18	4.42	5.95	329	1	39
	2021	14.33	10.70	17.96	350.00	1	410
Levant Sparrowhawk	2021	1074.86	263.84	1885.89	22.00	1	7000
	2020	282.00		691.29	15	1	2200
Long-legged Buzzard	2020	1.84	1.66	2.02	298	1	19
	2021	1.16	1.06	1.27	62.00	1	3
Marsh Harrier	2020	1.14	1.05	1.23	59	1	2
	2021	1.29	1.04	1.54	45.00	1	6
Montagu's Harrier	2020	1.05	0.95	1.14	22	1	2
	2021	1.00			5.00	1	1
Osprey	2020	1.00			5	1	1
	2021	1.00			8.00	1	1
Pallid Harrier	2020	1.00			24	1	1
	2021	1.00			19.00	1	1
Short-toed Eagle	2020	2.14	1.93	2.34	732	1	36
	2021	2.22	1.77	2.67	336.00	1	50

Sparrowhawk	2020	1.71	1.40	2.03	63	1	6
	2021	1.44	1.07	1.80	39.00	1	7
Steppe Buzzard	2020	40.58	36.52	44.64	2140	1	1800
	2021	47.58	42.79	52.36	1545.00	1	1800
Steppe Eagle	2020	9.82	8.72	10.93	1746	1	320
	2021	6.76	5.71	7.81	833.00	1	187
White Pelican	2020	78.00	-9.66	165.66	12	1	450
	2021	55.44	-4.45	115.34	9.00	1	250
White Stork	2020	592.13	424.29	759.97	261	1	13650
	2021	754.55	498.54	1010.56	180.00	1	10000

C) Migration Patterns: Daily schedule

The next step was to analyse the time of passage according to the time of the day. The monitoring extended continuously from around 7:00 am to 5:00 pm daily. The first figure shows the overall trend of all species pooled together. Since 8 am there was a sudden increase in the bird numbers, which remained high till around 10:00-11:00 pm. Then, the numbers started to decrease.

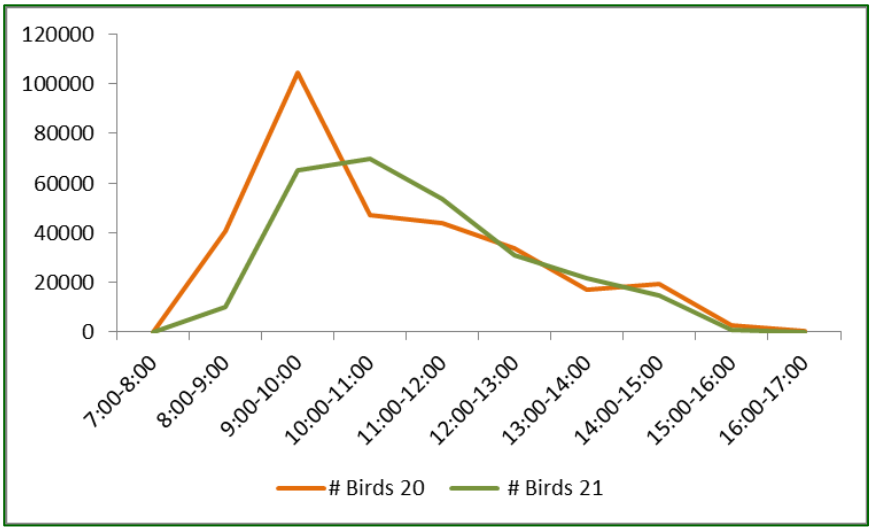


Figure 8-31: Bird numbers recorded at the project site in spring 2020 and 2021

Also, the cumulative curves for 2020 and 2021 show that by 2:00 pm a 94% of the birds recorded have passed in both years already.

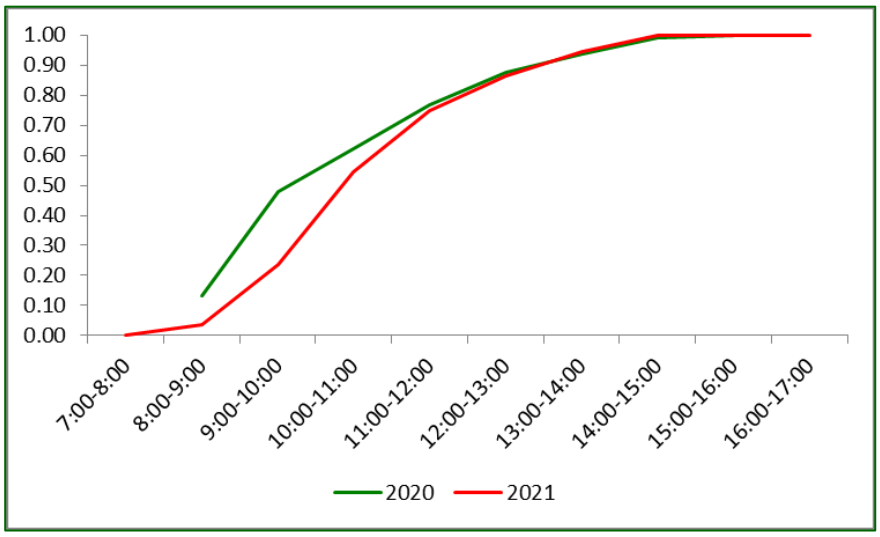


Figure 8-31: Cumulative curves for the percentage of birds recorded per hour interval

We also drew the trend for the bird records throughout the day – i.e., number of records per hour interval. 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 both 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.***

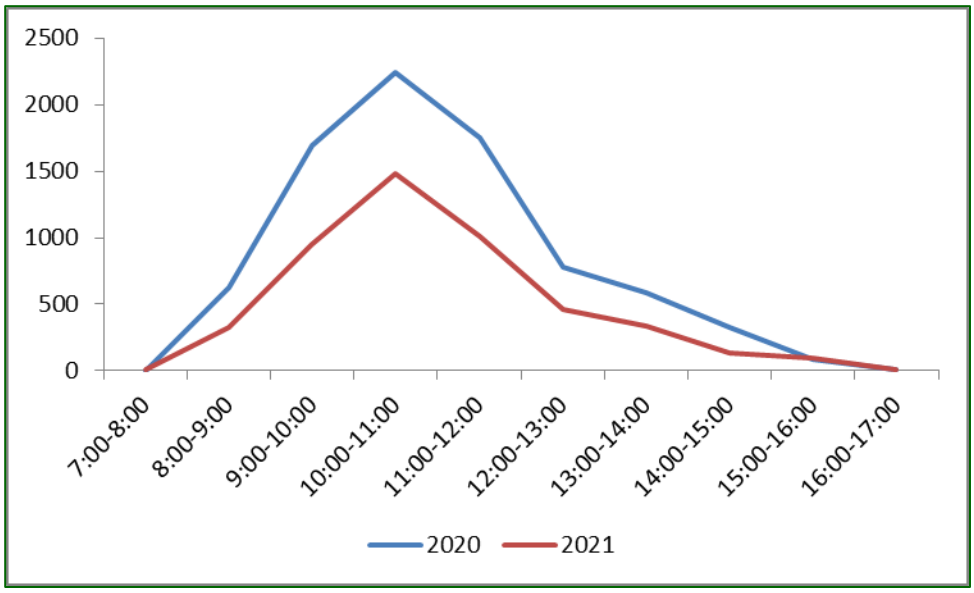


Figure 8-32: Number of records per hour interval in 2020 and 2021

The analysis below investigated further the migration for those key species noted earlier. The first species is the Black Kite, which shows a quite similar and identical pattern in 2020 and 2021, with most of the passage occurring between 9:00 am and 12:00 pm – this fall well within the overall established pattern noted for the site as presented in the figure below. After that number decrease significantly as noted in the figure below. The numbers of birds differ between years with higher numbers in 2020.

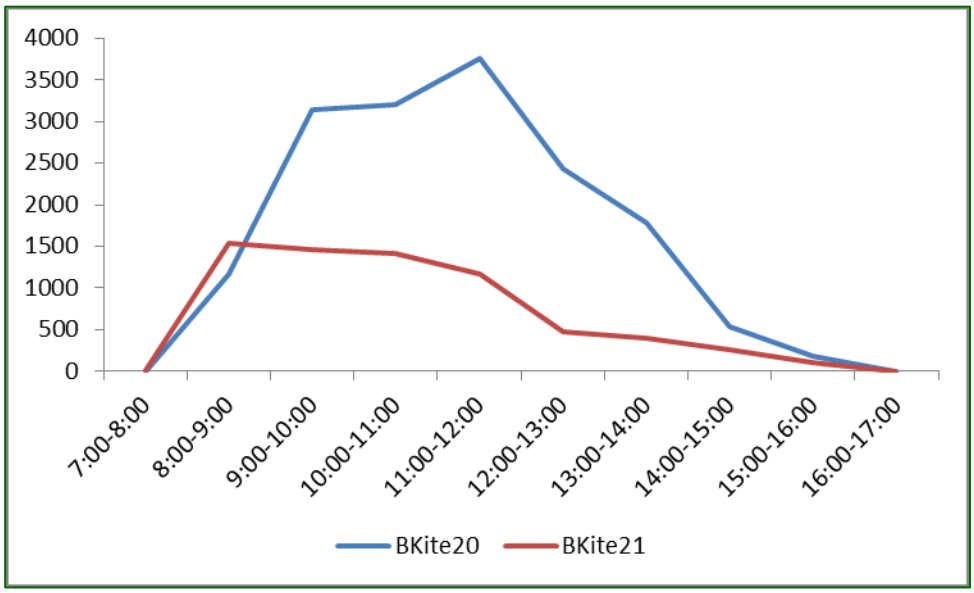


Figure 8-33: Daily migration pattern (hr. of the day) of the Black Kite

For the Honey Buzzard the trend differs from that of the Black kite, as it migrates earlier in the day in 2020 (with the higher numbers around 9:00-10:00 am) but a little bit later in 2021 (10:00 to 12:00 pm).

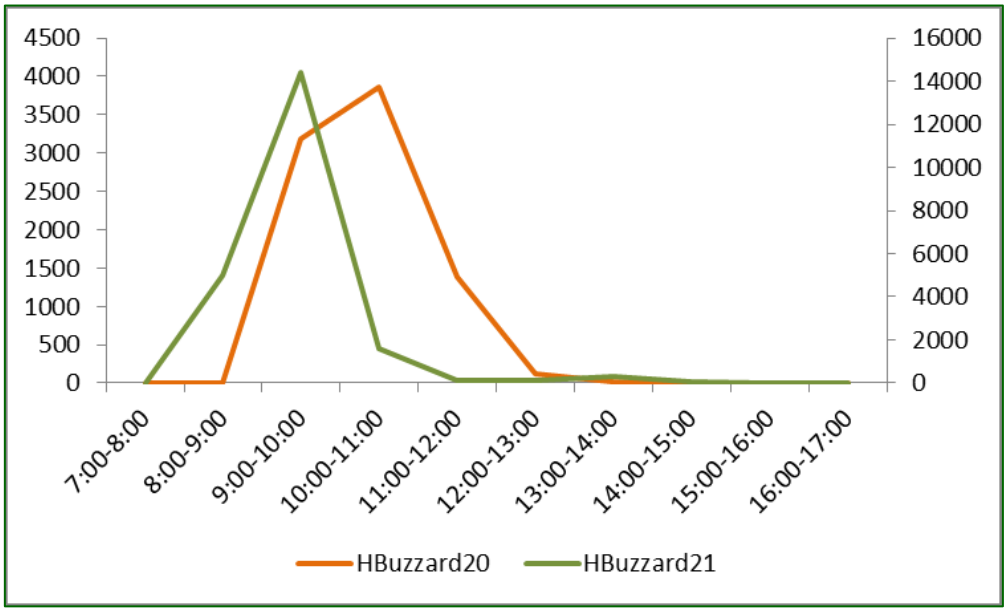


Figure 8-34: Daily migration pattern (hr. of the day) of the Honey Buzzard

The White Stork also has similar patterns in 2020 and 2021, but numbers differ between years. After the peak around 9:00-10:00 am numbers slowly decrease over the day, with no more birds after 16:00.

Figure 8-35: Daily migration pattern (hr. of the day) of the White Stork

The Steppe Buzzard shows almost identical trends in both seasons, with a peak at 11:00 am. The steadily increase from 8:00-9:00 am is followed by the mentioned peak and a slow decrease afterward in the afternoon.

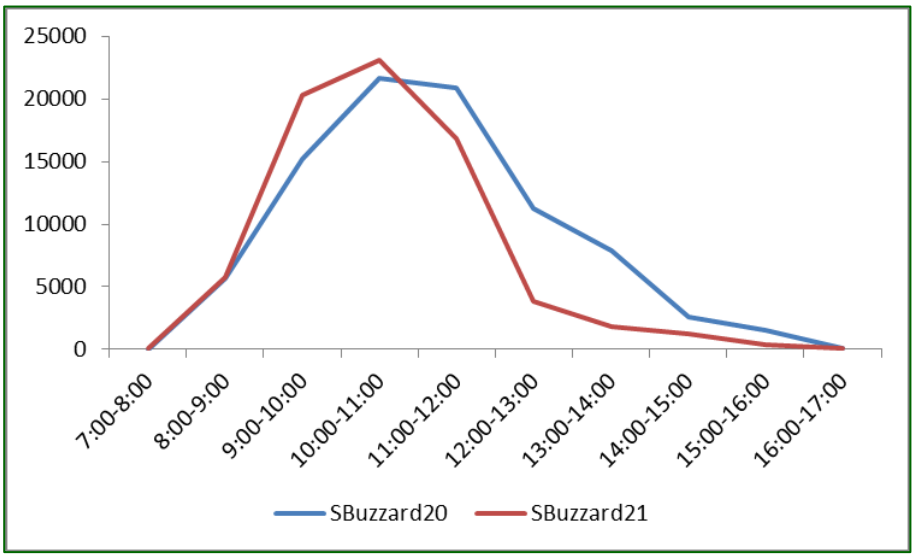


Figure 8-36: Daily migration pattern (hr. of the day) of the Steppe Buzzard

Finally, the Steppe eagle showed a very similar pattern with most of the birds with peak numbers being 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.

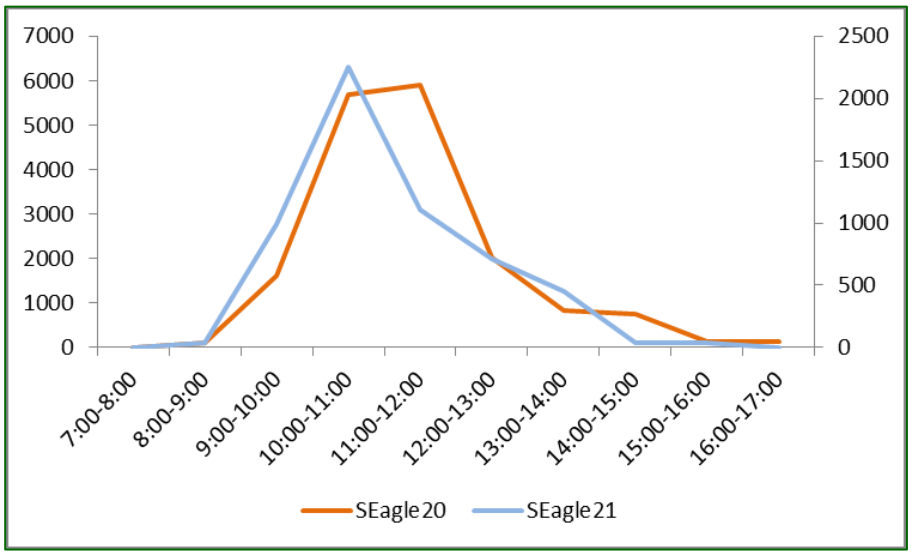


Figure 8-37: Daily migration pattern (hr. of the day) of the Steppe Eagle

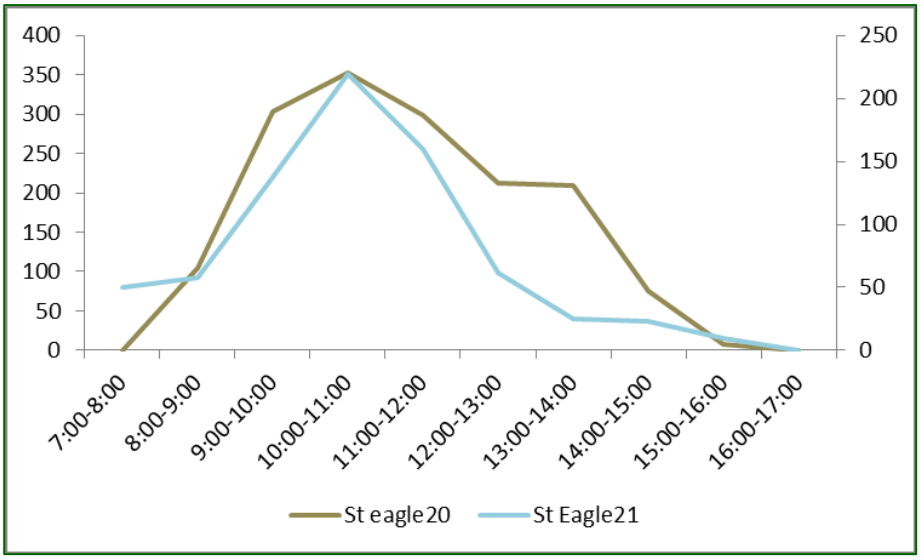


Figure 8-38: Short-toed Snake eagle

From this section we can conclude that:

1. The **migration pattern** (monthly-weekly) on a species-by-species basis **did not show differences with the migration studies developed so far in the region**. Each species has its own time of passage with very slight variations in some instances (i.e., the Steppe eagle) which cannot be explained.

2. The **migration dates** vary across species, as expected, with **no differences between 2020 and 2021**.

3. Birds tend to **cross as earliest as possible in the day, with the majority (94%) crossing before 2:00 pm**. This agrees with the preference to migrate as soon as possible in the day.

4. It could be argued that the monitoring time across day hours could affect the outcomes of the assessment. However, on average, each monitoring period (time/VP) lasted between 6:43 (range 0:27-8:36 hrs.) and 7:05 hours (range 2:15-8:35), with a total of 282 and 229 monitoring intervals in 2020 and 2021. The monitoring intervals not covering the "preferred passing hours (before 2:00 pm)", were only the 5.3-6.5%.

Flight Direction

The main flight directions for the two spring seasons appear in the figure below. There was 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.

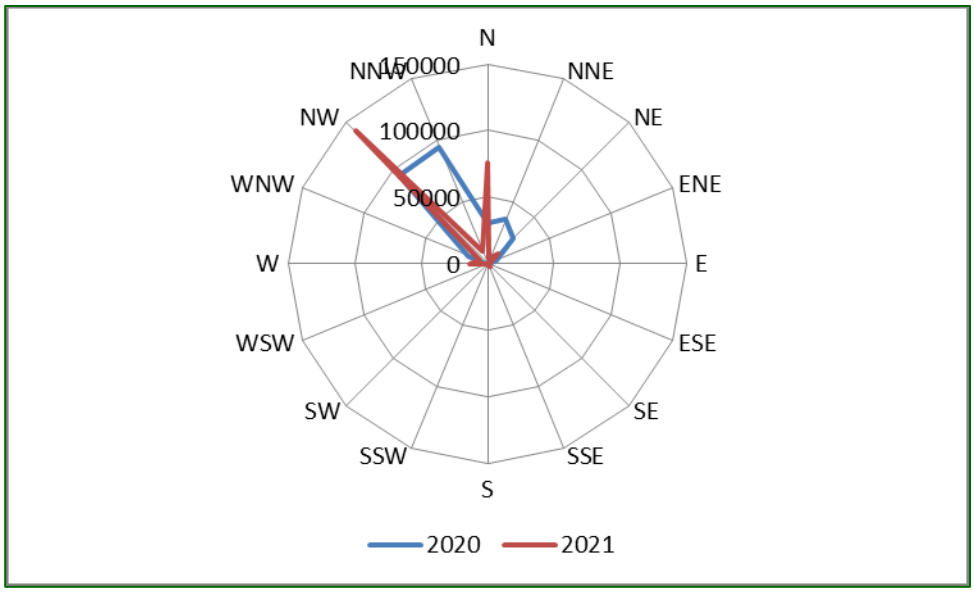


Figure 8-39: Observed flight direction of the migratory soaring birds in 2020 and 2021

(iii) Autumn Season

Data Analysis

A total of twenty-eight (28) species were recorded between both years, accounting for 11,071 birds (454 records) in 2019, and 19,351 birds (848 records) respectively in 2019 and 2020. The table below presents the detailed breakdown for records and species per year.

Three globally threatened species were recorded, the endangered (EN) Egyptian vulture and Steppe eagle 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, The Great White Pelican, and the White Stork, all accounting for 97-98% of all the birds recorded in 2019 and 2020 respectively, and between 53%-62% of all records. All the remaining species did not reach the 1% of individuals each year.

It **is noteworthy that specific passage numbers differed between years for the Eurasian Honey Buzzard and the White Stork**. The latter recorded one third of the number in 2019 during 2020 (from 5,316 to 7,419), whilst the Honey Buzzard increased by around 40%, from 4,986 in 2019 to 9,253 in 2020).

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 in 2019 and 2020 may result from the different migratory strategy through the GoS of the migratory birds, see related to this Shirihai et al. (2000), which includes a detailed explanation about the differences in the spring and autumn migrations.

Table 8-16: Species recorded in autumn 2019 and 2020

		2019		2020	
Species	**IUCN**	**Birds**	**records**	**Birds**	**records**
Barbary Falcon	LC	0	0	1	1
Black Kite	LC	85	38	99	52
Black Stork	LC	40	5	1	1
Booted Eagle	LC	5	5	3	3
Crane	LC	6	1	46	2
Egyptian Vulture	EN	0	0	2	2
Eleonora's Falcon	LC	2	2	3	3
Lesser kestrel	LC	8	5	10	6
Lanner Falcon	LC	3	3	0	0
Hobby	LC	0	0	3	3
Honey Buzzard	LC	4,986	191	9,253	447
Kestrel	LC	24	23	38	36
Lesser kestrel	LC	0	0	6	4
Lesser Spotted Eagle	LC	0	0	1	1
Long Legged Buzzard	LC	1	1	1	1
Marsh Harrier	LC	62	47	113	82
Montagu's Harrier	LC	16	9	32	27
Osprey	LC	3	3	1	1
Pallid Harrier	NT	12	11	24	24
Peregrine Falcon	LC	0	0	1	1
Red-footed Falcon	LC	1	1	1	1
Sooty Falcon	VU	5	5	19	16
Short-toed Eagle	LC	3	3	0	0
Sparrowhawk	LC	7	7	6	6
Steppe Buzzard	LC	12	11	12	11
Steppe Eagle	EN	6	5	3	2
White Pelican	LC	381	7	2,151	15
White Stork	LC	5,316	12	7,419	20
TOTALS		**10,984**	**395**	**19,249**	**768**

Spatial Distribution

The figures below present the overall median passing rates (birds/hour) per VP in autumn 2019 (first figure) and 2020 (second figure). There were no significant differences in the Median passing rates for the autumn 2019: ANOVA F (7; 446) and p=0.06, or 2020: F (7; 837) and p =0.77. Globally, birds did not show a pattern which made them to pass at higher rates through specific sites.

From the two figures below the following can be considered:

- If there would be preferred passing VPs in the project area, (i) differences should have appeared and (ii) being significant, the pattern of the passing rates between 2019 and 2020 should be similar or the same, however they are not.

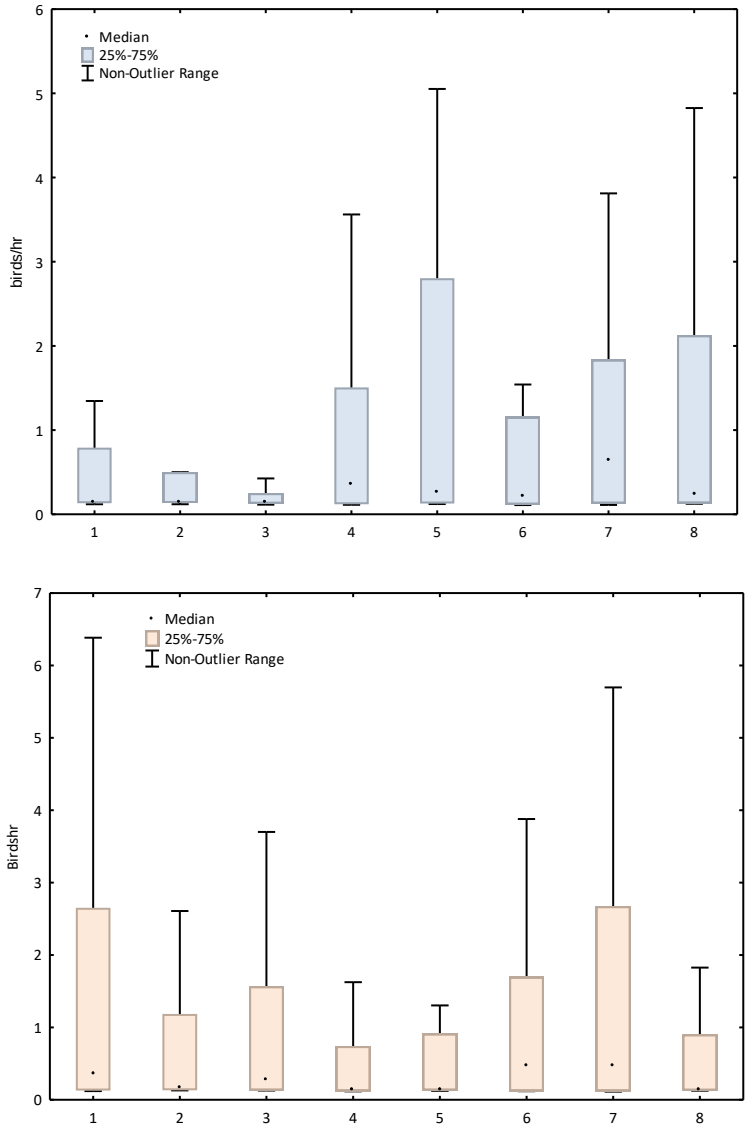


Figure 8-40: Median Passing Rates± 25-75% percentiles per VP in autumn 2020 and 2021

With this purpose, the Table 8-18 shows the results of the Analysis of Variance-ANOVA tests for the passing rates (birds per hour) for each species among the 8 VPs in 2019 and 2020.

