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Egypt Green Hydrogen SAE

Scatec 200MW Wind Farm in Egypt

Site Specific Environmental and Social Impact Assessment (ESIA)

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Abbreviation	Description
ASL	Above Sea Level
ATMP	Active Turbine Management Plan
BOO	Build, Own and Operate
CAA	Competent Administrative Authorities
CAPMAS	Central Agency for Public Mobilization and Statistics
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CLO	Community Liaison Officer
CRM	Collision Risk Model
DEM	Digital Elevation Model
E&S	Environmental and Social
EBRD	European Bank for Reconstruction and Development
EEAA	Egyptian Environmental Affairs Agency
EETC	Egyptian Electricity Transmission Company
EGPC	Egyptian General Petroleum Corporation
EHS	Environment, Health and Safety
EHSS-MS	Environmental, Social, Health and Safety Management System
EIA	Environmental Impact Assessment
EM	Environmental Management
EMP	Environmental Management Plan
EMU	Environmental Management Unit
EPC	Engineering, Procurement, and Construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GIIP	Good International Industry Practice
GIP	Good International Practice
GIS	Geographic Information System
GoE	Government of Egypt
GoS	Gulf of Suez
GWh	Gigawatt Hours
HSE	Health, Safety and Environmental
HW	Hazardous Waste
IBA	Important Bird Area
IFC	International Finance Corporation
IFI	International Financing Institution
ILO	International Labor Organization
IRENA	International Renewable Energy Agency
ISES	Integrated Sustainable Energy Strategy
IUCN	International Union for Conservation of Nature
IWGIA	International Work Group for Indigenous Affairs

KPI	Key Performance Indicators
kV	Kilovolt
kWh	Kilowatt Hour
LoS	Lines of Sight
MoM	Minutes of Meeting
MSB	Migratory Soaring Birds
MSDS	Material Safety Data Sheet
MV	Medium Voltage
MW	Megawatt
NCE	Nature Conservation Egypt
NGO	Non-governmental Organization
NHWTC	Nasiriya Hazardous Waste Treatment Centre
NREA	New and Renewable Energy Authority
NTRA	National Telecom Regulatory Authority
NTS	Non-Technical Summary
O&M	Operation and Maintenance
OHS	Occupational Safety and Health
OHSA	Occupational Health and Safety Administration
OHSP	Occupational Health and Safety Plan
OHTL	Overhead Transmission Line
OSHA	Occupational Safety and Health Administration
PM	Particulate Matter
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PR	Performance Requirement
PS	Performance Standard
PV	Photovoltaic
RAP	Recognized Air Picture
RCREEE	Regional Center for Renewable Energy and Energy Efficiency
RGWE	Ras Ghareb Wind Energy
SCA	Supreme Council of Antiquities
SCADA	Supervisory Control and Data Acquisition
SEP	Stakeholder Engagement Plan
SESA	Strategic Environmental and Social Assessment
TBT	Tool Box Talks
TSP	Total Suspended Particulate
UN	United Nations
VHF	Very High Frequency
WBG	World Bank Group
WWTP	Wastewater Treatment Plant

1 Introduction

1.1 Project Background

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

In 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 efficient systems, 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 2022, of which 12% of wind power plants is foreseen, mostly in the Gulf of Suez (GoS) due to the favorable 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 favorable 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, Egypt Green Hydrogen SAE (hereafter referred to as 'the Developer'), has been selected for the development of a 200MW Wind Power Project in the Gulf of Suez (GOS) (hereafter referred to as the 'Project'). The objective of the project is to design, develop, and construct a fully operational 200 MW wind farm, delivering clean energy to the national grid to produce green hydrogen, in line with Egypt's renewable energy goals.

1.2 Project Location

The Project is located in the Red Sea Governorate of Egypt, around 300 km to the southeast of the capital city of Cairo. More specifically, the Project is located near the Red Sea shoreline and within the Ras Gharib District of the Red Sea Governorate, where the closest residential areas include Ras Gharib city (located 35km to the north) refer to the figures below.

The closest official (under Ras Ghareb District) community settlements to the Project site include Wadi Dara settlement (located less than 1km to the south) and Ras Ghareb City (located around 35km to the north). Moreover, there is an unofficial community settlement known as Ras Shukeir that is located around 8km to the northeast of the Project site. This settlement is used by petroleum companies in the area as housing/accommodation units, offices, and also includes some petroleum facilities.

The Project is located within a 300km^2 Strategic Area that has been allocated by NREA for wind farm development Projects with a total capacity of 1,500 MW. A strategic ESIA study has been undertaken for the 300km^2 area known as the "ESIA for an Area of 300km^2 at the Gulf of Suez" (Lahmeyer & Ecoda, 2013) (hereafter referred to as "Strategic ESIA"), where this Strategic ESIA investigated the E&S issues at cumulative and strategic level. Within this, a land area of 21.7 km^2 has been allocated to the Developer by NREA for the development of this Project.

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

Figure 1-2: Project Site and Surrounding Communities

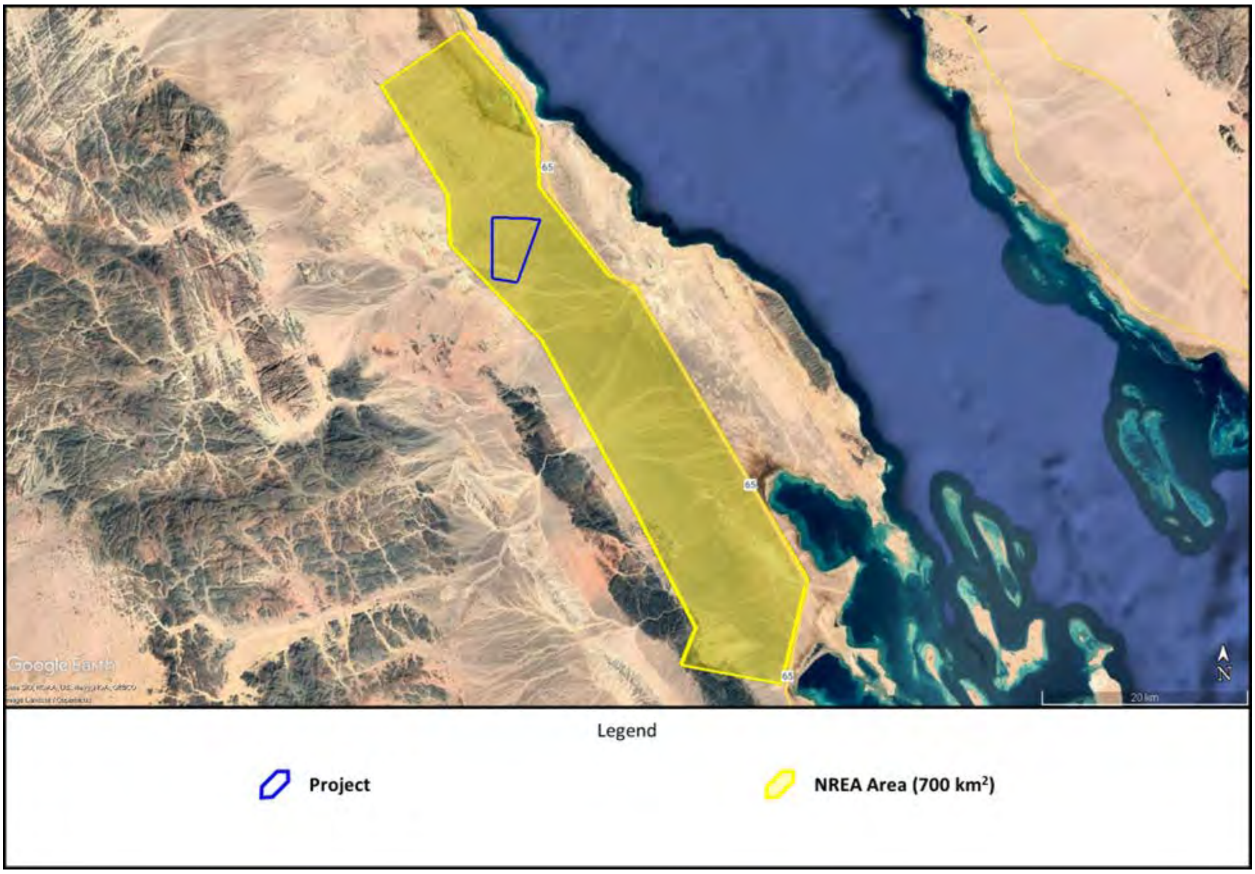


Figure 1-3: Project Site within the 300km2 Area Allocated for Wind Farm Developments by NREA

1.3 Project Components

The key components of the Project are discussed below.

- Wind turbines: the wind turbines which convert the kinetic energy in wind (i.e., movement of wind) into electricity.
- Foundations: will be constructed to bolt the tower of the turbine in place. The foundation will be built with concrete reinforced with structural corrugated steel.
- Crane Pad: next to each wind turbine to accommodate cranes for the installation of the turbines and for maintenance activities. Each crane pad will be around 1,500 m^2 in area (38 m in width and 40 m in length).
- 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.
- Medium Voltage (MV) Cables: The wind turbines will be connected through medium voltage cables 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 that is appropriate for connection with the High Voltage National Grid (220 kV). One substation will be located within the Project area.
- 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.

Associated Facilities

It is important to note that the Project also includes an overhead electricity transmission line. The electricity generated from the Project will be connected from the substation (discussed above) to the National Grid through an Overhead Transmission Line (OHTL) that will be developed by Egyptian Electricity Transmission Company (EETC).

1.4 Key Involved Entities

Different entities are involved in the construction and operation phase of the project. Responsibilities of each entity are listed below along with a general description of their roles.

- *Egypt Green Hydrogen SAE:* The owner and developer of the Project (hereafter referred to as 'the Developer');
- *Egyptian Environmental Affairs Agency (EEAA):* the official governmental entity responsible for protection of the environment in Egypt. The EEAA is responsible for approval of the Environmental and Social Impact Assessment (ESIA) and making sure it complies with the "Environmental Protection Law No. 4 of 1994" and granting the environmental clearance for the Project;
- *Engineering, Procurement, and Construction (EPC) Contractor:* will be responsible for preparing the detailed design and layout of the Project; supply of the material and equipment (e.g., wind turbines); construction of the Project and its various components (turbines, internal roads, building infrastructure, and etc.).
- *Project Operator:* responsible for Operation and Maintenance (O&M) of the Project.
- *Egyptian Electricity Transmission Company (EETC):* will be the off taker of electricity and is the entity that signed the Power Purchase Agreement (PPA) with the Developer. In addition, they will also be responsible for designing, building and operating the associated interconnection facilities. This will include the Overhead Transmission Line (OHTL) that will connect from the Project site to the existing national grid.
- *National Renewable Energy Authority (NREA):* is entity responsible for allocation of the land for the development of the Project;
- *International Financing Institutions (IFIs):* entities that will provide financing to the Developer for the development of the Project. Such IFIs will ensure that the Project is developed in accordance with GIIP E&S requirements. At this stage, the IFI will include EBRD as well as British International Investment (BII), European Investment Bank (EIB), U.S. International Development Finance Corporation (DFC) and the Deutsche Investitions und Entwicklungsgesellschaft (DEG).

- *Independent Environmental and Social Consultant (IESC):* is engaged by and on behalf of the IFIs to ensure that the Project is being developed in accordance with their E&S requirements.

- *Consultant (EcoConServ and Eco Consult):* hereafter referred to as the 'ESIA Team' who is the ESIA Practitioner and the consultant commissioned by the Developer to prepare the ESIA for the Project in accordance with the requirements of the "Law No. 4 of 1994" as well as GIIP requirements.

1.5 Overview of Related Project Elements

The proposed wind project is part of a larger integrated Green Hydrogen development that includes multiple interconnected components necessary for hydrogen production, storage, and export. These components include:

- **Electrolyzer:** A 100 MW pressurized alkaline electrolyzer facility that will produce green hydrogen, primarily powered by renewable energy sources.
- **Solar PV:** The project includes a 70 MWp solar PV plant in Benban, Aswan, supplying renewable electricity to the hydrogen production process complementing the wind project.
- **Desalination Plant:** A dedicated seawater desalination facility will provide freshwater for hydrogen production. Additionally, the project may integrate with a future national desalination initiative.
- **Ammonia Production and Export Infrastructure:** The green hydrogen output will be supplied to an existing ammonia production facility, which will undergo refurbishment to enhance its capacity. The ammonia will be transported via a dedicated pipeline to the Sokhna Port for international export.

2 ESIA Scope and Methodology

2.1 Introduction

The Environmental and Social Impact Assessment (ESIA) scope and methodology is a crucial component of the assessment process. It outlines the specific areas and aspects that will be evaluated to determine the potential environmental and social impacts of the Project. The scope defines the boundaries of the assessment, identifying the Project components, geographical area, and temporal scale to be considered. The methodology describes the approach and tools that were used to collect data, assess impacts, and engage stakeholders. This chapter discusses the methodology of conducting the ESIA.

2.2 ESIA Scoping

A scoping exercise was conducted to eliminate irrelevant impacts and focus on those that are most important. The identification process took into consideration the type of Sub-Project, its location, and the characteristics of the surrounding environment, as well as the sensitivity and importance of the receptors. Three types of receptors were identified: on-site receptors, receptors surrounding the site, and final sinks/receptors.

Using the impact identification matrix, different types of impacts were identified during construction, operation and decommissioning phases based on experience in the area, as well as: (i) detailed satellite image review; and (ii) detailed review of strategic studies for GoS.

2.3 Reviewed Project Description

The detailed description of the project was updated based on the new project design that includes the key components identified below. Providing and understanding a concise description would enable an effective and efficient process of identification of potential environmental and social impacts from the project.

- Project Rationale and Strategic Approach taking into account Government of Egypt (GoE) actions for renewable energy integration through Integrated Sustainable Energy Strategy (ISES) 2015 – 2030, Renewable Energy Law, and other.
- Wind energy potential at project area based on review of technical studies undertaken for the area
- Administrative Setup and Project Location and closest community settlements to the Project site
- Project Components and Design to include (i) wind turbines, (ii) infrastructure and utilities (cables, buildings, roads, substation, etc.); (iii) associated facilities (mainly Overhead Transmission Line); and (iv) project footprint. This will be supported with maps and layouts as appropriate.
- Project Phases and Timeline: detailed description of the activities that will be undertaken during planning and design phase, construction phase, and O&M phase of the project along with timeline anticipated for each.
- Anticipated Workforce: throughout the various project phases to include construction and operation with breakdown to include skilled and unskilled workers.

2.4 ESIA Baseline Methodology

2.4.1 Desktop Study and Secondary Sources

The consultant collected a significant amount of quantitative and qualitative information from multiple primary and secondary sources. The collection of secondary data involved reviewing information from previous reports and studies to extract background information on the environmental and socio-economic characteristics of the project area. Moreover, the consultant utilized material from a previously done ESIA covering the Project site.

RCREEE in cooperation with the ESIA Consultant conducted the assessment of the environmental and social baseline conditions of the project area and its surroundings based on the following:

- Desktop review and secondary data review was included in particular previous ESIA studies undertaken in the area as (e.g. Amunet 500MW ESIA, RSWE 500MW ESIA, NIAT 500MW, and IPH 200MW) as well as the strategi studies undertaken for the GoS area
- Data collection from the relevant governmental and non-governmental institutions. This includes for example socio-economic statistics, water supply information for the area, and other as applicable.
- E&S Surveys: for certain environmental and social receptors, secondary data might not be available and if available might be inadequate, not specific to the project site, and/or outdated. Therefore, RCREEE in cooperation with the ESIA Consultant undertook site assessments and surveys, to evaluate environmental and social baseline conditions. It is important to note that the assessment of E&S baseline conditions included the footprint of the project in addition to the associated facilities (i.e. overhead transmission line and substations of wind farm).

2.4.2 Consultations and Primary Sources

- In addition to the literature review, structured site visits were undertaken to collect primary data directly from stakeholders in order to engage their perceptions project. In accordance with the requirements of WB/IFC/EBRD, a Stakeholder Engagement Plan (SEP) was updated by the ESIA Consultant 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 was updated to include the following:

- Stakeholder analysis & planning: identify all project related stakeholders influenced by the Project to include but not limited to: (i) central governmental entities, (ii) local governmental entities; (iii) donor agencies; (iv) Non-Governmental Organizations; (v) local communities and Community Based Organizations (CBOs) (to include but not limited to Ras Gharib, Wadi Dara); (vi) academic and research institutions; (vii) private sector companies (including adjacent wind farm operators and developers); (ix) media organizations; and (x) most important any vulnerable groups (which as discussed earlier are likely to include women groups and Bedouin groups);
- Profile identified stakeholders to understand their priorities and relevance to the Project;
- On-going reporting to Affected Communities: Define the Project's approach to stakeholder engagement. Priority will be given to identification of engagement mechanisms that are: (i) culturally appropriate, (ii) scaled to the project risks and impacts, (iii) tailored to the characteristics and

interests of the stakeholder groups language preferences, and decision-making process. Under this we will identify the consultation methodology that will be adopted with each of these groups (e.g. focus groups, bi-lateral meetings, public consultation, formal communication, etc.);

- Identify the objective of undertaking such consultation activities for each stakeholder group;
- Identify the phase of involvement of stakeholders: This will include: (i) summary of stakeholder consultations and engagement undertaken as part of the ESIA (scoping process, baseline, impact assessment, mitigation, etc.) and (ii) future engagement post-ESIA phase to be implemented through the project duration to include four distinct phases – planning, construction, operation, and decommissioning; (iii) set out how the ESIA will be disclosed and consulted upon
- Disclosure & dissemination of information: identify appropriate and relevant channels that should be utilized by the Developer for disclosure and dissemination of all project information and updates; and
- Grievance mechanism: A detailed grievance/project complaints mechanism that is responsive and facilitates establishing and facilitating the resolution of stakeholders' concerns and grievances

2.4.3 Field Surveys and Measurements

Different filed surveys and measurements were carried out in 2022 and 2024 to assess the baseline conditions of the project area. The surveys covered environmental and social aspects related to the Project describing 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 5" to include the following: landscape and visual; land use; geology/hydrology/hydrogeology; biodiversity (birds (avifauna), bats and other); archaeology and cultural heritage; air quality and noise; infrastructure and utilities; and socio-economic conditions. Within each sub-section, the methodology of the survey which was undertaken is described in detail

2.5 ESIA Approach and Methodology

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

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

2.6 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 analyze 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 EBRD PR 1 and IFC PS 1.

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

2.7 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 the EBRD and IFC. The previous and future stakeholder consultation and engagement for the Project are summarized below and discussed in detail in "Chapter **Error! Reference source not found.**" and the Stakeholder Engagement Plan (SEP).

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 communities, and other as appropriate. This has been undertaken through bi-lateral meetings, e-mail communication, phone communication, formal letters, and other.

"Chapter 9" and the SEP also discusses future stakeholder engagement and consultations which are to take place at a later stage. This mainly includes: (i) a public disclosure session with stakeholders to present the findings and recommendations proposed within the ESIA; and (ii) implementation of the SEP by the Developer which describes the planned stakeholder consultation activities and engagement process' to take place after the ESIA approval.

2.8 Delineation of Study Boundaries and Scope of Assessment

2.8.1 Definition of Spatial Study Area

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

In general terms, the study area for the Project ESIA includes the footprint of Project disturbance as demarcated in the figure below. This includes the Wind Farm Project Site with a total area of 21.7 km^2.

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

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

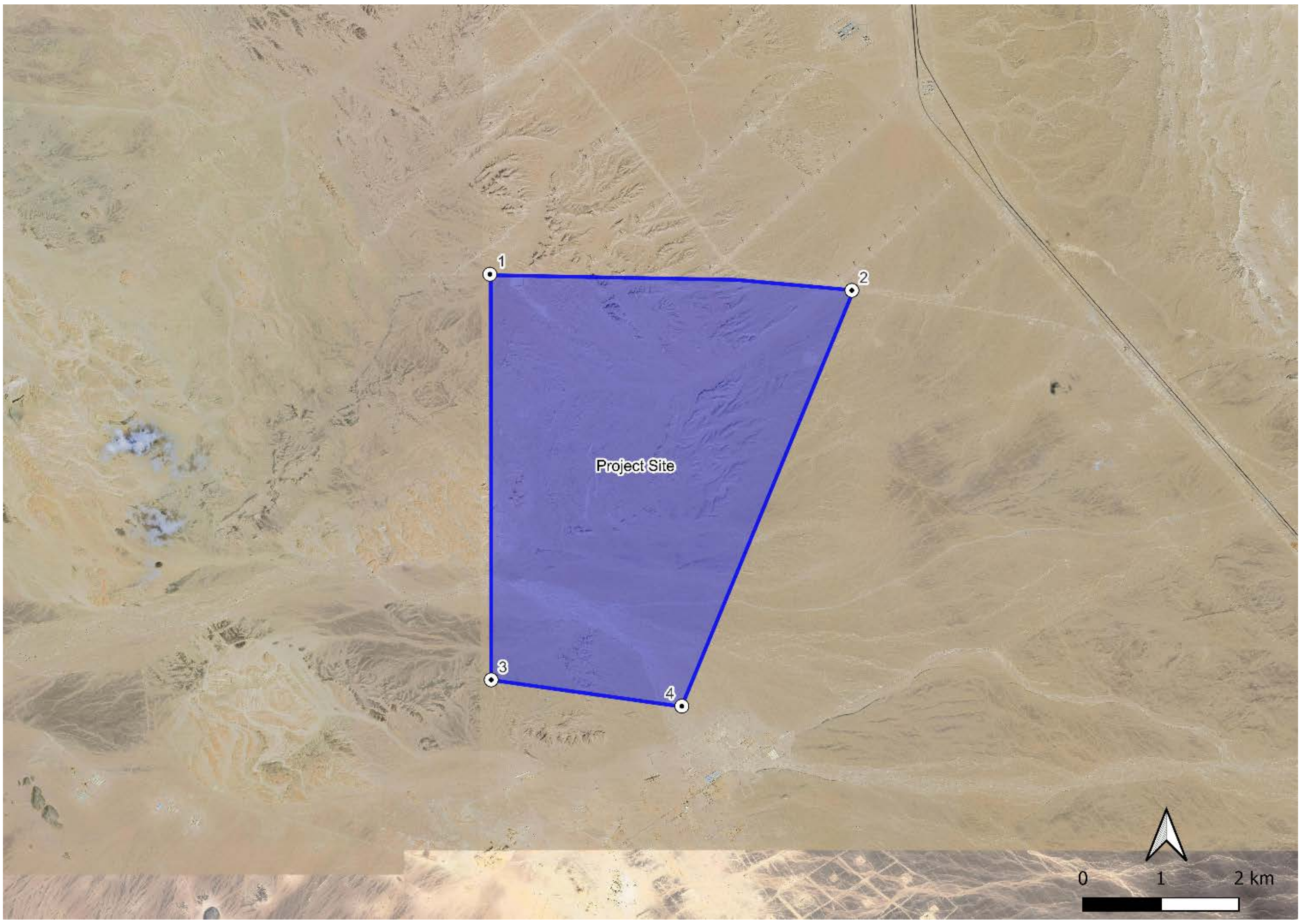


Figure 2-1: Study Area

2.8.2 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) <u>Planning and Construction Phase</u>

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

(ii) Operation Phase

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

(iii) Decommissioning Phase

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

2.9 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 5" 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.