Table 8-17: Results of the Analyses (Analysis of Variance-ANOVA) for Vantage Point passing preferences on a species per species basis for each autumn season 2019 and 2020

Species	2019	2020
Black Kite	F(7;30) = 1.41 p = 0.23	F (7;44) =2.86 **p <0.05**
European H. Buzzard	F (7;183) =1.62 p=0.13	F (7;439) =1.24 p=0.27
Great W. Pelican	F(1;5) = 0.04 p = 0.84	F (7;6) = 0.4431 p = 0.846
Western Marsh Harrier	F(6;40) = 0.98 p = 0.45	F (7;74) = 0.95 p =0.47
Montagu's Harrier	F(7;1) = 8.45 p = 0.25	F(7;19) = 1.18 p = 0.35
Steppe Buzzard	F(5;5) = 0.53 p = 0.74	F(5;4) = 218.77 **p < 0.001**
Booted eagle	n.a.	n.a.
Egyptian Vulture		n.a.
Eleanora's Falcon	n.a.	n.a.
Osprey	F(1;1) = 175.09 **p <0.05**	n.a.

Pallid Harrier	F(4;6) = 0.96 p = 0.48	F(7;16) = 0.56 p = 0.77
Eurasian Honey Buzzard	F(7;183) = 1.62 p = 0.13	F (7;439) =1.24 p = 0.27
White Stork	F(4;7) = 0.70 p = 0.61	F(6;13) = 0.80 p = 0.58
Black Stork	F(3;1) = 582.76 **p < 0.05**	n.a.
Lesser Spotted Eagle		n.a.
Steppe Eagle	n.a.	n.a.
Common Kestrel	F(5;17) = 6.22 p <0.01	F (7;28) =0.46 P =0.85
Short-toed eagle	n.a.	-
Common Crane	n.a.	n.a.
Hobby	-	n.a.
Lesser Kestrel	n.a.	F(2;3) = 4.90 p = 0.11
Long-legged Buzzard	n.a.	n.a.
Barbary Falcon	-	n.a.
Red-footed Falcon	-	n.a.
Sooty Falcon	-	F(6;9) = 0.56 p = 0.74
Lanner Falcon	F(1;1) = 1.15 p = 0.47	-
Sparrowhawk	F(3;1) = 3448.49 **p < 0.05**	F(4;1) = 1.45 p = 0.54

From the table above, the following is concluding:

1. Only three species in 2019 (Osprey, Black Stork, and Sparrowhawk) and two in 2019 (Black Kite and Steppe Buzzard), (highlighted and which have p <0.05) presented significant differences among VPs in terms of passage rates during (**passed in greater numbers through specific VPs compared to others)**. Thus, the passage differed among years.
2. From the table above ***it can be concluded that birds had no preferred sites*** through the wind farm. Again, this is further supported with the tables presented below that have been prepared, where the intensity of the passing rates is compared between the two years for the Black Kite and the Black Stork, the only two soaring species with had some difference.

Table 8-18: Intensity of passing rates (birds/hr) per VP in the autumn 2019 and 2020

Vantage Point	Black Kite		Black Stork	
	2019	2020	2019	2020
VP-1	Medium	Low	-	n.a.
VP-2	Medium	Low	-	n.a.
VP-3	Low	High	Low	n.a.
VP-4	Medium	Medium	Low	n.a.
VP-5	Medium	Medium	-	n.a.
VP-6	Medium	Low	High	n.a.
VP-7	Low	Low	Low	n.a.
VP-8	Medium	Medium	-	n.a.

From the numbers and spatial distribution of passage we can conclude that:

1. Autumn migration is much lower compared to the spring in terms of species and bird numbers. There are two species accounting for most of the birds (Honey Buzzard and White Stork). This migration patter has been described already in Shirihai et al. (2000) at least for the raptor species.
2. As stated for the spring, the number of birds per hour depends on other factors of the area rather than just counts but even also from areas further away where birds stayed before. The weather conditions (wind and temperature) allow or force birds whether to cross the sea or not.

A) Migration Patterns: Time of Weeks/Months

The timing of passing according to the months and weeks in the autumn season has been analysed. The figure below presents the weeks of the year for the autumn monitoring period which runs from August (starting at week number 33) until November (ending at week 46).

The passage considering the global bird numbers per week/month is presented in the figure 8-41. Overall, the passing time extends along fourteen weeks. In 2019, 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 2020 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 trends are similar in both years.

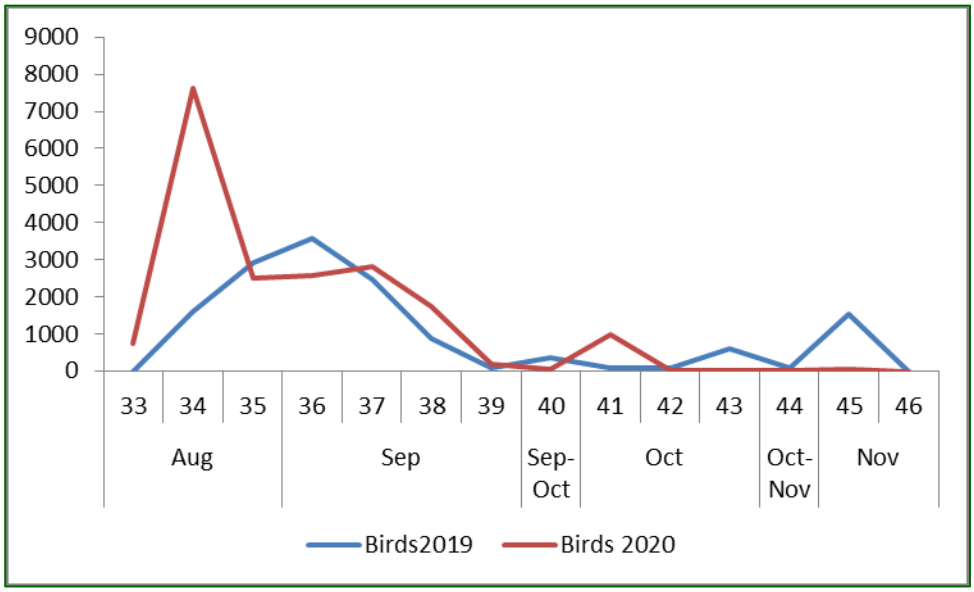


Figure 8-41: Bird numbers migrating per week/month in the autumn seasons

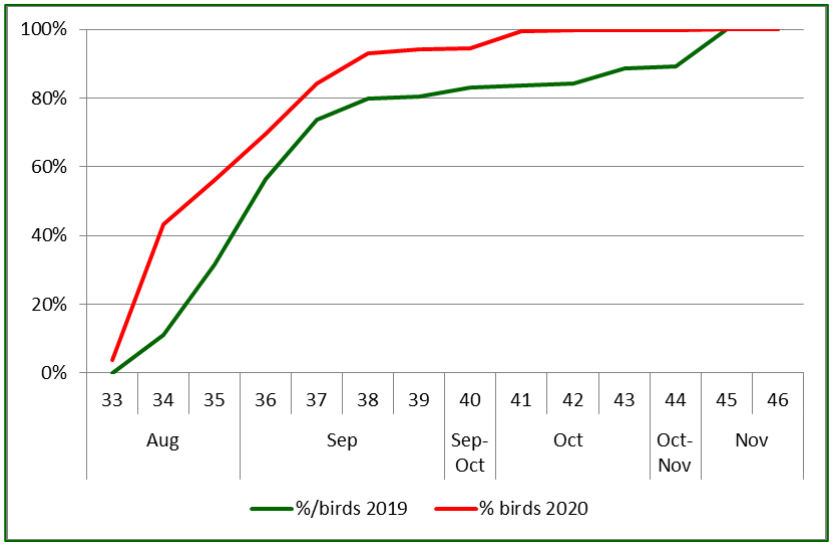


Figure 8-42 Percentages of birds per week and month in the autumns 2019 and 2020

In autumn most of the birds pass early in the season, the time of the White Stork, with nearly 80% of the individuals (12,000-20,000) of all species out already by mid-September. There is some delay in the migration in 2019 compared to 2020.

As we did for the spring, we compared these results with the study by Shirihai et al. (2000) "*Raptor Migration in the Middle East. A summary of 30 years of field research*". To analyse the migration pattern of the species recorded those species with enough data of observations and individuals were selected, which includes the Eurasian Honey Buzzard, White Stork, Black kite, and the Great White Pelican.

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).

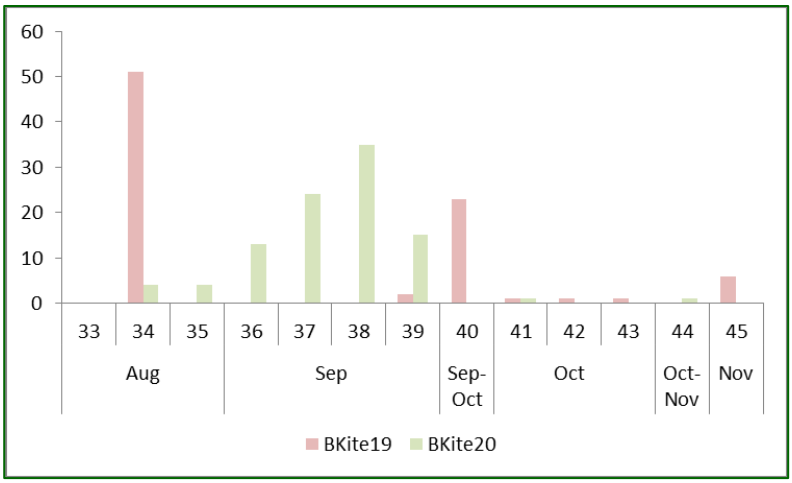


Figure 8-42: Migration pattern of the Black Kite

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. In 2019 the species passed in a narrower period of time compared to 2020.

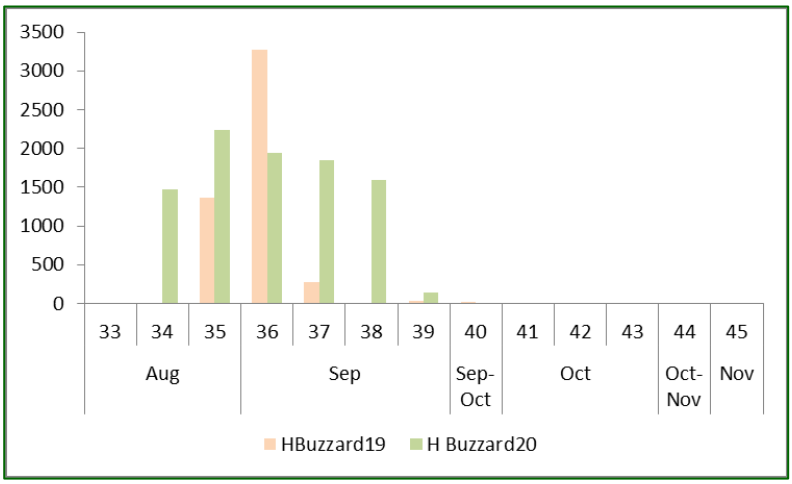


Figure 8-43: Migration pattern of the European Honey Buzzard

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) whom mentions that the storks needed only 14 to 24 days to fly from the breeding areas 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. There were differences between 2019 and 2020 with birds passing in two different weeks.

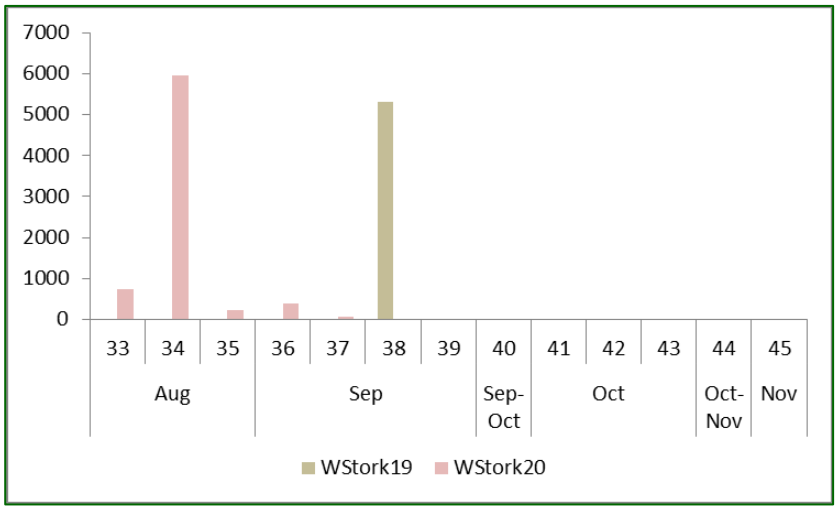


Figure 8-44: Migration pattern of the White Stork

The Great White Pelican appears irregularly with a great difference between years (381 birds in 2019 against 2,151 in 2020). 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, it is a species with capabilities for landing on water bodies.

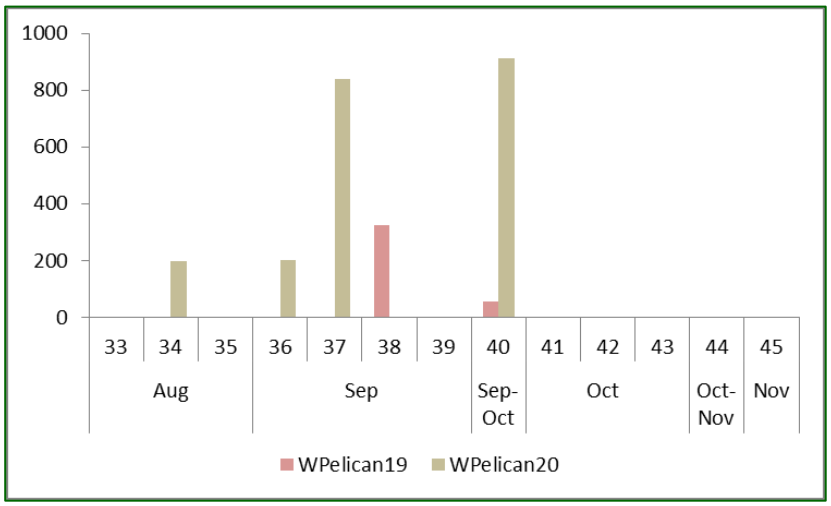


Figure 8-45: Migration pattern of the Great White Pelican

B) 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. The number of birds each year was sorted 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 similar pattern in 2019 and 2020. However, the number of birds is quite small compared to other species. Caution should be taken into account before making any further assumptions or conclusions for such small amount of kites.

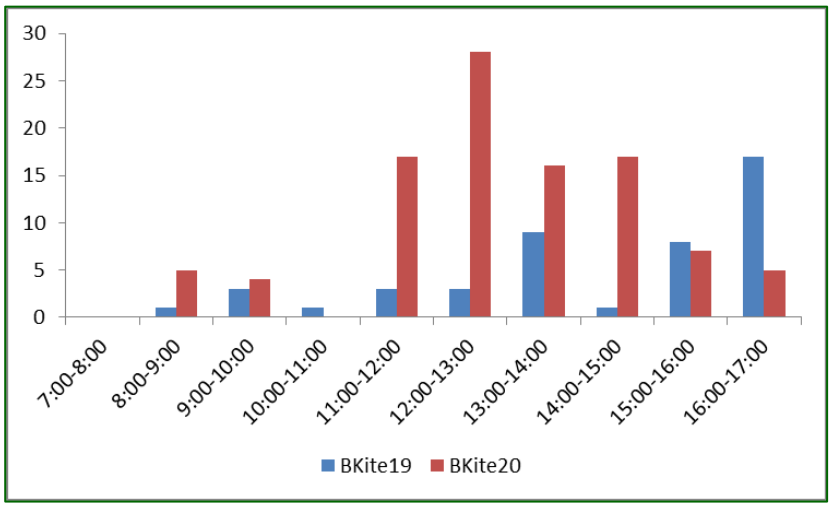


Figure 8-46: Daily migration pattern (hr. of the day) of the Black Kite

For the Honey Buzzard the trend is quite similar in both years, with higher numbers around noon. However, there were more birds in 2020 compared to 2019.

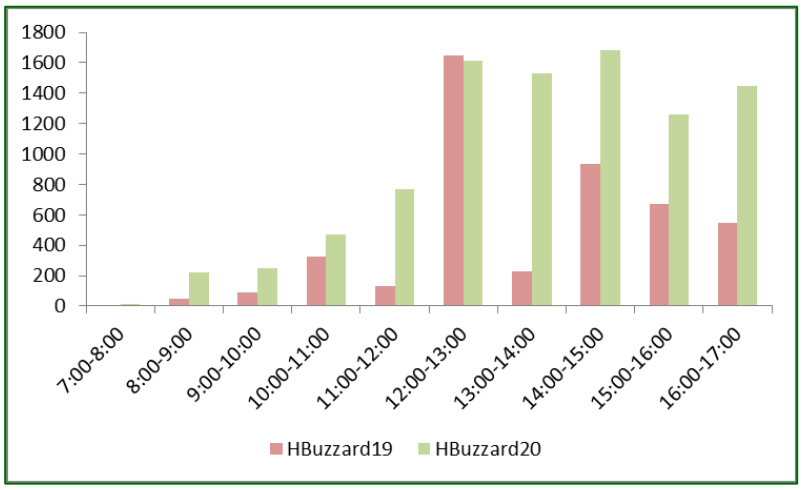


Figure 8-47: Daily migration pattern (hr. of the day) of the Honey Buzzard

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. 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.

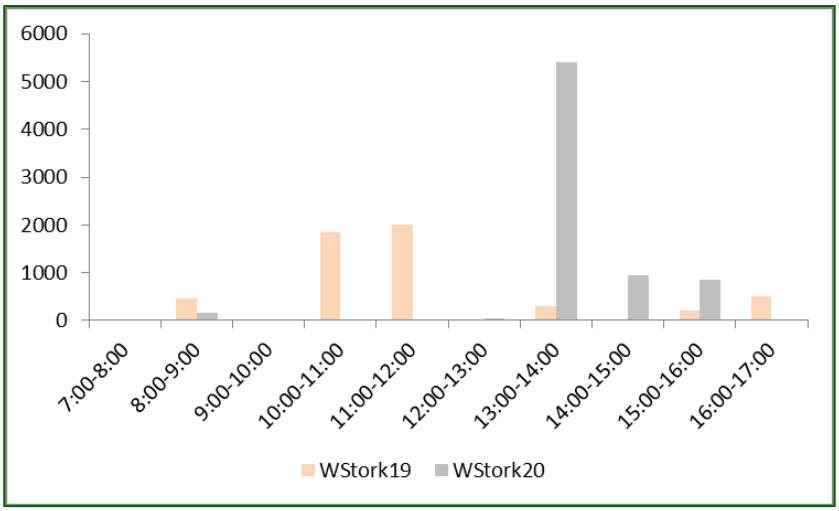


Figure 8-48: Daily migration pattern (hr. of the day) of the White Stork

Finally, the Great White Pelican showed an irregular pattern with more birds in 2020 compared to 2019 as seen above, but also uneven distribution throughout the day.

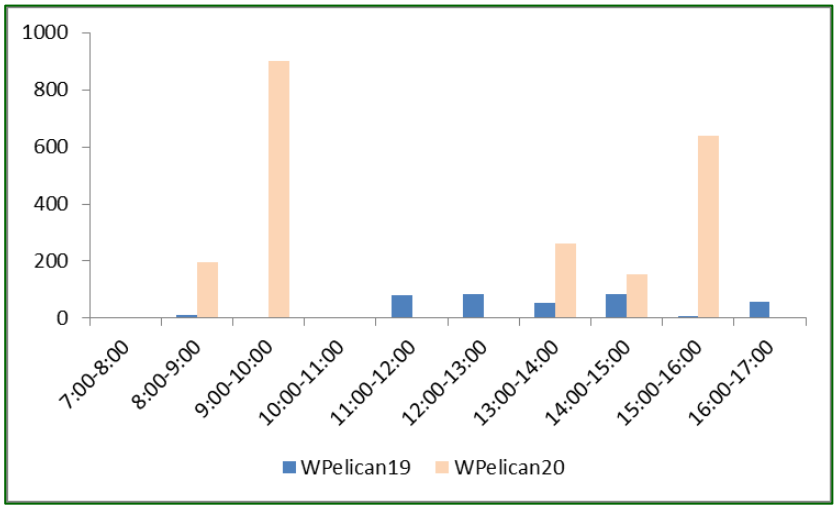


Figure 8-49: Daily migration pattern (hr. of the day) of the Great White Pelican

The main outcomes of the autumn are the following:

1. The autumn migration is of lower magnitude compared to spring, with a lower number of species and bird numbers.
2. As expected, 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.
3. 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. The peak is clearly influenced mainly by the numbers of the White Stork and the European Honey Buzzard.
4. Contrary to spring, more birds were recorded in the mid-day in 2019 but more in the afternoon in 2020. This could be related to birds arriving/passing the project late in the day, which should stay near the project for overnight.

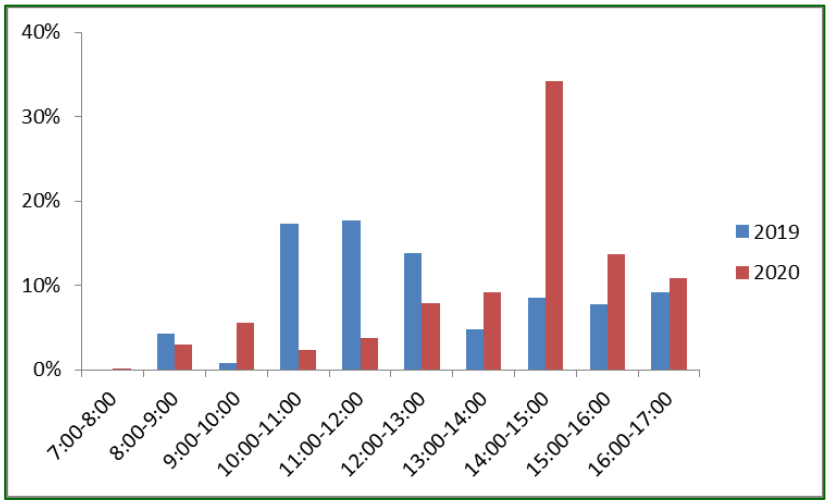


Figure 8-50: Distribution of Bird Numbers per Hour Interval

Flight Directions

The flight directions both in 2019 and 2020 have a preferred bearing (S, SE, and SW), between 60-79% of all the birds recorded. In particular, in 2019 there was strong bias for the SW bearing. Reason for this could be the differences in weather conditions (wind speeds and/or directions) which could divert the birds southwest between 2019 and 2020. Birds 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 El Zeit.

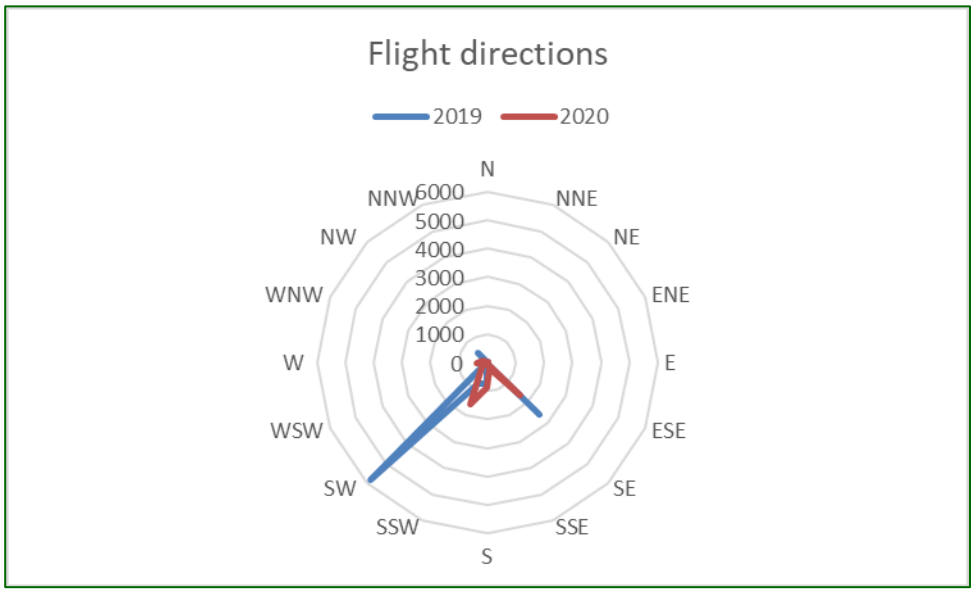


Figure 8-51: Preferred bird migration in 2019 and 2020

8.6 Bats - Chiroptera

This section provides an assessment of baseline conditions within the wind farm and its surroundings in relation to bats

8.6.1 Baseline Assessment Methodology

The baseline assessment of the Project site was based on a literature review and site survey both of which are discussed in further details below.