2.10 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 7.1".

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. The following section provides a description of the approach, methodology and process adopted for the impact assessment presented within this ESIA.

2.10.1 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.

2.10.2 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.

2.10.3 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.

2.10.4 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 2-1: Determination of Significance

Sensitivity of Receiving Parameter/Receptor	Magnitude of Impact		
	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'.

2.10.5 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.

2.10.6 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.

2.11 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 7.14".

2.12 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 Contractor, EEAA, and other responsible parties, but will require further development and detailing in each of these phases.

2.13 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.

2.14 Structure of the ESIA

The ESIA is structured in a number of consecutive chapters, leading up to the impact assessment and management plan. The chapters are organized as follows:

- Executive Summary
- Chapter 1: Introduction
- Chapter 2: ESIA Scope and Methodology
- Chapter 3: Project Description
- Chapter 4: Policy, Legal and Institutional Framework
- Chapter 5: Environmental and Socioeconomic Baseline
- Chapter 6: Analysis of Alternatives
- Chapter 7: Analysis of Impacts & Mitigation Measures
- Chapter 8: Environmental and Social Management Plan (ESMP)
- Chapter 9: Stakeholder Engagement and Public Consultation
- Chapter 10: Assessment for Associated Facilities

- Chapter 11: Annexes

3 Project Description

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

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, the position of the governorate is displayed in the figure below. The Red Sea Governorate covers a total area of 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. The capital of the Governorate is Hurghada that is located around 100km south of the Project site.

The Project site is located within the Ras Ghareb City (or District) and is administratively under the Ras Ghareb City Council. The closest official community settlements, under the Ras Ghareb district, to the Project site include Wadi Dara settlement, at less than 1 km south of the project site. Ras Ghareb City is located around 35 km to the north of the project site. Moreover, there is an unofficial community settlement known as Ras Shukeir that is located around 8km to the northeast of the Project site. This settlement is used by petroleum companies in the area as housing/accommodation units, offices, and includes some petroleum facilities. The city of Ras Ghareb is the second-largest city in the Red Sea Governorate, with a leading and prominent position in oil production.

The Project has a total area of 21.7 km2 area that has been allocated to the Developer by NREA for the development of this Project. It is important to note that the Project area is part of a larger 300km2 area which is owned by NREA and that is allocated for wind farm developments.

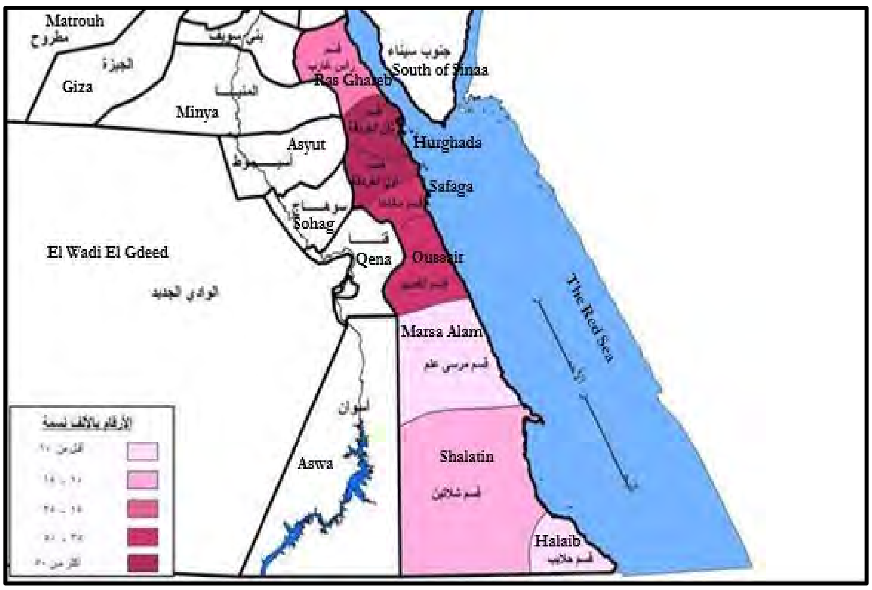


Figure 3-1: Administrative Borders of the Red Sea Governorate

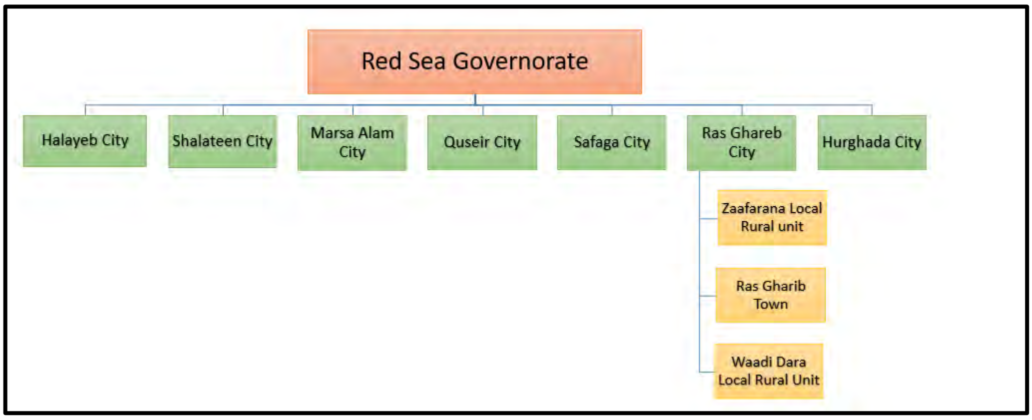


Figure 3-2: Administrative Division of Red Sea Governorate

Figure 3-3: Project Site in Relation to Closest Communities

The table and figure below present the coordinates of the Project site.

Table 3-1: Project Site Coordinates

Point	WGS Coordinates	
	Latitude	Longitude
1	28° 3'22.47"N	33°11'56.92"E
2	28° 3'14.84"N	33°14'47.46"E
3	28° 0'12.40"N	33°11'57.96"E
4	27°59'59.98"N	33°13'27.08"E

In addition to the above, as discussed in further details in "Section 5.2", there are several Bedouin tribes that implement a type of informal and unofficial claim to the Project area known as "Ghafra System". Such Bedouin groups do not reside within the Project area but are settled in the Ras Ghareb, Wadi Dara and other settlements within Red Sea Governorate.

Taking the above into account and for the purpose of this document, the term "local communities" will include Wadi Dara, Ras Gharib, Ras Shukeir and Bedouin groups in the area.

3.2 Outline of Wind Turbine Technology

The difference in pressure throughout the Earth's atmosphere is caused by the difference in temperature. This difference in pressure causes the movement of wind. Through this movement, wind is generated holding kinetic energy. Wind turbines convert the wind's kinetic energy from the wind that occurs naturally in the earth's atmosphere into electrical energy. Wind's kinetic energy is converted to rotational energy with the turbine's rotor. This rotational energy is then transferred to the gearbox to adjust its rotational speed, before it is transformed into electrical energy with the generator. After some rectifications through converters, transformers and substations the electricity is delivered to transmission and distribution systems and then to the end user.

3.3 Project Components

The project components include wind turbines used, the infrastructure and utilities, and all associated facilities.

3.3.1 Wind Turbines

Generally, a wind turbine consists of a foundation, tower, nacelle, rotor blades, a rotor hub, gearbox, generator and a transformer. The purpose of the foundation is to support the turbine by bolting it and connecting it to the ground. 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. The nacelle most importantly contains the gearbox and the generator. The gear box steps up the revolution per minute to a speed suitable for the electric generator, which in turn converts the kinetic energy from the movement of the blades into electricity.

Foundations will be constructed to bolt the tower of the turbine in place. Each turbine will have its own separate foundation. Each foundation will consist of a circular footing of around 20m diameter and a depth of around 3m to 4m. The foundation will be built with concrete reinforced with structural corrugated steel. In addition, each turbine is equipped with a transformer that converts and steps up the output from the turbine to a higher voltage (from 0.69kV to 22kV or 33kV) to meet a specific utility voltage distribution level that is appropriate for connection with a substation. Substations will be further discussed in the Section regarding Infrastructure and Utilities below.

Finally, next to each turbine will be a crane pad to accommodate cranes for the installation of the wind turbines and maintenance activities during operation. The crane pads will be suitable to support loads required for the erection, assembly and operation and maintenance of the turbines. Generally, crane pads have an area of around 1,500 m2. The following figure demonstrates the typical components of a wind turbine and a wind farm.

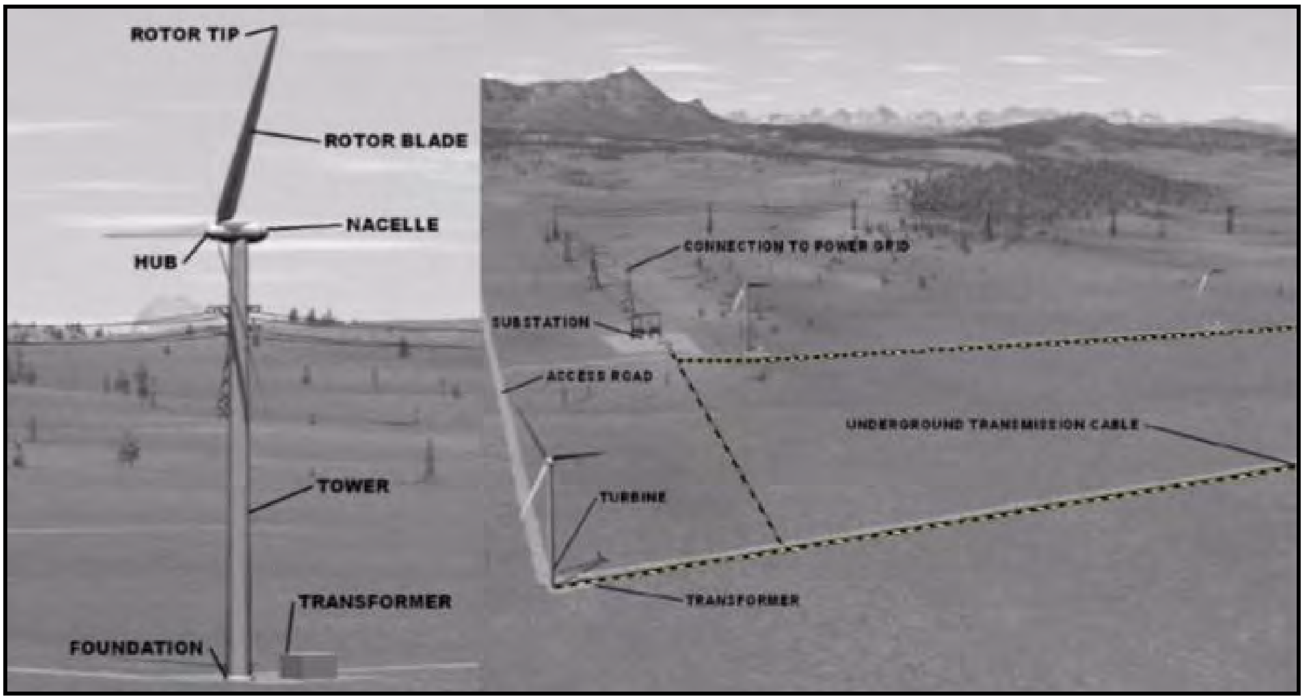


Figure 3-4: (a) Typical Structural Components of a Wind Turbine, (b) Typical Components of a Wind Farm (Source: EHS Guidelines for Wind Energy, IFC)

The following table demonstrates the scenarios for the wind farm, as provided by the designers.

Table 3-2: Wind Farm Scenarios

	Update 2 (Approved)
Turbine Model	EN171-8.0 MW
Turbine Quantity	25
Number of Rows	3

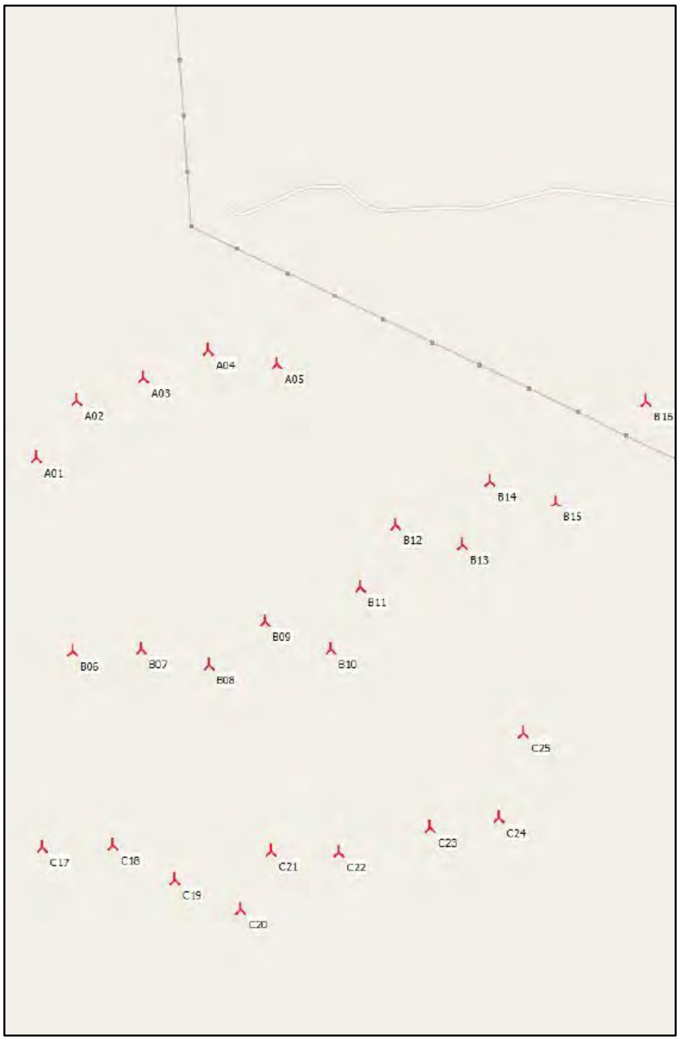


Figure 3-5: Final Layout

The following table demonstrates the specifications for the turbine specific to the latest update, as optimized by Tractebel.

Table 3-3: Wind Turbine Specification (Update 2)

Specification	Final Layout
Tip Height	185.5 m
Hub Height	100 m
Rotor Diameter	171 m
Turbine Size	8 MW
Noise Power Levels (without serrated trailing edges)	111.1 dB
Noise Power Levels (with serrated trailing edges)	109.6 dB

The design according to the final approved design will provide 200 MW of electricity. An illustration of the wind turbines to be used is shown in the figure below.

Figure 3-6: Visualization of Envision Wind Turbine Generator

Wind turbines consist of different subsystems which are described briefly below:

1. **Rotor**
    a. **Blades:** designed to maximize energy yield while minimizing weight and costs. Blades are also designed to resist extreme and fatigue loads, to be aeroelastic stable and to restrict tip deflections to elude tower collisions and avoid resonances.
    b. **Pitch System:** uses separate actuators for each blade. Pitch bearing, consisting of slewing ring arrangement, is used to connect blade to hub and meanwhile enables blade to rotate around its axis. Each blade, through root section, is bolted to the inner ring of a bearing which in turn is mounted to the hub through outer ring bolts. The blade 'pitching' is maneuvered by a pinion driven by the motor via a planetary gearbox. It engages with gear teeth on the inside of the inner ring of the pitch bearing to which the blade is bolted. The pitch system can be divided into two parts: electrical and mechanical. The mechanical part consists of a pitch gearbox, pitch bearing and internal connecting components. The electrical part consists of a control cabinet, a motor, and a backup power unit. As a compact unit, the pitch control cabinet houses controller, backup capacitor charging and monitoring, and pitch motor brake holding control functions.
    c. **Rotor Hub:** consists of a cast construction with a combination of star type and ball type. The shaft tilt angle, cone angle and blade pre-bending are optimally selected to ensure that the minimum distance between blade tips and the tower meets safety requirements.
2. **Mechanical Drive Train**
    a. **Main Shaft:** connected to the hub with bolts to transfer the rotational energy of wind rotor to the gearbox. The hollow main shaft leads the cable from the hub to the nacelle.
    b. **Main Bearing:** consists of a double-row spherical roller bearing. The main bearing and two elastic support for gearbox constitute a basic structure of three-point support drive train. Its inner race is connected to the main shaft, while its outer race connected to the main bearing housing.

c. **Gearbox:** is of a three-stage type. In the three-stage transmission, two stages of planetary gear train and one stage of parallel shaft are used.
d. **Coupling:** The gearbox and the generator are connected by a flexible coupling, which allows transmission between gearbox output and input shafts under certain assembly errors.
e. **Brake System:** aerodynamic braking is realized by pitching three blades as the primary approach, and the pitch control keeps the wind rotor in a safe operating speed range. Supercapacitors supply power to three pitch systems individually and independently, thus enabling individual and independent pitch control. Additional braking torque is provided by calipers clamping a disc brake which is mounted on the HSS. After aerodynamic braking are brought by blade pitching whereas the rotor speed is reduced to certain level, the braking force from HSS brake will be applied to lock the whole drive train. In addition, based on EHS requirements, an all-round protective cover for HSS end is designed to ensure personal safety.

3. **Nacelle**
   a. **Nacelle Structure:** The nacelle structure is arranged at the top of the tower to provide support for the shafting, gearbox, generator, etc. And the nacelle structure supports the nacelle cover also. The nacelle baseplate is connected to the d rear frame with bolts.
   b. **Yaw System:** The yaw system is for wind alignment and cable untwisting. The yaw system consists of yaw ring gears, yaw gearbox and yaw caliper. The yaw ring gear is arranged between the tower top flange and the yaw caliper, fixed on the flange with bolts. The yaw caliper and drives are bolted to the nacelle baseplate. By engaging the yaw ring gear with the yaw drive gear, the yaw caliper and the nacelle baseplate can slide relative to the yaw ring gear.
   c. **Nacelle Cover:** There is an emergency escape hole at the tail of nacelle housing for emergency personnel to escape. The top of nacelle housing is equipped with a wind speed sensor and a skylight, through which people can reach the top of the nacelle from inside the nacelle.
4. **Electrical System**
   a. **Electrical Drive Train:** The wind turbine electrical system mainly includes doubly fed induction generator (DFIG), converter, transformer, electrical cabinet, power cable and pitch control etc. The electrical drive train mainly composes of DFIG and converter. The generator divides the energy into two parts. The stator is connected to the box transformer directly. The rotor is connected to the converter through power cable, slip ring and carbon brush, then the voltage is boosted by the box transformer and connected to the grid.
   b. **Generator:** Doubly fed induction generator with multiple pairs of poles.
   c. **Converter:** The converter system consists of an LV distribution circuit, complete converter power, control and distribution protection circuits. The rotor-side converter in the converter is connected to the rotor side of doubly fed generator while the gird-side connected to the grid. The rotor-side converter controls. the generator torque and the reactive power exchanged between the stator side and the power grid by generating three-phase voltages with different amplitudes and frequencies. The gird-side converter exchanges active power with the power grid. The amplitude of such active power is the active power absorbed or emitted by the rotor-side converter.

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 (22kV or 33kV) to an on-site substation (discussed below). 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 fiber 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 unit that collects and converts the output from the turbines to a higher voltage (from 22kV or 33 kV to 220 kV) that is appropriate for connection with the High Voltage National Grid (220 kV). The substation also includes all the control and protection equipment, like circuit breakers, relays, disconnectors, surge arrestors, etc.

- **Building Infrastructure**: On-site building infrastructure will be required for the daily operation of the Project. Such buildings could include an administrative building (offices) used for normal daily operational related work, control room, workshop, and a warehouse for storage of equipment and machinery such as spare parts, oil cartridges, fuel, lubricants, etc.

- **Road network:** A road network will be required for installation of the turbines during the construction process and for ease of access to the turbines for maintenance purposes during operation.

- **Batching Plant:** a mobile / temporary concrete batching plant will be used for the concentrated mixing of concrete required for the construction of site infrastructure to include but not limited to foundations, buildings, and other.

- **Waste Management:** refer to Section 5.11.4.

- **Water Supply and Management:** refer to Section 5.11.3.

- **Equipment and Machinery:** refer to Section 3.6.

- **Transportation and Traffic Management:** transportation of materials from the port to the site will mainly involve two routes, from Ain Sokhna traffic will pass by Zaafarana, Ras Gharib, and Ras Shukeir; from Safaga traffic will pass by Hurghada and El Gouna).

- **Power Supply:** During the construction phase, power will be supplied via 6 power generators as mentioned in Section 3.6. During the operation phase, the project site will be connected to national grid which will supply the needed power.

Figure 3-7: Typical 33/220kV Substation

3.3.3 Associated Facilities

All available details regarding associated facilities are included under Chapter 10. The following is a summary for the associated facilities of the project.

Associated facilities will mainly include the Overhead Transmission Line (OHTL) and the substation. EETC will be responsible for offsite connection work from the onsite substation to the National Grid that will be through a 220 kV OHTL. The OHTL has a length of approximately 1.5 km and connects to the existing HV network. It is important to note that at this stage limited details are made available on the OHTL specifications (height, number of electrical towers, etc.).

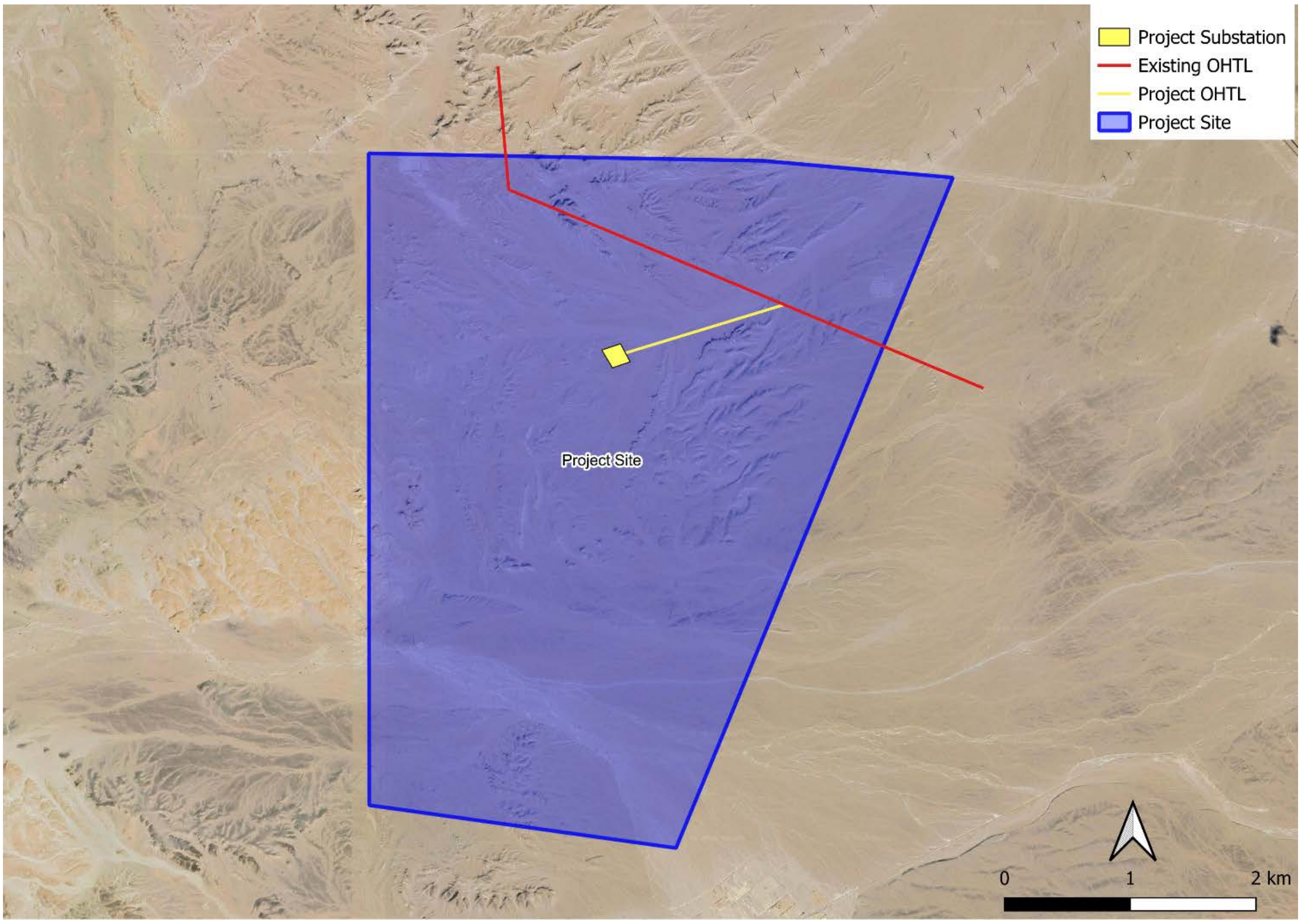


Figure 3-8: Associated Facilities (Substation and OHTL) with respect to the Project Site and Existing OHTL

The grid connection of the wind farm will be done as loop in into the existing 220 kV line Gabal al Zeyt – Hurghada which is crossing the site in the north via a connection pylon. The project involves the connection of a 220/33 kV substation equipped with two 2X140 MVA transformers to an existing double-circuit 220kV EETC overhead line. The distance from the new substation to the existing line is approximately 1.5 km. The main components are as follows:

1. Transformers: Two transformers rated at 140 MVA each (total capacity of 280 MVA at 220/33 kV)
2. Overhead Lines: The existing double-circuit 220kV EETC line will be tapped with a lowering mechanism to facilitate the connection. This will allow the 220 kV line under the planned 500 kV line. The lowering will occur on an angle tower or support structure, allowing the overhead line to drop to the appropriate elevation for connection without disrupting the existing transmission setup.