(i) Literature Review

Little is known about the distribution of the bats of Egypt. Qumsiyeh (1985), Osborn (1988), and Hoath (2003) reported around 20 species as can be seen in Table 8-19. As for the study area, Osborn (1988) reported only two species from the Red Sea Mountains of Egypt; namely *Tadarida aegyptiaca* and *Plecotus christiei.* Both species are resident within the area, and no large-scale migration was reported in Egypt. Qumsiyeh (1985) reported four bats from the Red Sea Mountains including *Taphozous nudiventris* from Quseir, *Pipistrellus kuhlii*, *Taphozous perforatus* and *Asellia tridens.*

Table 8-19: Bat species recorded from Egypt

Family	Species
Pteropodidae	*Rousettus aegyptiacus* (E. Geoffroy St.-Hilaire, 1810)
Rhinopomatidae	*Rhinopoma microphyllum* (Brunnich, 1782).
	Rhinopoma cystops Thomas, 1903
Emballonuridae	*Taphozous perforatus* Geoffroy, 1818

	Taphozous nudiventris Cretzchmar, 1830
Nycteridae	*Nycteris thebaica* (Geoffroy, 1813)
Rhinolophidae	*Rhinolophus clivosus* Cretzschmar, 1828
	Rhinolophus hipposideros (Borkhausen, 1797)
	Rhinolophus mehelyi Matschie, 1901
Hipposideridae	*Asellia tridens* (Geoffory, 1813)
Vespertilionidae	*Pipistrellus kuhlii* (Kuhl, 1817)
	Vansonia rueppellii (Fischer, 1829)
	Hypsugo ariel (Thomas, 1904)
	Eptesicus bottae (Peters, 1869)
	Otonycteris hemprichii Peters, 1859
	Nycticeius schlieffenii Peters, 1859
	Barbastella leucomelas (Cretzschmar, 1826)
	Plecotus christiei Gray, 1838
Molossidae	*Tadarida teniotis* (Rafinesque,1814)
	Tadarida aegyptiaca (E. Geoffroy St.-Hilaire, 1818)

All species recorded within the Project site and vicinity based on the literature review are not threatened and classified as "Least Concern" according to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as shown in Table 8-20.

Table 8-20: List of Bat Species with Their Conservation Status

Family	Scientific name	Common name	IUCN Red List of Threatened Species (IUCN, 2020)
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
	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

(ii) Field Survey

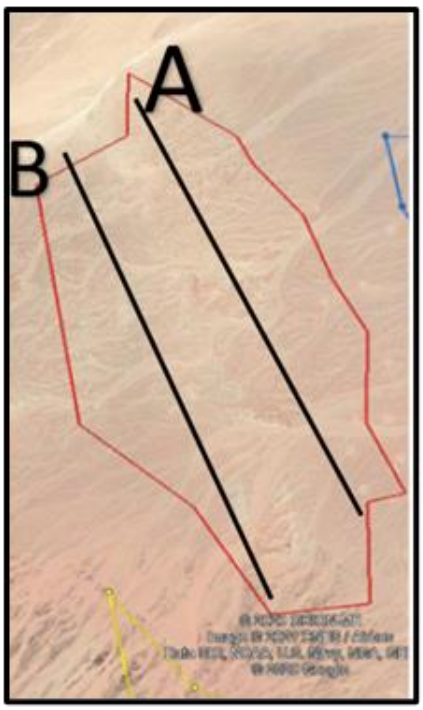
The project area is located in the desert and xeric shrub lands biome, specifically in the Ecoregion of Red Sea Coastal Desert. Collectively, the Project study area can be classified as Hamada Desert, crossed by wadi system and small mountains. The Project site mainly consists of flat pebble desert cut by shallow drainage lines in the form of wadis. As typically for desert regions, habitats are limited in diversity and coverage. However, 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. Therefore, the wadis tend to support the most vegetation due to generally higher soil moisture levels.

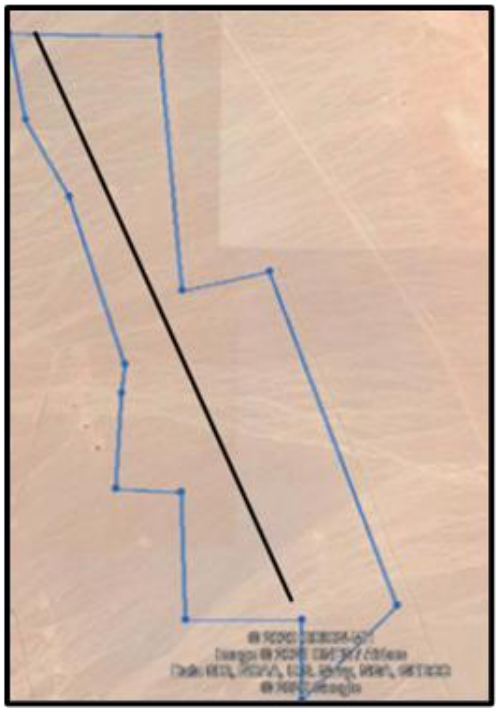
Figure 8-52: Outline of Habitats Within the Study Area

The survey methodology includes following route-transects that are distributed throughout the Project area. The survey was undertaken from the months of July until November 2020 given that bats become active after the hibernation which may last from December to March. Song meter SM4 acoustic recorder was used during this study to monitor bat at the study site.

The route transects were divided into Block A and Block B as seen in the figure below, where observation points were spread-out to be 200m apart, that is at least five stops per one (1) kilometre (km). The bat detector at each point was used to record any bat activity. Each point was covered for 10 minutes, whereas at least four (4) hours were spent at each transect and each transect was covered at least once a month for five (5) consecutive months. The surveying procedure usually started one (1) hour before sunset and continue during night-time as bats usually rest and sleep during the day and are active during night as they search for prey to feed on.

Note: the transects provided below were based on the previous Project boundary considered by the Developer however such transects still cover the new boundary of the Project site.





Dates	Dates
July	29-30.9.2021
28-29.7.2021	30.9.2021-1.10.2021
29-30.7.2021	**October**
30-31.7.2021	24-25.10.2021
31.7.2021- 1.7.2021	25-26.10.2021
August	26-27.10.2021
27-28.8.2021	27-28.10.2021
28-29.8.2021	**November**
29-30.8.2021	4-5.11.2021
30.8.2021-1.9.2021	5-6.11.2021
September	6-7.11.2021
27-28.9.2021	7-8.11.2021
28-29.9.2021	

In the case of bat activity is encountered, the bat detector records the coordinates of the event as well as recording data for further in-depth desktop analysis.

Recordings of the sound waves were then analysed and compared with a comprehensive database for the sound waves of all bats species known to match and determine the species of the recorded bat accordingly. The assessment will provide quantitative and qualitative data about bats in terms of following:

- Species identification;
- Speculations on height. This will be based on field observations that will aim to identify to the extent possible the height at which the bat was recorded but also based on review of published papers and literature for recorded species;
- Activity index (the significant of bat activity is based on the concept of activity index which is the number of bat contracts per surveying hour);
- Map with locations of detected bats within the area;

- Weather conditions and its effect on bat activity. The bat recorder that will automatically records temperature, and wind speed and other meteorological data could be obtained from met mast data; and
- Significance of bat activities for the project including degree of bat activity and species encountered (if any) and identification of any further recommendations to be considered if required (e.g., monitoring at height).

In addition to the bat monitoring undertaken, during the survey period, the Project area (including WTG locations) and its surrounding were inspected through field observations for potential roosting sites at least once per month. Any observed potential roosting sites (such as caves, cervices, etc.) were noted and inspected for roosting activity or any indication of roosting activity (e.g., search for faecal remains). In addition, interviews were carried out with people from the local area who might recommend potential locations for roosting. However, it is expected that due to the nature of the sites (barren, open areas, with very low vegetation cover) that it does not offer roosting areas for bats.

8.6.2 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 8-21.

Table 8-21: 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
	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

Based on the site survey, calls or recordings obtained throughout the survey study period from the Project study area were analysed using bat detection software (Kaleidoscope and Batexplorer). As a result, no defined calls were detected from all the recordings during the survey study period for all transects (refer to Table 8-22). All recorded waves represented only wind blowing. Moreover, the rocky areas, as mentioned previously, were inspected for bat roosts, nevertheless, no signs of activity or faecal dropping were found near the rocky outcrops or in the crevices.

It was noticed and indicated during the field work that high wind velocity prevailed during the night visits which makes it difficult for the bats to fly. In addition, no key or permeant water sources were noted within the vicinity of the study area and in addition insect activity was noted to be very low; all of which are considered key factors for bat attraction to the site.

Table 8-22: Bat Activity Records at the Project Study Site Over the Survey Study Period

Dates	Bat Activity observed	Bat recording results
28-29.7.2021	None	None

29-30.7.2021	None	None
30-31.7.2021	None	None
31.7.2021- 1.7.2021	None	None
27-28.8.2021	None	None
28-29.8.2021	None	None
29-30.8.2021	None	None
30.8.2021-1.9.2021	None	None
27-28.9.2021	None	None
28-29.9.2021	None	None
29-30.9.2021	None	None
30.9.2021-1.10.2021	None	None
24-25.10.2021	None	None
25-26.10.2021	None	None
26-27.10.2021	None	None
27-28.10.2021	None	None
4-5.11.2021	None	None
5-6.11.2021	None	None
6-7.11.2021	None	None
7-8.11.2021	None	None

In summary, the Project site was void of bat activity. Typically, this is due to lack of close roosting sites within the Project area and nearby areas. In addition, the Project area is not considered as feeding or foraging area for bats mainly due to its windy nature as well as the barren nature of the area with low vegetation coverage, as well as absence of key or permanent water sources which could attract flying insects and in turn bats.

8.7 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

8.7.1 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 Wind Farm 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.

In addition to the above, targeted consultations were undertaken with relevant governmental entities to include: (i) Red Sea Antiquities Inspection Office; and (ii) Suez Antiquities Inspection Office. The objective was to discuss the results and outcomes of the assessment, and identify any key issues of concern or additional requirements they might have.

8.7.2 Results

This section presents the results in accordance with the methodology discussed above. Based on the literature review through desktop research as well as consultations with the Red Sea Antiquities Inspection Office and Suez Antiquities Inspection Office, 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 Table 8-23 below and presented in the figure that follows.

Table 8-23: 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.	19km to the north
Saint Anthony Monastery (Deir erl Qidis Antun)	Saint Anthony's disciples founded the monastery between 361 and 36 (Starkey.2012:205)	40km 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).	19km to the north

Figure 8-53: 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 Wind Farm Project site. The outcomes of the assessment were discussed with key stakeholder to include: (i) Red Sea Antiquities Inspection Office; and (ii) Suez Antiquities Inspection Office. Similarly, no key issues of concern were raised and no additional requirements were identified by such entities.

8.8 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

8.8.1 Baseline Assessment Methodology

Assessment of baseline conditions was based on 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 microns in diameter or PM10); 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 CO, 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 into account the following criteria. Monitoring was undertaken for 24h at each point respectively for a total of 96 hours of monitoring. The location of the points is presented in the figure that follows.

- Proximity to the nearest receptor: typically, an air quality and noise monitoring program should take into account the location of sensitive receptors. However, as noted earlier, there are no sensitive receptors within the Project site. Therefore, during the point selection one point was located on the Project boundary so that it is considered the closest to potential sensitive receptors (M2). As discussed earlier, the closest potential sensitive receptor would be the Air Force Defence Unit which is located around 3.4km to the east of the Project site (refer to "Section 8.2.3" earlier).

- Coverage of the site in which one point was selected in each of the three (3) Project plots. In addition, coverage of the site took into account to the greatest extent possible ensuring a point is included in each key geographical location of the Project to include North, South, East and West.
- Prevailing wind directions: review of secondary data in relation to wind rose at the Project site indicates that the dominant direction is North and North-West. Therefore 2 points were selected so that one is located upwind (M1) and one is located downwind (M2)
- Logistical issues such as the particular method of instrument used for sampling, resources available, physical access and security against loss and tampering were also taken into account

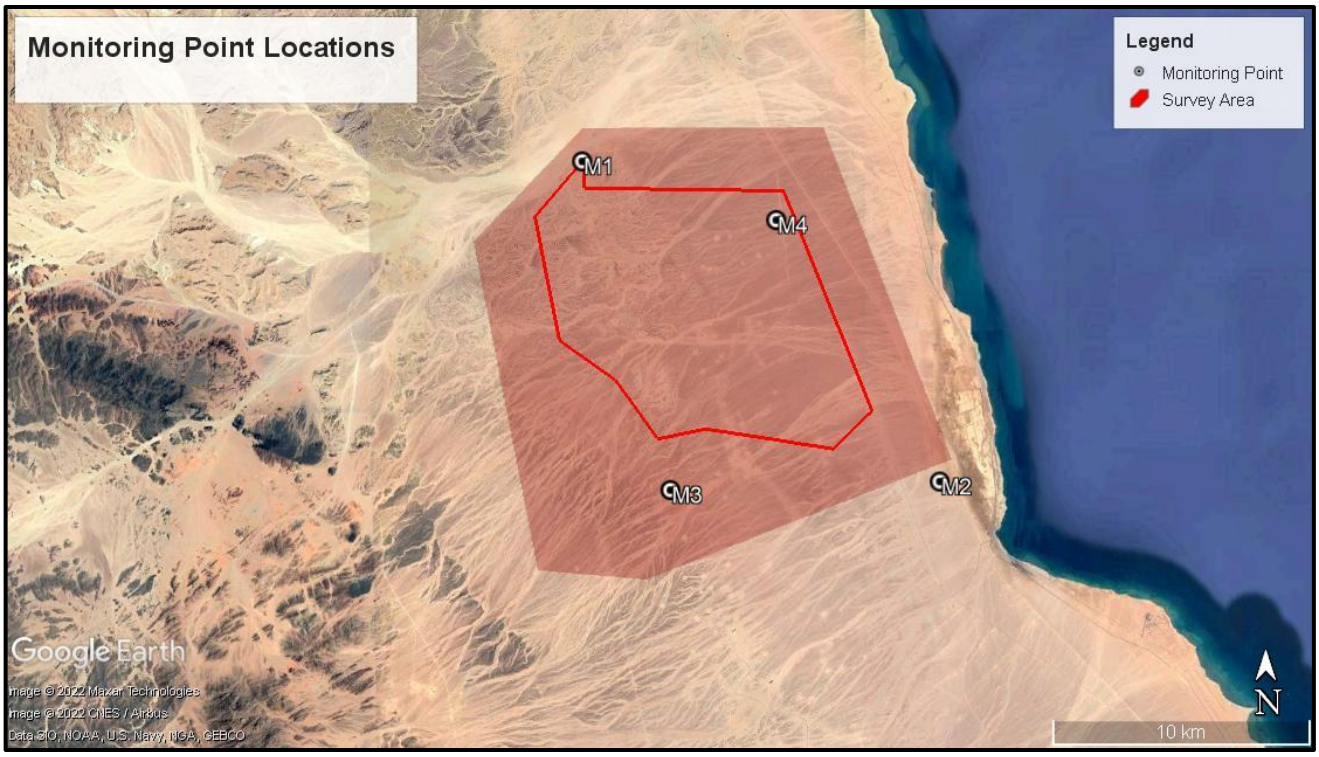


Figure 8-54: Location of Monitoring Points

(iii) Instrumentation

With regards to air quality a mobile lab unit (check figure below) was utilized for undertaking ambient air quality measurements that was equipped with the following:

- Thermo Model 42i NO-NO2-NOx Analyzer
- Thermo Model 43i SO2 Analyzer
- Thermo Model 48i CO Analyzer
- Thermo Model FH62 C14 PM-10 Monitor
- Thermo Model 5014i TSP Monitor

With regards to noise, a Bruel & Kjaer (B&K) Modular Precision Sound Analyzer Type 2238 and Hand-held Analyzer Types 2270 was used.

Figure 8-55: Instrumentation Used for Onsite Monitoring

(iv) 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 were used for comparison given the industrial nature of the site that includes petroleum activities and wind farms.

Table 8-24: 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 were 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 8-25: 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***

8.8.2 Results

The table below presents the overall results for the air quality monitoring that was undertaken.

As noted in the table 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. This includes both hourly limits as well as 24h average limits as required in the legal limits.

It is important to note that within the Project site and surrounding areas, no point sources of pollutant emissions were noted that could affect the results level. In addition, as noted earlier, within the Project site there is a petroleum storage facility as well as an oil rig – however activities undertaken in such areas are minimal, limited, and utilise minimal equipment and machinery and do not include any significant or key sources of emissions that could affect monitoring results. The only noticeable equipment used which could affect result levels were generators that do not operate all day long.

Taking the above into account, the main source of such pollutants onsite is attributed to their trace values in the atmosphere which could be potentially from the infrequent and periodic vehicular movement within the road networks onsite as well as the minimal emissions from the generators used onsite. Nevertheless, as discussed earlier, all monitoring results are well within the limits specified and none exceed maximum allowable limits for ambient air quality.

The following table follows presents the overall results for the noise monitoring that were undertaken (the LAeq average noise level at each monitoring point). As noted in the table below, in general all results are within the maximum allowable noise limits set for the area with no exceedances recorded. It is important to note that within the Project site and surrounding areas there are no point sources of noise generation that could affect the results or noise levels. In addition, the activities undertaken at the petroleum storage facility and oil rig onsite did not generate any key sources of noise during the monitoring period.

The only source of noise that can be recorded onsite was the occasional vehicles within the onsite road network as well as the high wind speeds which can significantly affect noise baseline levels.

Table 8-26: Outcomes of Ambient Air Quality Monitoring

Date	Time	Point 1					Point 2					Point 3					Point 4				
		NO_2	SO_2	CO	TSP	RSP	NO_2	SO_2	CO	TSP	RSP	NO_2	SO_2	CO	TSP	RSP	NO_2	SO_2	CO	TSP	RSP
1/11 – 2/ 11 Point 1	12:00	2	1	4	60	23	1	6	2	40	17	1	3	2	41	16	1	1	2	93	40
	13:00	1	0	4			1	6	3			1	3	2			1	1	2		
	14:00	1	0	4			1	10	2			1	0	2			2	5	2		
2/11 – 3/11 Point 2	15:00	1	0	4			1	26	2			1	1	2			1	5	2		
	16:00	1	0	3			1	33	2			1	1	2			1	1	2		
	17:00	1	0	3			4	4	1			1	1	2			2	1	2		
3/11 – 4/11 Point 3	18:00	2	1	4			2	1	2			1	1	2			2	1	2		
	19:00	1	0	4			1	1	2			2	2	2			2	1	1		
	20:00	2	0	4			1	1	2			2	2	2			1	1	1		
4/11 – 5 /11 Point 4	21:00	4	0	4			1	1	1			1	1	2			1	1	2		
	22:00	2	0	3			2	1	1			1	1	2			1	1	2		
	23:00	3	0	4			2	1	2			0	1	2			1	1	2		
	0:00	3	0	4			1	1	2			0	1	2			12	1	1		
	1:00	5	1	3			1	1	2			0	1	2			2	1	1		
	2:00	2	1	3			1	0	2			1	1	2			1	0	1		
	3:00	1	1	3			1	1	2			1	0	2			1	0	1		
	4:00	1	1	3			1	0	2			0	0	2			3	1	1		
	5:00	4	1	3			1	0	2			1	0	2			2	1	1		
	6:00	3	1	3			1	0	2			1	1	2			1	1	1		
	7:00	5	1	3			1	1	2			1	1	2			1	2	1		
	8:00	4	0	3			1	1	2			0	1	2			2	2	1		
	9:00	2	0	3			1	12	2			0	1	2			3	2	1		
	10:00	2	0	3			1	10	2			0	1	2			2	4	1		
	11:00	2	0	3			1	4	2			1	1	2			2	7	2		
Max. 1h		5	1	4			4	33	3			2	3	2			3	7	2		
Max. 8h		-	-	1			-	-	1			-	-	1			-	-	1		
Avg. 24h		2	0	-			1	5	-			1	1	-			2	2	-		
Legal Limits	Max1h	300	350	30	-	-	300	350	30	-	-	300	350	30	-	-	300	350	30	-	-
	Max8h	-	-	10	-	-	-	-	10	-	-	-	-	10	-	-	-	-	10	-	-
	Avg24h	150	150	-	230	150	150	150	-	230	150	150	150	-	230	150	150	150	-	230	150

All units in the above table are in µg/m³ except for CO which is recorded in mg/m³.

Table 8-27: Ambient Noise Levels Monitoring Results

Monitoring Point	Daytime Average dB (A)	Night-time Average dB (A)
1	69	64
2	65	63
3	59	64
4	61	45
Legal limit [dB(A)]	70	70

8.9 Infrastructure and Utilities

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

8.9.1 Baseline Assessment Methodology

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

8.9.2 Existing Roads and Networks

Based on the survey undertaken on the Project site it was indicated that there are two types of roads in the Wind Farm area (refer to Figure 8-56 below). This includes: (i) dirt road that is used by the quarry sites that are located around 20km from the Project area (as discussed in "Section 8.2.1" earlier) – the dirt road is located just north of the Project site; (ii) existing road networks in and around the Project site that is used by the General Petroleum Company for their activities in the area.

8.9.3 Electricity Lines

An electricity line runs within the most eastern parts of the Wind Farm area including 4 pylons located within the site (refer to Figure 8-60 below). The electricity line is under the responsibility of the Egyptian Electricity Transmission Company (EETC).

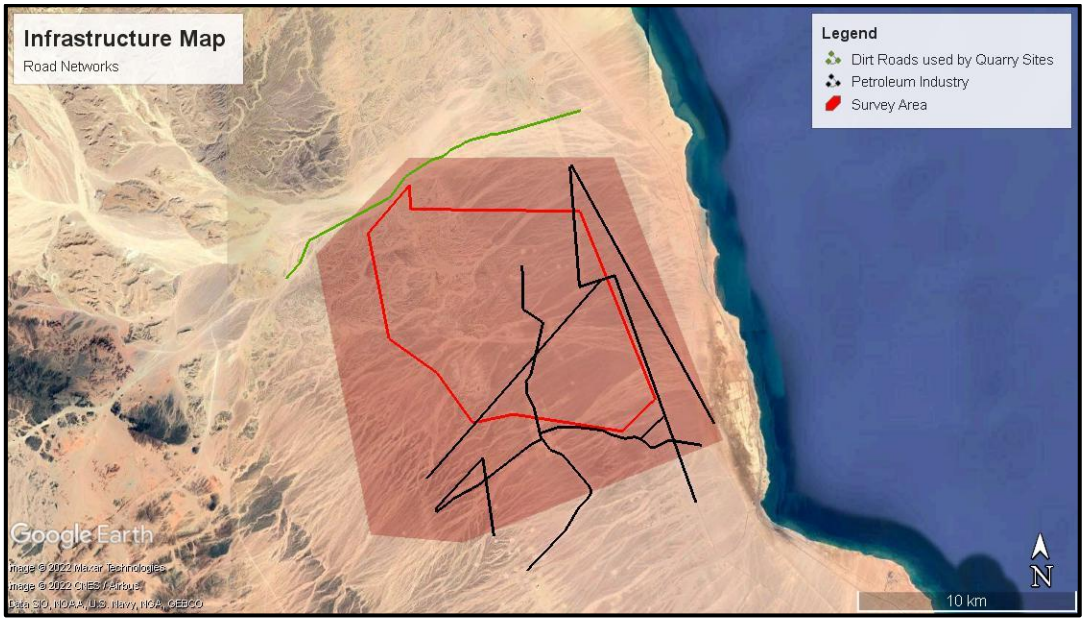


Figure 8-56: Existing Roads Networks within the Wind Farm area

Figure 8-57: Dirt Roads Used by Quarries

Figure 8-58: Roads Used by Petroleum Activities

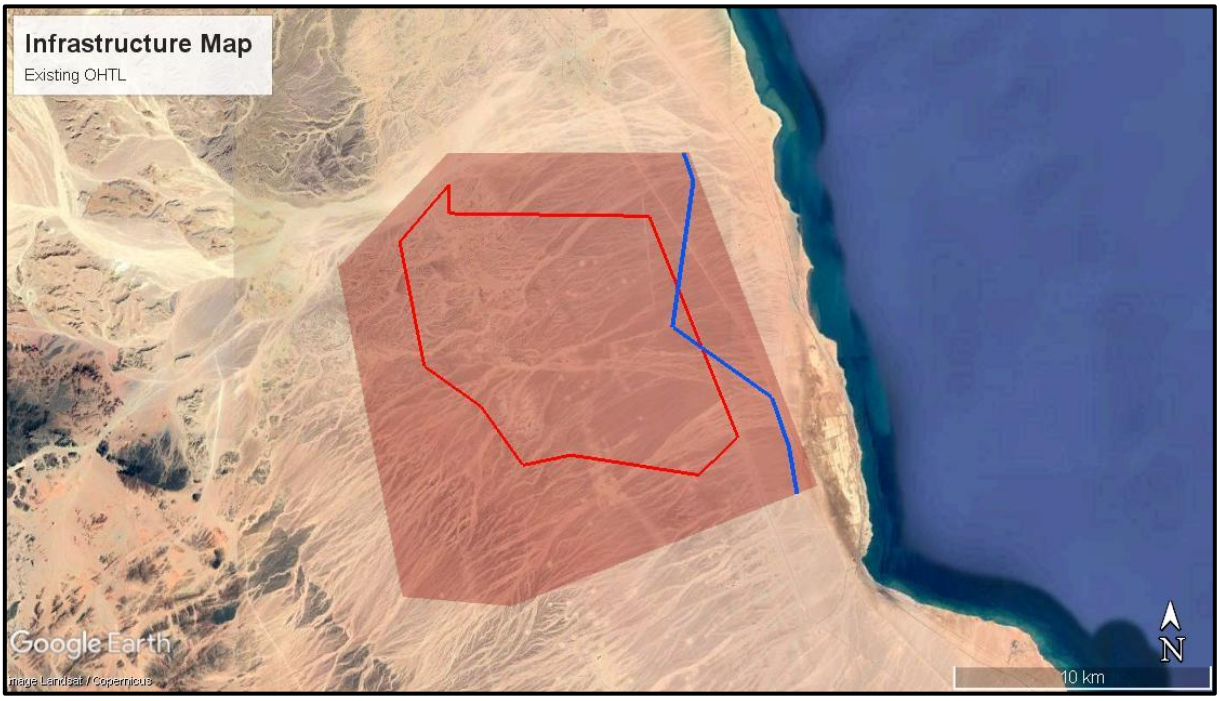


Figure 8-59: Electricity Line within the Project Site

Figure 8-60: Pylons within the Project Site

8.9.4 Natural Gas Line

A natural gas pipeline runs to the east of the Project site by around 1km at the narrowest point as noted in the figure below.