The following figure is an illustration of the loop in concept to the existing HV network:

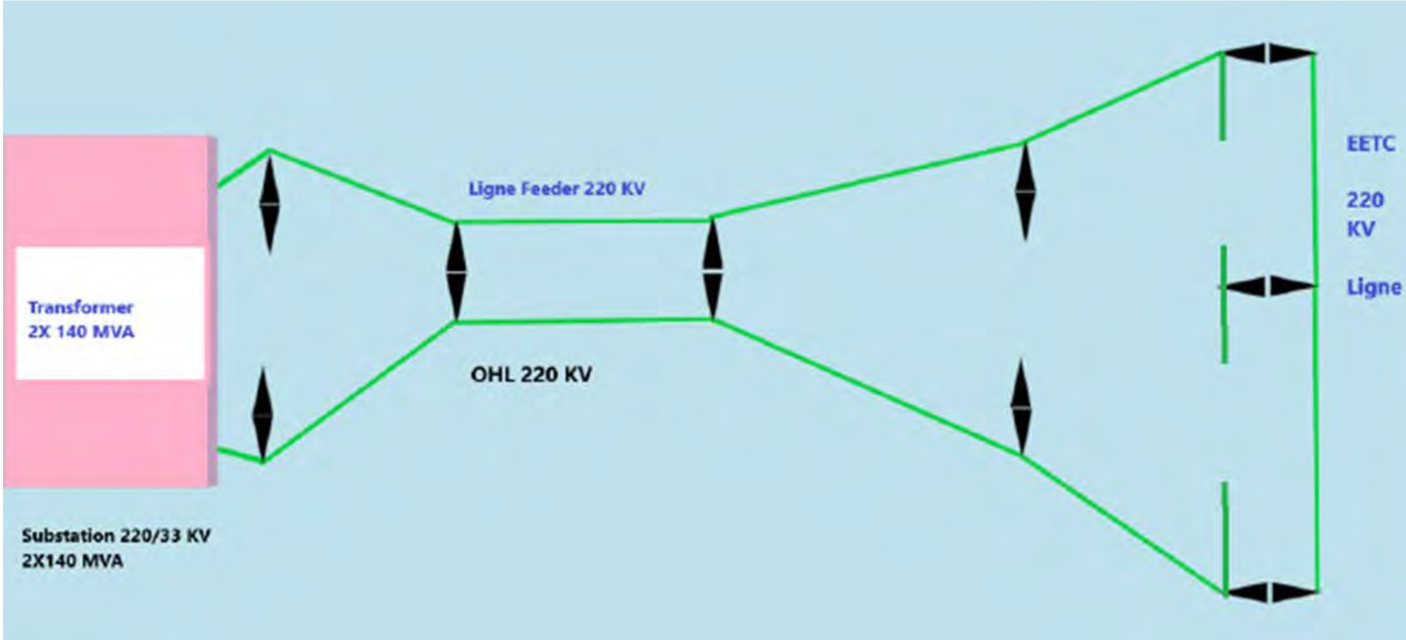


Figure 3-9: Illustration of the Loop in Concept

3.4 Footprint of the Project Components

This section provides an estimate on the footprint of the Project considering the components discussed in the previous section and based on assumptions made by the ESIA team to determine footprint values. In addition, the calculations assumed the 'worst-case' scenario from the two (2) turbine scenarios (i.e. the option that had more turbines and in turn a bigger footprint).

As noted in the table below, the total area of disturbance for the Project is significantly small, calculated at around 1.5% of the total boundary of the Project area.

Table 3-4: Footprint of the Project Components

Component	Footprint	Description
Turbines	0.16km^2	Typically, each crane pad is around 1,500 m^2 in area, whereas each foundation typically consists of a circular footing of 20m diameter.
Building Infrastructure	0.05km^2	Typically, footprint for such facilities is around 0.05 km^2. This includes substation, warehouse, storage facilities, offices and batching plant.
Trenches for MV cables and communication cables	0.1 km^2	This includes trenches with a calculated length of around 42 km and a width of 1.7 m.
Road networks	0.3km^2	This includes the road network with a total length of 42 km and a width of 6.5 m.
Total Project Footprint	0.6km^2	
Total Project Area	38km^2	Project footprint is around 1.6% of the total boundary 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 four distinct phases: (i) pre-construction, (ii) construction, (iii) operation, (iv) decommissioning as well as the project schedule for the different phases. Each of which is summarized below.

3.5.1 Pre-Construction Phase

- 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.);
- Land acquisition agreements, and finalizing lease agreements.
- Topographic, geotechnical, and hydrological surveys.
- Wind turbine generator manufacturing release and the notice to proceed with project activities;
- Mobilization of Project team, equipment, machinery and materials to the site;
- Development of E&S training modules for the project team, covering basic Lender E&S requirements;
- Develop a procedure for rolling out a summarized version of Lender E&S requirements to the EPC contractor and subcontractors;
- The manufacturing of the wind turbine generator in this project;
- Transportation of wind turbine components to the Project site. The components are expected to be transported to the closest marine port and then transported by road to the Project site;
- Preparing access roads on site for ease of transportation within the site specifically upgrading or constructing access roads to facilitate transportation of heavy equipment and materials;
- Preparation of Lender-compliant Environmental & Social Impact Assessment (ESIA);
- Preparation of an Environmental, Social and Health and Safety (ESHS) Manual as guiding E&S document throughout all project phases;
- Preparation of Environmental & Social Management Plans (ESMPs);
- Identify public safety hotspots along the transportation routes of wind turbine components.
- Preparation of Right-of-Way (RoW) areas for the overhead transmission line (OHTL), including vegetation clearance and minor grading to establish access routes and line corridors;
- Preliminary layout planning for underground cable routes, wind turbine foundations, and substation footprint to ensure optimization and minimal land disturbance;
- Preparation and disclosure of ESIA and its Non-technical Summary in English and Arabic.
- Preparation of preliminary E&S management documents consisting of an overarching ESMS - accompanied by topical ESMPs as its annexes.
- Draft E&S requirements for the RFP phase and E&S clauses for the contracting phase.

3.5.2 Construction Phase

The activities that will take place during t construction phase for this wind farm include the following:

- Site preparation of the turbine foundation. Such activities are limited to relatively small individual footprints of the foundations and will include excavations and land clearing activities for building the foundations;
- Installation of the first wind turbine generator on site;
- Preparation and installation of site facilities;
- Execution of substation within the site;
- Installation and execution of transmission lines on site to transport electricity to substations;
- Pre-assembly of turbine components;
- Installation and Assembly of turbine components to include tower assembly, hub, rotor, blades and nacelle lift and rotor assembly;
- Completion of electro-mechanical component of the wind turbine farm

- Additional construction work (which could include excavations, land clearing activities, etc.) and installation work that must be conducted to connect each turbine to the power grid. This will include installation and laying of transmission and communication cables, installation of substation, road networks, building infrastructure, etc.;
- Reinstatement and restoration of the site following completion of main construction works. This includes but not limited to turbine excavated areas, batching plant area, building footprint area, and trenches/road networks.
- 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;
- Troubleshooting of turbine components and farm to ensure smooth functionality.
- Implementation of the ESHS Manual and associated management plans by the EPC contractor and subcontractors to ensure compliance.
- Clearing of vegetation and stripping of topsoil in designated turbine, substation, and facility areas. Topsoil will be stockpiled for reuse during site reinstatement;
- Excavation of foundation pits, ground compaction (if required), installation of reinforcement steel cages and formwork, and pouring of concrete for reinforced foundations capable of withstanding turbine loads and wind forces;
- Construction of substation foundations and installation of transformer pads, switchgear bases, and control building slabs, followed by placement of associated equipment;
- Construction of access roads and internal transport routes using earthworks, grading, and gravel surfacing to enable safe and reliable movement of turbine components and construction vehicles;
- Construction of the overhead transmission line (OHTL), including tower foundation excavation, concrete pouring, steel tower assembly, and conductor stringing using specialized lifting equipment;
- Installation of underground electrical collection system, including trench excavation, laying of medium-voltage cables between turbines and substation, installation of communication lines, and backfilling;
- Construction of operations and maintenance (O&M) buildings and facilities, including control rooms, storage units, utility rooms, and associated infrastructure such as water, electricity, and communications systems;
- Construction works to include civil works, electrical works and mechanical works for the development of the substation and building infrastructure, etc.;
- Deliver a simplified version of the E&S requirements to the project workforce through induction training and toolbox talks.
- Finalize ESMS and ESMPs
- Roll out Lender E&S requirements to the EPC contractor and subcontractors
- Reconnaissance of the transportation route for wind turbine components from ports (Ain Sokhna or Safaga) to the Project site to identify public safety hotspots (schools, hospitals, markets, etc.) and design mitigation measures

3.5.3 Operation Phase

Regarding the typical wind farms, farms the Project is expected to be operational for 25 years. Wind turbines require limited operational activities. According to the documents provided, the maintenance activities include the following:

- Overview of Maintenance Responsibility

  - **Wind Turbine Maintenance:** Performed by the Original Equipment Manufacturer (OEM).
  - **Balance of Plant (BoP) Maintenance:** Handled by a BoP Contractor with relevant experience.

- General Operations and Maintenance
  - Maintenance follows the O&M contracts, manuals, and local regulations.
  - Maintenance activities are categorized into:
    - Planned Maintenance
    - Corrective Maintenance
    - Unplanned Maintenance
  - Maintenance results are managed using the contractor's operating system to maximize plant efficiency.

- The planning and maintenance activities include the scope and schedule of the activities, initial maintenance checks, routine activities, and compliance and objectives of the wind farm
  - Scope and Schedule
    - Maintenance is aligned with manufacturer specifications, warranty requirements, and contractual obligations.
    - Includes activities for up to two years post-commercial commissioning (COD), reviewed annually.
  - Initial Maintenance Checks:
    - Major equipment maintenance ahead of schedule during the first year to assess component conditions.
    - Maintenance schedules can be modified to improve efficiency.
  - Routine Activities Include:
    - 24/7 plant monitoring via SCADA and remote systems.
    - Continuous on-site security and staff availability.
    - Regular communication with external stakeholders and reporting (daily, monthly, annual).
    - Spare parts managed per O&M Agreements.
  - Compliance and Objectives:
    - Ensures warranty compliance and maximizes equipment availability.
    - Defects or hazards detected during planned maintenance are recorded for corrective action.

- The purpose of corrective maintenance is to address non-routine maintenance. The trigger for corrective maintenance includes issues identified during routine servicing, risks flagged by SCADA or on-site monitoring, and visual inspections of the plant.
  - The corrective maintenance will be classified according to urgency including
    - Production-impacting issues that need immediate corrective action
    - Non-production issues that can be scheduled and repaired appropriately
  - Spare Parts and Downtime Management
    - Manufacturer-recommended spare parts stored on-site for urgent repairs
    - Downtime monitored via SCADA; corrective actions analyzed for optimization.

- Warranty Compliance:
  - All corrective services adhere to warranty requirements

- All maintenance work and services performed will be carried out in accordance with the regional HSSO&Q requirements to always ensure the safety and well-being of all personnel and the wind plant.
- Maintenance staff will be on-site 7 days a week and key personnel will be available on standby and on call 24 hours a day.
- Implementation of the ESHS Manual and associated management plans by the operator.
- Roll out Lender E&S requirements to the O&M contractor
- O&M contractor to develop an ESMS and ESMPs for the operation phase

3.5.4 Decommissioning Phase

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. Additionally, it is expected that the base will be left in place and covered by gravel and sand from within the area as applicable. Tracks used for maintenance vehicles will be restored and can be kept as routes that could be used for other activities as applicable. Gates and fences (if considered) will be removed.

3.5.5 Project Schedule

This section presents the overall Project schedule based on the information available at this stage from the Developer.

- **Planning and Construction Phase:** that will include: (i) preparation of the detailed design, (ii) transportation of components to the site, (iii) site preparation activities (land clearing, excavations, etc.), and (iv) installation of components. This phase will last between the 26th of June in 2025 and will finish on the 30th of September in 2027.
- **Operations Phase (2027 – approximately 2052):** that will include the normal daily operation of the wind farm, and the undertaking of maintenance activities as required.
- **Decommissioning Phase (to be determined):** that will include the dismantling of the various Project components at the end of the lifetime.

The machines and equipment requirements are as follows:

1. Cranes: (2-4)
2. Trucks (6)
3. Bulldozers (2)
4. Forklifts (4)
5. Roller compactor (1-2)
6. Diesel generators (5)

3.6 Machine and Equipment Requirements

The construction of the wind farm will require a variety of heavy machinery and equipment to facilitate site preparation, transportation, installation, and assembly of wind turbine components. The following is an overview of the key equipment requirements:

Equipment	Quantity	Purpose & Usage
Cranes	2-4	Used for lifting and assembling wind turbine towers, nacelles, blades, and other heavy components.
Trucks	6	Transporting wind turbine components, construction materials, and equipment between the storage areas and the site. Trucks will also be used for general logistics and material handling.
Bulldozers	2	Used for land clearing, leveling, and site grading to prepare for turbine foundations and access roads.
Forklifts	4	Essential for handling and moving construction materials, electrical components, and smaller wind turbine parts within the site. Forklifts with 5-10 tons lifting capacity will be used.
Roller Compactors	1-2	Used for compacting soil and gravel in foundation areas, access roads, and substation platforms to ensure stability and load-bearing capacity.
Diesel Generators	5	Temporary power supply for site operations, machinery, and lighting.

3.7 Work force and Training

Around 450-500 job opportunities are expected during the peak construction phase for a duration of approximately 24 months. This will mainly include around skilled job opportunities (to include engineers, technicians, consultants, surveyors, etc.) and unskilled job opportunities (mainly laborers but will also include a number of security personnel). Unskilled labor will include construction workers and security personnel.

During operation, job opportunities will last for the duration of the lifetime of the wind farm. The expected duration is 25 years. Similar to labor requirements during construction, this will include around 25 jobs including both skilled and unskilled labor. Skilled labor may include engineers, technicians, and administrative employees. Unskilled labor may include security personnel and drivers.

Taking the above into account, labor will be sourced from the local community members to the greatest extent possible throughout the construction and operation phase for skilled and unskilled jobs. The Developer shall be committed to adhering to transparent recruitment procedures which includes local community members as discussed in further details in "Section 0".

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. Based on preliminary assessments and stakeholder consultations, it is recommended setting the following targets:

Construction Phase: The Project aims to allocate at least 30-40% of employment opportunities to residents from local communities, prioritizing unskilled and semi-skilled labor roles.

Operation Phase: For long-term operational roles, the Project is committed to achieving an employment target of 20-25% for local community members, with a focus on technical and administrative positions supported by tailored training programs.

These percentages are indicative and will be refined as the Project progresses and based on further dialogue with local stakeholders and contractors.

4 Policy, Legal and Institutional Framework

This chapter first provides an overview of the environmental clearance process for the Project. The Chapter then discusses the regulatory context which is directly related to E&S 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.

4.1 Egyptian Environmental Institutional Framework

4.1.1 Egyptian Environmental Affairs Agency (EEAA)

The EEAA is an authorized 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.

4.1.2 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.

4.1.3 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).

4.2 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 requires undertaking an assessment of the likely environmental impacts of development projects. An ESIA is required for all electricity generation projects including renewable energy projects.

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

The ESIA process is set according to the guidelines issued by the EEAA including: "EIA Guidelines (2009)" and "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 key requirements for a full ESIA as per the requirements above include the following:

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

Upon submission of the ESIA report by the ESIA Practitioner to the CAA in charge of issuing licences, the CAA sends the ESIA to EEAA for evaluation. 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 NREA.

After submission of the ESIA for review, EEAA may request revisions in the ESIA report within 30 days, including additional mitigation measures. If there are no comments and/or if the revision is considered sufficient, EEAA will approve the report and issue an environmental permit for the project.

4.3 Egyptian E&S Regulatory Context

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

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

It is important to clarify that while Labor Law No. 12 of 2003 has governed labor rights for over two decades, a new labor law was formally approved by the Manpower Committee of the Egyptian Parliament on February 19, 2025. According to Article 12 of the law's issuance provisions, it will come into effect 90 days after its publication in the Official Gazette. Therefore, as of now, Labor Law No. 12 of 2003 remains the legally binding framework, but the new labor law is expected to take full effect later in 2025. Once the new labor law is officially enacted and enforced, future reports will be updated accordingly to reflect any changes in worker rights, OHS standards, and labor conditions under the new legal framework.

Table 4-1: 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 center for extremely high voltage OHTL - 13 meters from the center 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	▪ Recognizes 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 Hazardous Waste (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
Waste Management Law 202/2020	Article 16	▪ Waste producers and generators are required to sort their waste, reduce its volume, and manage it in an environmentally safe and sustainable manner.
	Article 18	▪ Solid waste must be stored in suitable containers or facilities that prevent its spread or contamination. Waste storage must comply with health, safety, and environmental standards.
	Article 19	▪ The licensee has the responsibility to provide training and qualification for all workers involved in any integrated waste management activities they practice.
	Article 20	▪ Burning waste openly is not allowed.
	Article 21	▪ The licensee of an integrated waste management activity cannot mix any waste types without the approval of the Agency. The executive regulations of this law outline the guidelines, requirements, and standards for collecting, transporting, treating, reusing, and disposing of such waste.
	Article 29	▪ It is not permissible to practice any activity of the integrated management of non-hazardous waste without obtaining a license issued by the Agency, and the executive regulations of this law specify the model for the license, its duration, mechanisms for issuance, requirements, standards and specifications related to it, the controls for its renewal, and the cases of its suspension or cancellation. ▪ Those in charge of carrying out any integrated waste management activity are obligated to take all necessary precautions so as not to cause any damage to the environment. ▪ In all cases, the person licensed to practice any of the activities of the integrated management of non-hazardous waste may not assign that license to a third party except after obtaining a prior approval from the Agency, in accordance with the conditions specified by the executive regulations of this law and on the form prepared for that. ▪ The agency sets the requirements for receiving and treating non-hazardous waste and final disposal thereof. The executive regulations of this law determine the requirements and standards for this in coordination with the Environmental Affairs Agency. ▪ The license referred to in the first paragraph of this article for industrial establishments shall be issued by the Public Authority for Industrial Development in accordance with the provisions of the Law to Facilitate the Procedures for Granting Licenses for Industrial Establishments promulgated by Law No. 15 of 2017, and its provisions shall also apply to the requirements for granting and waiving these

		licenses, in accordance with the controls and Conditions Granting and waiving these licenses, in accordance with the controls and conditions to be issued within three months from the date of enforcement of the provisions of this law, by a decision of the Minister of Commerce and Industry in agreement with the competent minister.
	Article 38	▪ It is prohibited to throw, sort or treat municipal waste except in designated places in accordance with the procedures specified by the executive regulations of this law.
	Article 42	▪ When carrying out demolition and construction works, all entities and individuals are obligated to manage the transportation, recycling and safe disposal operations through the persons authorized to do so in the manner indicated by the executive regulations of this law. ▪ Persons licensed to practice the activities of integrated management of demolition and construction waste must recycle or dispose of it in the designated sites. ▪ In all cases, the competent administrative authority may carry out any of these stages as detailed in the executive regulations of this law.
	Article 43	▪ The administrative body responsible for granting licenses for demolition and construction work is required to withhold issuing licenses unless the license holder provides proof of a contract with an authorized individual or entity designated by the Agency to manage the waste produced from such activities. Failure to comply with this requirement may result in disciplinary action taken against the responsible specialist.
	Article 55	▪ Handling hazardous materials and waste is forbidden without obtaining approval from the Agency and obtaining a license from the appropriate administrative authority. ▪ Individuals who are licensed to handle hazardous materials or waste are not allowed to abandon or transfer them to any location other than those designated for such purposes or to individuals who are authorized to receive them.
	Article 56	▪ Individuals who are responsible for producing or managing hazardous materials and waste, whether in gaseous, liquid, or solid form, must take all necessary precautions as outlined by the Agency and the committee mentioned in Article (53) of this law to prevent any harm to the environment. The facility owner or manager who is involved in the production of hazardous waste must maintain a record of these materials, including their disposal methods, as well as the names of any parties contracted for waste management. The record-keeping must adhere to the standards and requirements specified in the executive regulations of this law. If the facility is suspended or transferred, the owner or manager who produces hazardous waste must disinfect the waste, the soil, and the surrounding area as required
	Article 61	▪ All establishments whose activities generate hazardous waste are obligated to classify, collect and package them, and are also obligated to provide tools and requirements for separation, collection, transportation and storage within the facility. The executive regulations of this law clarify the requirements and standards necessary for these tools and supplies.
	Article 64	▪ it is prohibited to dump hazardous materials or waste into the regional sea, continental shelf, exclusive economic zone, or high seas of Egypt
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	▪ Defines fauna and flora which are forbidden to be hunted or disturbed.