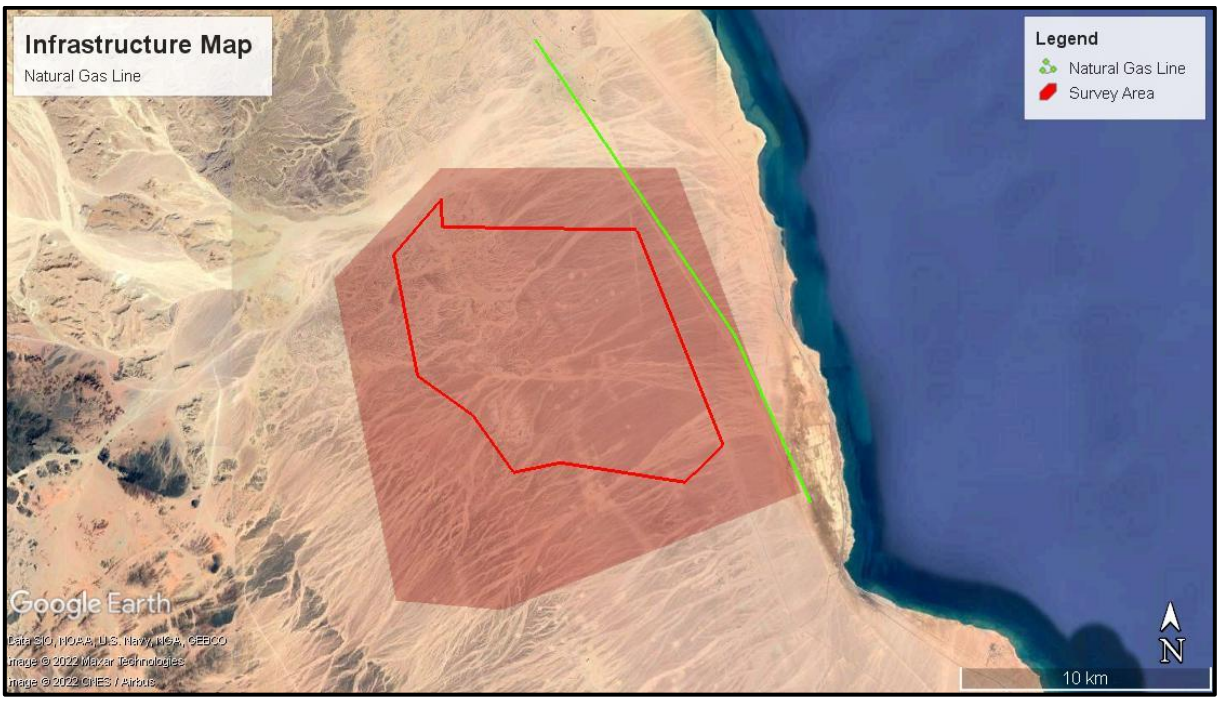


Figure 8-61: Gas Pipeline

8.9.5 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.

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

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 west of the City of Ras Ghareb. The dumpsite is owned and operated by the Ras Ghareb City Council.

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 WWTP.

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.

8.9.7 Telecommunication Towers

Based on the site assessment, only 1 telecommunication tower was noted within the Project site located within the Petroleum Storage Facility onsite. The tower is presented in the figure below. No additional details were available on this telecommunication tower. In addition, no details are available on telecommunication broadcasting towers in the area in general including Line of Sight (LoS) connections.

Finally, located within the Project site are 5 meteorological towers that were installed to monitor wind speed and direction for Wind farm development in the area.

Figure 8-62: Telecommunication Tower within Petroleum Storage Facility Onsite

Figure 8-63: Met Mast Located Onsite

8.9.8 Civil and Military Radars and Aviation

As discussed earlier, located around 3.5km from the Project site is an Air Force Unit. During the site assessment it was noted that the Unit include military radar. However, no additional details could be obtained on this. In addition, no details are available on civil aviation radars in the area.

8.10 Occupational Health and Safety

Assessment of baseline conditions with regards to occupational health and safety is considered irrelevant. In addition, it is important to note that at this stage the Wind Farm EPC Contractors have not been selected and therefore no details are available on the worker accommodation strategy.

8.11 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

8.11.1 Assessment of Baseline Conditions

As discussed earlier, the human settlements to the Project site are located at around 45km to the north (Zaafarana) and 40km to the southeast (Ras Ghareb); both of which are considered at a distance from the area.

In addition, as discussed within the land use section (refer to part of the land use survey that was undertaken, within the Wind Farm site and a 2km radius around it the following receptors were identified:

- An existing petroleum storage facility located within the eastern part of the western plot of the Project site

- 1 oil rig located within the eastern part of the western plot of the Project site.

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. In addition, land use activities in the area in general were also investigated based on review of secondary data available. Key activities noted include the following as presented in the figure below:

- Air Force Defence Unit located around 3.4km to the east.
- Several existing petroleum activities mainly located to the north and east, closest of which is around 4.6km to the north. These activities include oil storage, transportation and oil rigs.
- Other oil rig stations (around 5) located around 3.5km to the south.

The above are not considered to be key sensitive receptors which are 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.

8.12 Socio-Economics

This section presents the baseline assessment of the Project site in relation to socio-economic conditions

8.12.1 Baseline Assessment Methodology

Socioeconomic conditions were assessed through a combination of a desk-based study, site visits, and consultations with relevant stakeholders. Based on a combination of both primary data collected from the field and secondary resources reviewed, including statistical data, this section highlights basic information about the demographic characteristics and human development profile, access to basic health services, economic characteristics, roads and transportation, and other services.

8.12.2 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 8-28: 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:

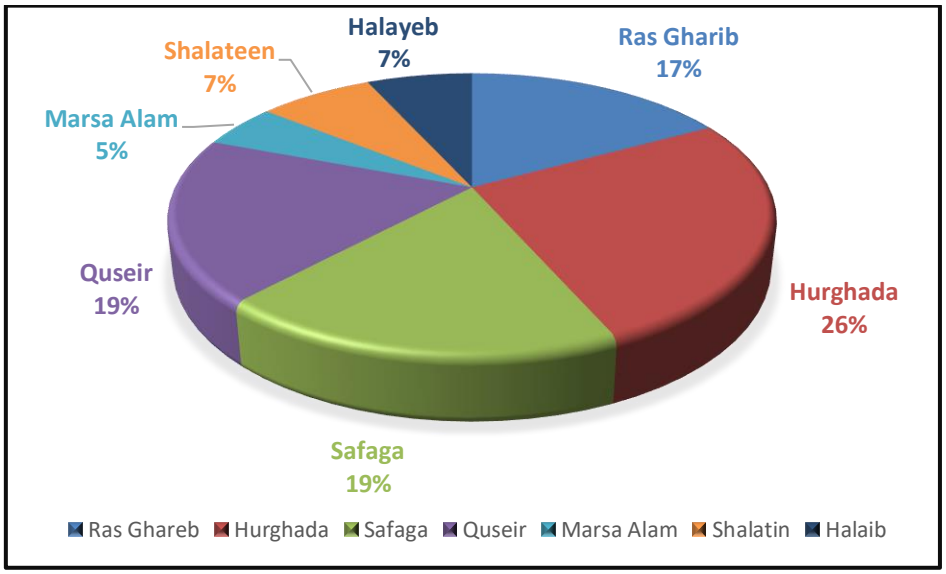


Figure 8-64: Distribution of Population Density According to Districts in the Red Sea Governorate

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'aza, 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, Zaafarana and Wadi Dara. 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 Section 8.2.3).

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 disproportionate 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 (*Source: Red Sea Governorate Information Centre, 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 8-29: Demographic Trends in the Red Sea Governorate (Red Sea Governorate Information Centre, 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 8-30: Workforce Research Results for Q2 2018 (CAPMAS, Workforce Research Results for the Second Quarter of 2018)

Workforce[4]	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[5]	Females[6]	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 8-31: 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%

[4] Including the number of employed and unemployed persons.
[5] Out of the total number of males (15 years of age and above) nationwide.
[6] Out of the total number of females (15 years of age and above) nationwide.

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 8-32: 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%
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[7] 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.

[7] 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).

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 secondary vocational training schools. According to Ras Gharib City Council officials who were interviewed by the field research team, 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 8-33: 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 8-34: Education Mapping of Ras Gharib City (The Statistical Yearbook, Ras Gharib City Information Centre, 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 8-35: Ministry of Health Hospitals & Other Entities in the Red Sea Governorate (The Statistical Yearbook, Red Sea Governorate Information Centre, 2018)

Item	Value
Hospitals Affiliated with the Ministry of Health	7
Hospitals of the General Authority for Health Insurance	0
Medical Treatment Institutions	0
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; about 40 km from the project area. 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, about 15 km from the project area, 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 8-36: 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

Infrastructure

According to data from the Statistical Yearbook, Red Sea Governorate, a brief summary on access to basic infrastructure services available in the Red Sea Governorate is presented in the following tables.

- *Potable Water & Sanitation*

The following table presents the production and consumption rates of drinking water, as well as the sanitation capacity within the Red Sea Governorate

Table 8-37: Access to Potable Water & Sanitation in the Red Sea Governorate (Red Sea Governorate - Egypt Description by Information, 2014)

Item	Unit	Value
Production of Potable Water	Thousand m3 /Day	107.57
Consumption of Potable Water	Thousand m3 /Day	81.96
Water Consumption Per Capita	Litre. day/ Person	249.24
Capacity of Sanitation	Thousand m3 /Day	16.57
Sanitation Capacity Per Capita	Litre. day/ Person	50.39

The total capacity of wastewater treatment plants in the Red Sea Governorate was 18,000 m3/day in 2014/2015.

The actual capacity of total wastewater treatment plants capacities in Red Sea Governorate was 92.06% in 2014/2015.

The amount of potable water consumption to average produced water in the Red Sea Governorate was 76.19% in 2014/2015.

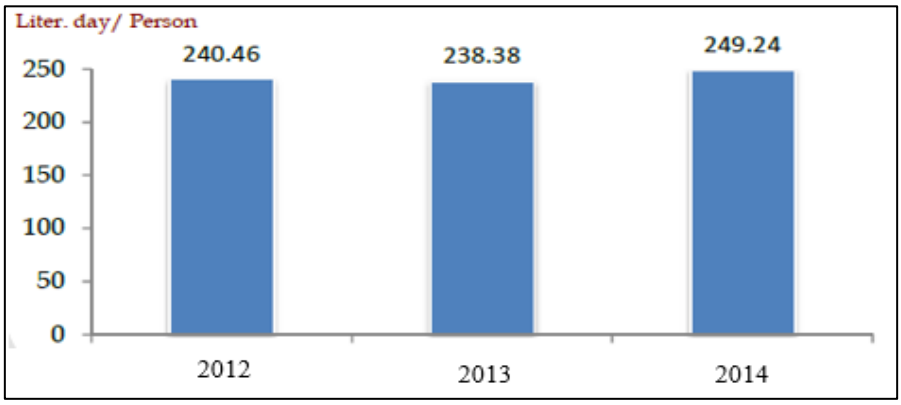


Figure 8-65: The Administrative Borders of the Red Sea Governorate (Source: Red Sea Governorate - Egypt Description by Information, 2014)

Ras Gharib city is connected to Beni Suef's water pump station via the Kuraymat-Zaafarana-Ras Gharib pipeline. CAPMAS poverty mapping 2013 shows that 100% of individuals have access to the public water network in the city of Ras Gharib, and approximately 69.4% in Zaafarana village.

According to CAPMAS 2013, 6.66% of the population in Ras Gharib, and at 6.1% of the population in Zaafarana Village are connected to sanitation and sewage networks. However, the Environmental Department's representative at Ras Gharib City Council stated that sanitation and sewage systems are being completed, and up to 90% of households in the city will soon have access to sanitation and sewage systems.

Electricity

According to Egyptian Human Development Report 2010, access to electricity in Upper Egypt Governorates is around 99.0%; even squatter areas have access to electricity, regardless of their illegality.

The East Delta Electricity Production Company serves the governorates of (Damietta, Ismailia, Port Said, Suez, North Sinai, South Sinai & the Red Sea).

Table 8-38: Access to Electricity in the Red Sea Governorate (Red Sea Governorate - Egypt Description by Information, 2014)

Item	Unit	Value
Total Electricity Production	Million kwh/year	730.00
Total Electricity Consumption	Million kwh/year	621.90
Electricity Consumption for Lighting	Million kwh/year	424.27
Electricity Consumption for Industrial Purposes	Million kwh/year	197.63
No. of Subscribers in the Electricity Grid	Thousand subscribers	157.05
Per Capita Share of Electricity used for Lighting	kwh yearly/Person	1290.21

According to CAPMAS poverty mapping data, access to electricity is estimated at 99.3% in Ras Gharib and 73.65% in Zaafarana.

- *Roads*

The Red Sea Governorate includes a 6,252km network of paved roads, serving all districts of the Governorate. A number of major highways and roads serve the region. Paved roads account for 98.33% of total roads. There are only two major roads in Ras Gharib City, which are classified as highways, with a length of 198 km (Hurghada--Ismailia Rd. & Zaafarana--Ras Gharib Rd.) as presented in the figure below.

Figure 8-66: Zaafarana--Ras Gharib Road

- *Communication*

The Governorate serves around 24% of the population with fixed telephone lines, in addition to mobile networks that serve all governorates. (*Source: The Statistical Yearbook, Red Sea Governorate Information Centre, 2018*).

- *Environment*

The Red Sea Governorate has three natural reserves: Wadi El-Gemal & Hamata, Northern Islands and Elba.

Table 8-39: Environmental Facilities in the Red Sea Governorate (Red Sea Governorate - Egypt Description by Information, 2014)

Item	Number
Natural Reserves	3
Garbage Collection Companies	0
Garbage Recycling Factories	1
Air-Monitoring Stations	0
Solid Waste Landfills	0
Noise-Monitoring Stations	0
Cars Converted to Natural Gas Fuel	1098
Public Buses Using Natural Gas	0
Natural Gas Fuelling Stations	2

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 8-40: 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 abundant in the southern part of the Red Sea coast compared to the northern part.	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 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 centres, 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.	

Item	Red Sea Governorate	Ras Gharib
	▪ 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 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 centre 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.	

Facilities Offered for Investment in the Governorate

The Investors' Service Office provides the following services for investors:

- Providing technical and administrative advice so that projects comply with the nature of the Governorate and suits investors' capabilities.
- Presenting facilities and support to provide building materials through the Association in the Governorate.
- Helping investors to speed up obtaining necessary permits for construction.
- Granting letters of mortgaging for projects' superstructure that require loans from banks.
- Informational support by providing necessary data, maps and satellite images.

9 IMPACT ASSESSMENT

9.1 Overview of Strategic Environmental and Economic Impacts

9.1.1 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 7.2".

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.

9.1.2 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 2,200-Gigawatt hours (GWh) – 2,500 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).

9.1.3 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 (SO_2), Nitrogen Dioxide (NO_2), 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.

9.2 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.

9.2.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the Wind Farm EPC Contractors 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 8.1.1", there are no key sensitive visual receptors within the Project site and surrounding vicinity.

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 Wind Farm EPC Contractors 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 9.4.2 '.

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 Wind Farm EPC Contractors during the construction phase:

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

9.2.2 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) 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:

- Within the Project area and the 15km radius there are no key sensitive visual receptors such as recreational activities, environmental reserves, remarkable historical or cultural sites, water courses or other natural structures normally seen as valuable by the human perception. In addition, as discussed earlier, visibility impacts after 10km are considered irrelevant and can only be seen as minor elements in the landscape (if seen at all).
- 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 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, there are no key visual receptors in the project route and its surroundings therefore 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.

9.3 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.

9.3.1 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 (to include Wind farm including substation area) in general is uninhabited and vacant and does not include any physical or economical land use activities (with the exception of the petroleum storage facilities as discussed further below). Therefore, physical and economical displacement impacts are considered irrelevant.
- 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. However, based on discussions with the Developer it was indicated that initial coordination and discussions were undertaken with such Bedouin groups to provide job opportunities as well as services (security services, some construction services, equipment rentals, food and consumables supplies, etc.).
- As noted earlier, within the Project site there is an existing petroleum storage facility and an oil rig. The preliminary layout prepared by the Developer has avoided this area completely therefore there are no impacts related to physical or economical displacement. 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.

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:

- Establish coordination with the Bedouin Groups for inclusion and engagement in employment and procurement opportunities. This issue is further discussed in "Section 8.12"; and
- Establish coordination via NREA/EETC with the relevant entity along with NREA 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" to include for example spacing between turbine rows and individual turbines as well as agreed buffer from existing facilities (such as the petroleum storage

facility); (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.

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:

- Implementation of Community Integration Plan (CIP) with Bedouin groups (refer to "Section 8.12" for additional details); and
- Submission of formal communication letter (or similar) with General Petroleum Company

9.4 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.

9.4.1 Potential Impacts from Flood Risks on the Project Site

In general, it is important to investigate potential risks of local flood hazard during from such wadi systems 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.

To this extent, as part of the ESIA a preliminary flood risk assessment has been undertaken to investigate such risks. Results are discussed below.

Literature Review

A flash flood is defined as a rapid developed flood in just a few minutes or hours of excessive rainfall without visible signs of rain, or an accident like a dam or levee break. A flash flood can be generated during or shortly following a rainfall event, especially when high-intensity rain falls on steep slopes with shallow, impermeable soils, exposed rocks and poor or sparse vegetation (Lin, 1999).

Based on the geomorphometric analysis of the drainage basins in the Eastern Desert (ElShamy, 1992) the Red Sea and Gulf of Suez basins are classified into three classes according to the groundwater potential and flood possibility. It is stated as noted in the figure below, that Wadi ElDahal and Wadi Hawashyia are characterized by least groundwater potential and high flooding probability in the times of heavy rainfall.

However, it is important to note that the Project site is quite away from such small drainage basins that could collected a large quantity of rain (Wadi ElDahal is located 3 km to the north while Wadi Hawashiya is located 12 km to the south).

In recent years, flash floods in Egypt became more frequent causing life losses and significant damages. Destructive flash floods along Coastal Areas of Red Sea frequently occurred in Egypt between 1972 to 2016 as presented in the table below. The information included in this table were collected from available reports, newspaper, dissertations and published articles as Eliwa, et al. (2015). As noted in the table below, there are no reported destructive flash floods within the Project area in general.

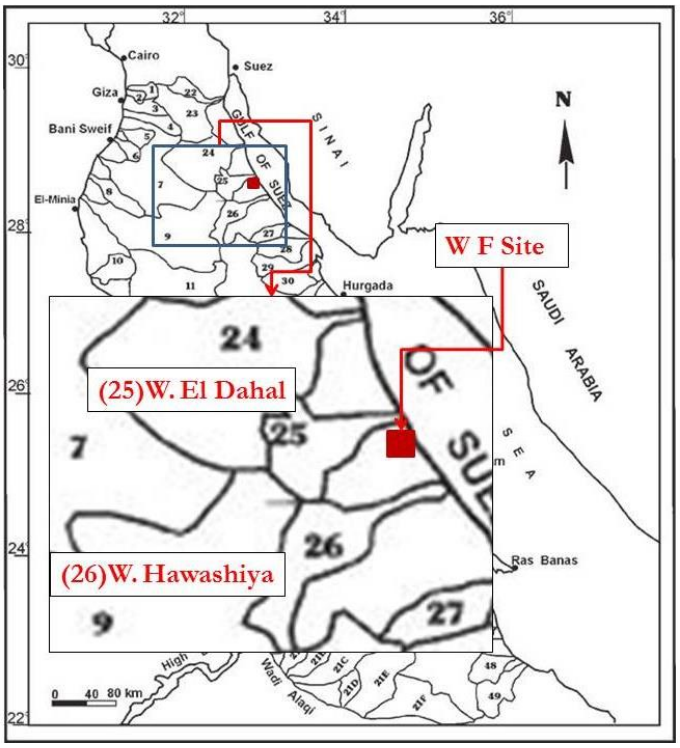


Figure 9-1: Map Showing Drain-Age Basins in the Eastern Desert (El-Shamy, 1992)

Table 9-1: Historical Records of Flash Floods along Coastal Areas of Red Sea

Date	Area	Recorded damages	References/consulted entity
Oct 2016	Ras Ghareb		Local Unit
Feb 2015	Sinai, Red Sea region	Road damages	
May 2014	Zafarana, G. Zeit, Taba, Sohag, Aswan, Kom Ombo Safaga	Dam failure at Sohag, road damages El Wafd	News papers
2013	South Sanai	2 deaths, road damage	
2012	Wadi Dahab, Catherine area	Dam failure, destroyed houses	News papers
Jan 2010	Along the Red Sea		Water Resources Research Institute (WRRI) Local Unit
Oct 2004	W. Watier	Road damage	News paper
May 1997	Safaga and El Qusier		- Information and Decision Support Centre in Red Sea Governorate, 2009. - The National Authority for Remote Sensing and Space Sciences (NARSS) – Red Sea Governorate, 1997
Nov 1996	Hurghada and Marsa Alam		
Nov 1994	Dhab, Sohage, Qena, Safaga, El-Qusier		
Aug 1991	Marsa Alam		Arab tribe members
20 Oct 1990	Wadi El Gemal between Marsa Alam and Shalateen		
23 Oct 1979	Marsa Alam and El Quseir		
Jan 1988	Wadi Sudr	5 deaths	Local ambulance unit
Oct 1987	South Sanai	1 death, roads damage	News papers
May/Oct. 1979	Aswan, Kom Ombo, Idfu, Assiut, Marsa Alam, El-Qusier	23 deaths. demolished houses	News papers
Feb 1975	W. El-Arish	20 deaths, road problems	
1972	Giza	Destroying houses, roads and farms	

In collecting the data required for the flood risk assessment, the team consulted with the following:

- Consulted entity

- Local Arab tribe members
- Local ambulance station on the Zaafarana – Ras Ghareb Road
- Public Petroleum Company
- Ras Ghareb local Unit
- Red Sea Governorate
- Water Resources Research Institute

Field Visit Findings

Before conducting the field visit, topographic maps, landsat images and the digital elevation models were developed for the Project area using the Shuttle Radar Topography Mission (SRTM) images.

As noted below, such maps show that Project site is characterised by a very simple topography with gentle and regular slope toward the Gulf of Suez. In addition, the drainage basins crossing the project site are characterised as several short and small drainage lines as opposed to Wadi Eldahal for example. There are no large drainage basins crossing the site, the closest of which is Wadi Eldahal which runs outside the Project site.

Based on the above, a field visit was undertaken to assess the possibility of flooding in the Project area. The site visit focused on documenting any actual evidence which confirms the occurrence of floods. Key outcomes include:

- The eastern part of the Project site is wide and almost horizontal with complete absence of deep surface incisions of strong surface flow. The Quaternary sediments are mainly made up of fine to coarse grains clays, sand, and chart that reflects the week intensity of flow that can't carry boulder sized fragments (Figure 9-4).
- The middle parts of the area are shallow and have very wide drainage lines that have been exposed with multi sized grain deposits and sinuosity in some parts which reflect the weakness of the surface flow (Figure 9-5).
- The western parts of the area include small tributaries that are very shallow, tortuous and have no wide alluvial fans which reflect small volume of water they carry and slow surface water flow (Figure 9-6).

Based on the field study it can be stated that the Project site is far from being subjected to flash flood even in times of heavy rainfall.