	Law 9 of 2009. Annex 4 of the Executive Regulations of law 4/1994, amended by Prime Minister Decree 1095 of 2011	▪ 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 kilometers 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.
Telecommunication Regulation Law 10/2003	Article 42	▪ The entity authorized to grant licenses for construction of buildings shall not have the right to permit the construction of buildings exceeding 50 meters in height, raise or modify such buildings without consulting the National Telecom Regulatory Authority (NTRA). Such entity shall notify the NTRA of buildings being constructed, raised or modified in excess of the aforementioned height. ▪ A space vacant of buildings shall be left around Radio and Television Transmission Centers in a circle having the transmitter mast or tower at its center and a radius of not less than one and a half times the mast or tower height, and without prejudice to the right of compensation.
	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 Labor 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 Labor and Workforce Safety and Book V on Occupational Safety and Health (OSH) and assurance of the adequacy of the working environment	Minister of Labor Decree 48/1967. Minister of Labor Decree 55/1983. Minister of Industry Decree 91/1985 Minister of Labor 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 Labor 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	All	▪ Egyptian Drinking Water Quality Standards should be met for all water bought and stored on site for the workers' use.
Worker Rights & General Working Conditions		
Labor Law No. 12 of 2003 and its amendments by Labor Law 2021[1]	Working Hours	▪ According to the new Labor Law 2021, which is scheduled to come into force by the end of 2025, The standard workweek remains 8 hours per day and 48 hours per week, as per Article 90. Employers must provide at least one rest day per week, preferably on Fridays. Breaks: Workers must receive a rest period after every five continuous hours of work (Article 92). Breaks must not be less than one hour per day and are not counted as part of the total working hours. ▪ According to the current Labor Law No. 12 of 2003 According to Article 80, the maximum working hours shall not exceed eight hours per day or 48 hours per week, excluding rest periods. Article 81-83 mandates a rest break of at least one hour per working day. , and 21 days of annual leave after completing one year of service,

[1] It is important to clarify that while Labor Law No. 12 of 2003 has governed labor rights for over two decades, a new labor law was formally approved by the Manpower Committee of the Egyptian Parliament on February 19, 2025. According to Article 12 of the law's issuance provisions, it will come into effect 90 days after its publication in the Official Gazette. Therefore, as of now, Labor Law No. 12 of 2003 remains the legally binding framework, but the new labor law is expected to take full effect later in 2025.
Once the new labor law is officially enacted and enforced, future reports will be updated accordingly to reflect any changes in worker rights, OHS standards, and labor conditions under the new legal framework.

		increasing to 30 days after ten years or upon reaching the age of fifty (Article 47).
	Worker Protection and Employment Rights:	▪ According to the new Labor Law 2021, which is scheduled to come into force by the end of 2025, - The new labor law explicitly prohibits harassment, bullying, or any form of verbal, physical, or psychological violence against workers, aligning with international agreements and ensuring a safe working environment that meets decent work conditions. - Article (4) of the proposed law states that it is prohibited to employ a worker under coercion or forced labor. Additionally, harassment, bullying, or any form of verbal, physical, or psychological violence against workers is strictly forbidden. The internal work regulations and disciplinary sanctions within the establishment shall specify the penalties for such violations. - Furthermore, Article (281) stipulates that any violation of Articles (4) and (5) of this law shall be punishable by a fine of no less than 5,000 EGP and no more than 50,000 EGP. The fine shall be multiplied based on the number of workers affected by the offense, and in cases of repeated violations, the fine shall be doubled. - As a result, workplace bullying and harassment in the private sector and establishments subject to labor law shall be penalized with fines ranging from 5,000 EGP to 50,000 EGP. ▪ According to the current Labor Law No. 12 of 2003 Article 92 prohibits discrimination in wages based on gender, ensuring fair treatment. Article 120 establishes strict rules regarding contract termination, requiring justified reasons and severance compensation when applicable.
	Overtime Pay	▪ According to the new Labor Law 2021, which is scheduled to come into force by the end of 2025, Employees required to work overtime must be compensated at a rate of at least 35% higher than their normal wage for daytime overtime and 70% higher for night shifts (Article 95). Work performed on public holidays entitles employees to double their normal wage, plus an additional day off in lieu (Article 98). ▪ According to the current Labor Law No. 12 of 2003 Overtime Pay: Articles 85 and 88 specify that any overtime work must be compensated at 35% above normal pay for daytime overtime and 70% for nighttime overtime.
	Other Working Conditions	▪ The law prohibits discrimination in employment and wages based on gender, disability, or social status (Article 3) and prohibits discrimination on the basis of sex in hiring, wages, promotions, and termination of employment (Article 35). ▪ Maternity leave has been extended to four months instead of three, with full salary benefits (Article 108). ▪ Flexible working arrangements are introduced to support women in the workforce.
	Occupational Health & Safety (OHS) Regulations	▪ OHS regulations remain governed under the existing Labor Law No. 12 of 2003 until the new law takes effect. Employers must provide a safe working environment, conduct regular risk assessments, and ensure employee health protection measures are in place. ▪ The Egyptian Environmental Law (Law No. 4 of 1994, amended in 2009) also imposes safety and environmental protection obligations in industrial and construction activities.
Law No. 148 of 2019, which came into force on January 1, 2020	Social Protection and Benefits Egyptian Social Insurance	▪ The Egyptian Social Insurance Law No. 148 of 2019, which came into force on January 1, 2020, continues to regulate job protections, benefits, and social security matters.
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.

4.4 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 labor rights. The following table lists the key conventions:

Table 4-2: Relevant Egyptian International Conventions and Agreements

Name of Multilateral 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
Labor Rights and Working Conditions	
Egypt joined the International Labour Organization (ILO) in 1936; however, the five ILO core labor standards	1936

<table>
<tr><th>Name of Multilateral Agreement</th><th>Date</th></tr>
<tr><td>were established later as fundamental principles and rights at work. Regarding the ILO Core (or Fundamental) Labor Standards, Egypt has ratified the following:
<table>
<tr><td>Freedom of Association and Collective Bargaining</td><td>• Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87): Ratified by Egypt on November 6, 1957.
• Right to Organize and Collective Bargaining Convention, 1949 (No. 98): Ratified by Egypt on July 3, 1954.</td></tr>
<tr><td>Elimination of Forced or Compulsory Labor</td><td>• Forced Labor Convention, 1930 (No. 29): Ratified by Egypt on November 29, 1955.
• Abolition of Forced Labor Convention, 1957 (No. 105): Ratified by Egypt on October 23, 1958.</td></tr>
<tr><td>Abolition of Child Labor</td><td>• Minimum Age Convention, 1973 (No. 138): Ratified by Egypt on June 9, 1999.
• Worst Forms of Child Labor Convention, 1999 (No. 182): Ratified by Egypt on May 6, 2002.</td></tr>
<tr><td>Equality and Non-Discrimination</td><td>• Equal Remuneration Convention, 1951 (No. 100): Ratified by Egypt on July 26, 1960.
• Discrimination (Employment and Occupation) Convention, 1958 (No. 111): Ratified by Egypt on May 10, 1960.</td></tr>
</table></td><td></td></tr>
<tr><td>Convention Concerning the Protection of Workers Against Ionizing Radiation</td><td>1960</td></tr>
<tr><td>Convention Concerning the Protection of Workers Against Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration</td><td>1977</td></tr>
</table>

4.4.1 International Labour Organization (ILO) Standards

The ILO core (or fundamental) labor standards are a framework of 5 fundamental principles and rights at work: (1) freedom of association and the right to collective bargaining, (2) the elimination of forced or compulsory labor, (3) the abolition of child labor, (4) the elimination of discrimination in employment and occupation, and (5) the right to a safe and healthy working environment.

These standards are enshrined in 10 ILO Core (or Fundamental) Labor Conventions. Countries sign on to Conventions - not to standards.

1. Freedom of Association and Protection of Right to Organized Convention (No.87)
2. Right to Organize and Collective Bargaining Convention (No.98)
3. Forced Labor Convention (No. 29)
4. Abolition of Forced Labor Convention (No.105)
5. Minimum Age Convention (No.138)
6. Worst forms of Child Labor Convention (No.182)
7. Equal Remuneration Convention (No.100)
8. Discrimination (Employment Occupation) Convention (No.111)
9. Occupational Safety and Health Convention (No. 155)
10. Promotional Framework for Occupational Safety and Health Convention (No. 187)

Egypt signed and ratified below listed 8 Core Labor Conventions. However, it is mandatory for any ILO member state to comply will all five core labor standards (and their underlying 10 Conventions), as per the statutes of the ILO (whether a country signed these standards or not), as they form the fundament of international labor legislation.

- C029 - Forced Labour Convention, 1930 (No. 29)
- 29 Nov 1955 In Force
- C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)
- 06 Nov 1957 In Force
- C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
- 03 Jul 1954 In Force
- C100 - Equal Remuneration Convention, 1951 (No. 100)
- 26 Jul 1960 In Force
- C105 - Abolition of Forced Labour Convention, 1957 (No. 105)
- 23 Oct 1958 In Force
- C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- 10 May 1960 In Force
- C138 - Minimum Age Convention, 1973 (No. 138)Minimum age specified: 15 years 09 Jun 1999 In Force
- C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)
- 06 May 2002 In Force

4.5 Requirements for Project Financing – IFI's Requirements

The Project will be seeking financing from International Financing Institutions (IFIs). Therefore, the Developer wishes to design and manage the Project in accordance with GIIP for the purpose of the ESIA, it will be based on: (i) European Bank for Reconstruction and Development (EBRD)'s requirements to include EBRD's 2019 E&S Policy and Performance Requirements (PRs), and (ii) the International Finance Corporation's requirements to include IFC Policy on E&S Sustainability (2012), IFC Performance Standards (2012), and relevant IFC EHS Guidelines. Both are discussed in further details below.

4.5.1 EBRD Requirements

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

- Are socially and environmentally sustainable;
- Respect the rights of affected workers and communities; and

- Are designed and operated in compliance with applicable regulatory requirements and good international practice.

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

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

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

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

Table 4-3: Overview of Key Points of EBRD Performance Requirements of Relevance to the Project

EBRD PR	Key Points Relevant to the Project
PR 1: Assessment and Management of E&S Risks and Impacts	This PR outlines the process of appraising, managing and monitoring environmental and social issues associated with a project consistent with the European Union environmental impact assessment directive (85/337/EEC as amended).
PR 2: Labor and Working Conditions	This PR assures that human resources policies worker rights and general working conditions, procedures and standards will meet the following minimum requirements during the life of the project with regards to labor and working conditions: ▪ Establish and maintain a sound worker-management relationship and promote the fair treatment, non-discrimination and equal opportunity of workers; ▪ Promote compliance with any collective agreements to which the client is a party, national labor and employment laws, and the fundamental principles and key regulatory standards embodied in the applicable ILO conventions; and ▪ Protect and promote the health of workers, especially by promoting safe and healthy working conditions. In addition, EBRD requires compliance with applicable EU Occupational Health and Safety requirements and, where such requirements do not exist, applicable IFC Occupational Health and Safety guidelines (IFC PS2).

EBRD PR	Key Points Relevant to the Project
PR 3: Resource Efficiency and Pollution Prevention and Control	Pollution prevention and abatement are key ingredients of a sustainable development agenda and EBRD - financed projects must meet good international practice in this regard. The impacts and issues associated with polluting activities need to be considered in all economic activities, and from effluents and emissions at the facility level, to impacts at a regional and global level where appropriate. This performance requirement assures that all aspects of the Project will meet the following objectives: ▪ To avoid or, where avoidance is not possible, to minimize adverse impacts on human health and the environment by avoiding or minimizing pollution directly arising from projects; ▪ To assist clients in identifying project-related opportunities for energy and resource efficiency improvements and waste reduction; and ▪ To promote the reduction of project-related greenhouse gas emissions.
PR 4: Health. Safety and Security	While bringing many positive benefits to local communities, projects can also increase the potential for community exposure to risks and impacts arising from temporary or permanent changes in population; transport of raw and finished materials; construction, operations and decommissioning; accidents, structural failures, and releases of hazardous materials. This performance requirement addresses the project proponent's responsibility to identify and to avoid or minimize the risks and adverse impacts to community health, safety and security.
PR 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Involuntary resettlement refers both to physical and economic displacement as a result of project-related land acquisition. Where involuntary resettlement is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.
PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	EBRD recognizes the need for the protection and conservation of biodiversity in the context of projects in which it invests. In pursuing these aims, EBRD is guided by and supports the implementation of applicable international law and conventions and applicable EU Directives: ▪ To protect and conserve biodiversity; ▪ To avoid, minimize and mitigate impacts on biodiversity and offset significant residual impacts, where appropriate, with the aim of achieving no net loss or a net gain of biodiversity; ▪ To promote the sustainable management and use of natural resources; ▪ To provide for fair and equitable sharing of the benefits from project development and arising out of the utilization of genetic resources; ▪ To strengthen companies' license to operate, reputation and competitive advantage through best practice management of biodiversity as a business risk and opportunity; and ▪ To foster the development of pro-biodiversity business that offers alternative livelihoods in place of unsustainable exploitation of the natural environment.
PR 8: Cultural Heritage	Cultural heritage is important as a source of valuable historical and scientific information, as an asset for economic and social development, and as an integral part of a people's cultural identity, practices, and continuity. EBRD requires the protection of cultural heritage from project activities.

EBRD PR	Key Points Relevant to the Project
PR 10: Information Disclosure and Stakeholder Engagement	EBRD considers stakeholder engagement as an essential part of good business practice and corporate citizenship. In particular, effective community engagement is central to the successful management of risks and impacts on communities, as well as central to achieving enhanced community benefits. The specific objectives of this PR are: ▪ To identify people or communities that are or could be affected by the Project, as well as other interested parties; ▪ To ensure that such stakeholders are appropriately engaged on environmental and social issues that could potentially affect them through a process of information disclosure and meaningful consultation; and ▪ To maintain a constructive relationship with stake holders on an ongoing basis through meaningful engagement during project implementation.

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

4.5.2 IFC Requirements

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 4-4: 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: Labor 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 Labor 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 labor and employment laws; ▪ To protect the workforce by addressing child labor and forced labor; 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.

IFC Performance Standard	Key Points Relevant to the Project
PS 5: Land Acquisition and Involuntary Resettlement	Involuntary resettlement refers both to physical and economic displacement as a result of project-related land acquisition. Where involuntary resettlement is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	This Performance Standard reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote the use of renewable natural resources in a sustainable manner. This Performance Standard addresses how project sponsors can avoid or mitigate threats to biodiversity arising from their operations as well as sustainably manage renewable natural resources. Specific objectives of this Performance Standard are: ▪ To protect and conserve biodiversity; and ▪ To promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.
PS 8: Cultural Heritage	Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to protect irreplaceable cultural heritage and to guide project sponsors on protecting cultural heritage in the course of their business operations.

Note: PS 7 (Indigenous Peoples) is not considered to be applicable to this Project similar to rationale provided earlier.

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.

4.5.3 EIB Environmental and Social Standards

The EIB finances projects to achieve a number of priority EU policy objectives. The standards and principles are outlined in the statement of Environmental and Social Principles and Standards issued in October 2018.[2]

EIB Environmental and Social Standards ESSs	Key Points Relevant to the Project
EIB Standard 1: Assessment and Management of Environmental and Social Impacts and Risks	The overall objective of this Standard is to outline the promoter's responsibilities in the process of assessing, managing and monitoring environmental and social impacts and risks associated with the operations, specifically policy commitment, assessment, management, monitoring & evaluation and stakeholder engagement. This Standard applies to all operations likely to have significant and material environmental and social impacts and risks. These impacts and risks need be taken into account at the earliest possible stage in all the technical planning and decision-making processes.
EIB Standard 2: Pollution Prevention and Abatement	The objective of the second standard is to avoid and minimise pollution from EIB-supported operations. It outlines a project-level approach to resource efficiency and pollution prevention and control in line with best available techniques and internationally disseminated practices
EIB Standard 3: Biodiversity and Ecosystems	Underpinning the Biodiversity and Ecosystem Standard of the EIB is the overall goal of maintaining the integrity of areas important for biodiversity as well as the natural functions, processes, and resilience of ecosystems, with the aim of achieving no net loss or a net gain of biodiversity and ecosystem. The rationale is that for any given environment, it is possible to compare current biodiversity values with those that would occur in an ideal state of conservation. All projects should seek to contribute towards this state, avoid or minimize further losses and finally compensate for any residual impact.
EIB Standard 4: Climate Related Standards	EIB financing as a whole is aligned with EU climate policies, which should be taken into account at all stages of the project cycle, in particular regarding the assessment of the economic cost of greenhouse gas emissions and the climate vulnerability context. Specifically, project promoters must ensure that all projects comply with appropriate national and, where applicable, EU legal requirements, including multilateral agreements, related to climate change policy.
EIB Standard 5: Cultural Heritage	The EIB standard defines cultural heritage as a variety of components that contribute to the heritage of a community, both in the past and in the present. Tangible heritage, which includes buildings, structures, technology, as well as archaeological, historical, cultural and religious value. The standard also recognizes intangible heritage such as language, art, music, religion and customary practices and traditions. The objective of the Cultural Heritage Standard is to outline the responsibilities to be taken in order to promote cultural heritage management.

[2] https://www.eib.org/attachments/strategies/environmental_and_social_practices_handbook_en.pdf

EIB Standard 6: Involuntary Resettlement	The development of projects may require land acquisition, resulting in the temporary or permanent resettlement of people. As such, it is crucial to identify affected members and be provided an opportunity participate through consultation, as well as be informed on both the project and the grievance mechanism in place. The objective of Standard 6 is to minimize project related resettlement whenever feasible, respecting the rights of communities and groups to adequate housing.
EIB Standard 7: Rights and Interests of Vulnerable Groups	Standard 7 sets out to avoid or minimize, or otherwise mitigate and remedy, potential harmful effects of EIB operations to vulnerable individuals and groups whilst seeking that these populations duly benefit from such operations. As a means to foster those project outcomes, Standard 7 proposes a framework and tools to address inequalities and other factors contributing to vulnerability, and, as appropriate, to allow for equal access to and enjoyment of project benefits for those individuals and groups.
EIB Standard 8: Labour Standards	Standard 8 aims to provide all involved labour with the necessary protections to foster security, productivity and efficiency throughout the entirety of a project's lifecycle. The Promote fair and non-discriminatory treatment and opportunities in the workplace. Compliance with international and national labor and employment rules and regulations, particularly concerning health and safety. Prohibit the use of child labour throughout all stages of a project's development. Provide workers, particularly those belonging to a vulnerable group, with protections from exploitation, unacceptable employment practices.
EIB Standard 9: Occupational and Public Health, Safety and Security	The Promote and protect the health and safety of employees at work throughout the project life cycle by ensuring safe, healthy, hygienic and secure working and accommodation conditions and, effectively, a working environment that respects and safeguards the right to privacy, and when appropriate, to the enjoyment of the highest attainable standard of physical and mental health of workers and their families (e.g. in workers accommodation). Ensure that promoters duly anticipate, avoid or minimize, and effectively mitigate risks and adverse impacts to the health and safety of host communities within the project's determined area of influence (including all associated facilities) as well as end users, during both construction and operation phases. Help promote public health and safety across the project's area of influence by inter alia supporting and promoting programme which aim at preventing the spread of major communicable diseases. Ensure the provision of private or public security to protect the project's workers and assets consistent with international human rights standards and principles and, ensure effective access to grievance mechanism and recourse to remedy for all project workers and members of the public in cases of violations of their rights falling within the scope of the present standard.
EIB Standard 10: Stakeholder Engagement	Stakeholder Engagement is the establishment of a relationship with relevant stakeholders. Engagement activities, which are tailored, based on the nature of the project and its stakeholders aim to achieve the following objectives: a) Maintain constructive dialogue between the promoter, affected communities and identified stakeholders through meaningful consultations and disclosure of information. b) Provide equal opportunities for marginalized communities to engage and express concerns. c) Assess quality of engagement process undertaken by third parties.

	d) Ensure transparency, non-discriminatory practices and public participation are applied throughout the consultation activities. Consultations will be conducted as part of the ESIA and RAP, that could be developed as needed. Related information disclosure will be done using the appropriate modalities for each group of the stakeholders as per the SEP.

4.6 Other Requirements

There are currently no laws or regulation regarding shadow flicker and blade glint from the operation of wind turbines in Egypt.

However, several countries (including the UK, Germany and Australia) have developed guidelines around the potential shadow flicker impacts and are aligned with the World Bank Group / IFC guidelines. The relevant guidelines include:

- The World Bank Group / IFC EHS Guideline for Wind Energy
- The "Hinweise zur Ermittlung und Beurteilung der optischen Immissionen vonWindenergianlagen; Stand: 13.03.2002" (WEA-Shattenwurf-Hinweise) – German Standard for the evaluation of optical emissions from WTGs (WEA, 2002)
- The Best Practice Guidance to Northern Ireland Planning Policy Statement (PPS) 18: Renewable Energy (also applied in the rest of the UK)
- Australian Department of State Development, Infrastructure, Local Government and Planning, State code 23

The limits of shadow impact for a neighbor to a wind farm according to the guidelines are:

- A maximum of 30 hours per year of astronomical maximum shadow (considered worst case); and
- A maximum of 30 minutes per day of astronomical maximum shadow (considered worst case).

If one of these thresholds is exceeded, mitigation measures should be devised in the form of curtailment strategies which would not allow for shadow flicker to occur – i.e., not operate certain turbines at times and conditions when shadow flicker would occur. Shadow flickering effects are only considered for domestic dwellings with one or more windows / openings that face in the direction of the turbines in question. Areas which are not used for human occupancy should not be considered in such an assessment (i.e., garages and storage areas).

5 Environmental and Socio-economic Baseline

This chapter presents in detail the E&S baseline conditions for the Project as applicable and for the various attributes.

5.1 Landscape and Visual

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

5.1.1 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 Gharib Local Governmental Unit and Red Sea Governorate), any current plans in the area as well as key visual receptors within a 10km radius from the Project site were identified.

Such distance (10km 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 5-1: 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

5.1.2 Results

<u>*Landscape and Topography*</u>

The figure below presents the overall landscape and topographical features of the Project site. As noted below and confirmed through a site assessment, the eastern and southern parts of the site are considered peneplain areas with very gentle slopes towards the east. However, the western parts of the site in particular consist of dissected hills with well recognized wide and shallow drainage lines.

The entire Project area is considered of desert nature, being barren and arid with extremely limited vegetation coverage that is restricted to the drainage lines. In addition, the Project site is covered by clastic sediments of gravels, pebbles as well as boulders of different rock fragments impeded in fine sand and silt.

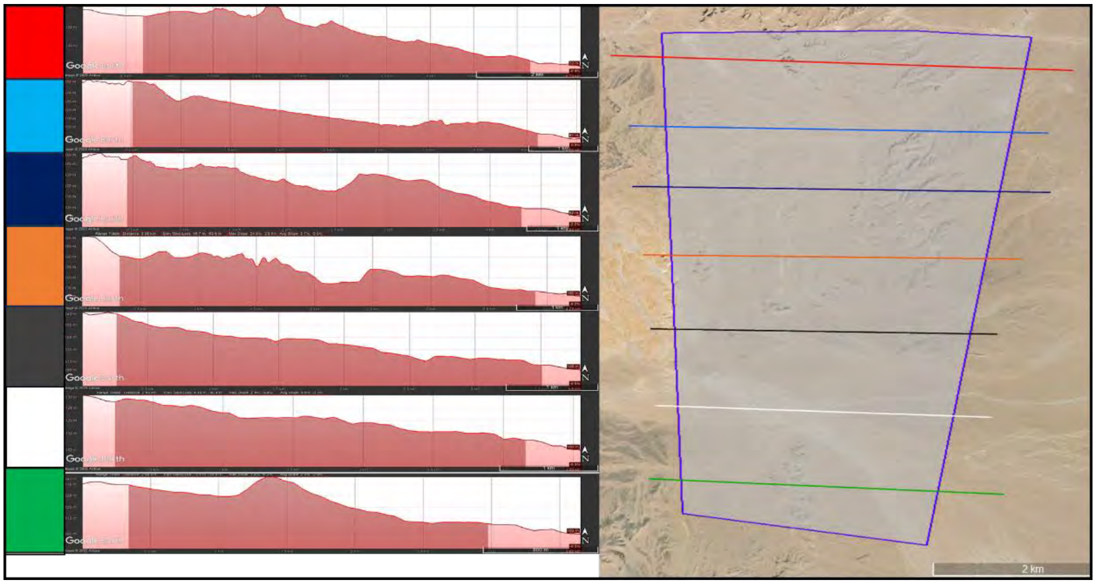


Figure 5-1: Elevation Profile for the Project Area

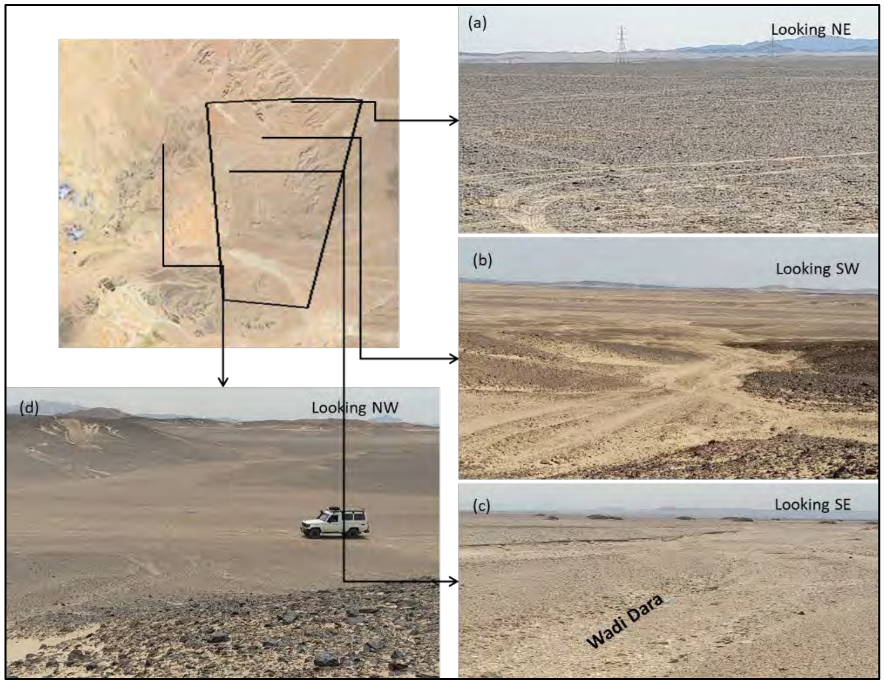


Figure 5-2: General Topography of Eastern and Southern Parts of the Project Site

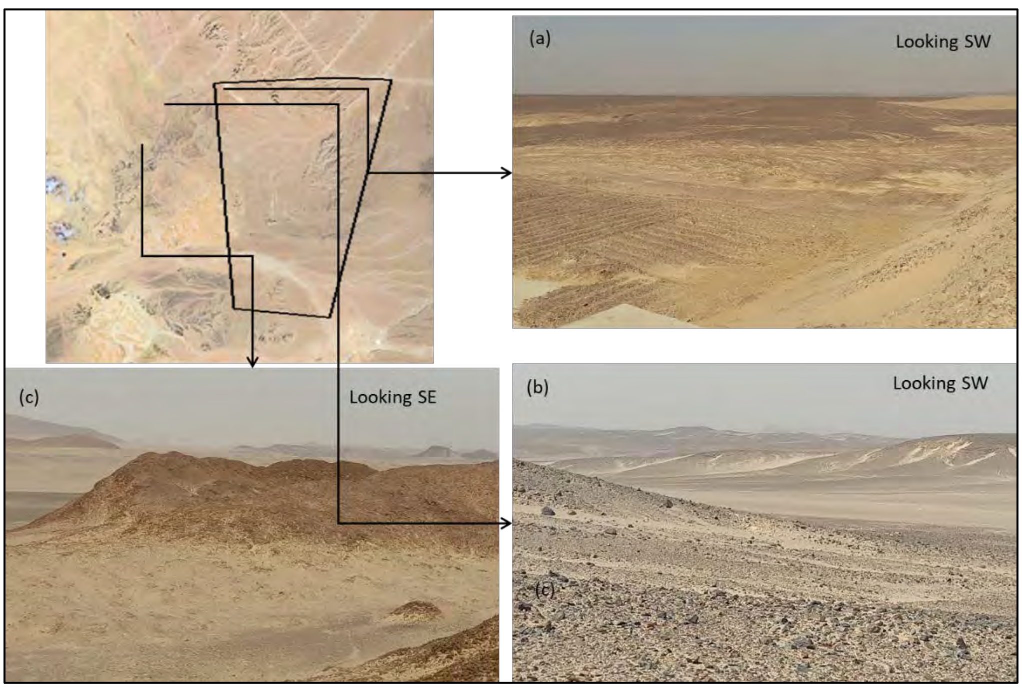


Figure 5-3: General Landscape and Topography Characteristics of the Project Site

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.

As discussed in further details under "Section 5.2", the Project site and surrounding areas mainly includes receptors such as oil and gas facilities, substations, desalination plant, existing wind farm developments, electricity transmission lines, etc.

The only receptors that could classify as visual sensitive receptors within the 10km radius would include the following as also presented in the figure that follows:

- Wadi Dara Town. As discussed previously in "Section 5.2", Wadi Dara does not have a large stable community where the total population is between 100-150, this includes 2 families that are there on a permanent, basis while the reminder of the population are mainly workers and guards employed at the various poultry, livestock and agricultural farms within the settlement (mainly at a rotational basis). Wadi Dara is located less than 1km to the south.
- Ras Shukheir. This settlement is used by petroleum companies in the area as housing/accommodation units, offices and also includes some petroleum facilities.
- Ras Ghareb City is located more than 10km from the site (around 35km to the north) and therefore is not considered a visual sensitive receptor. Ras Shukeir that is located around 8km to the northeast of the Project site.

Figure 5-4: Nearby Visual Receptors to the Project Site

5.2 Land Use

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

5.2.1 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 Gharib; and (ii) area of critical environmental concern planning.

Understanding and characterizing the informal, customary, or actual land use of the Project site was mainly based on a detailed land use survey for the Project site and a 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, customary, or actual land use practices as identified throughout the text below.

5.2.2 Formal Land Use

Strategic Planning

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 "Presidential Decree No. 116 of the year 2016", it has been allocated to NREA for the development of wind farm projects. These plots have been allocated to various developers by NREA.

Land Ownership

The Government of Egypt (GoE) has allocated to the NREA through "Presidential Decree No. 116 of the year 2016", land for development of renewable energy projects through usufruct rights. In line with the decree, this includes an area of 300km^2 (NREA Area) in the Gulf of Suez (GoS), more specifically in the Gebel El Zeit region, in which the Project is located as noted in the figure below.

Based on the above, NREA has granted the Developer full access rights to the specific Project for the development of a 200MW Wind Farm Project. Therefore, the land is currently under the ownership of NREA.

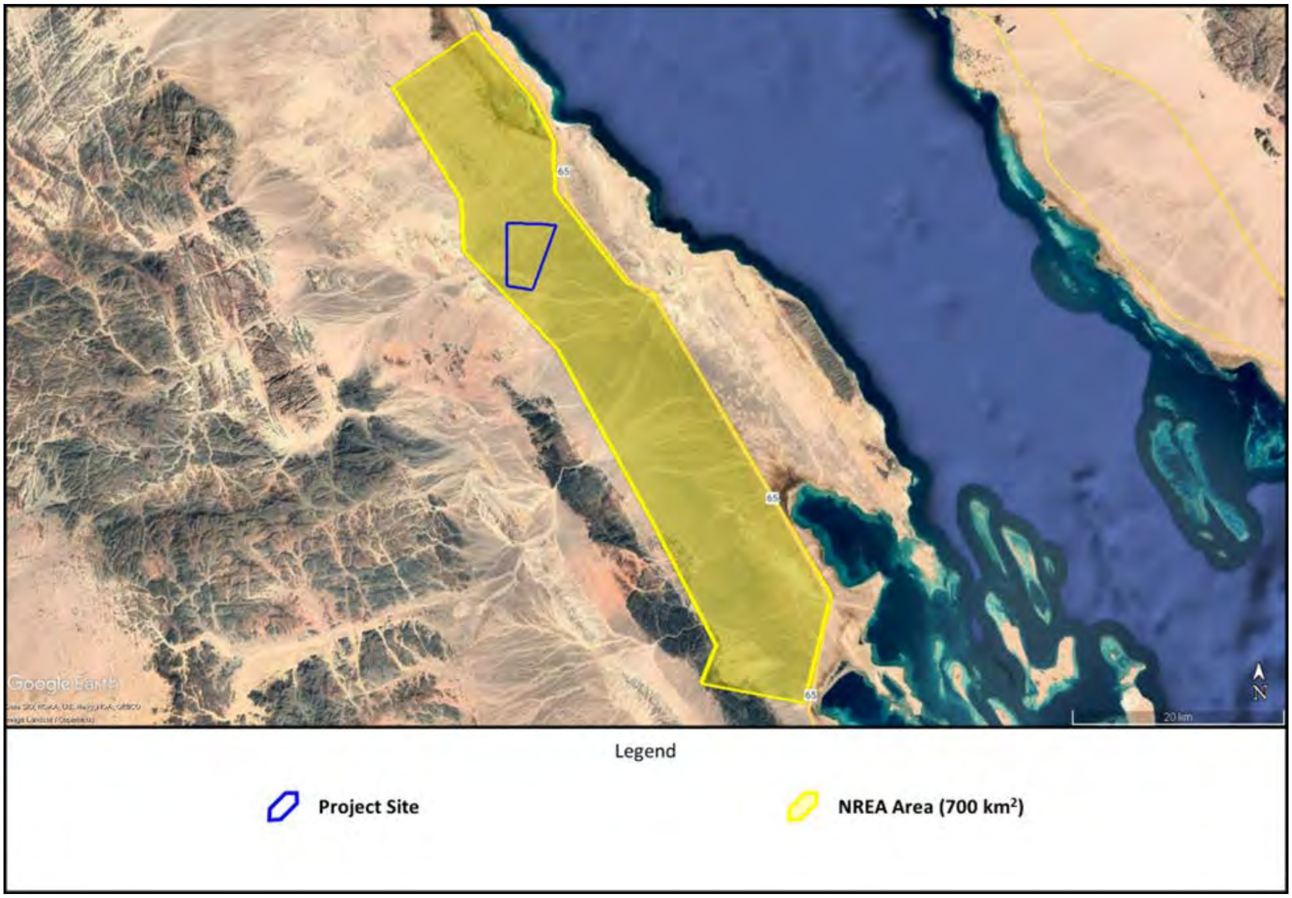


Figure 5-5: Project Area Within NREA Area

Areas of Critical Environmental Concern

Planning for areas of critical environmental concern is under the responsibility of the EEAA and this includes Important Bird Areas (IBAs) and natural protectorates. EEAA's nature protection team published in 2013 the locations for all current and future natural protectorates. The Project site is situated in one of the most important flyways (Rift Valley/Red Sea Flyway) between Africa, Europe and the Middle East. In addition, the Project site is also located within the Gabal El Zayt Important Bird Area (IBA) – a nationally designated area by EEAA.

Given this, NREA commissioned a study for regional birds' migration in 2006 and 2007 (Decon, 2007) (hereafter referred to as the "Decon Study"). The Decon study categorized the NREA Area according to the weight of the predicted environmental impact, taking competing environmental goals like bird preservation and renewable energy generation. The study categorized the NREA area into 3 parts which are further discussed below.

Table 5-2: NREA Zones

Zone	Requirement
Zone 1: Wind Farm Construction is Banned	To reduce the risk of bird collision with wind turbines, the Decon Study had reduced the original NREA Area that was intended to be used for wind energy generation by 60% by delineating this zone. Wind farm construction is prohibited within this zone as it is part of the key corridor for migrating birds heading to Sinai.
Zone 2: Construction Subject to Further Ornithological Monitoring and Verification	Within this zone, wind farm construction is allowed but is subject to further ornithological monitoring. This zone represents around 15% of the area.
Zone 3: Construction Critical	The terrain in Zone 3 widens out, giving birds more room to move. Most birds here were observed headed to Suez. Therefore, any wind farm installation in the zone would require technical avoidance/mitigation measures at the plants and infrastructure. Wind fam construction is allowed in Zone 3, however, is considered critical and is subject to regulations (25% of the area).

<u>Taking the above into account, the Project site is located in Zone 2.</u>

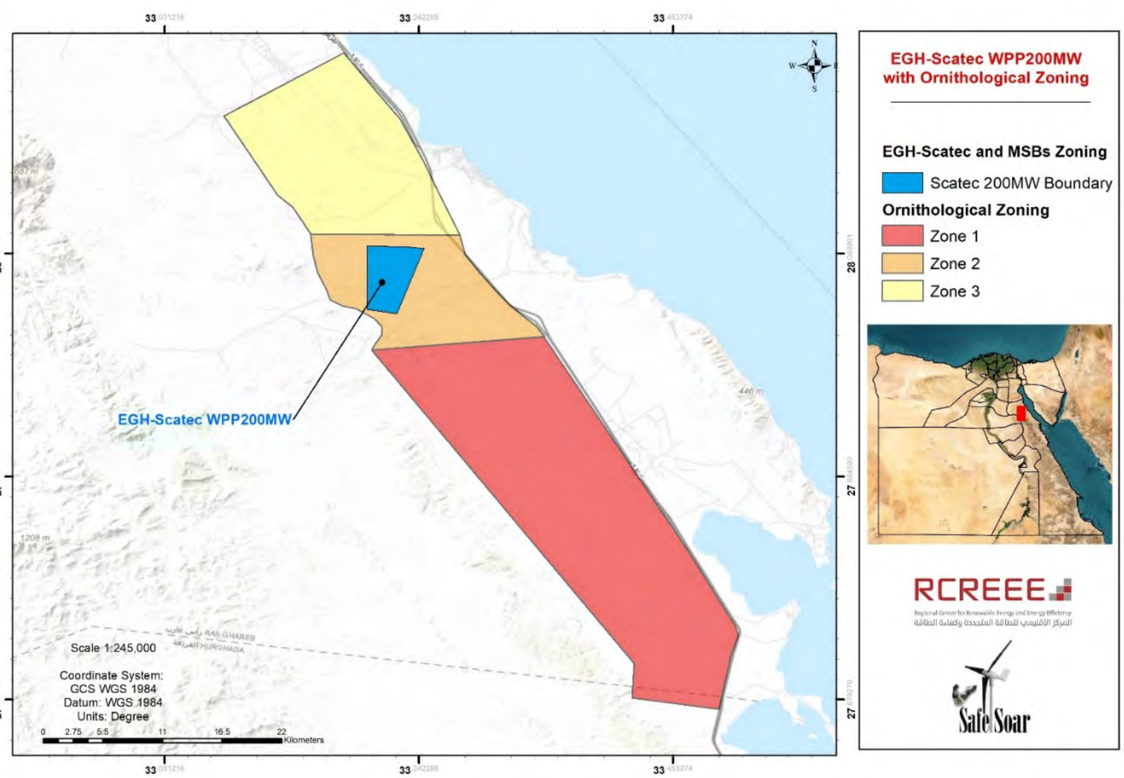


Figure 5-6: Project Site within Zone 2 of the NREA Area

5.2.3 Land Use Activities

As discussed earlier, a detailed land use survey was undertaken for the Project site to document and understand any land use activities undertaken such as physical activities (houses, structures, etc.) or economical activities (such as grazing, agricultural, etc.). Based on the above, no physical activities or economical activities were recorded within the Project site nor any evidence of such activities.

The figure below presents the key activities within the Project site and surrounding areas. The location of the existing facilities and activities are shown on the map in the figure below, while their coordinates are listed in the table that follows.

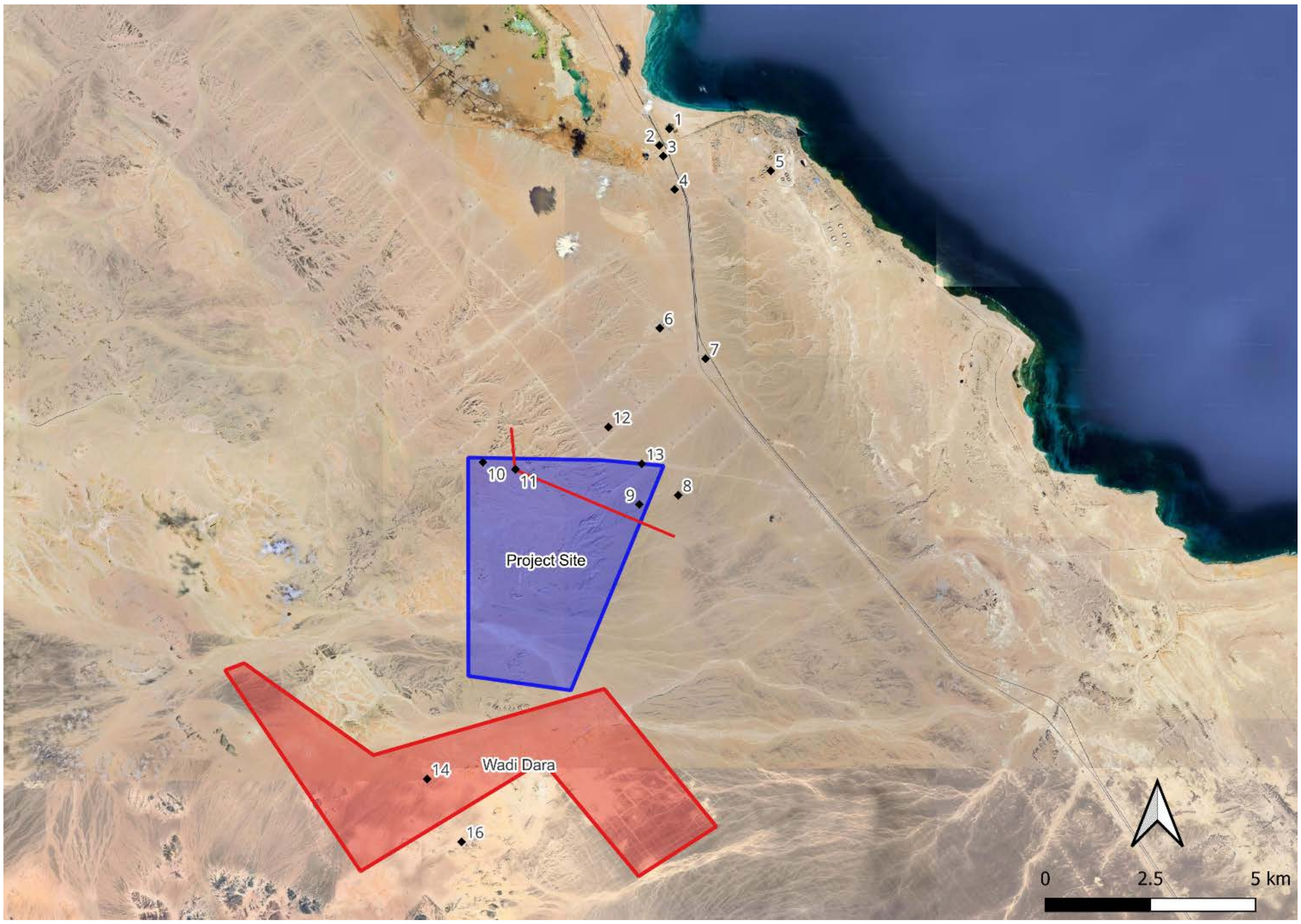


Figure 5-7: Location of the Recognized Facilities and Infrastructures Around the Project Site.