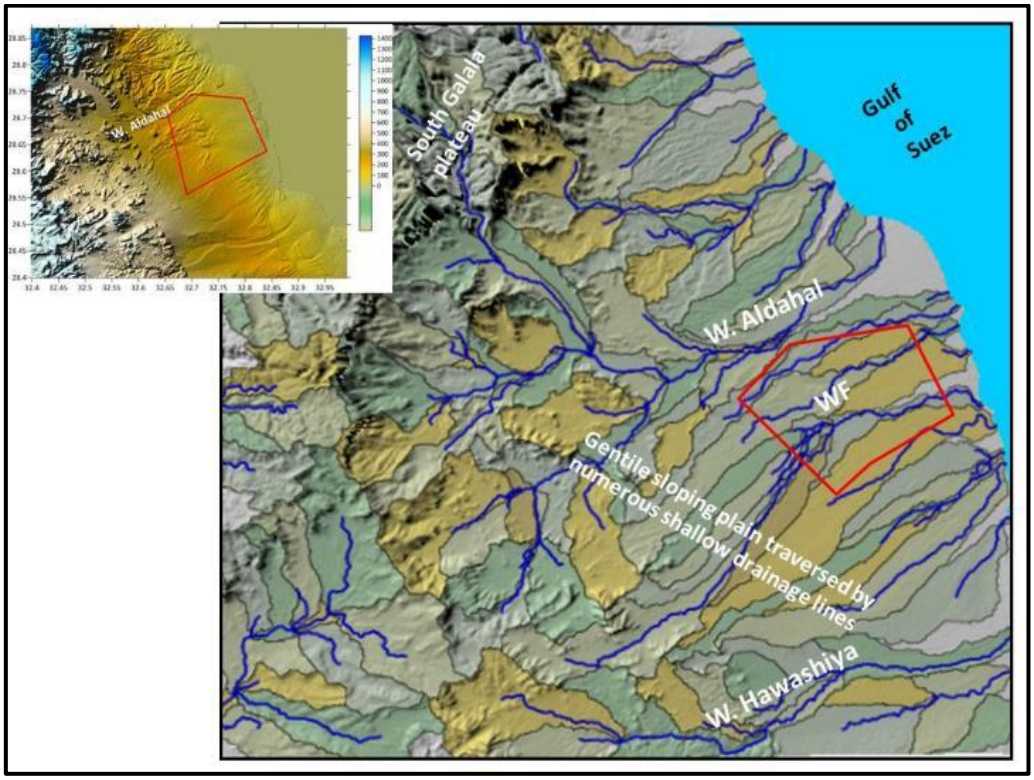


Figure 9-2: Drainage Basins Crossing the Project Site and Nearby Areas

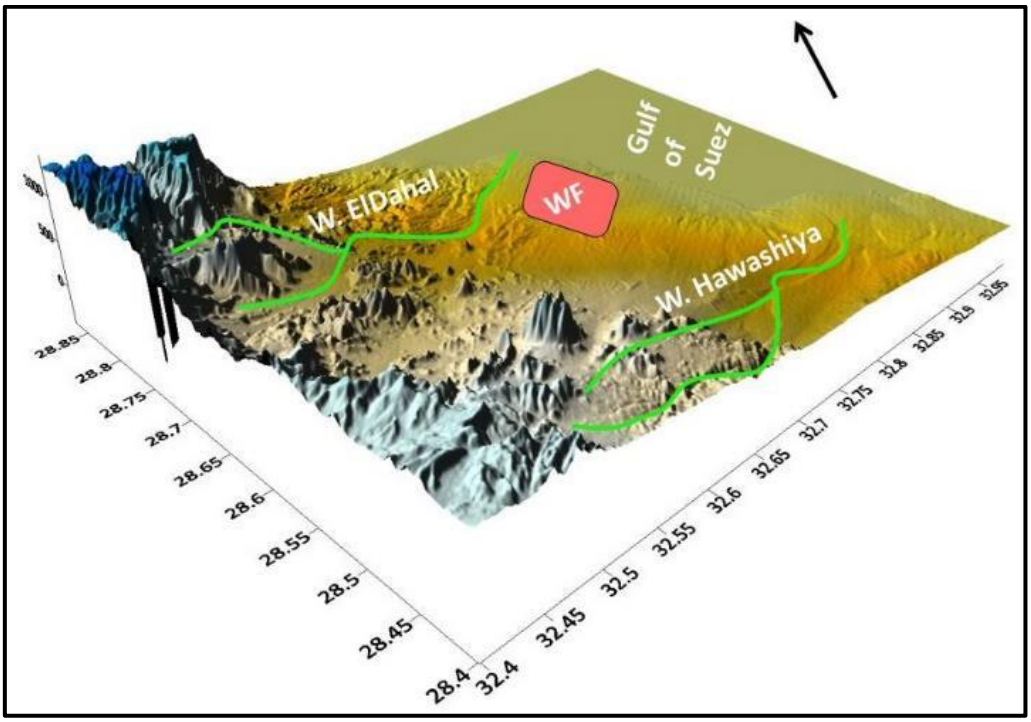


Figure 9-3: Large Drainage Basins in the Area

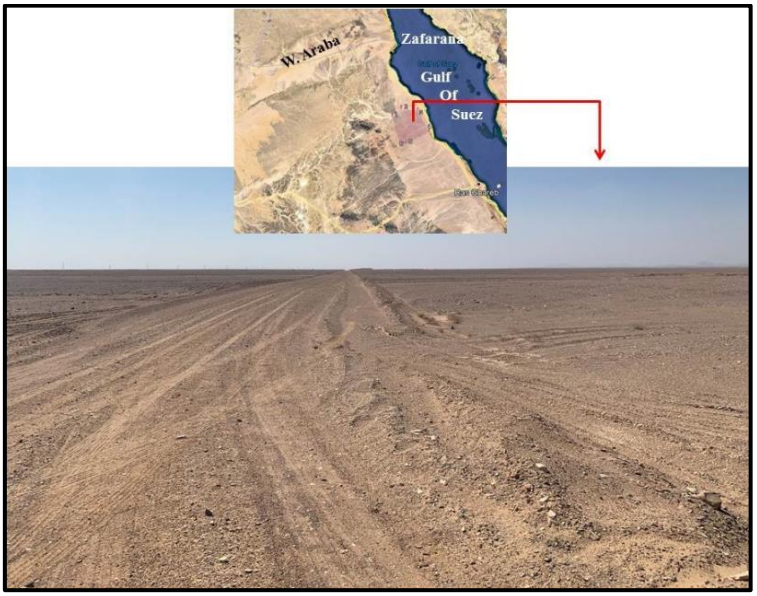


Figure 9-4: Eastern Part of the Project Site

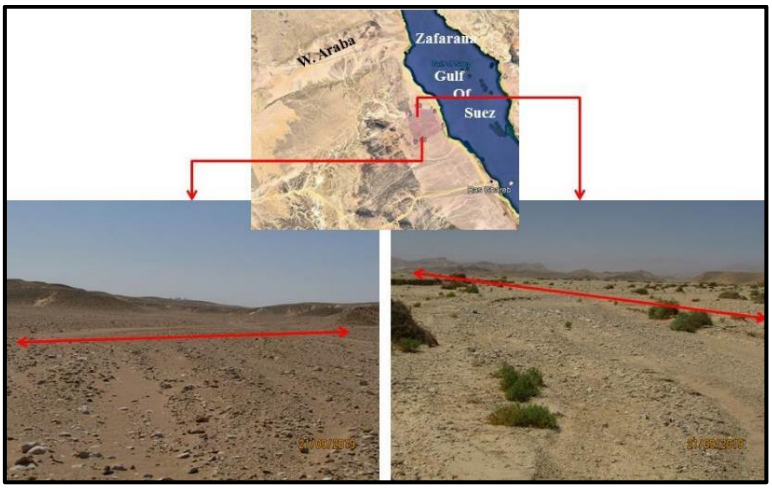


Figure 9-5: Western Part of the Project Site with Shallow and Wide Streams

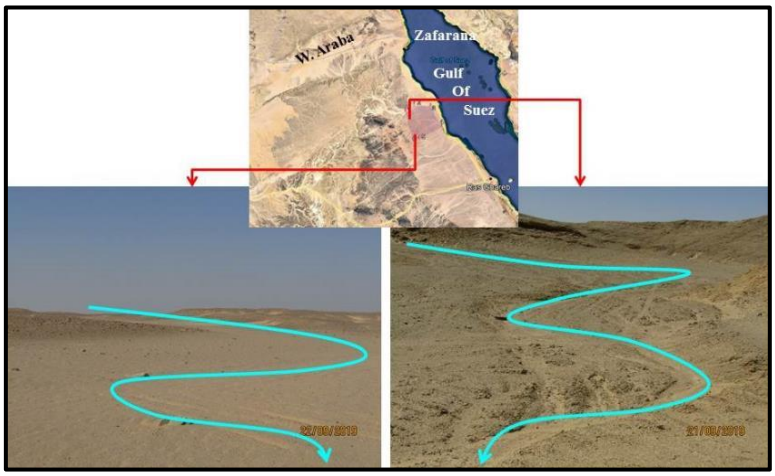


Figure 9-6: Wide Tributaries in South-Western Parts

<u>Consultations</u>

The 'ESIA team' undertook several consultations with stakeholders focusing on the issues of flood risks that could occur in the Project area and it surrounding. This included in particular the following stakeholders: (i) Ras Ghareb City Council; (ii) existing civil defence unit in the area; and (iii) the General Petroleum Company which is operating in the area for years.

In general, the key outcomes of such consultations indicated the following:

- The Project area in particular is not sensitive to flooding, but only weak surface flows during the period of rainfall that quickly disappear through subsurface leakage or runoff to the Gulf.
- The areas where flood occurs on a semi-annual basis is the area of Ras Gharib, about 35 km south of the site.
- Severe runoff may occur in Wadi Hawashiay 10 km south of the site and Wadi Al-Dahal 3 km north of the site.
- No serious floods have been recorded in the project area in the last 10 years
- No damage has been recorded at any facility in the Project area in general as a result of flood nor any deaths

In addition, the Ras Ghareb City Council provided a map of local constructions that were applied on the areas of expected surface flow to save the coastal road from the danger of flood (refer to figure below). The map shows the locations of the culverts along the coastal road near the project site and one can note that the closest locations of culverts to the location are at the outlet of Wadi Eldahal and Wadi Hawashiay.

Figure 9-7: Areas of Safety Application for Flooding at Gulf of Suez (Ras Ghareb City Council, 2019)

<u>Conclusions</u>

Flood possibility in the Project site has been studied and concludes the following:

- The bed rocks of the 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 south Galala Plateau is due to southeast. This means that, the dry wadies that drain the plateau are directed to the southeast toward Wadi El Dahal out of the project site to the north toward Gulf of Suez.
- The site is in a very simple relief area with a very gentle slope in east and southeast direction.
- There is no sign of deep dry wadis crossing the concession site or even large alluvial fan deposits reflecting strong surface flow.

- The concession site is away 'to the north' from the main course of wadi Hawashiay that could expect flooding.
- The drainage lines that drain the project site are very short, wide and shallow that reflects a complete absence of floods.
- Dangerous flooding is not commonly recorded in area of project or even in the areas nearby.

Therefore, taking the above into account there is no evidence to support the cause of serious flooding in the Project area under the current climatic conditions. *Therefore, there are no anticipated impacts in relation to flood risks and there are no further mitigation or monitoring measures to be considered as part of the planning or design phase of the Project.*

9.4.2 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 Wind Farm EPC Contractors throughout construction phase and Wind Farm 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 dumpsite (Ras Gharib Public Dumpsite) 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 Wind Farm EPC Contractors during the construction phase and the Wind Farm 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 (the closest dumpsite being Ras Gharib Public 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 Contractors 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 Contractors 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 Contractors 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 Wind Farm EPC Contractors during the construction phase and the Wind Farm 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).

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the Wind Farm EPC Contractors during the construction phase and the Wind Farm 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);
- 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 Contractors 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 Wind Farm EPC Contractors during the construction phase and the Wind Farm 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 Wind Farm EPC Contractors during the construction phase and the Wind Farm 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 Wind Farm EPC Contractors during the construction phase and the Wind Farm 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 Wind Farm EPC Contractors during the construction phase and the Wind Farm 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 that a minimum of 1,000 litters of general-purpose spill absorbent is available at hazardous material storage facility. Appropriate absorbents include zeolite, clay, peat and other products manufactured for this purpose; and
- If spillage on soil occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the Wind Farm EPC Contractors during the construction phase and the Wind Farm 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.

9.4.3 Potential Impacts from Erosion and Runoff during the Construction Phase

Site preparation activities which are to take place onsite by the Wind Farm EPC Contractors 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 are 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 Wind Farm EPC Contractors 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 Wind Farm EPC Contractors during the construction phase:

- Inspection for erosion and runoff control to include inspections for implementation of mitigation measures.

9.5 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 9.6" and "Section 9.7" respectively.

9.5.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the Wind Farm EPC Contractors 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.

Mitigation Measures

The following identifies the additional studies and mitigation measures to be applied by the Wind Farm EPC Contractors during the construction phase and which include:

- A detailed Egyptian Dabb Lizard survey should be 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 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 construction workers onsite;

- Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in Section 9.4.2;

- 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 8.8".

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 EPC Contractors during the construction phase and which include:

- Submission of pre-construction Egyptian Dabb Lizard survey report and subsequent reports should relocation be necessary.

- Inspection of the works should be carried out at all times

9.5.2 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 Wind Farm 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 9.4.2; 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:

- Inspection of the works should be carried out at all times.

9.6 Birds (Avi-Fauna)

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.

9.6.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the Wind Farm EPC Contractors 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 short-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 of 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 9.4.2".
  - 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

9.6.2 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. This section provides a qualitative and quantitative assessment of such impacts. As discussed previously, to determine the significance of an impact it is important to understand the sensitivity of the receiving environment and the magnitude of the impact both of which are discussed in further details below.

Background

As discussed earlier in "Section 3.2", in 2020 a previous ESIA study was submitted by the ESIA Consultant to EEAA and IFIs that included different turbine characteristics and a layout than that presented in "Section 3.2". The previous turbine characteristics included a total of 173 turbines with a rated power of 2.9MW and a tip height of 120m.

In July 2022 new governmental approvals have been issued allowing an increase in tip height up until 220m, where previously due to various governmental restrictions the allowed tip height was set at 120m (as noted above). Based on that, all wind farm developers within the GoS are currently assessing installing such bigger turbines (including the RSWE).

Therefore, the Developer has opted at this point for the selection of such new turbine characteristics as well as layout presented in "Section 3.2", for technical and economical/financial reasons that include 84 turbines with a rated power per turbine of 6MW and a tip height of 180m.

The previous ESIA submitted in 2020 included 2 avifauna monitoring seasons (spring 2019 and autumn 2020). However, as presented throughout this section, this updated ESIA now includes 4 monitoring seasons (spring 2019, autumn 2020, spring 2020, autumn 2021).

In addition, as noted in the methodology below, it is important to note that the monitoring data throughout all 4 monitoring seasons included various height bands that account for the previous and new turbine heights and specifications.

Since the early 2000s, wind turbines have grown in size—in both height and blade lengths—and therefore generate more energy. Turbine towers are becoming taller to capture more energy. 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.

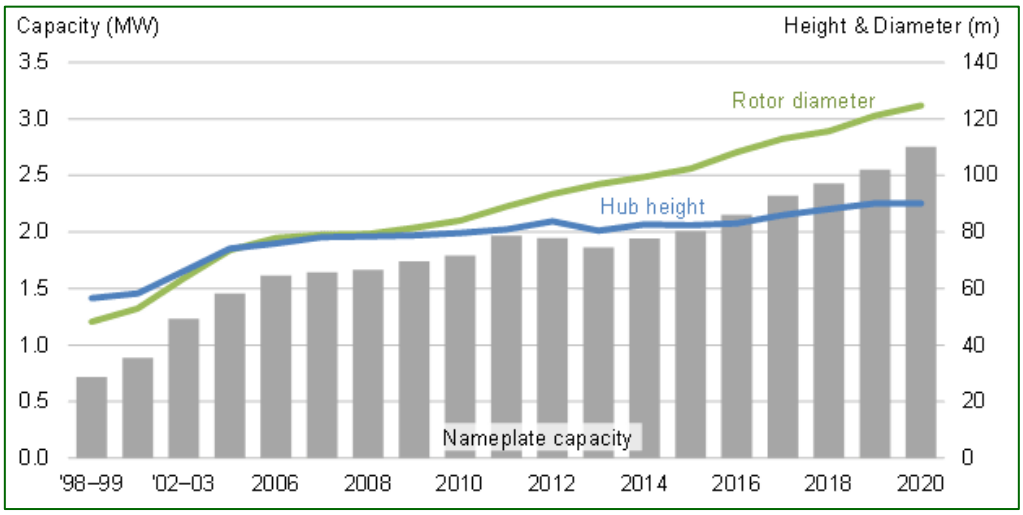


Figure 9-8: Average turbine hub height, rotor diameter, and nameplate capacity for land-based wind projects from the Land-Based Wind Market Report: 2021 Edition

Objective

To assess potential associated collision risks of birds for wind turbines of both 120 and 200 m tip heights through the Collision risk modelling (CRM). As explained earlier (Section 8.5.1), the avifauna data was collected at heights ranging from 0-120 m, 120-200 m, 200-500 m, and above 500 m. At that time, the increase of turbine tip height to 180 m had not been yet considered. Thus, the 200 m height band had to be used for comparisons as representative of the new proposed 180 m.

Project Components

As explained earlier, the new specifications for which the change has been proposed are the following:

Number of Wind Turbines	84
Rated Power per Turbine (MW)	6.00
Rotor Diameter-D (m)	165
Hub Height (m)	97.5
Tip height (m)	180

The comparison of the previous 120 and new 180 m tip heights indicates a nearly doubling the RSA with the newer 6.0 MW turbines. Despite the tip height changes, the distance between turbines within a row as well as the distance between rows of turbines also increases (spatial foot print increase).

In line with the above it is evident that the Project layout has been adjusted to include less WTGS (from 173 turbines to 84 turbines) that are further spaced further apart within rows (from 228m to 404m), plus rows spaced further apart (from 1140m to 1772m). Evidence from offshore wind energy projects and some evidence/considerations from onshore wind projects suggests such design changes should reduce avian collision risk[8].

TURBINE SIZE	120 m	180 m
Project size (number of turbines) (A)	173	84
Rotor Swept Area (RSA) per turbine (B)	10,207.03 m^2	21,382.46 m^2
Total rotor swept area (A X B)	1,765,816.97 m^2	1,796,127.06 m^2

[8] For example, A unifying framework for the underlying mechanisms of avian avoidance of wind turbines (biofund.org.mz); Assessing the impact of marine wind farms on birds through movement modelling - PMC (nih.gov); Addressing-the-Factors-that-Juxtapose-Raptors-and-Wind-Turbines.pdf (researchgate.net)

Estimated space between turbines within a row	228 m	404m
Estimated space between turbine between rows	1140m	1772m

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.

However, the model has some limitations as it does not consider aspects related to the effect of weather variables (e.g., temperature or wind speed and direction), landscape features, or prey availability for a specific species. Others are the representativeness of the flight activity data (which will affect the accuracy of the predicted transit rate) and the simplifications involved in the calculation of collision probabilities, In addition, the Band model does not incorporate 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).

Avoidance rates

As described by the Band model (SNH-Nature Scot 2018 Use *of Avoidance rates in the SNH Wind Farm collision Risk Model*), the avoidance action is the behaviour a bird exhibits towards the presence of the turbines to avoid collision: "*a bird sees a wind turbine or a moving turbine blade, evaluates the potential risk, and takes action to prevent what might be a fatal collision*". More insight about the concept can be found in such document, but globally, the avoidance rates have been recommended between 95 and 99.5%. Variations in the CRM outputs should be interpreted **considering that these small variations in the avoidance rates,** which range from 95% to 99.5% (only a 4.5 points) but **result in large, estimated collision numbers** (a 990% change in the predicted collision as it is the example of the White Stork in spring 2020).

There are not many studies analysing the avoidance rate for many species. For some species, another source of uncertainty is that the flight activity data is necessarily restricted to daylight hours, while these species may also be active at night as happens with the Lesser Kestrel or the Common Crane. Because of that, a precautionary principle has been assumed, using the minimum and maximum avoidance rates used by the CRM, being 95% and 99.5%. Using the widest interval, any potential variation in the predicted fatalities is captured. This idea is reinforced by the fact that the review of the post-construction fatality of an operational wind farm in the GoS for three years between 2019 and 2021 (RCREEE unpublished data), and for which CRM was performed and associated fatalities reported, the predicted MSBs fatalities did not match with the field findings afterward.

The CRM was conducted for the purpose of obtaining quantitative predictions of collision risk during the two migratory seasons **but for every single year given the variations in bird numbers, birds at risk height, and flying times, for the 120 and 180 m tip heights**.

The tables 8-7 and 8-16 in Section 8 on migratory birds summarized the findings of bird numbers and records for the spring and autumn seasons for the period 2019-2021. Data inputs for the CRM analysis were derived from the results of the VP surveys, as well as the following turbine specifications and the following assumptions and physical characteristics of the bird species:

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

Data on physical dimensions of birds were derived from Cornell Lab of Ornithology's Birds of the World (https://birdsoftheworld.org), 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 9-2: Physical and observational characteristics of each bird species in the region and considered within the CRM analysis.

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 different 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 height 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 = Between 120 and 200 m**

As a first step, 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 four seasons considering the tip height of the turbine 120 m.

Table 9-3: Observational data from the VP surveys used to derive bird density inputs for the spring CRM analysis in spring (120 m tip height). For all species and year, percentage, and time of flights at risk height.

Species	2020 / 120m			2021 / 120m		
	% Risk	# of Birds at risk	Time (min.)	% Risk	# of Birds at risk	Time (min.)
Black Kite	25.42%	4125	453.33	44.86%	3075	692.83
Black Stork	24.35%	525	56.00	44.08%	842	72.17
Booted Eagle	18.53%	159	172.25	15.12%	31	41.33
Common Crane	50.00%	4	0.00	4.76%	1	2.00
Egyptian Vulture	28.61%	113	69.67	29.29%	29	34.00
Greater S. Eagle	13.49%	46	21.25	0.00%		0.00
Griffon Vulture	37.50%	3	7.00	0.00%		0.00
Honey Buzzard	55.69%	12043	142.33	49.69%	4296	88.00
Imperial Eagle	29.55%	13	12.00	28.95%	11	10.00
Lesser Spotted Eagle	12.84%	219	55.00	4.92%	247	76.67
Levant Sparrowhawk	47.42%	2006	5.00	20.99%	4964	11.00
Long-legged Buzzard	36.50%	200	77.58	40.28%	29	40.17
Marsh Harrier	64.18%	43	84.00	55.17%	32	42.17
Montagu's Harrier	91.30%	21	38.33	80.00%	4	6.17
Osprey	40.00%	2	1.00	0.00%		0.00
Pallid Harrier	79.17%	19	41.00	42.11%	8	13.67
Steppe Buzzard	25.96%	22520	927.58	33.88%	24906	979.83
Short-toed Eagle	25.78%	403	242.83	43.70%	326	254.75
Sooty Falcon	100.00%	2	3.00	100.00%	2	1.00
Sparrowhawk	18.52%	20	20.50	19.64%	11	11.50
Steppe Eagle	39.73%	6815	492.02	25.82%	1453	662.83
White Pelican	15.28%	143	82.00	33.27%	166	26.50
White Stork	67.77%	104736	428.50	39.90%	54187	365.33

Table 9-4: Observational data from the VP surveys used to derive bird density inputs for the autumn CRM analysis in autumn (120 m tip height). For all species and year, percentage, and time of flights at risk height.

	2019 / 120m			2020 / 120m		
Species	risk%2019	Time (min.)	# of Birds at risk	# of Birds at risk	%risk20	Time (min.)
Black Kite	45.88%	18.00	39	35	35.35%	35.75
Black Stork	10.00%	3.00	1	1	100.00%	5.00
Booted Eagle	20.00%	3.50	4	0	0.00%	0.00

Crane	0.00%	0.00	0	0	0.00%	0.00
Honey Buzzard	21.24%	22.00	1059	3474	37.54%	203.87
Kestrel	54.17%	19.92	13	27	71.05%	38.10
Lesser Kestrel	50.00%	3.00	4	3	30.00%	2.00
Long-legged Buzzard	0.00%	0.00	0	0	0.00%	0.00
Marsh Harrier	38.71%	9.67	24	53	46.90%	52.18
Montagu's Harrier	18.75%	5.50	3	24	75.00%	31.67
Osprey	0.00%	0.00	0	0	0.00%	0.00
Palid Harrier	66.67%	9.67	8	16	66.67%	18.83
Short-toed Eagle	0.00%	0.00	0	0	-	0.00
Sooty Falcon	80.00%	7.00	4	16	84.21%	16.67
Sparrowhawk	66.67%	0.06	5	1	16.67%	0.03
Steppe Buzzard	8.33%	1.50	1	4	33.33%	2.83
Steppe Eagle	50.00%	3.50	3	0	0.00%	0.00
White Pelican	85.04%	6.50	324	1567	72.85%	65.83
White Stork	18.38%	21.50	977	6626	89.31%	216.50

As explained earlier, the proposed change in the turbine size (from 120 m to 180 m tip height) was decided once these monitoring campaigns had been completed. Therefore, the 200 m was used as an estimation of the existing risks at 180 m.

Table 9-5: Observational data from the VP surveys used to derive bird density inputs for the spring CRM analysis in spring (200 m tip height). For all species and year, percentage, and time of flights at risk height.