Table 5-3: The Coordinates of the Land Use Activities Close to the Project Site

No.	Latitude (N)	Longitude (E)	Location Activity	Location
1	28° 8'8.38"N	33°14'52.73"E	Wastewater Treatment Plant	Offsite
2	28° 7'53.98"N	33°14'43.97"E	Gas Compression Station	Offsite

No.	Latitude (N)	Longitude (E)	Location Activity	Location
3	28° 7'44.63"N	33°14'47.34"E	GPC Oil Tanks	Offsite
4	28° 7'15.97"N	33°14'57.27"E	Communication Tower	Offsite
5	28° 7'31.83"N	33°16'20.95"E	GUPCO Oil Tanks	Offsite
6	28° 5'14.96"N	33°14'44.42"E	Substation	Offsite
7	28° 4'48.39"N	33°15'24.19"E	Desalination Plant	Offsite
8	28° 2'49.63"N	33°15'0.37"E	Levelled Area for Construction	Offsite
9	28° 2'41.69"N	33°14'26.54"E	Levelled Area for Construction	Onsite
10	28° 3'18.38"N	33°12'10.42"E	Excavated and Levelled Area for the Construction of a Substation (220/30KV)	Offsite
11	28° 3'12.14"N	33°12'38.70"E	Existing OHTL	Offsite
12	28° 3'48.91"N	33°13'58.62"E	Three Existing Wind Farms	Offsite
13	28° 3'16.94"N	33°14'28.65"E	Culverts	Offsite
14	27°58'42.83"N	33°11'21.94"E	Wadi Dara	Offsite
15	28° 1'14.03"N	28° 1'14.03"N	Communication Tower	Offsite
16	27°57'48.13"N	33°11'51.85"E	Wadi Dara Wells	Offsite

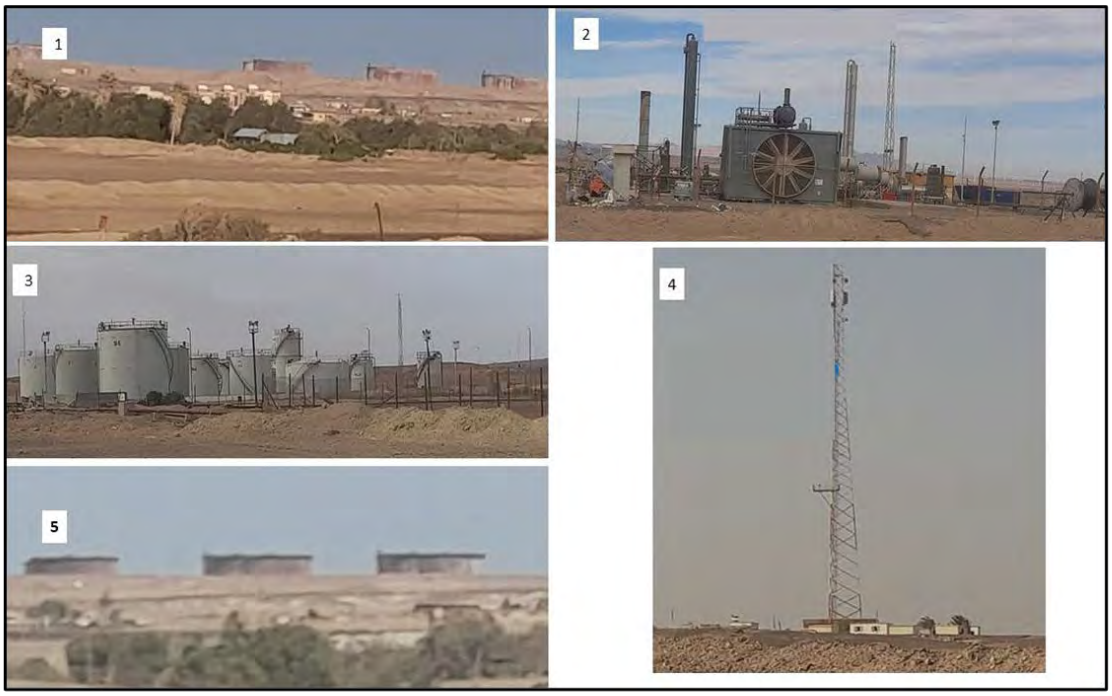


Figure 5-8: Field Photographs

Figure 5-9: Field Photographs

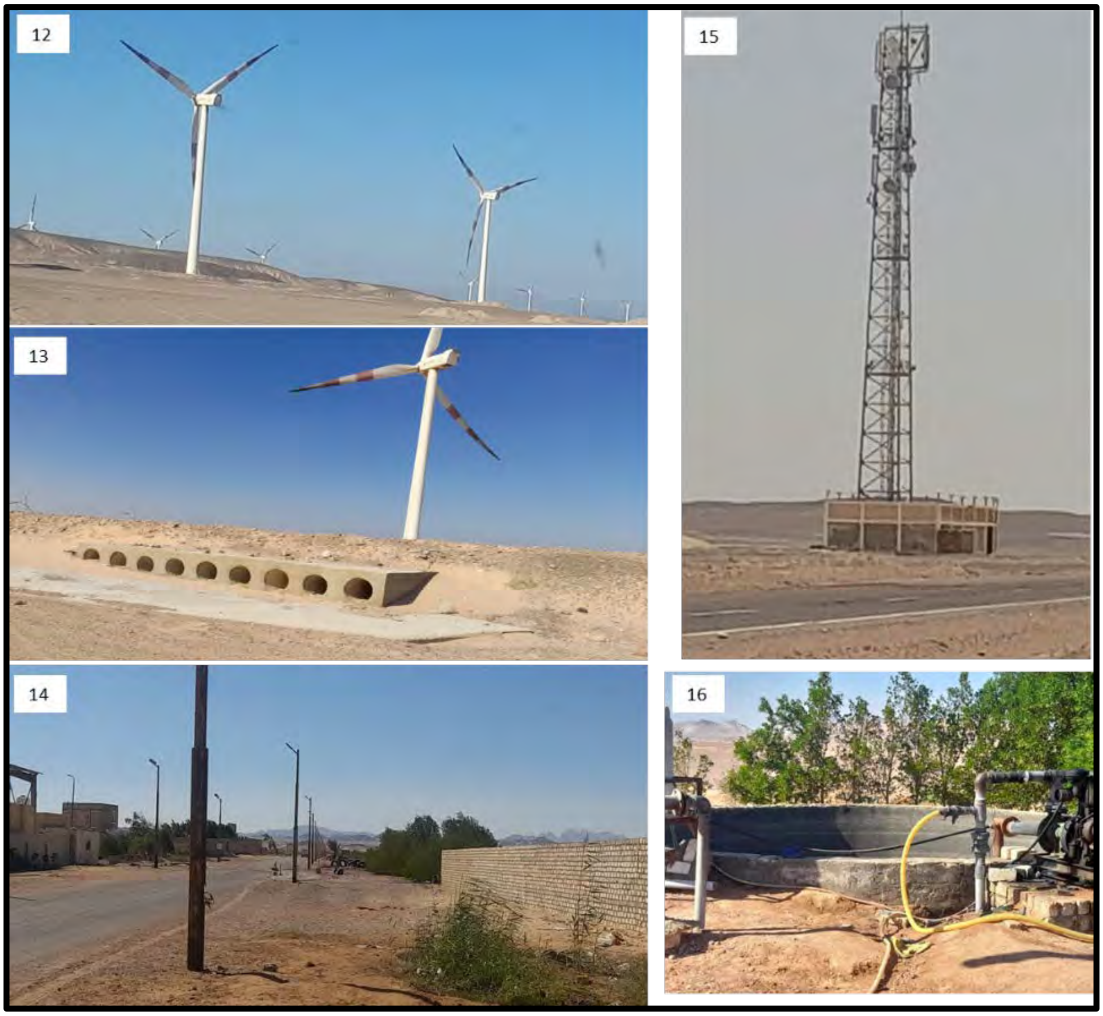


Figure 5-10: Field Photographs

Wadi Dara

In general, Wadi Dara doesn't have a large stable community where the total population is between 100-150 – this includes 2 families while the reminder of the population are mainly workers and guards employed at the various poultry, livestock, and agricultural farms within the settlement. Wadi Dara is officially allocated by the city council and Red Sea Governorate as an area for poultry, livestock, and agricultural farming. Generally, farms in Wadi Dara have an average size of 0.02 km^2 (equivalent to 5 Egyptian Feddan) and are categorized into 3 types: (i) Palm Tree Farms, (ii) Poultry Farms, and (iii) Livestock Farms.

Taking the above into account, a detailed land use survey has been undertaken for Wadi Dara. This included visiting each and every receptor by the ESIA consultant accompanied by: (i) President of the Agricultural Cooperative Association in Wadi Dara; and (ii) Secretary of Wadi Dara Local Unit. At each receptor a questionnaire was filled out in consultation with the people residing within such structures. The following information was obtained:

- Coordinates
- Pictures
- Type of Structure: (i) Poultry Farm; (ii) Livestock Farm; (iii) Agricultural Farm; (iv) Other (this mainly included a mosque, electricity unit, governmental buildings, and a car repair workshop)
- Occupancy: (i) full-time residents; or (ii) part-time residents. Full-time residents were considered as follows:
  - Structures which have workers and/or guards residing at a full-time basis. In general, these farms either have guards residing within such structures and/or worker accommodation units for workers. Generally, the guards and workers reside there for a couple of months continuously and then take some time off after which they return to the farm. Such workers could also change every couple of months. A total of 36 full time structures were recorded.
  - Structures used permanently for residence of a family (only 2 structures were recorded in particular – structure #55 and Structure #61)
  - Part-time residents include mainly workers that work in the farm during the day and then leave to another village/city at the end of the day (e.g., Ras Ghareb).

According to the results of the survey conducted on the Wadi Dara farms, the distance between the project land border and the nearest farms in the Wadi Dara area ranges from approximately 700m to 1km depending on the location of each farm, considering that not all of these nearby farms are inhabited by families, and some of them have been abandoned for a long time.

The figure below presents the location of these receptors and the figure that follow in particular the full-time residents' structures.

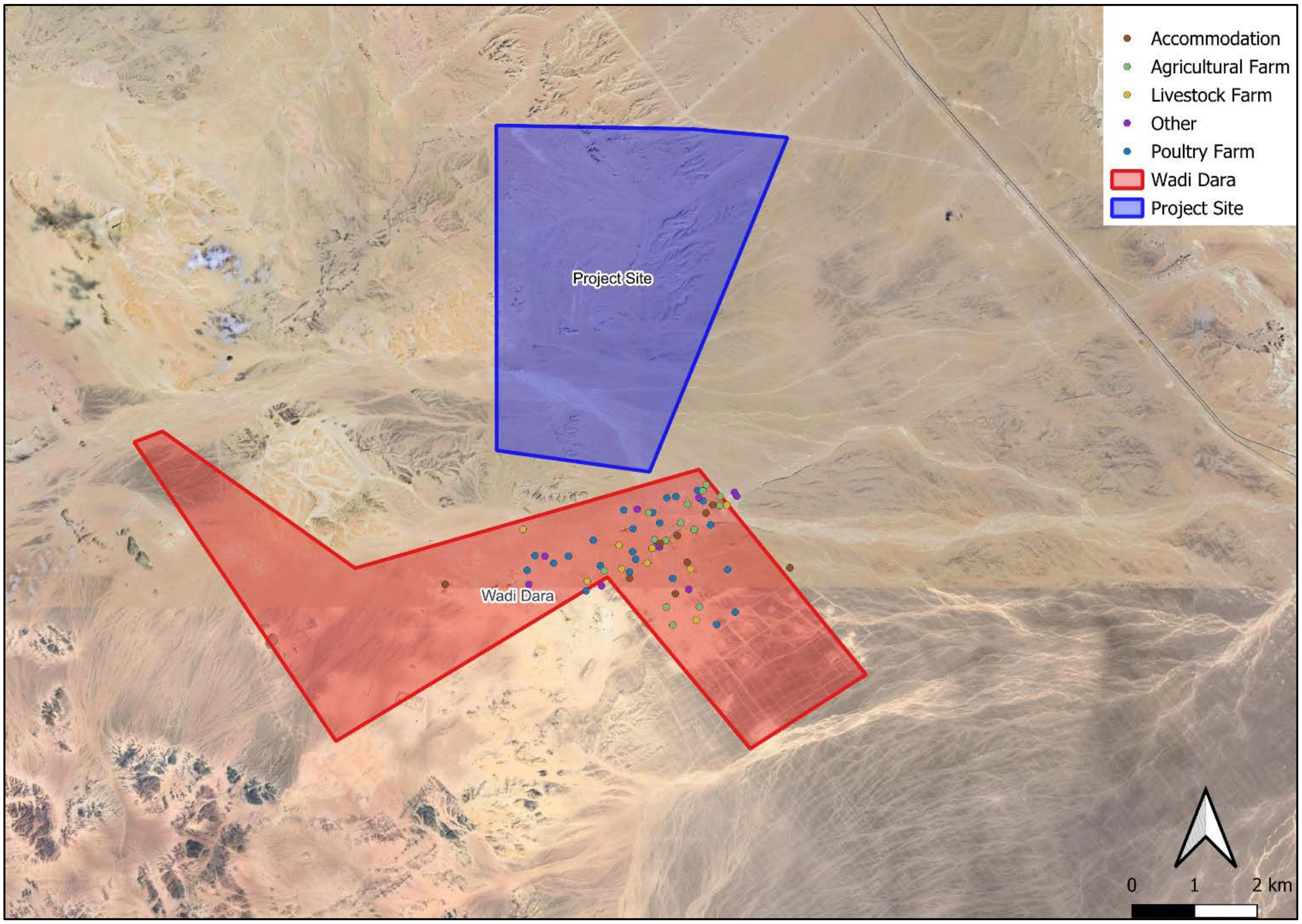


Figure 5-11: All Structures within Wadi Dara in Relation to Project Site

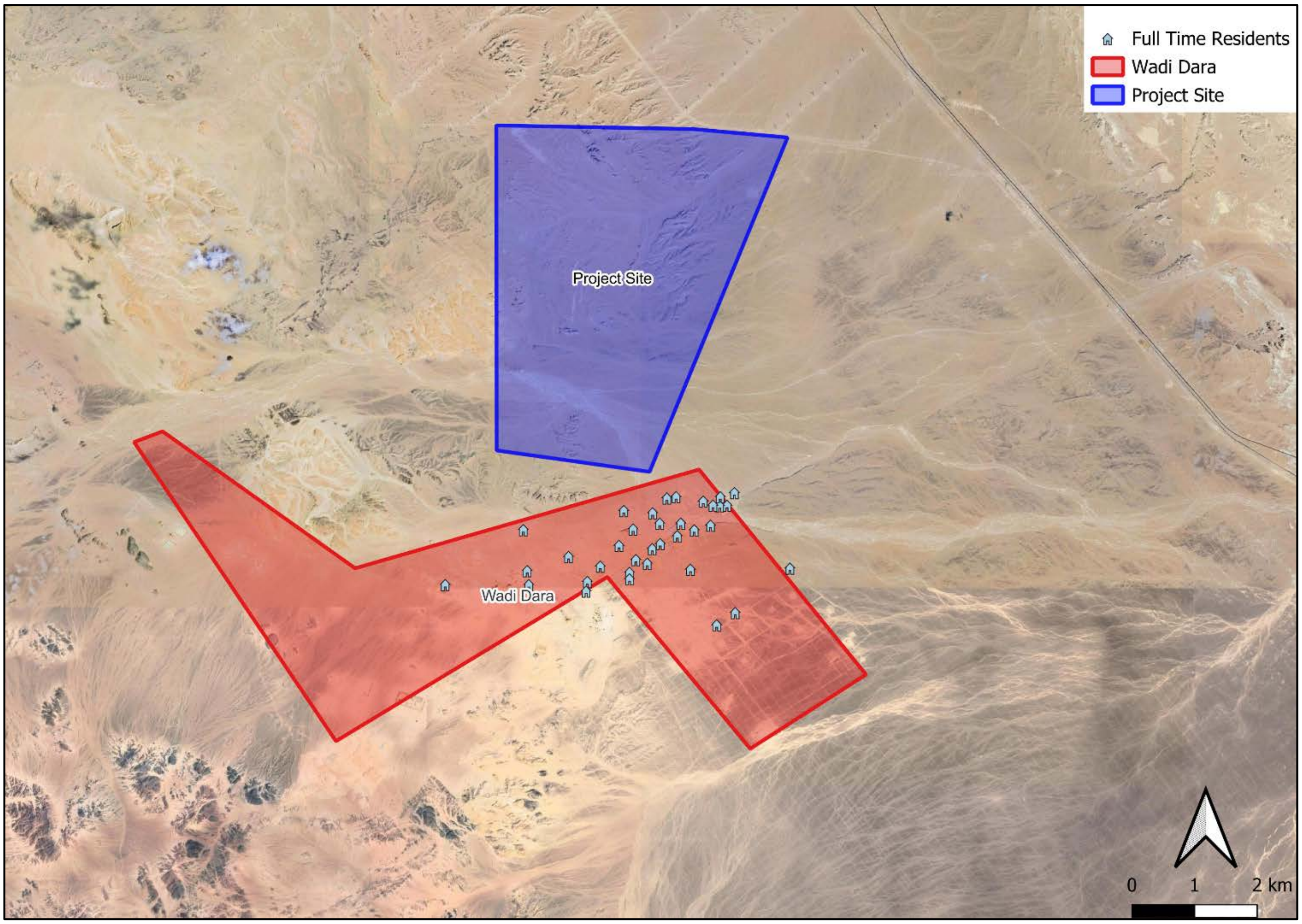


Figure 5-12: Full-time Structures in Wadi Dara

5.2.4 Informal Land use

A key point to be considered under informal land use is related to Bedouin Groups. The key Bedouin group known in the area is the Hammadin and Khoshman families. In general, local Bedouin tribes do not abide to the legal process required to own land. Therefore, Bedouins apply a type of customary ownership which is not an official process known as "Urfi" or "Ghafra system" that governs them, where the Ghafra system is an informal security system and the "Urfi" is the unofficial law that governs the relations of Bedouin families and the borders of their control over land.

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.

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

Consultations were undertaken with the head of the Hammadin family along with a number of male and female representatives from this family and the Khoshman family. Key outcomes are summarized below:

- The project site falls under the Ghafra system of the Ma'aza tribe and specifically under the Hammadin family of the Ma'aza tribe. Nevertheless, the Khoshman family works with the Hammadin family through the Ghafra system as the two families are related.

- There are no stable Bedouin communities in or near the Project site (i.e. Bedouin communities that settle either permanently, temporarily or nomadically). The only settled villages in the desert for Bedouin families are in Zaafarana and Wadi Dara Which is at least 50 km away from the Project site.

- The Project site does not have any key land use activities for them such as grazing or farming activities. However, the area in general is subject to the Ghafra System of the Hammadin families as discussed earlier.

5.3 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.

5.3.1 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 as well as to conduct a detailed flood risk assessment.

5.3.2 Regional Geology, Hydrology and Hydrogeology

5.3.2.1 Geology

The Gulf of Suez Region forms a distinct structural unit that was involved throughout time in movements that brought it under the sea for almost the entire length (Figure 5-13). The gulf area was subjected to tectonic movements that led to the accumulation of a great thickness of sediments in this continuously subsiding area (Said, 1962).

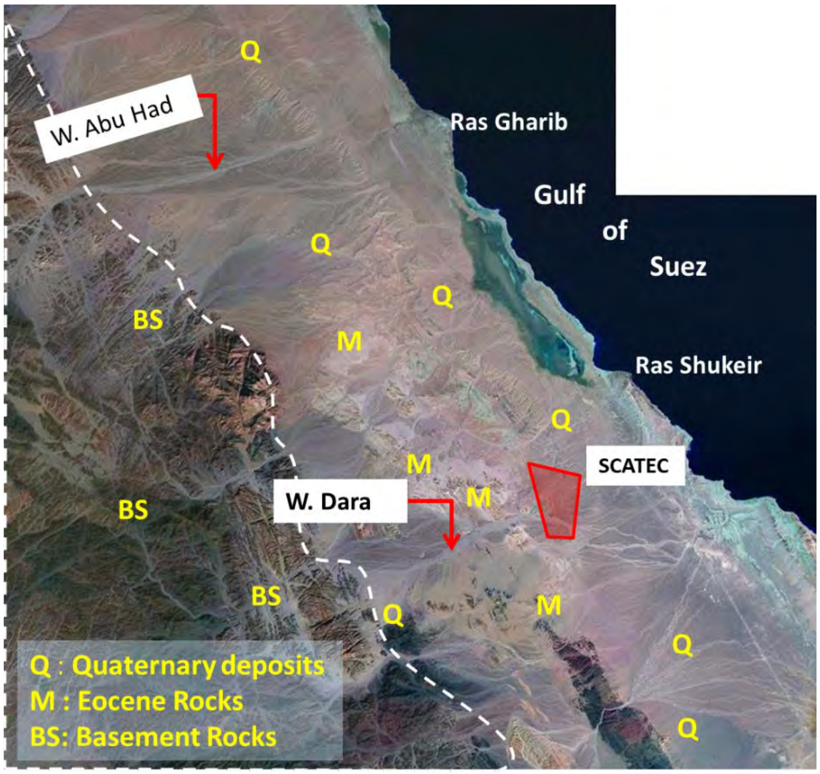


Figure 5-13: Land sat image showing the location of the project site

The Gharib Plain is a wide coastal plain that extends northwest-southeast (NW-SE) between the Red Sea Mountain series to the west and the Gulf of Suez to the east (Figure 5 14).

The Gharib Plain was formed as a result of tectonic movements associated with the opening of the Gulf of Suez Rift. These movements caused the land to subside along fault lines, creating a structural depression where sediments gradually accumulated over time, shaping the geological formations of the region.

The Red Sea Mountain series, forming the western boundary of the plain, is composed primarily of Precambrian basement rocks, including igneous and metamorphic formations. These basement rocks represent some of the oldest geological units in the region and have a significant influence on the hydrology of the area.

To the west of the Gharib Plain, the basement rock outcrops form the watershed for several dry wadis, particularly Wadi Dara (Conoco & EGPC, 1987; Conoco, 1989). Wadi Dara is a major drainage feature in the region, channeling runoff from the Red Sea Mountains toward the plain. Over time, erosion and sediment transport from these basement outcrops have contributed to the deposition of younger sediments across the plain.

Further east, beyond the basement rock exposures, upper Miocene evaporites (gypsum and anhydrites) are well-exposed. These formations, located west of the project site, have been shaped by erosion into highly weathered cone hills. The deposition of these evaporites was controlled by past marine transgressions and subsidence within the Gulf of Suez region.

The surface geology of the Gharib Plain is dominated by Quaternary deposits (post-Miocene), which cover much of the area. These younger sediments, consisting of gravels, sands, and alluvial deposits, were transported by wadis such as Wadi Dara and gradually accumulated over time, forming the primary surface materials observed across the plain.

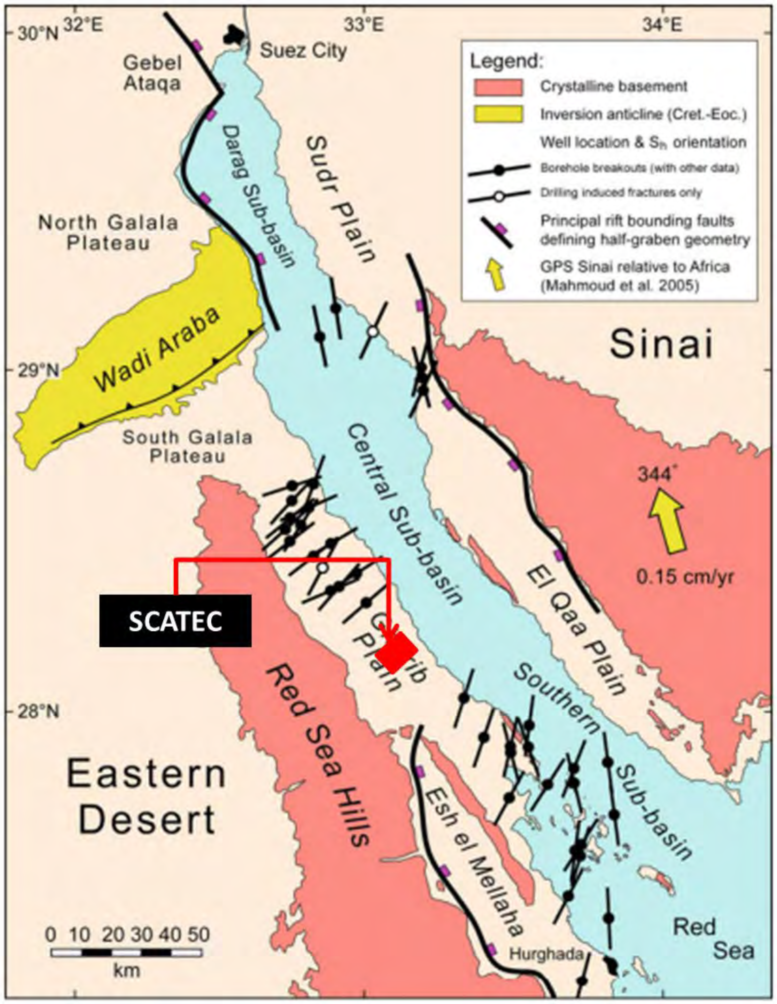


Figure 5-14 The structure domains of the Gulf of Suez. The project is located in Gharib plain. (Bosworth and Durocher 2017).

The project site, located within the Gharib Plain, shares the broader geological characteristics previously described. It lies on Quaternary deposits, which overlay older formations and gradually thicken eastward toward the Gulf of Suez. The site's sediment composition and structure have been shaped by the tectonic activity and depositional processes that define the region, with Wadi Dara playing a key role in local sediment transport and distribution.

5.3.2.2 Stratigraphy

The exposed rock units in the area and its surroundings (**Figure 5-15**) are represented by various lithologic associations ranging in age from Late Paleozoic to Quaternary.

As shown in the geologic map below, the rock units that could be recognized in the project location are mainly Quaternary deposits. During the field study, with the help of Land sat images, some rock units were found, dating back to earlier ages, and may reach the Upper Cretaceous – Tertiary rocks exposed to the northwest and southeast of the project site. This is shown in the map below.