Species	2020 / 200m			2021 / 200m		
	%Risk	# of Birds at risk	Time (min.)	%Risk	# of Birds at risk	Time (min.)
Black Kite	28.76%	4667	1088.83	69.64%	4774	1120.83
Black Stork	29.45%	635	119.50	92.41%	1765	134.00
Booted Eagle	23.31%	200	371.75	46.83%	96	99.67
Common Crane	50.00%	4	3.00	47.62%	10	5.00
Egyptian Vulture	32.91%	130	190.33	57.58%	57	77.33
Eleanora's Falcon	100.00%	1	4.00	-	-	-
Greater S. Eagle	14.66%	50	61.00	0.00%	-	0.00
Griffon Vulture	50.00%	4	12.00	83.33%	5	4.33
Honey Buzzard	58.55%	12662	290.83	84.30%	7288	161.67
Imperial Eagle	36.36%	16	31.50	57.89%	22	30.50
Lanner	50.00%	1	1.00	-	-	-
Lesser Spotted Eagle	15.54%	265	183.00	40.15%	2014	249.50
Levant Sparrowhawk	99.46%	4207	14.50	45.52%	10764	21.00
Long-legged Buzzard	39.23%	215	238.75	83.33%	60	74.67

Marsh Harrier	67.16%	45	134.00	87.93%	51	56.50
Merlin	100.00%	1	0.67	-	-	-
Montagu's Harrier	91.30%	21	47.83	80.00%	4	6.17
Osprey	40.00%	2	4.00	37.50%	3	3.00
Pallid Harrier	83.33%	20	51.50	57.89%	11	20.67
Red-footed Falcon	100.00%	1	2.00	-	-	-
Short-toed Eagle	33.40%	522	619.50	73.46%	548	405.42
Sooty Falcon	100.00%	2	3.00	100.00%	2	1.00
Sparrowhawk	23.15%	25	36.50	53.57%	30	22.50
Steppe Buzzard	28.63%	24830	2150.83	61.90%	45511	1732.33
Steppe Eagle	41.02%	7036	1584.18	56.11%	3158	1243.83
Great White Pelican	15.28%	143	135.00	33.47%	167	27.33
White Stork	71.86%	111055	939.00	70.77%	96120	568.67

Table 9-6 Observational data from the VP surveys used to derive bird density inputs for the spring CRM analysis in autumn (200 m tip height). For all species and year, percentage, and time of flights at risk height.

Species	**2019 / 200m**			**2020 / 200m**		
	%Risk	**# of Birds at risk**	**Time (min.)**	**%Risk**	**# of Birds at risk**	**Time (min.)**
Black Kite	51.76%	44	4.75	71.72%	99	73.58
Black Stork	100.00%	40	11.00	100.00%	**1**	5.00
Booted Eagle	60.00%	3	1.00	66.67%	**3**	1.17
Common Crane	100.00%	6	7.00	86.96%	46	2.00
Egyptian Vulture	-	0	-	50.00%	2	0.50
Eleonora's Falcon	0.00%	0	0.00	100.00%	3	2.00
Honey Buzzard	47.97%	2392	7.80	71.06%	9253	429.35
Kestrel	95.83%	23	5.75	89.47%	38	28.43
Lanner Falcon	100.00%	3	3.50	-		-
Lesser Kestrel	100.00%	8	11.00	60.00%	10	6.50
Long-legged Buzzard	100.00%	1	1.00	0.00%	1	0.00
Marsh Harrier	54.84%	34	16.25	66.37%	113	75.10
Montagu's Harrier	25.00%	4	4.50	96.88%	32	21.17
Osprey	66.67%	2	4.50	0.00%	1	0.00
Palid Harrier	75.00%	9	11.50	87.50%	24	14.67

Red-Footed Falcon	100.00%	1	1.00	100.00%	1	3.00
Short-toed Eagle	33.33%	1	0.25	-		.
Sooty Falcon	100.00%	5	7.00	84.21%	19	9.00
Sparrowhawk	100.00%	6	11.00	50.00%	6	2.53
Steppe Buzzard	50.00%	6	11.08	75.00%	12	10.50
Steppe Eagle	100.00%	6	19.50	0.00%	3	0.00
White Pelican	100.00%	381	19.00	72.85%	2151	67.83
White Stork	66.35%	3527	9.75	94.59%	7419	38.00

Association between risk and non-risk numbers

There is a common agreement that numbers of birds and risk versus non-risk are associated with each other, 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. The total species and year counts for all of the spring and autumn seasons were used, and the number of birds at risk vs. non risk height listed. These numbers have been compared as follows:

- A Chi-square test measures if the numbers at risk and non-risk are associated across different years. When the test (Chi-square result) shows values close to zero, then there is no association between risk and non-risk and vice versa. However, this test does not allow us to know how strong this association is. For this, a second step is included,
- The Cramer's V is calculated, 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 birds being or not at risk). 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 are not possible. Thus, they do not appear in the tables below.
- Finally, this analysis has been undertaken with the spring data only. Due to the small numbers recorded in autumn, it makes the test impossible to perform due to the low sample size.

Species	SPRING 120 m		SPRING 200 m	
	Chi-sq	Cramer	Chi-sq	Cramer
Black Kite	848.64	0.19	3,349.43	0.38
Black Stork	176.71	0.21	1,659.71	0.63
Booted Eagle	1.31	0.03	46.23	0.20
Common Crane	-	-	-	-
Common Kestrel	-	-	-	-
Eastern Imperial Eagle	-	-	-	-
Egyptian Vulture	0.01	0.06	22.08	0.21

Eurasian Sparrowhawk	0.03	0.014	15.31	0.30
European Honey Buzzard	89.32	0.054	1,822.90	0.24
Great White Pelican	62.33	0.20	63.58	0.21
Greater Spotted Eagle	-	-	-	-
Lesser Spotted Eagle	123.70	0.13	345.86	0.22
Levant Sparrowhawk	1,336	0.21	4,198.55	0.39
Long-legged Buzzard	0.39	0.02	52.18	0.29
Montagu's Harrier	-	-	-	-
Osprey	-	-	-	-
Pallid Harrier	-	-	-	-
Red-footed Falcon	-	-	-	-
Short-toed Snake Eagle	75.02	0.18	329.80	0.38
Steppe Buzzard	1,195	0.08	18,051.74	0.33
Steppe Eagle	354.89	0.12	395.40	0.13
Sooty Falcon	-	-	-	-
Western Marsh Harrier	-	-	-	-
White Stork	22,669.47	0.27	33.87	0.01

The highlighted species resulted in a Chi-square test showing high significant differences which means there is association between the risk and non-risk flights. However, THERE IS NOT for others. The significance is slightly different when considering the 120 m (eleven out of fourteen species showed significant differences) or 200 m tip height (all species show significant differences).

When considering the effect size of such association through the Cramer's V, all of the species in spring for the 120 m tip height (except the two storks and the Great White Pelican) had Cramer V values lower than 0.2, indicating weak association. The three mentioned species showed moderate association. On the contrary, when considering the 200 m there is strong association for the Black Stork, and very weak one for the Steppe eagle and the white stork. All the remaining had a moderate one.

Considering the above, the lack of association for some scenarios/species would make us to consider with caution of the CRM outcomes, 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 present the results of the CRM analysis for each of the seasons, spring 2020-2021 and autumn 2019-2020. As explained earlier, the predictions for the 180 m tip heights.

Table 9-7 Collision risk estimates (birds/year) assuming avoidance rates (min: 95%-max: 99.5%) for the RSWE wind farm under the scenario of turbines 120 and 180 m tip height for the spring seasons 2020-2021 and applying for large array correction.

Species	2020 (120 m)	2021 (120 m)	2020 (200 m)	2021 (200 m)
Black Kite	9-92	4-38	3-28	3-29
Black Stork	1-7	1-10	0-4	1-11
Booted Eagle	0-2	0	0-1	0-1
Common Crane	0	0	0	0
Eastern Imperial Eagle	0	0	0	0

Egyptian Vulture	0-1	0	0-1	0
Eurasian Sparrowhawk	0	0	0	0
Honey Buzzard	10-101	4-36	5-53	3-32
Great White Pelican	0-2	0-3	0-1	0-1
Greater Spotted Eagle	0	0	0	0
Lesser Spotted Eagle	0-3	0-3	0-2	1-13
Lanner Falcon	-	0	-	0
Levant Sparrowhawk	2-22	6-55	2-23	6-59
Long-legged Buzzard	0	0-2	0	0-1
Montagu's Harrier	0	0	0	0
Osprey	0	0	0	0
Pallid Harrier	0	0	0	0
Red-footed Falcon	0	0	0	0
Short-toed Snake Eagle	1-6	0-5	0-4	0-4
Steppe Buzzard	19-189	20-201	10-99	18-182
Steppe Eagle	6-62	1-13	3-32	1-13
Sooty Falcon	0	0	0	0
Western Marsh Harrier	0	0	0	0
White Stork	133-1,318	69-682	67-687	60-594

Table 9-8 Collision risk estimates (birds/year) assuming avoidance rates (min: 95%-max: 99.5%) for the RSWE wind farm under the scenario of turbines 120 and 200 m tip height) for the autumn season and applying for large array correction.

Species	2019 (120 m)	2020 (120m)	2019 (200 m)	2020 (200 m)
Black Kite	0	0	0	0
Black Stork	0	0	0	0
Booted Eagle	0	0	0	0
Common Crane	0	0	0	0
Common Kestrel	0	0	0	0
Eastern Imperial Eagle	0	0	0	0
Egyptian Vulture	-	0	-	0
Eurasian Sparrowhawk	0	0	0	
Honey Buzzard	1-9	3-29	1-10	1-3
Great White Pelican	1-6	3-27	0-3	1-13

Greater Spotted Eagle	-	-	-	-
Lesser Spotted Eagle	-	-	-	-
Lanner Falcon	0	-	0	-
Levant Sparrowhawk	-	-	-	-
Long-legged Buzzard	0	0	0	0
Montagu's Harrier	0	0	0	0
Osprey	0	0	0	0
Pallid Harrier	0	0	0	0
Red-footed Falcon	0	0	0	0
Short-toed Snake Eagle	0	-	0	-
Steppe Buzzard	0	0	0	0
Steppe Eagle	0	0	0	0
Sooty Falcon	0	0	0	0
Western Marsh Harrier	0	0	0	0
White Stork	1-12	8-83	2-22	4-44

Anyway, the CRM outcomes reflect what has been collated during the monitoring and which include the following:

- The collision risk generally is lower in the autumn compared with the spring migration period
- Overall, predicted impact seems similar but higher for the taller turbines, but there is a trade-off in the predicted fatalities between an increase in turbine tip height and number and spacing of turbines. The tip height increases only 20 m for birds that usually fly within the 1,000 m height above ground (Shamoun-Baranes et al. 2017), Considering the 1,000 m height occupied by the bird flux, the increase in the height of airspace from 120 to 180 m represents a 6% of occupation.
- Those species flying in flocks have higher predicted collisions and which include in particular the Black kites, Honey and Steppe buzzards, and the White Stork.
- There are variations in the CRM outcomes between years for the same season due to variations in the respective recorded bird numbers.
- There are species for which the predicted impact is zero. However, for such species such as the Marsh harrier are known in reality to collide sooner than others, despite the non-predicted impacts and because of all times lower flying heights.
- The outcomes of the CRM does not affect the mitigation strategy to be implemented (discussed later throughout this section), it just measures how the impact might be without mitigation.
- The new layout has two components, the size and the number of turbines. For this project, it is known that the size of the turbines has increased, while the number of turbines decreased, and the Rotor Swept area increase with the new layout is only around 30,000 sq. m (less than one and a half of the older turbines). Despite the many assumptions of the CRM, like the use of the time a bird is flying at tip height, number of birds at risk, the avoidance rate, or working scenario of the turbines, other factor also affects the birds flight and the passing rates, as it has been

demonstrated in the scientific literature. The main drivers in the birds' flight, wind speed and direction which also affect flying height are variables the CRM does not consider.

Impact Assessment Outcome

(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 avifauna. 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

As discussed earlier, some of the key outcomes of the CRM assessment indicates that overall, the predicted impact seems similar for the higher turbines, but there is a trade-off in the predicted fatalities between an increase in turbine tip height and number of turbines. For the majority of MSBs passing through the project site airspace during spring and autumn migration, the risk of collision is low or zero, however, those species flying in flocks have higher predicted collisions and which include in particular the Black kites, Honey and Steppe buzzards, and the White Stork. 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.

Given all the above, the potential impacts on birds created during the operation phase would be of a long-term duration as they are as long as the wind turbines are operating. Such impacts are considered of negative nature and range from a low magnitude to a medium magnitude and the receiving environmental is determined to be of a high sensitivity. Given all of the above, such an impact is considered to be of moderate significance.

(iii) Residual Impacts

As discussed further below within the mitigation section, 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 of minor significance.

Mitigation and Monitoring Measures

(iv) 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 9.15" for full list of wind farm projects within the GoS region.

(i) Cumulative Effect Assessment (CEA)

The ESIA Consultant undertook a CEA Study for the Project site. The assessment included an analysis of the potential cumulative effects on biodiversity of wind farms in development by Red Sea Wind Energy Project on the Gulf of Suez, Egypt. The analysis identifies priority bird Valued Environmental Components (VECs) (IFC 2013) and a preliminary list of other VECs. High-level mitigation and monitoring actions that will be adopted by RSWE were presented. Additional actions that RSWE and other developers in the study area will undertake or support to address their contribution to the cumulative effects of their developments together with others in the region were also presented. A staged screening of the list of preliminary bird species was undertaken, to develop a final list of priority bird VECs that were likely to be at greatest overall risk from the Projects. The process has identified 14 species, which had an Overall Risk of Major or Moderate, are considered priority bird VECs for the Projects. Fatality thresholds assessment resulted in identifying a zero-fatality threshold for ten of the priority species identified, whereas the remaining four had a threshold ranging from 10 to 100. Finally, mitigation measures and monitoring actions were proposed, to be adopted by RSWE project, and others that are proposed to be undertaken collectively and collaboratively by all wind energy developers across the study area. These mitigation and monitoring actions focus on the potential impacts to the 14 priority VECs are based on industry good practice while building on the already existing experience of adaptive management at operational wind farms along the Gulf of Suez.

The CEA above will be updated in 2022 to reflect updates in monitoring programs undertaken in the Gulf of Suez area for autumn season.

(ii) Avi-Fauna Monitoring and Active Turbine Management Program (ATMP)

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 behaviour.

Monitoring will be undertaken during the migration seasons. The start and end of the monitoring period will be agreed with the ATMP Technical Committee[9] prior to commencement of each migration season. Based on current information, monitoring must take place during the spring migration season (from 20 February until 20-May) and autumn migration season (from 10 August till 10 November). Throughout these periods, monitoring must take place continuously on a daily basis.

The program will be implemented through a Visual Observations (VOs) approach and may be assisted by the combination of VOs with use of a Radar Systems (RSs) approach.

Four criteria for triggering the shutdown of the wind turbines should be applied as summarized below.

- **Threatened species:** Wind turbines should be shut down whenever a bird or birds of a threatened species (according to the last updated IUCN Red List of Threatened Species) are detected migrating through the wind farm area or heading towards it at risky flight altitudes (i.e., within the rotor-swept area).

Common name	Scientific name	IUCN status 2022
Northern Bald Ibis	*Geronticus eremita*	EN

[9] This includes members from RCREEE, EEAA, and EETC

Lappet-faced Vulture	*Torgus tracheliotos*	VU
Egyptian Vulture	*Neophron percnopterus*	EN
Steppe Eagle	*Aquila nipalensis*	EN
Greater Spotted Eagle	*Aquila clanga*	VU
Eastern Imperial Eagle	*Aquila heliaca*	VU
Red-footed Falcon	*Falco vespertinus*	VU
Sooty Falcon	*Falco concolor*	VU
Saker Falcon	*Falco cherrug*	EN
Unidentified eagle*	*Aquila/Clanga sp.*	-

** The large eagles of the genus Aquila/Clanga which migrate through the area are often difficult to identify. Since three of these species are considered threatened (Steppe, Greater Spotted and Eastern Imperial Eagles) it is advisable that when in doubt the turbines should be shut down. Near Threatened species are not considered in this updated criteria.*

- **Flocks with 10 or more large soaring birds (target species):** wind turbines should be shut down whenever flocks with 10 or more large soaring birds are detected migrating through the wind farm area or heading towards it at risky flight altitudes (≤200 m).

- **Imminent high risk of collision:** a single wind turbine or turbines should be shut down whenever there is an imminent high risk of collision of a large soaring bird (e.g. a bird approaching a turbine at a close distance).

- **Extreme weather:** turbines should be shut down during extreme weather events (e.g., sand/dust storms) or other precarious events that threaten the safety of the monitoring team or the targeted soaring birds, whenever conditions 1 or 2 above have been verified in the two hours that preceded the event.

- **Roosting inside or near windfarm area:** whenever bird(s) of a threatened species (Condition 1) or flocks with 10 or more soaring birds (Condition 2) is detected roosting or attempting to roost inside or near the windfarm area (≤2000 m); risky turbines should be shut down until the bird(s) depart the risk zone, or until the risk is assessed as low.

The following parties will be involved in the ATMP:

- *RCREEE:* RCREEE, EETC and EEAA have been involved in the development of the ATMP in the GoS since 2015 (additional details provided below). RCREEE as one of these responsible entities, has already been selected for execution of the ATMP through tendering the ATMP, assigning experienced consultants, reviewing and supervising the implementation of the ATMP, coordinating with other responsible entities and informing all other involved parties.

- *Consultant(s): a* consultant(s) experienced in bird migration and shutdown on-demand in the GoS and in bird/wind turbine-interactions will be selected and assigned by RCREEE. The selected consultant(s) will be responsible for the overall execution, mainly including coordination and communication between all involved parties, execution of meetings and workshops, organization and execution of the field work, data analysis and preparation of reports, compilation of databases and capacity building.

- *Technical Committee:* in order to guarantee a thorough execution of the ATMP, a Technical Committee will be formed (consisting from RCREEE, EEAA, EETC, NREA and other). The Technical Committee will be involved from the very beginning of the ATMP (i.e., in the planning and preparatory phase) and will review and comment on the main steps to be conducted in the course of the ATMP (e.g., proposed technical approaches, proposed way of data analysis, conclusions and recommendation made by the ATMP and FMP consultant(s). Therefore, the ATMP consultant(s) will provide the Technical Committee with the required information on a regular basis (e.g., once a month). In addition, meetings will be held to discuss all technical issues (twice a year). In doing so, the ATMP will be adjusted, if necessary, according to the recommendations of the Technical Committee strengthening the outcome of the ATMP and contributing to an effective adaptive management process.

- *Developer, lenders and/or other organisations:* Developer, lenders and/or other Organization (e.g., NGOs) will be informed on the current status and the progress of the ATMP, the main conclusions and any recommended adjustments regularly. Therefor RCREEE will provide them with final reports prepared by the ATMP consultant(s). In addition, Developer, lenders and other Organizations (e.g., NGOs) will be invited to participate in regular meetings and will get the opportunity to ask for clarifications, raise concerns and propose adjustments.

Successful Practice in Operational Wind Farms Under ATMP

RCREEE, EETC, EEAA, and NREA have signed on 15 December 2015 a Protocol titled "Executive Framework for Strategic Cumulative Environmental and Social Impact Assessment (SESA) & Program of Ornithological Monitoring and Active Turbine Management Program (ATMP) for Wind Energy Developments in the Gulf of Suez". Based on the signed Protocol, RCREEE is responsible for the execution of the strategic framework for the ATMP for multiple windfarm projects at GoS on behalf of private wind energy developers. The ATMP projects aim to ensure the protection and risk mitigation of the environment while increasing the feasibility and the productivity of the wind turbines over the project's lifetime.

In the GoS there are two operational wind farms projects working under ATMP namely: Ras Gareb wind farm 262.5 MW (RGWE) and West Baker Wind Farm WBWF 250 MW.

- **RGWE Wind Farm 262.5 MW at Gulf of Suez:** the Ras Ghareb Wind Energy S.A.E (RGWE) project is the biggest operational wind farm in Egypt and the MENA region to date, with a total capacity of 262.5 MW executed on a build-own-operate model. The windfarm operation started in November 2019
- **WBWF 250 MW at Gulf of Suez:** The West Bakr Wind Farm Project is considered one of the largest wind projects grid-connected electricity generation from renewable wind source, developed by Lekela Egypt Wind Power.

After about four (4) years of operation for RGWE and two (2) years for WBWF projects the following is concluded:

- The mitigation measures had proven its effectiveness by reducing the collision risk of the migratory birds at the GoS
- Created successful capacity building initiatives which led provide/increase the job opportunities in the biodiversity field
- The ATMP has created supportive and cooperative business model by bringing different governmental bodies to work together and harmonizing their efforts toward environment conservation aligning with renewable energy deployment

(iii) Fatality Monitoring Program 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 1.

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 monthly, Additionally, a comparative assessment between the fatality monitoring results and the outcomes of the pre-construction ESIA CRM will be provided annually.

Following implementation of the above, the residual significance can be minor.

9.6.3 THE CONCEPT OF "CORRIDORS": RELATIONSHIP BETWEEN LAYOUT AND BIRDS PASSING

Another issue to take into account is related to the *Strategic and Cumulative Environmental and Social Assessment* – known as SESA developed in 2016-2017. It was developed for the 284km^2 area allocated for wind farm developments in the GoS (was carried out by the RCREEE on behalf of NREA); this area is much larger than that in the Figure 9-9 which only represents the RSWE project.

To efficiently reduce potential barrier effects of multiple wind farms in the 284km^2 area, the SESA recommended *sufficient space is maintained between wind farms to enable large soaring birds to safely migrate over the coastal desert plains and continue migration during spring and autumn time and seasons (**known as bird corridors**)"*, the installation of turbines within the allocated areas presented in red in the figure below. A minimum 1.6km buffer should be maintained between each plot, also requiring an additional 1km buffer between the rows of turbines within each plot.

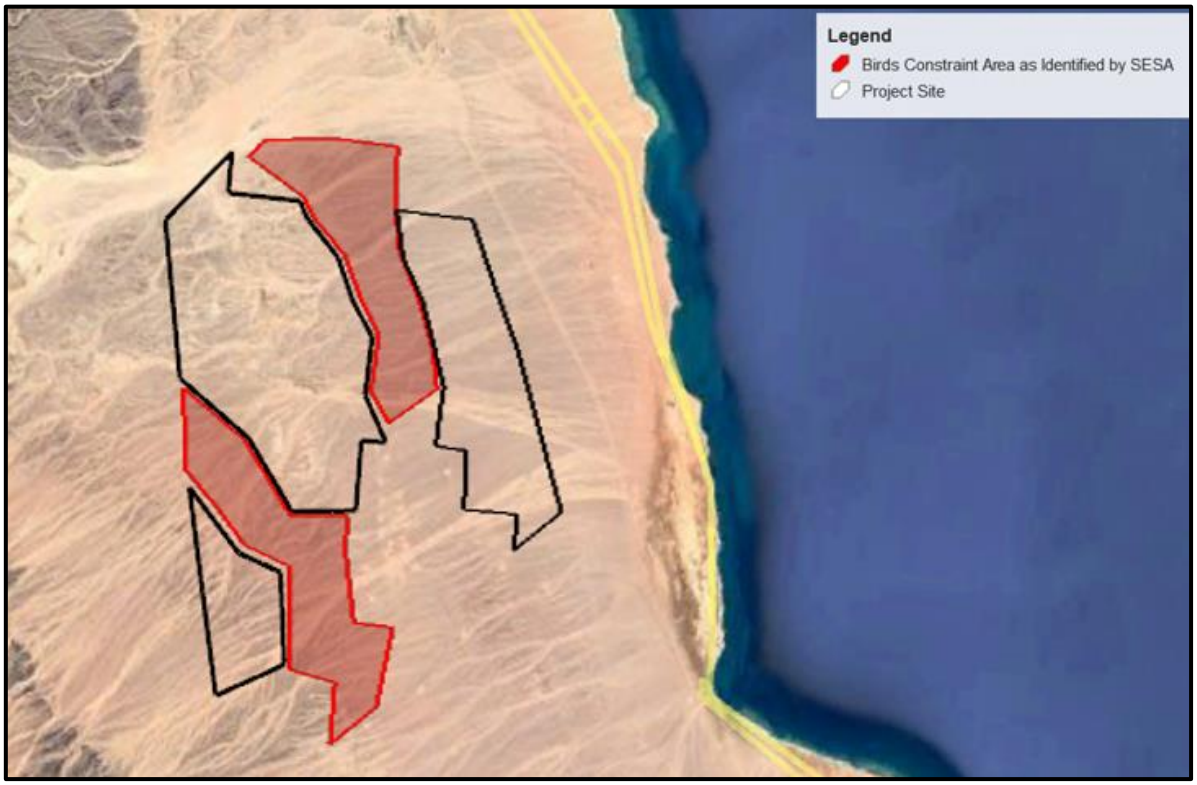


Figure 9-9: Bird Constraint Areas as Identified in the SESA

The new turbine layout showed in the Figure 9-11 places turbines within one of the SESA recommended areas as to be maintained as a corridor. This section analyses the bird behaviour in 2019-2021 in relation to this SESA proposed "corridor", and the potential risks associated with its occupation.

Defining the "corridors"

The two "corridors" in the SESA, fall within the OP2 and OP5 monitoring sites of the RSWE study (see "Section 8.5.1"), Figure 9-10. The new layout plans some turbines within the eastern bird corridor (OP2) as shown in the Figure 9-11, and not using the western corridor. Based on communication with ECODA (authors of the study) corridors were not based on field baseline bird observational data, but rather just proposed as a mitigation measure to keep some free space between turbines. As stated in Section 8.5.1, the client developed spring (2020-2021) and autumn (2019-2020) MSBs counts using eight vantage points.

The hypothesis is:

- If birds use the proposed "corridors" the passing rates should be the same within each migratory season (spring 2020 = spring 2021, and autumn 2019 = autumn 2020 respectively). And,

- The passing rates through OP2 and OP5 would show significant differences compared to the remaining VPs.

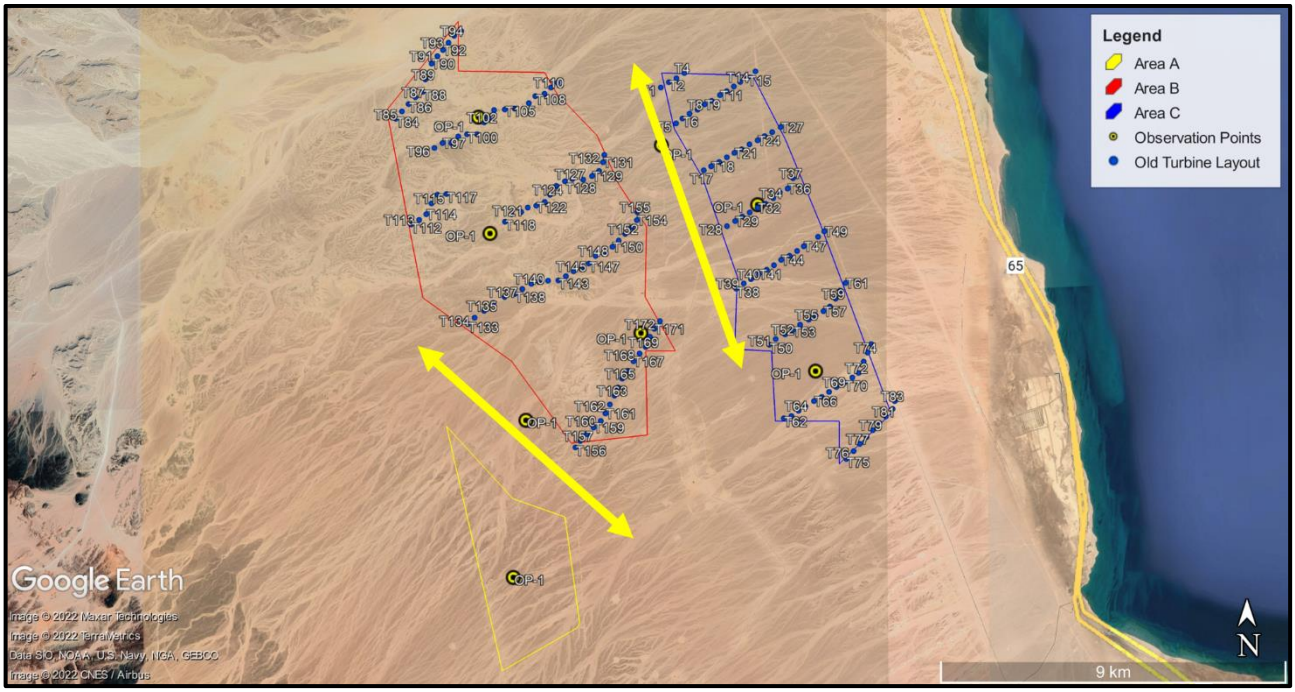


Figure 9-10: Initial development plots (Areas A, B, and C), and Observation Points (OP1 to OP8); see the text for the definition of "corridors" (yellow arrows) within the OP2 and OP5

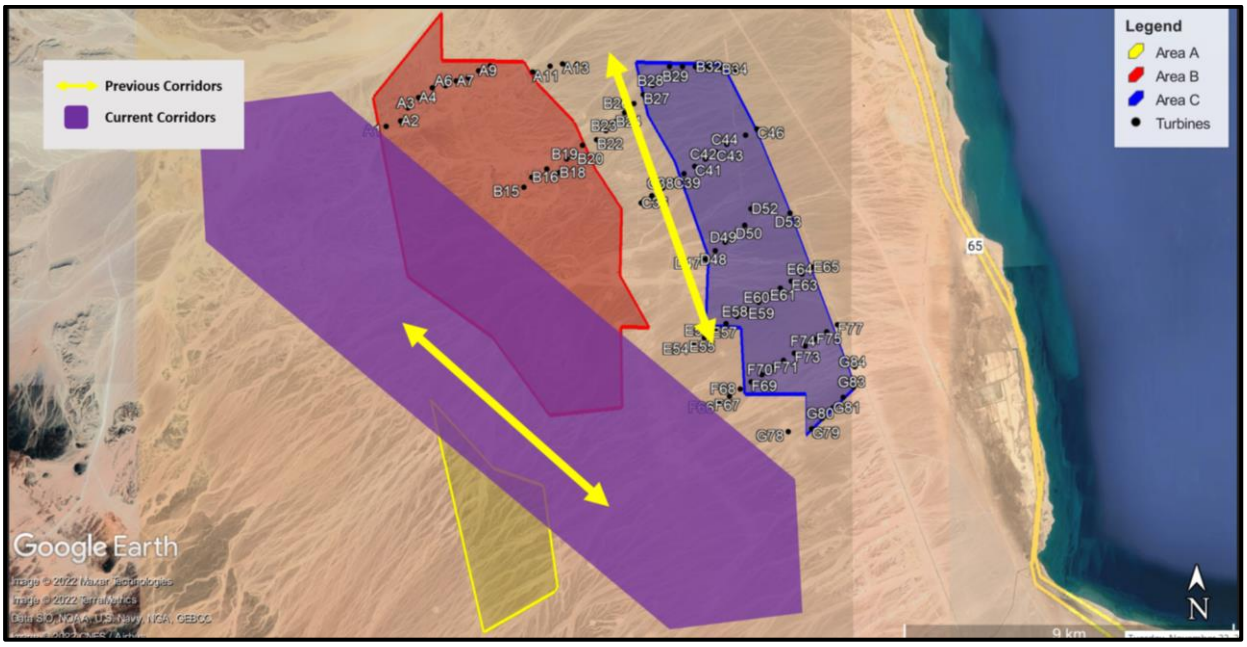
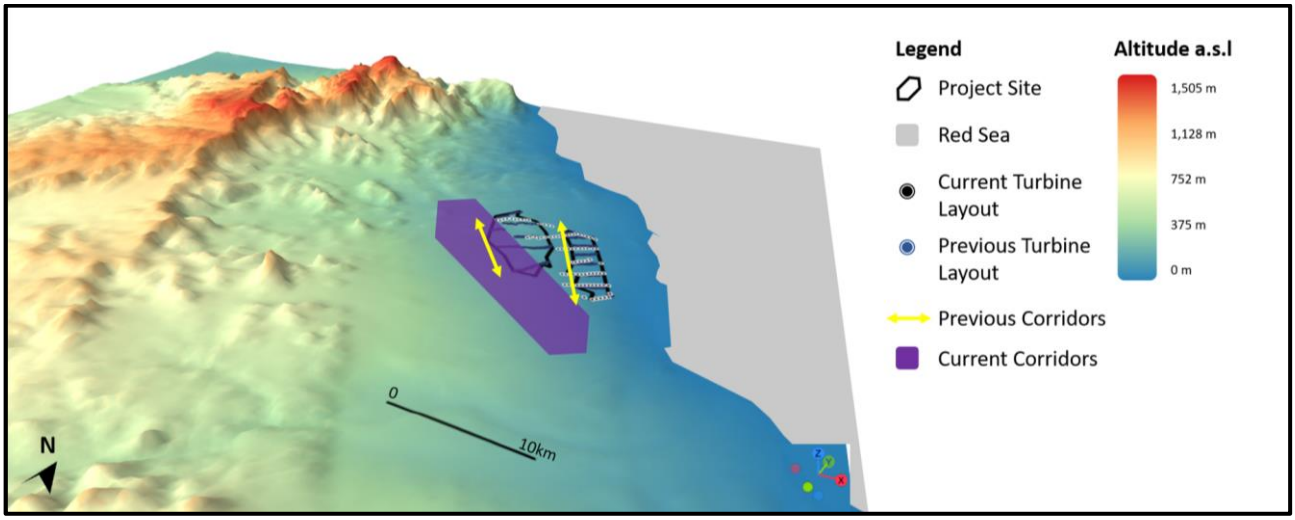


Figure 9-11: Final Layout which occupies Area C (entirely) and B (partially) but also occupies "corridor" OP2

Finally, landscape has been argued as a potential factor affecting the migration in the area. A Digital Elevation Model (DEM) was developed indicating that there are no features which would suggest that there is a preferred passing area or features that would affect bird behaviours because of the proximity of the mountains in the area, which is really far away. The project footprint has a gentle slope and despite no monitoring taking place within this entire area west from the left plot, based on the results of the analysis in the ESIA, there is no reason to believe that different bird behaviours could take place over such region compared to the areas where the corridors where initially suggested by the SESA.



The Section 8.5.2 analysed the spatial distribution of the passing rates (birds/hr) for the spring (pages 88-93 of this ESIA) and autumn (Pages 108-111) seasons. Information was presented using graphs, visual tables and statistical analyses. The main outcomes were:

- Globally, considering all the species together, there were no differences in the passing rates (birds/hr) per OP in spring 2021, and autumn 2019-2020. There were however, significant differences in spring 2020.
- The species-by-species analyses showed that the significant differences (i) only occurred for a few species each season; (ii) there was inconsistency between years, and the same species had different results each year. Thus, it is not realistic to refer to preferred passing sites/OPs.
- Differences observed might be caused by weather conditions at the site or along the migration route, as scientific and other wind energy related studies have demonstrated. Birds show great flexibility in their migratory movements except when crossing bottlenecks and if being an obligate soaring bird.[10]
- Additional confirmation came from the SESA re-analysis of the raw data collated in 2016 and 2017, where there was also a lack of spatial explicitness, when assessing the corridors on a species per species basis.
- The results **confirm the hypothesis of a no spatial explicitness, so birds are flexible to move throughout and outside the project footprint**". While the new layout places some turbines in the former OP2 corridor (from the SESA), it creates additional corridors, which birds may utilise. This is achieved by:
    - leaving the OP5 west corridor free of turbines (in line with the previous layout);
    - increased space between the turbines;
    - increased distance between rows of turbines;
    - not fully occupying the "OP2 corridor";
    - not utilising former zone A for turbines; and
    - placing less turbines in former zone B.

[10] Vansteelant, W. 2016. From thermal to flyway: how weather shapes the soaring migration of European Honey Buzzards *Pernis apivorus* at multiple scales. Ph.D. Gildeprint – the Netherlands and references therein.

This combined with the implementation of the ATMP is expected to significantly reduce collision risk noting further the findings of the Collision Risk Modelling (CRM) that considered the previous and the current turbine layout.

9.7 Bats - Chiroptera

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.

9.7.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the Wind Farm EPC Contractors 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, 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.

9.7.2 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).

However, such impacts are anticipated to be of a long-term duration as negative nature, low magnitude, and low sensitivity and therefore not significant 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 or foraging 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. This was in fact confirmed through the bat survey that was undertaken for the Project area.
- Based on a site survey undertaken, the Project area does not support any roosting sites for bats. In summary, the Project site was void of bat activity. Typically, this is due to lack of close roosting sites within the Project area and nearby areas.

It is recommended that as part of the Fatality Monitoring Program during Operation discussed under "Section 9.6.2" bats are included as well. Based on the outcomes of the Program should it indicate any potential impacts on bats, mitigation and monitoring measures should be revised.

9.8 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.

9.8.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the Wind Farm EPC Contractors 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 Wind Farm 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 Wind Farm EPC Contractors during the construction phase and which include:

- 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 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 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.

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:

- 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.

9.9 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.

9.9.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the Wind Farm EPC Contractors 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 workers in Petroleum Storage Facilities). 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 workers in Petroleum Storage Facilities).

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 Wind Farm EPC Contractors 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 Wind Farm EPC Contractors 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., Petroleum Storage Facilities) 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.

9.9.2 Potential Impacts during the Operation Phase

The main foreseen impacts during the operation phase are 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 9.12 – Public Health and Safety" along with other relevant impacts such as shadow flicker.

9.10 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.

9.10.1 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 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 Wind Farm EPC Contractors 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 Contractors 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 Wind Farm EPC Contractors as part of the planning phase of the Project:

- As noted earlier in "Section 9.3.1", 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 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 Wind Farm EPC Contractors 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.

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 proof of coordination with relevant entities

9.10.2 Potential Impacts on Electricity Lines during the Planning and Construction Phase

As noted earlier, an electricity line runs within the most eastern parts of the Wind Farm area including 4 pylons located within the site. 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 the electricity lines within the Project area. The EETC through the Electricity Law 87/2015 states that any OHTL has a right of way of 25 m from both sides which should be taken into account. However, this should be confirmed through consultations with EETC.

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 high magnitude and medium sensitivity. Given the above impact is considered of moderate significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the Wind Farm EPC Contractors during the construction phase:

- Establish coordination with relevant entity 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 Wind Farm EPC Contractors during the construction phase and which include:

- Submission of proof of coordination with relevant entities

9.10.3 Potential Impacts on the Gas Pipeline during Construction

As noted earlier, the natural gas pipeline runs to the east of the Project site by around 1km at the narrowest point as noted in the Figure 8-61. Given that it is located outside of the Project site there are no anticipated impacts on the gas pipeline. Therefore, there are no mitigation or additional requirements to be considered.

9.10.4 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).

Based on information provided by the Developer, 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 Wind Farm EPC Contractors during the construction phase and Wind Farm Operator during the operation phase respectively and which include:

- Coordinate with the Ras Ghareb Water Company to sector the water requirements of the Project.

9.10.5 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 Wind Farm EPC Contractors during the construction phase and Wind Farm 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 Ras Ghareb Public Dumpsite.
- 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.

9.10.6 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 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

9.11 Occupational Health and Safety

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;
- 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 Wind Farm EPC Contractors are expected to prepare an Occupational Health and Safety Plan (OHSP) each for their construction, installation and commissioning works as well as the general construction site operations. In addition, the Wind Farm 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), EBRD PR 4 (Health and Safety) and World Bank ESS 2 (Labour and Working Conditions) 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 detail 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 detail 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.

All entities (to include Wind Farm EPC Contractors and Wind Farm Operator) are expected to adopt and implement the provisions of the OHSP throughout the Project construction and operation phase.

In relation to workers accommodation, as discussed earlier the Wind Farm EPC Contractors have 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.

Nevertheless, the Wind Farm EPC Contractors 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 involved entities as relevant (Wind Farm EPC Contractors during the construction phase and Wind Farm Operator during the operation phase).

- 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".

9.12 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.

9.12.1 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 (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 111.6 dBA between 10 m/s and 20 m/s, worst cases would be defined as operation within wind speeds which exceed 10 m/s.
- A 1 dB correction has been applied in accordance with the wind turbines 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 9-9: 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 = 25ºC							
Atmospheric Attenuation Coefficients (dB / km)	63 Hz	125 Hz	250Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
	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. The sound power levels during standard operation mode ranges from 103.3 dBA at low revolutions per minute (rpm) to 111.6 dBA 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 111.6 dBA
- Noise Sensitive Receiver locations (NSR) as identified in "Section 8.11.1" earlier. Review of identified receptors indicate that only one potential receiver has been identified in the vicinity of the proposed wind farm which includes the military base in the form of an Air Force Defence Unit located approximately 3.4km east of the closest wind turbine location.

A noise contour map for the worst-case noise scenario for the turbine layout options has been calculated and are presented in the figures 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 9-10: Noise Contour Map Setup Specification (Consultant, 2022)

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 - 75 dB(A)

As noted in the figure below, generally the noise levels at the Air Force Defence Unit are likely to exceed the prescribed noise limit of 35 dB(A) at a wind speed of 10 meters/second (m/s) at 10 m as required by the Guidelines. Nevertheless, in general, such a receptor is unlikely to be classified as an NSR given that based on observations it includes offices, training grounds, radar system, mosque and barracks for soldiers. Such a barracks is likely to include sleeping arrangements for soldiers whom are likely there on a rotational basis and it is unlikely to include any permanent residences living there.

Taking the above into account, such impacts are considered irrelevant and no detailed noise assessment is required.

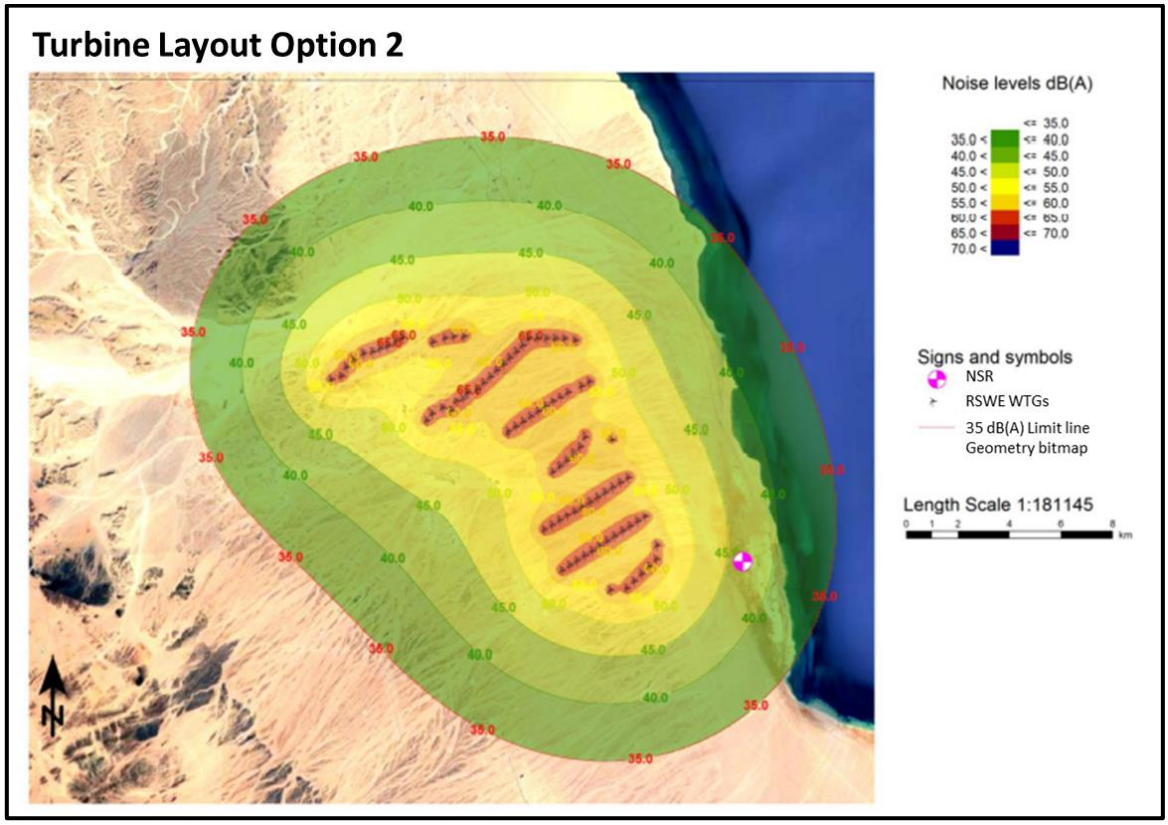


Figure 9-12: Noise Contour Map for Final Project Turbine Layout

Table 9-11: Predicted Contribution Noise Levels at NSR from RSWE Wind Farm (W10)

Predicted Contribution Noise Level at 10m/s Wind Speed (W10) – dB(A)
43.1

9.12.2 Potential 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 165m – therefore shadow flicker effects are likely to occur within 1,750m 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 3.5km from the Project; such impacts are considered irrelevant and no detailed shadow flicker modelling is required.

9.12.3 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 Wind Farm 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.
  - Present to the local communities the public safety hazards of the turbines and the various other Project components.
  - 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 Wind Farm Project Operator during the operation phase of the Project and which include:

- Submission of Security Risk Assessment

9.12.4 Potential Impacts from Worker Influx during Construction

During construction the Project a relatively significant number of workers will be expected onsite (around 1,600 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.

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

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 Wind Farm EPC Contractors are 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.

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 Wind Farm EPC Contractors:

- Submission of the Worker Influx Plan

9.12.5 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 Wind Farm EPC Contractors and Wind Farm 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); (ii) EBRD PR 2 (Labour and Working Conditions); (iii) WB ESS 4 (Community Health and Safety), 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 Wind Farm EPC Contractors and Wind Farm operator:

- Submission of the Security Management Plan

9.12.6 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 Wind Farm 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 Wind Farm 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.

9.12.7 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 facilities (such as the petroleum storage 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 9.3.1", 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 (such as the petroleum storage facilities) which could be based on the IFC setback distance requirements.

9.13 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 1,600 job opportunities at peak during the construction phase for a duration of approximately 28 months. This will mainly include around 300 skilled job opportunities (to include engineers, technicians, consultants, surveyors, etc.) and 1,300 unskilled job opportunities (mainly laborers but will also include a number of security personnel).
- Around 40 job opportunities during the operation phase for a duration of 25 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 especially since, as discussed earlier, the local community in general suffers from high unemployment and poverty rates.

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.

- Taking all of the above into account, it is important for the Developer to adopt different plans and measures to implement initiatives that would contribute to enhancing the living environment of the local communities, elevate their standards of living, and bring social and economic prosperity.

- Due to the high unemployment levels in the area, it is important to prioritise employment in the new planned governmental and private sector investment projects from the community. This shall be reflected in the EPC Contract and subsequent subcontracts. This could be implemented through a joint collaboration between the Developer/EPC Contractors and the other wind farm developers in the area.

- The project development shall entail some indirect positive benefits to the local community from the increase in demand for local services, supplies, and businesses. This could include for example possible engagements from local contractors or local community, as well as other supplies and services (accommodation services, food, household products, etc.). Such demands could improve the existing local economic activities and impact certain sectors, such as construction, wholesale/retail trade, and accommodations, etc.

- The above should be clearly outlined as prerequisites from the contractors and service providers commissioned for development projects in the area. The Developer shall ensure implementation of such measures by clearly stipulating such conditions in the contracts.

- Therefore, it is recommended that the Developer adopt and implement a Community Integration Plan (CIP) for working with the local community members. The Plan must aim to support the local economy stating its aims and objectives and should acknowledge the importance of building a strong socio-economic relationship with the local community through a participatory planning program even before the development is in place. The Plan must include the key requirements identified below.

  - Project Updates Procedure: the procedure should aim to ensure timely and continuous communication and dissemination of information with the local community through appropriate local platforms – this could include for example timely consultation and information disclosure with the related stakeholders, informed participation and have open communication channels with the related stakeholders, a copy of the NTS and SEP in English and in Arabic shall be distributed to the related stakeholders, etc.

    The objective is to: (i) alleviate potential sense of social marginalisation, (ii) improve their understanding and perception of the benefits associated with development, and (iii) manage expectations related to opportunities from the Project and clearly identify commitments by developers related to social development.

  - 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 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.

9.14 Summary of Anticipated Impacts

The tables below present a summary of the anticipated impacts during the planning and construction, operation, and decommissioning 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 is implemented (major, moderate, minor, or not significant).

Table 9-12: 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 petroleum storage facility and an oil rig of the General Petroleum Company.	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	Negative	Short - Term	Reversible	High	Medium	Moderate	Mitigation Available	Not Significant

	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.								
	Electricity network – if planning activities are not well managed onsite it could damage/disturb existing onsite electricity network and pylons.	Negative	Short – Term	Reversible	High	Medium	Moderate	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
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 result 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 local communities.	Positive	Not applicable.						

Table 9-13: 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	Minor
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 result	Negative	Long – term	Could be Irreversible	Medium	High	Moderate	Mitigation Available	Not Significant

	in various public safety hazards.								
	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	High	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 local communities.	Positive	Not applicable						

9.15 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 9-14: 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 could be impacted from the Project during operation were identified.	Site-specific mitigation and monitoring requirement. Refer to "Section 9.2"
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. Within the site there is only a petroleum storage facility and an oil rig. 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 "9.3".
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 9.4"
Biodiversity	No major issues identified by SESA since the habitats of the area are considered 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.	No floral species were identified at the project site to be of high concern. Faunal species, including three mammal species and one reptile require consideration since literature has shown that the project site is located in their distribution range.	Site-specific mitigation and monitoring requirement for biodiversity management. Refer to "Section 9.6"
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	The autumn survey is generally in line with the SESA as the numbers of birds recorded were moderate with the highest numbers being for species of low concern.	Site-specific mitigation and monitoring requirements. Refer to "Section 9.6"

	since species recorded were of least concern and were relatively low.		
Bats	Bats were not considered specifically by the SESA	The Literature review has shown that there are some species that could be of high vulnerability to collision with wind power infrastructures	Mobile detection survey carried out in spring-summer 2020 to verify findings of the literature review. Refer to "Section 9.7"
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 9.8"
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 9.9".
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 not identify any additional requirements.	No key issues of concern identified. Several site-specific infrastructure and utility elements were noted within the area to include a petroleum storage facility, oil rig, roads, telecommunication tower, electricity network, and other which could be impacted during the construction and operation phase if improperly managed.	Site-specific mitigation and monitoring requirement. Refer to "Section 9.10".
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 9.11".
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 farm to the Project site. Results are discussed in further detail 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 1750m 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 9.12".
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 9.13".

Cumulative Noise Assessment

Similar to the noise screening assessment undertaken in "Section 9.12.1", 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 figures that follows with respect to the two (2) turbine layout options of the proposed Project.

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 Siemens Gamesa SG 2.6-114 IA wind turbine. The table below details the basic specifications.

Table 9-15: Lekela Wind Farm – Siemens Gamesa SG 2.6-114 CS Wind Turbine Generator Specification

Manufacturer	Siemens Games Renewable Energy (SGRE)
Model Type	SG114-2.6
Rated Power	2,625 kW
Rotor Diameter	114 m
Hub Height	63 m

RGWE 262.5MW 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 9-16: RGWE 262.5MW Wind Farm - G97- 2.1MW MaxPower Wind Turbine Generator Specification

Manufacturer	Siemens Gamesa Renewable Energy (SGRE)
Model Type	G97-2.1
Rated Power	2,100 kW
Rotor Diameter	97 m
Hub Height	71.5 m

Amunet 500MW Wind Farm

This project consists of 77 wind turbine generators, each of which houses a 6.5 MW wind turbine. The table below details the basic specifications.