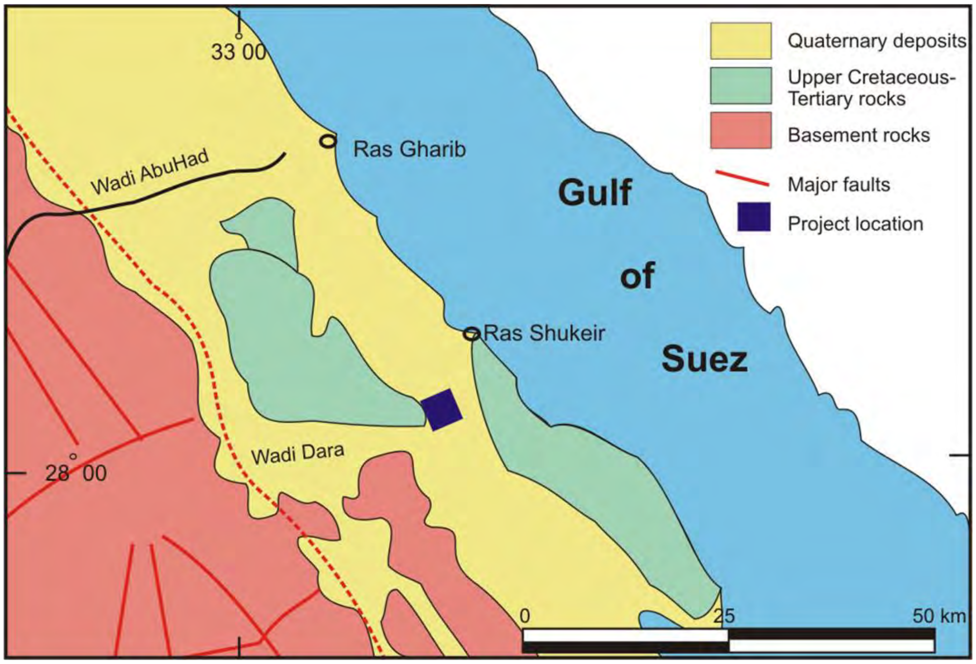


Figure 5-15: Regional geologic map of the area. Modified from the geologic map of Egypt

5.3.2.3 Subsurface Geology

The Gharib Basin is a tectono-stratigraphic basin characterized by gentle topography with a gradual eastward slope. The area is predominantly composed of basement rocks, which form high and rugged mountains in the western and southwestern regions. In contrast, the central and eastern parts of the site are covered by sedimentary rocks, creating a landscape of hills and ridges with low to moderate relief. The far western and southwestern portions exhibit higher relief due to the exposure of basement rocks.

According to studies by Conoco and the Egyptian General Petroleum Company (EGPC) (1987, 1989), basement outcrops are primarily observed in the far west and southwest, whereas Quaternary deposits (post-Miocene) are widely exposed across the area. The sedimentary sequence overlying the basement consists of different facies, with the lower part dominated by sandstones and clays, while the upper part is composed mainly of limestone and dolomite.

The electrical resistivity of the subsurface formations is influenced by several factors, including water salinity, saturation, lithology, and porosity. A calibration process was conducted to establish correlations between the available drilled wells and interpreted Vertical Electrical Soundings (VESes) to obtain a clear understanding of the geological and hydrogeological conditions. Calibration of geoelectrical sounding results—such as layer thicknesses and resistivities—was carried out using borehole data. Specifically, three VES points (6, 11, and 14), were compared with wells RIGW-2, Kanady-2, and Dara-5, respectively (Figure 27a).

The calibration between VES-6 and the RIGW-2 well demonstrated a strong correlation between the interpreted geoelectric layers and borehole data. The subsurface layers in the investigated sections were classified into five distinct units, each varying in thickness and resistivity, as detailed in the resistivity spectrum of the subsurface sequence.

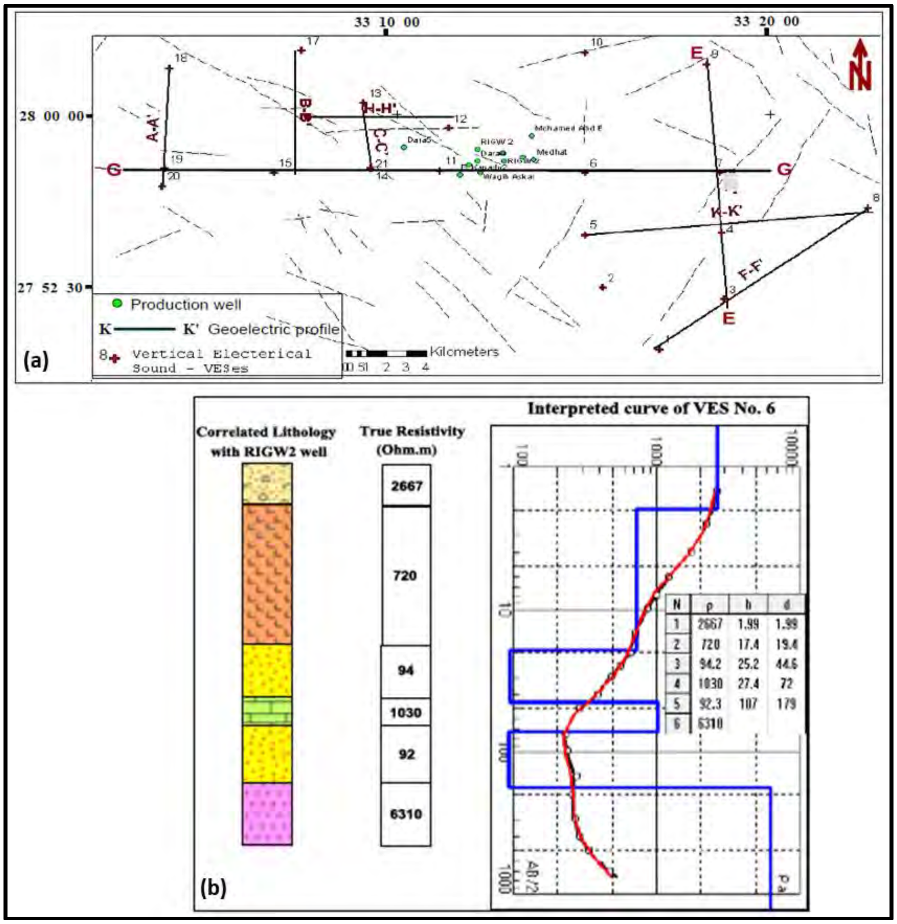


Figure 5-16: Location map of the sounding points and geoelectrical profiles, b) graph of the interpreted curve of V^ with RIGW-2 drilled well.

Table 5-4: Resistivity spectrum and its lithological units of geoelectrical sections. (Source, Bedair 2015)

Geoelectrical Unit	Resistivity (Ωm)	Description of the expected lithological Units	Common thickness (m)
First unit	240-3200	Surface deposits, pebbles, gravel, cobbles, sand, and hard cuttings (Gravelly sand)	8

Second unit	410-550	Fine to coarse grain of dry sand, shale intercalation.	15
Third unit	250-275	Green shale with dry sand, argillaceous in some parts.	22
Fourth unit	45-95	Water saturated zone, medium to coarse sandstone of different colors, argillaceous sandstone and clayey in some parts.	90
Fifth unit	6500-9800	/Basement rocks, blocky, v. hard, soft red color.	N - A
Sixth unit	1400-1600	Weathered evaporates and gypsum of pink color.	N - A

At the project site, the constructed cross-section reveals a topmost geoelectrical unit consisting of a thin layer with high resistivity values, corresponding to gravels, sands, and hard boulders. This aligns with the Quaternary deposits observed in the region, which have accumulated over older formations.

Beneath this, the second unit is thicker due to the sculpturing of the underlying third layer, a characteristic feature influenced by the structural evolution of the basin. This unit has lower resistivity values, indicating its composition of dry sand, consistent with the sedimentary formations found in the central and eastern parts of the Gharib Basin.

The third geoelectrical unit exhibits resistivity values that confirm prevailing dry conditions, similar to the overlying layers. The top three geoelectrical units (> 45 m thick) represent an unsaturated (dry) zone, which reflects the broader hydrogeological conditions of the basin, where groundwater presence is primarily controlled by structural and lithological factors.

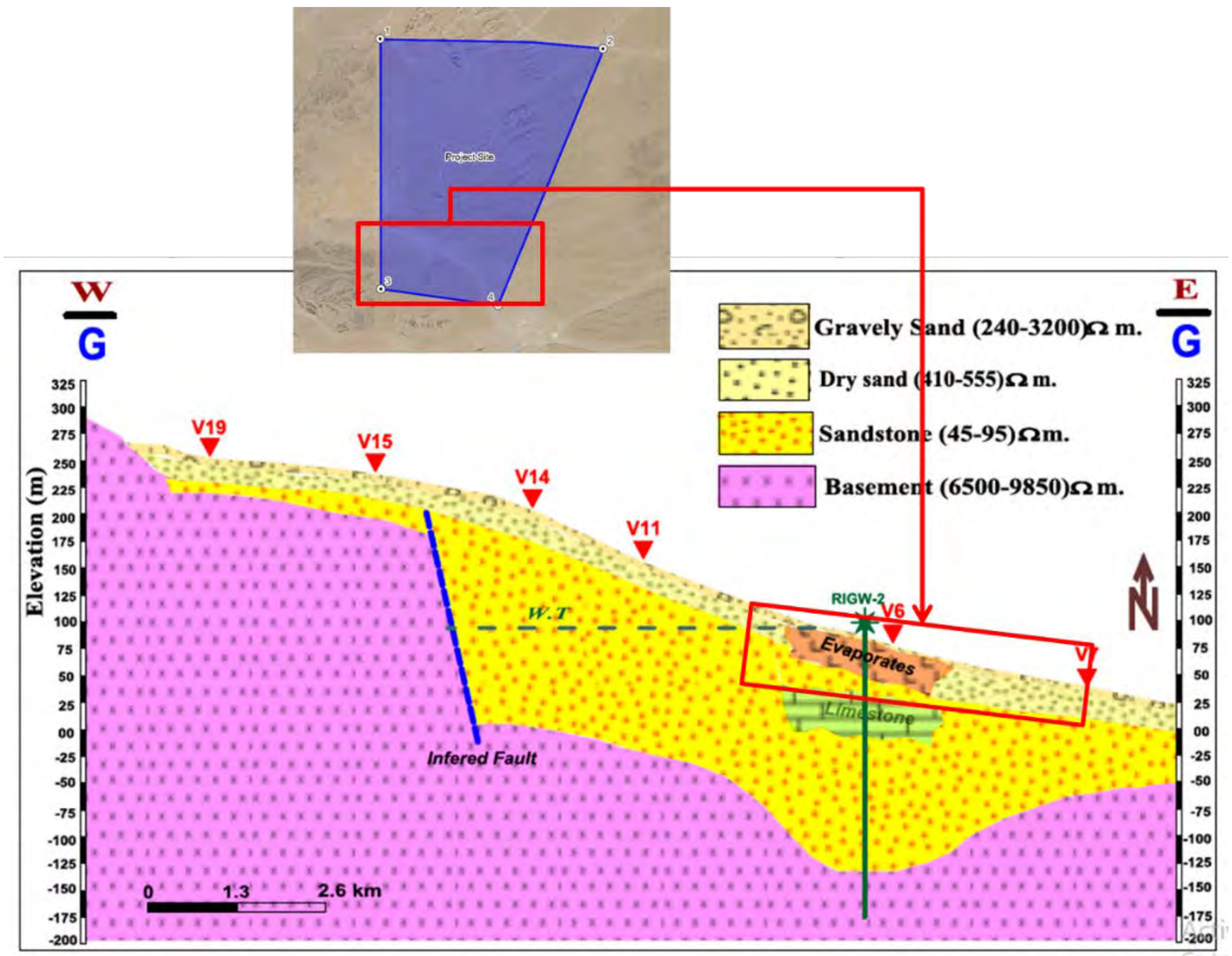


Figure 5-17 Geoelectrical cross section G – G and its lithologic unit at Wadi Dara. (Source, Bedair 2015)

5.3.2.4 Structures

The Gos rift basin is about 325 km long and 90 km wide at its broadest in the south at the junction with the northern Red Sea as shown in the figure below. The basin is subdivided into three large-scale mega-half grabens. The main dip in the Southern sub-basin is toward NE-direction, in the Central sub-basin is SW-dipping, and in the northern sub-basin is to the NE. Between the opposing-dip domains are regions of complex structure referred to as accommodation zones (Bosworth, 1985 Rosendahl, 1987) or transfer zones (Morley et al., 1990; Patton et al., 1994).

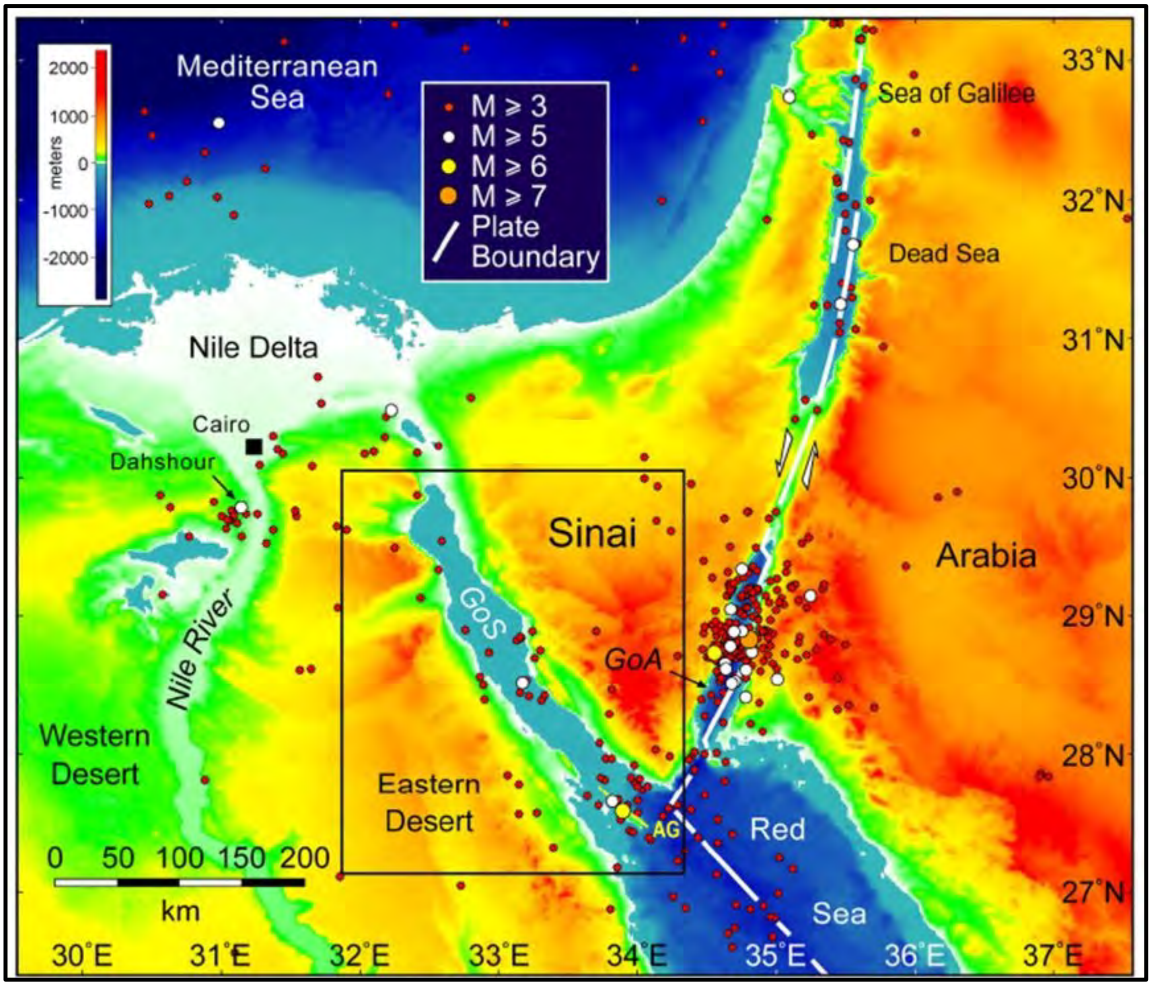


Figure 5-18 Plate tectonic setting of the Gulf of Suez. (Bosworth & Durocher, 2017)

Despite the low extension rate, a broad belt of extensional faults developed along the central western margin of the Gulf of Suez in the Gharib alluvial plain. where the project site located.

The location of the site may be observed in the map presented below. Associated surface fault-line scarps are formed in partially lithified sands and gravels. The scarps are largely uneroded except where they are cut by the active wadi systems. The deformed sands and gravels overlie Late Miocene evaporate beds and are themselves overlain by the terraces. Their age is therefore post-Miocene to early-Pleistocene. The deformation appears to have been purely dip-slip although no fault plane kinematic data have been observed. The faults are very straight with an average strike of 145° belt probably developed in a stress field similar to that present.

The Gharib fault today in the Central sub-basin and accommodated rift-normal extension. Because this fault array lies above Late Miocene evaporites it is possible that none of the faults is directly linked to basement structures. However, the straight fault pattern is not suggestive of basin-ward mass wasting or three-dimensional flow above rising salt domes or ridges.

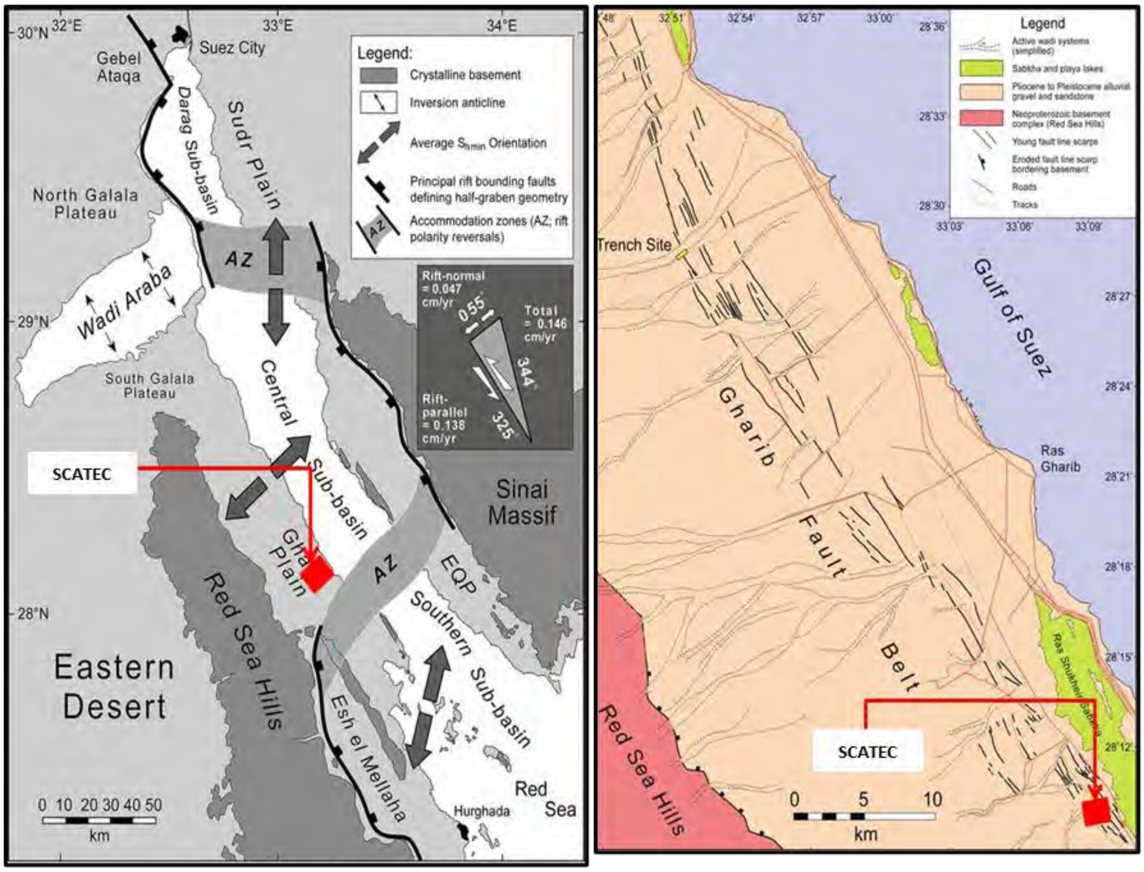


Figure 5-19 (At Left) Average Shmin (minimum horizontal stresses) orientations in the sub-basins of the Gulf of Suez. The Central sub-basin (Gharib plain, where the project is located) presently displays Shmin parallel to the long-term NE-SW extension direction that prevail. (At Right): Young fault-line scarps in Pliocene-Pleistocene alluvium on the west flank of the central Gulf of Suez (Gharib fluvial plain). Faults are straight and most are down-thrown toward the NE (Boswerth etal., in rasil & Stewart, 2019)

5.3.2.5 Hydrology

The Project site located in a tectono-stratigraphic basin called Gharib basin. The physiographic features of the project area and its surroundings could be distinguished into three units; high, medium, and low relief as noted below.

- High Relief Unit: this unit comprises the mountainous area, which is composed essentially of Pre-Cambrian basement rock. This unit rises above 500 m above mean sea level (refer to figure below);
- Medium Relief Unit: this unit occupies the eastern foot slopes of the mountainous area. This area is composed of dissected hills and weathered zone. The elevation of this unit ranges from 200 up

to 500 m above sea level (asl). This unit is characterized by the presence of shallow wide drainage lines with dissected hills. This unit is characterized by the presence of some applications to control the flash flood hazards.

- Low Relief Unit: the unit occupies the low land area between the hilly unit and the Gulf of Suez. The ground surface elevation of this unit is less than 200 m (asl). This unit comprises many dissected alluvial terraces and dissected peneplain at the exits of drainage basins like Wadi Dara at the southern part of the site. It has a ground elevation ranging between zero to about 200 m (a.m.s.l), with a general surface slope towards the east. The following geomorphic features are expected in this plain.

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

- Dissected alluvial terrace unit: it occupies an extended plain covered by thick alluvial terraces. It faces the hilly area and receives its outwash of the weathering products.
- Coastal plain unit: it occupies a limited zone towards the east between the dissected alluvial plain and the Gulf of Suez shore line. This coastal plain is completely out of the site area to the East. It receives the finer sediments carried through streams, which cut the dissected alluvial plain and the peneplain.
- Salinas and sabkha unit: it occupies a low land area north and south Ras Shukier
- Wadi channel unit: it occupies the main channels of Wadi Dara.