Table 9-17: AMUNET 500MW Wind Farm - Envision EN171-6.5 MW Wind Turbine Generator Specification

Manufacturer	Envision
Model Type	EN171-6.5MW
Rated Power	6,500 kW
Rotor Diameter	171 m
Hub Height	94.5 m

NIAT Wind Farm

This proposed project consists of 173 wind turbine generators, each of which will house wind turbine with the below specifications.

Table 9-18: NIAT Wind Farm – Siemens Gamesa Wind Turbine Generator Specification

Manufacturer	Siemens Gamesa Renewable Energy (SGRE)
Model Type	SG114-2.9
Rated Power	3,000 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 has been calculated and are presented in the figures below. Based on the results of the noise contour map and the identification of the potential NSR (i.e., Air Force Defence Unit), the contribution noise levels at the NSR for the designated worst-case scenario for a W10 of 10 m/s from a cumulative perspective is calculated at 44.6 dB(A) for the final layout. Therefore, the results show that under these conditions, the Air Force Defence Unit will exceed the prescribed noise limit of 35 dB(A) required in the IFC Wind Energy EHS Guideline.

However, as discussed earlier in "Section 9.12.1", the Air Force Defence Unit can be declassified as an NSR. Occupancy details on the Air Force Defence Unit were requested but could not be obtained. Nevertheless, in general, such a receptor is unlikely to be classified as an NSR given that based on observations it includes offices, training grounds, radar system, mosque and barracks for soldiers. Such a barracks is likely to include sleeping arrangements for soldiers whom are likely there on a rotational basis and it is unlikely to include any permanent residences living there.

Taking the above into account, such impacts are considered irrelevant and no detailed noise assessment is required.

Table 9-19: Predicted Contribution Noise Levels at NSR from RSWE and Adjacent Wind Farms (W10)

Potential Noise Sensitive Receptor	**Predicted Contribution Noise Level at 10m/s Wind Speed (W10) – dB(A)**	
	Isolation	**Cumulative**
Air Force Unit	43.1	44.7

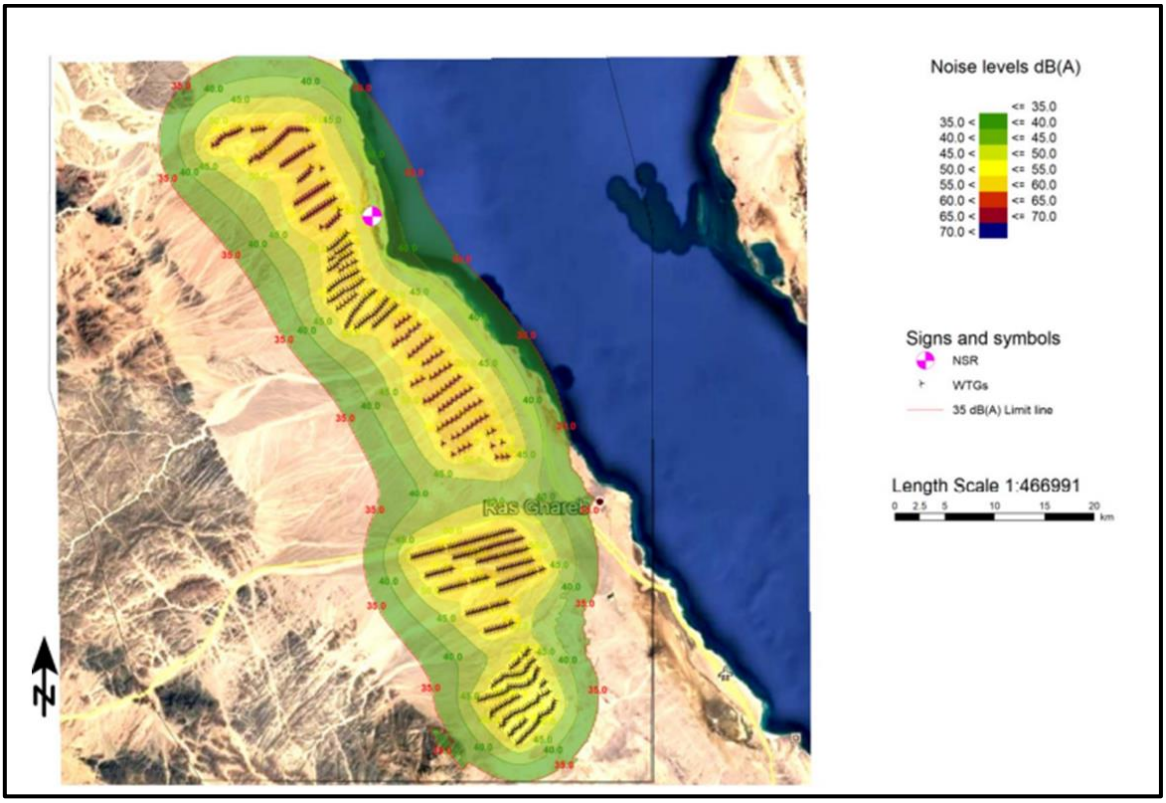


Figure 9-13: Noise Contour Maps for Cumulative Assessment with the final layout for the Project

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

10.1 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 detail in below). 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 detail below). This should include an organisational structure that identifies the lines of authority and roles and responsibilities of all involved entities.

Table 10-1: Roles and Responsibilities of Entities Involved in ESMP

Project Role	Entity	Responsibilities	Staffing Requirements
Project Owner and Developer	Red Sea Wind Energy	▪ Selection of EPC Contractors and Project Operator; ▪ Implement mitigation and monitoring requirements as applicable for such entity as detailed in the ESMMP; and ▪ Ensure overall compliance of EPC Contractors and Project Operator with the requirements of the ESMMP and ESHS MS.	Appoint competent HSE Manager or as part of Third-Party Employer representative (e.g., Owner's Engineer)
Wind Farm EPC Contractors	Orascom Construction, Siemens Gamesa Renewable Energy	▪ Appoint a competent HSE team. ▪ Implement mitigation and monitoring requirements as detailed in the ESMMP 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.
Wind Farm Operator	Red Sea Wind Energy	▪ Appoint a competent HSE team. ▪ Implement mitigation and monitoring requirements as detailed in the ESMMP and ESHS MS requirements;	For Project nature and duration, this is expected to include HSE Manager (which is not required to be full-time or onsite at all times)
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 Wind farm EPC Contractors and Wind Farm 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 Contractors and subcontractor crew
- Emergency response training for all workers onsite to include for example EPC Contractors 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.

Table 10-2: Project Training Requirements

Training	Wind Farm EPC Contractor	Wind Farm 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, Wind farm EPC Contractors, and Wind Farm 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 Contractors 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

Table 10-3: Project Inspection and Monitoring Requirements

Inspection and Monitoring	Developer	Wind Farm EPC Contractors	Wind Farm 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, Wind farm EPC Contractors, and Wind Farm 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

Table 10-4: Project Meeting Requirements

Meetings	Developer	Wind Farm EPC Contractors	Wind Farm 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 ESMMP 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).

Reporting should be submitted to the Developer as applicable by the relevant entities as identified below.

Table 10-5: Project Reporting Requirements

Reporting	Wind Farm EPC Contractors	Wind Farm Operator
Reporting	Monthly	Semi-annually

10.2 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 Contractors 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
- Community Integration Plan (which includes local recruitment and procurement procedures)
- Stakeholder Engagement Plan and Community Grievance Mechanism

Wind Farm EPC Contractors

- 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 Management Plan
- Air Quality and Noise Management Plan
- Traffic and Transport Plan
- Worker Accommodation Plan
- Worker Influx Plan
- Occupational Health and Safety Plan
- Emergency Preparedness and Response Plan
- Security Management Plan
- Chance Find Procedures
- Worker Grievance Mechanism

Wind Farm 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 Management Plan
- Occupational Health and Safety Plan
- Emergency Preparedness and Response Plan
- Security Management Plan

10.3 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 10-6: 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	Wind Farm EPC Contractors
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 storage facility and an oil rig of the General Petroleum Company.	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 relevant entity 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" with NREA; (ii) provide detailed design to include turbine locations, cables, roads, etc; (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
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 dumpsite (the closest dumpsite being Ras Gharib Public Dumpsite)	Mitigation	Submit contract	Not applicable	Once before commencement of construction	Wind Farm EPC Contractors
		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	
		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	Mitigation	Submit contract	Not applicable	Once before commencement of construction	Wind Farm EPC Contractors
		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	Wind Farm EPC Contractors
		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	Wind Farm EPC Contractors
		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 a minimum of 1,000 litters of general-purpose spill absorbent is available at hazardous material storage facility.	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	Wind Farm EPC Contractors
		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) condition to the greatest extent possible	Mitigation	Visual inspections	At construction active areas	Upon occurrence	
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).	Undertake a detailed survey (through an ecological expert) to identify the presence of any active Egyptian Dabb Lizards as well as their burrows within all assigned areas to be disturbed by construction.	Additional Requirement	Submit survey report	At project site	Prior to construction	Wind Farm EPC Contractors
		Implement proper housekeeping practices on the construction site at all times	Mitigation	Visual inspections	At construction active areas	Daily / weekly	
		Should any fencing be erected as part of the Project, it must be ensured that it allows for the natural movement of small faunal species within the area	Mitigation	Inspection	At construction active areas	Once	
Birds (avi-fauna)	Construction activities could disturb existing habitats of birds breeding and/or nesting within the Project site.	A breeding bird survey to be carried out during the suitable breeding season from March until May of the year 2023	Additional Requirement	Submit survey report to be added as Addendum to ESIA	At project site	Prior to construction	Consultant
		Implement proper housekeeping practices on the construction site at all times	Mitigation	Visual inspections	At construction active areas	Daily / weekly	Wind Farm EPC Contractors
Archaeology and Cultural Heritage	Improper management of construction activities could disturb/damage archaeological remains which could be buried in the ground (if any).	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 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	Mitigation	Visual inspections and submittal of chance find report	At applicable area	Upon occurrence	Wind Farm EPC Contractors
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 petroleum storage facilities and internal road networks	Upon occurrence	Wind Farm EPC Contractors
		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	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
		such excessive noise levels should be identified and adequate control measures must be implemented			and other receptors to include petroleum storage facilities		
		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, 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.	Additional study	Submission of Traffic and Transport Plan and approval from local authorities	Not applicable	Once before commencement of construction	Wind Farm EPC Contractors
		Establish coordination via NREA/EETC with the relevant entity 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 relevant entity 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.)	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	Wind Farm EPC Contractors
	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	Wind Farm EPC Contractors
	Aviation, telecommunication and TV/Radio management	Establish coordination 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 (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)	Additional requirement	Submit formal communication letter with relevant entities	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	Wind Farm EPC Contractors
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	Wind Farm EPC Contractors
	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	Wind Farm EPC Contractors
	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 existing onsite facilities (such as the petroleum storage 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	▪ Adopt different plans and measures to implement initiatives that would contribute to enhancing the living environment of the local communities,	Recommendation	Regular reporting on outcomes of Program	Not applicable	Continuous	Project Developer/EPC

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
	extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity	elevate their standards of living, and bring social and economic prosperity. ▪ Prioritise employment in the new planned governmental and private sector investment projects from the community. This shall be reflected in the EPC Contract and subsequent subcontracts. This could be implemented through a joint collaboration between the Developer/EPC Contractor and the other wind farm developers in the area. ▪ Include prerequisites from the contractors and service providers commissioned for development projects in the area. Such measures shall be clearly stipulated in the contracts. ▪ Adopt and implement a Community Integration Plan (CIP) for working with the local community members. The Plan must aim to support the local economy stating its aims and objectives and should acknowledge the importance of building a strong socio-economic relationship with the local community through a participatory planning program even before the development is in place. The Plan must include the key requirements identified below. - Project Updates Procedure: the procedure should aim to ensure timely and continuous communication and dissemination of information with the local community through appropriate local platforms – this could include for example timely consultation and information disclosure with the related stakeholders, informed participation and have open communication channels with the related stakeholders, a copy of the NTS and SEP in English and in Arabic shall be distributed to the related stakeholders, etc. - 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 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.		implementation			Contractors

Table 10-7: 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 dumpsite (the closest dumpsite being Ras Gharib Public Dumpsite)	Mitigation	Submit contract	Not applicable	Once before commencement of operation	Wind Farm 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	Mitigation	Submit contract	Not applicable	Once before commencement of operation	Wind Farm Operator
		Prohibit illegal disposal of wastewater to the land	Mitigation	Visual inspections	At operational active areas	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 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 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	Wind Farm 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	Wind Farm 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 a minimum of 1,000 litters of general-purpose spill absorbent is available at hazardous material storage facility.	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	
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	Wind Farm 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.	Additional requirement	Submission of study	GOS region	Once before commencement of operation	RCREEE
		Avi-Fauna Monitoring and On-Demand Turbine Shutdown	Mitigation	Submission of report	At operational active areas	Continuous	Consultant
		Avi-Fauna Carcass Search during Operation	Additional requirement	Submission of report	At operational active areas	Continuous	
		Carcass Search Surveys	Additional requirement	Submission of report	At operational active areas	Continuous	
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.	Bat mortality survey	Additional requirement	Submission of report	At operational active areas	Continuous	Wind Farm Operator
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	Wind Farm 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	Wind Farm 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
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	Wind Farm 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	Wind Farm 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	Wind Farm 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	Wind Farm 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	▪ Adopt different plans and measures to implement initiatives that would contribute to enhancing the living environment of the local communities, elevate their standards of living, and bring social and economic prosperity. ▪ Prioritise employment in the new planned governmental and private sector investment projects from the community. This shall be reflected in the EPC Contract and subsequent subcontracts. This could be implemented through a joint collaboration between the Developer/EPC Contractor and the other wind farm developers in the area. ▪ Include prerequisites from the contractors and service providers commissioned for development projects in the area. Such measures shall be clearly stipulated in the contracts. ▪ Adopt and implement a Community Integration Plan (CIP) for working with the local community members. The Plan must aim to support the local economy stating its aims and objectives and should acknowledge the importance of building a strong socio-economic relationship with the local community through a participatory planning program even before the development is in place. The Plan must include the key requirements identified below. - Project Updates Procedure: the procedure should aim to ensure timely and continuous communication and dissemination of information with the local community through appropriate local platforms – this could include for example timely consultation and information disclosure with the related stakeholders, informed participation and have open communication channels with the related stakeholders, a copy of the NTS and SEP in English and in Arabic shall be distributed to the related stakeholders, etc. - 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 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,	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
		company vision, timeline for implementation as well as other factors.					

11 E&S ASSESSMENT FOR PROJECT SUBSTATION

As discussed earlier, the Project components will include a substation and a project electricity transmission line as provided in detail below. As required by RCREEE and in order to clarify the specific impacts and mitigations for such components, this has been included in a standalone chapter.

- **Substation**: as discussed throughout the document, the ESIA also includes the assessment of impacts from the substation components. The substation is a high voltage transformer substation that collects and converts 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 location of the substation is presented in the figure below.

Figure 11-1: Location of Substation within Project Area

- **Project Electricity Transmission Line:** electricity generated from the Project will be connected to the national grid from the substation through an Overhead Transmission Line (OHTL). As discussed earlier, a standalone ESIA was undertaken and provided for the OHTL.

The table below provides a summary of: (i) the baseline conditions (which are similar to the Project area given that the substation is located within the same Project plots), (ii) anticipated impacts from the substation; and (iii) mitigations required.

Attribute	Summary of E&S Baseline	Impact	Mitigation Measures
Landscape and Visual	No key issues of concern given that no key sensitive visual receptors which could be impacted from the Project during operation were identified.	***Construction Phase***. Site preparation activities which are to take place onsite by the Wind Farm EPC Contractor for the substation 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	Application of similar mitigations to those identified in Section 9.2.1 which are to be implemented by the Wind Farm EPC Contractors
Land Use	Project site is uninhabited and vacant and does not include any physical or economical land use activities. Within the site there is only a petroleum storage facility and an oil rig. In addition, Bedouin Groups in general implement the Ghafra system in such land areas to include Project site	***Construction Phase***. Project area includes petroleum storage facilities and an oil rig as well as informal land use by Bedouin Groups through the Ghafra system. Inappropriate management of such issues could result in land use impacts and disputes.	Application of similar mitigations to those identified in Section 9.3.1 which are to be implemented by the Wind Farm EPC Contractors
Geology, Hydrology, Hydrogeology	No key site-specific issues of concern noted and based on preliminary assessment, there are no flood risks anticipated at the Project site.	***Construction and Operation Phase***. Construction and operation activities for the substation area will generate waste streams to include solid waste, wastewater and hazardous waste. In appropriate management of such waste stream could contaminate and pollute soil which in turn could pollute groundwater resources	Application of similar mitigations to those identified in Section 9.4.2 which are to be implemented by the Wind Farm EPC Contractors and Operator.
Biodiversity	No floral species were identified at the project site to be of high concern. Faunal species, including three mammal species and one reptiles require consideration since literature has shown that the project site is located in their distribution range	***Construction Phase***. Site preparation activities which are to take place onsite for the substation are expected to include land clearing activities, levelling, excavation, grading, etc. Such activities are limited to the relatively small individual footprints of the substation 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	Application of similar mitigations to those identified in Section 9.5.1 which are to be implemented by the Wind Farm EPC Contractors

Avi-Fauna (birds)	The autumn survey is generally in line with the SESA as the numbers of birds recorded were moderate with the highest numbers being for species of low concern.	***Construction Phase***. Site preparation activities which are to take place onsite for the substation 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	Application of similar mitigations to those identified in Section 9.6.1 which are to be implemented by the Wind Farm EPC Contractors
Bats	The Literature review has shown that there are some species that could be of high vulnerability to collision with wind power infrastructures	***Construction Phase***. Site preparation activities which are to take place onsite by the Wind Farm EPC Contractor for the substation 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, 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.	Application of similar mitigations to those identified in Section 9.7.1 which are to be implemented by the Wind Farm EPC Contractors
Archaeology and Cultural Heritage	There are no site-specific archaeology or cultural heritage remains.	***Construction Phase***. Site preparation activities which are to take place onsite by the Wind Farm EPC Contractor for the substation 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	Application of similar mitigations to those identified in Section 9.8.1 which are to be implemented by the Wind Farm EPC Contractors
Air Quality and Noise	No key issues of concern identified.	***Construction Phase***. Site preparation activities which are to take place onsite by the Wind Farm EPC Contractor for the substation 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, air emissions and noise.	Application of similar mitigations to those identified in Section 9.9.1 which are to be implemented by the Wind Farm EPC Contractors.
Infrastructure and Utilities	No key issues of concern identified. Several site-specific infrastructure and utility elements were noted within the area to include a petroleum storage facility, oil rig, roads, telecommunication tower, electricity network, and	***Construction Phase***. Improper management of construction activities could affect the infrastructure and utility elements present onsite such as road networks, electricity lines, telecommunication towers, etc.	Similar mitigations to those identified in Section 9.10 which are to be implemented by the Wind Farm EPC Contractors

	other.		
Occupational Health and Safety	N/A	***Construction and Operation Phase***. Activities at the substation entail occupational health and safety risks and hazards such as electrocution, exposure to hazardous materials, etc.	Similar mitigations to those identified in Section 9.11 which are to be implemented by the Wind Farm EPC Contractors
Public Health and Safety	N/A	***Operation Phase – Public Access***. Public access of unauthorized personnel to the substation area could result in safety issues such as electric shock, thermal burn hazards, exposure to chemicals and hazardous materials, etc.),	Similar mitigations to those identified in Section 9.12.3/9.12.4/9.12.5 which are to be implemented by the Wind Farm EPC Contractors
		Operation Phase – EMF exposure. Electric and magnetic fields (EMF) are radiation associated with the use of electric power such as household wiring, electric appliances and also from substations. Electric fields are produced from the voltage in the electrical lines while magnetic fields are produced from the electric current. While electric fields can be shielded by objects (such as buildings or trees), magnetic field pass through most objects. Such fields are strongest at the source and decrease significantly with increasing distance from the source. Extensive scientific research and studies have been undertaken to address potential human health impacts from long term exposure to EMF. The general consensus is that the overall scientific evidence for human health risk from EMF exposure is weak however EMF exposure could not yet be recognized as entirely safe. Similarly, the EHS Guidelines for Electric Power Transmission and Distribution issued by the IFC also states that although there is public and scientific concern over the potential health effects associated with exposure to EMF (not only high voltage power lines and substations, but also from everyday household uses of electricity), there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern. The IFC EHS Guideline also requires that exposure level limits to the public should remain below the International Commission on Non-Ionizing Radiation Protection (ICNIRP) limits provided in the table below.	None

Frequency	Electric Field (V/m)	Magnetic Field (µT)
50 Hz	5000	100
60 Hz	4150	83

According to the National Institute of Environmental Health Sciences (NIEHS) at a distance of around 100m EMF from power lines are similar to typical background levels found in most homes ("Electric and Magnetic Fields Associated with the Use of Electric Power" (NIEHS, 2012)). In addition, several other studies indicate that EMF produced by substation equipment are generally not appreciable beyond the substation boundaries (US National Academies Press, 1997) and therefore the above limits are likely to be met. Finally, the IFC EHS guideline also state that transmission lines and facilities require Right of Way (RoW) to protect the system and also protection from potential hazards and in which RoW for transmission lines are generally from 15m to 100m.

Taking the above into account, as discussed earlier, there are no key sensitive receptors located within the surrounding area of the Project site including the substation area including in specific within 100m from it (as well as up to 1km from it). Therefore, such impacts are considered irrelevant.

12 ANNEXES

Annex 1: Fatality Monitoring Methodology

Objectives of the fatality monitoring guidance

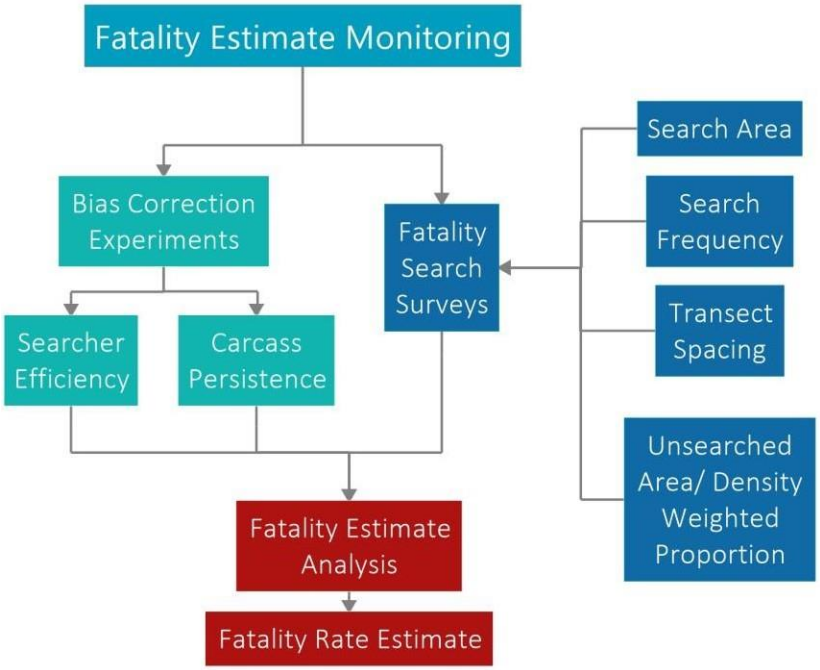
The proposed approach aims to provide:

- 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 100m 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).

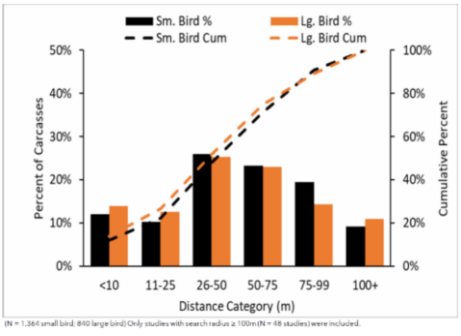
Sample size

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 analysed 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 centre-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 their 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 -

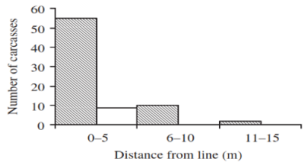
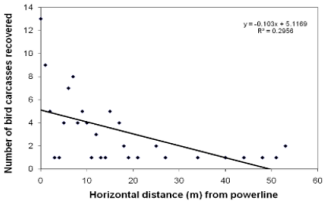


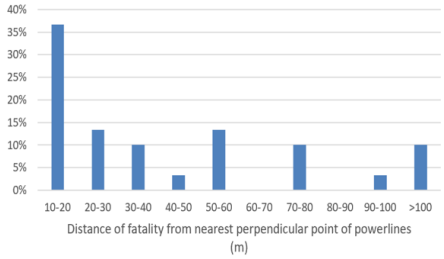
Figure 3. Distance of Blue Crane carcasses from the power line in open habitats, i.e. pasture and stubble (shaded), and closed habitats, i.e. mature cereal and veld (white).

Shaw *et. al.* 2010



Appendix A. Distribution of distances at which bird carcasses were discovered from powerlines at Rowe, spring 2007 (R. Murphy and T. Smith, University of Nebraska-Kearney, unpublished data).

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 storagebag

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 analysed 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.