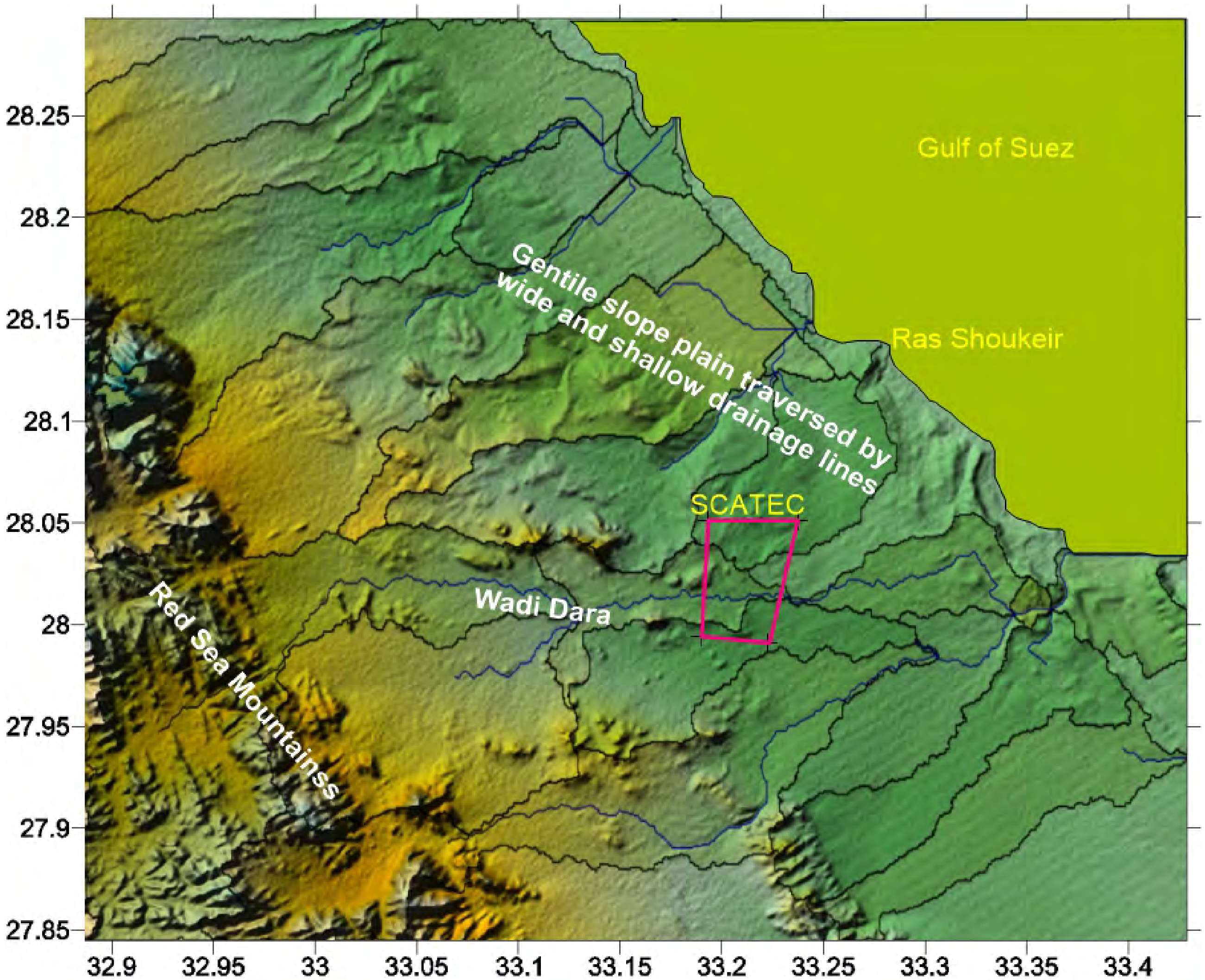


Figure 5-20: Digital Elevation Map of the Area

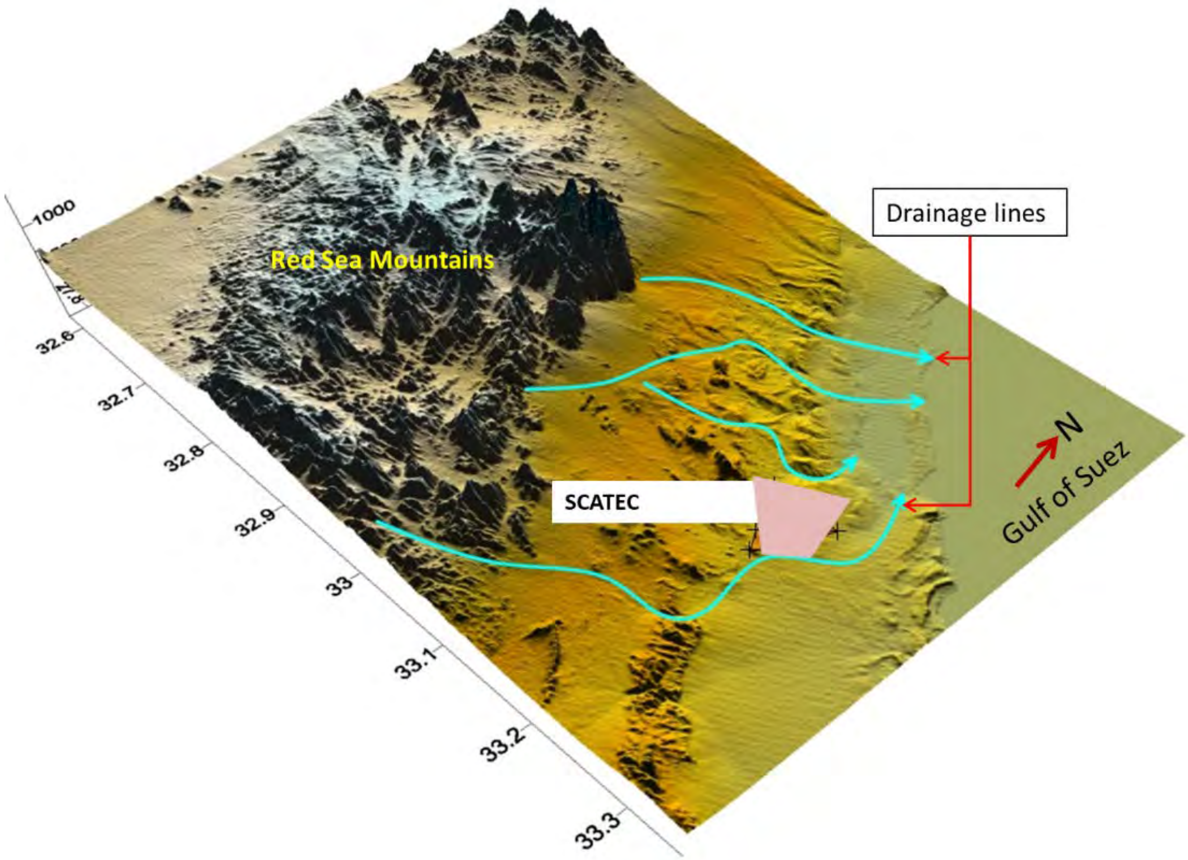


Figure 5-21: Elevation Model of the Project Area

5.3.2.6 Surface Hydrology

The region lacks permanent fresh surface water bodies or streams. However, shallow dry drainage lines are present, directing occasional precipitation from the Red Sea Mountains toward the Gulf of Suez.

These flash floods could represent serious events resulting in extensive loss of life and property. The Red Sea area is subjected to seasonal flash floods which are characterized by their high velocity and low duration with a sharp discharge peak. The recorded history indicates the occurrence of significant flash floods that affect the coastal areas along the Red Sea. These floods threaten people and man-made structures along their main streams and the outlet of their catchments either to save a quantity of rain for consumption or save inhabitants and constructions from the danger of flood.

5.3.2.7 Hydrogeology

Groundwater in The Middle Western part of the GoS was studied by several authors in the fields of geology, hydrology, hydrogeology and geophysics.

The groundwater accumulations could exist in the weathered zone of hard rocks, Paleozoic to Lower Cretaceous sandstones, pealeo-karastified carbonates of upper Cretaceous – Eocene as well as alluvium deposits and controlled mainly by the presence and configuration of underlying clays. Faulting could have likely brought impervious formations down against pervious rocks supporting this aquifer, thus cutting off groundwater discharge to the east.

In the Gulf of Suez, groundwater is used mainly for tourist 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. Attention must be paid toward its protection and sustainability to cope with the excessive needs of the development programs as shown in the figure below.

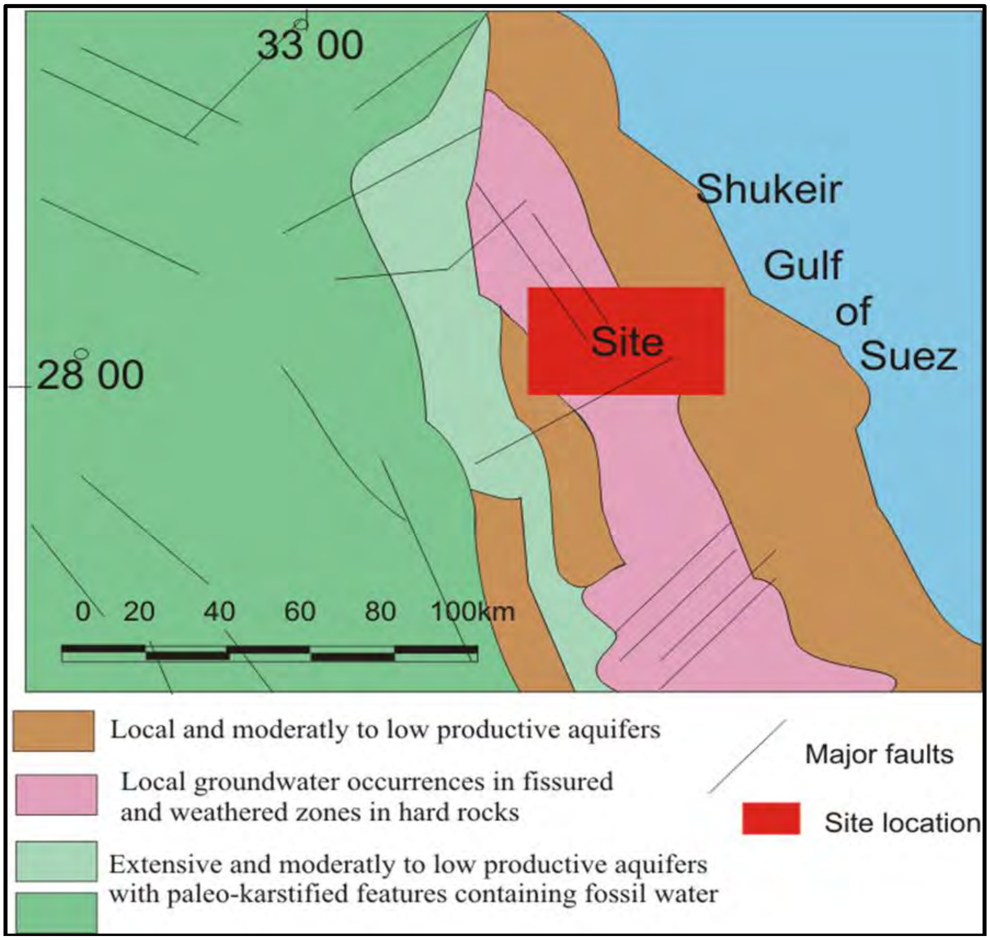


Figure 5-22: Hydrogeological Map of the Area around the Project Site[3]

In Wadi Dara, the groundwater has been utilized only for land reclamation but its Total Dissolved Solids "TDS" is high to be incompatible with the domestic purposes. The aquifer has a thickness varying from 100 m to 300 m and generally decrease west wards. The depths are displayed in the map below. This also confirmed by the results obtained from the drilled well. The depth to water varies between 9 m to 120 m. The water quality in the aquifer is brackish.

[3] Source: Hydrogeological map of Egypt, Second Edition (1999), Scale 1:2,000,000

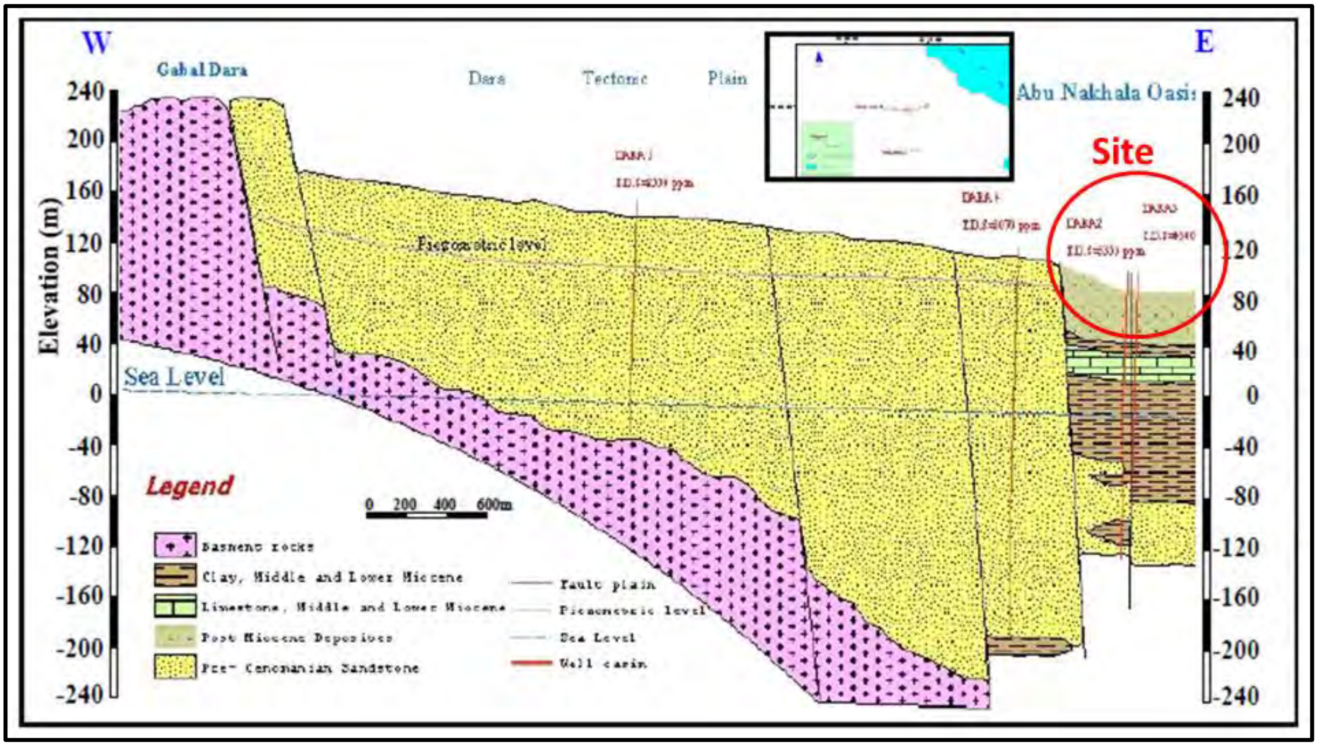


Figure 5-23 Cross section of the hydrological foundation under Wadi Dara

5.3.3 Site Geology, Hydrology and Hydrogeology

5.3.3.1 Geology

The project area lies on a wide coastal plain, situated east of the northern part of the Red Sea Mountain series. This plain extends parallel to the Gulf of Suez and is influenced by the geological processes of the broader region. The stratigraphy of the area consists of various exposed rock units, soil formations, and structural anomalies that reflect the region's complex geological history.The Post-Miocene deposits, composed mainly of gravels and sands, are widespread across the Gharib Plain. In the study area, these deposits form a thin layer above the Miocene evaporites or, in some areas, over Cretaceous deposits in the western part of the site. Their thickness gradually increases eastward, following the natural downstream direction of sediment transport, reaching over 100 meters near the Gulf of Suez coastline.

5.3.3.2 Stratigraphy

As in the wider region of the project, the rock units that could be recognized in the project location are mainly Quaternary deposits. During the field study, with the help of Land sat images, some rock units were found, dating back to earlier ages, and may reach the Upper Cretaceous – Tertiary rocks exposed to the northwest and southeast of the project site.

The following is a focus on the rocks and sediments that exposed in the areas close to the project site based on what was identified during the field visit from old to young.

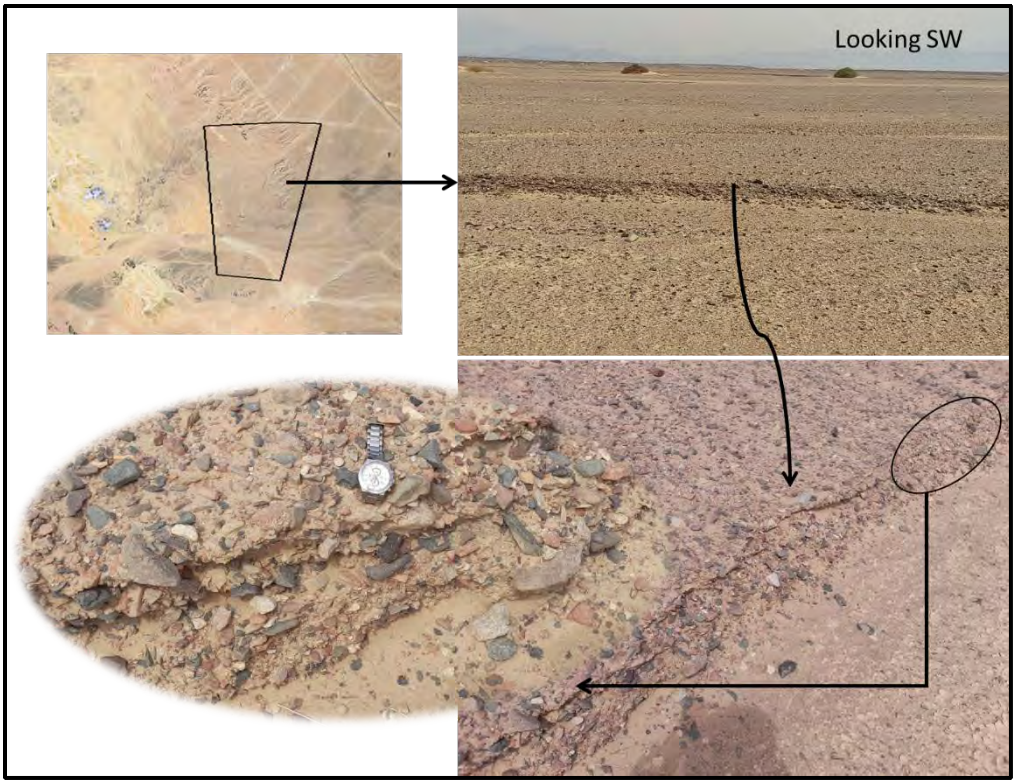


Figure 5-24: Field photograph of the Quaternary deposits at the mid-eastern part of the site.

**Note, the layer is composed of rock fragments of basement impeded in sand and silt.*

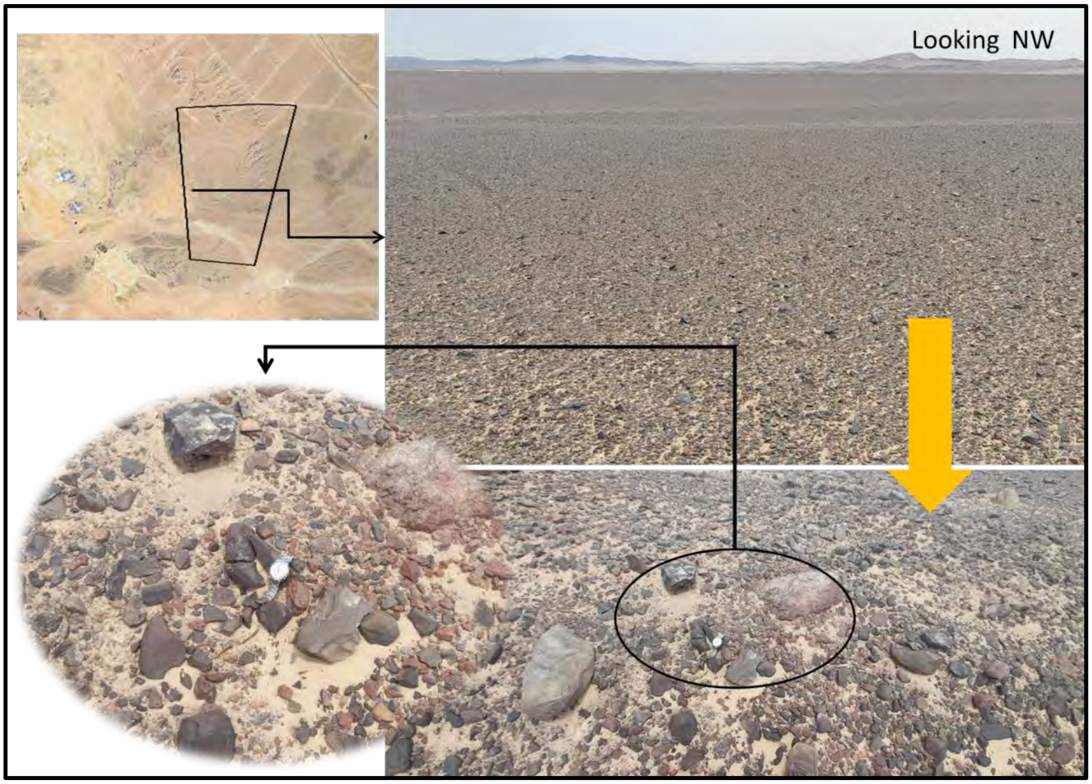


Figure 5-25: Field photograph of the Quaternary deposits at the mid-western part of the site.

**Note, the layer is composed of rock fragments of basement impeded in sand and silt, where the size of the fragment is slightly larger than the same deposits at the east.*

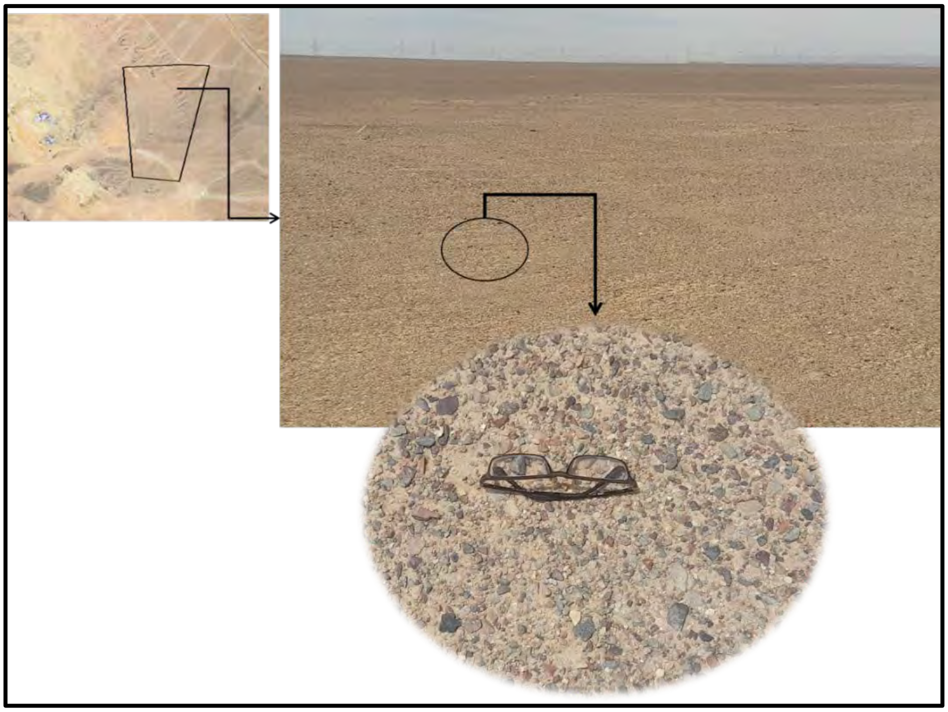


Figure 5-26: Field photograph of the Quaternary deposits at the NE part of the site. Note, the surface is covered by rock fragments of basement impeded in sand and silt, where the size of the fragment is much smaller than the same deposits at the west.

At the west and southwest, the Miocene evaporite is exposed on the surface of the site, sometimes covered by a very thin layer of Quaternary deposits (Figure 5-195-19).

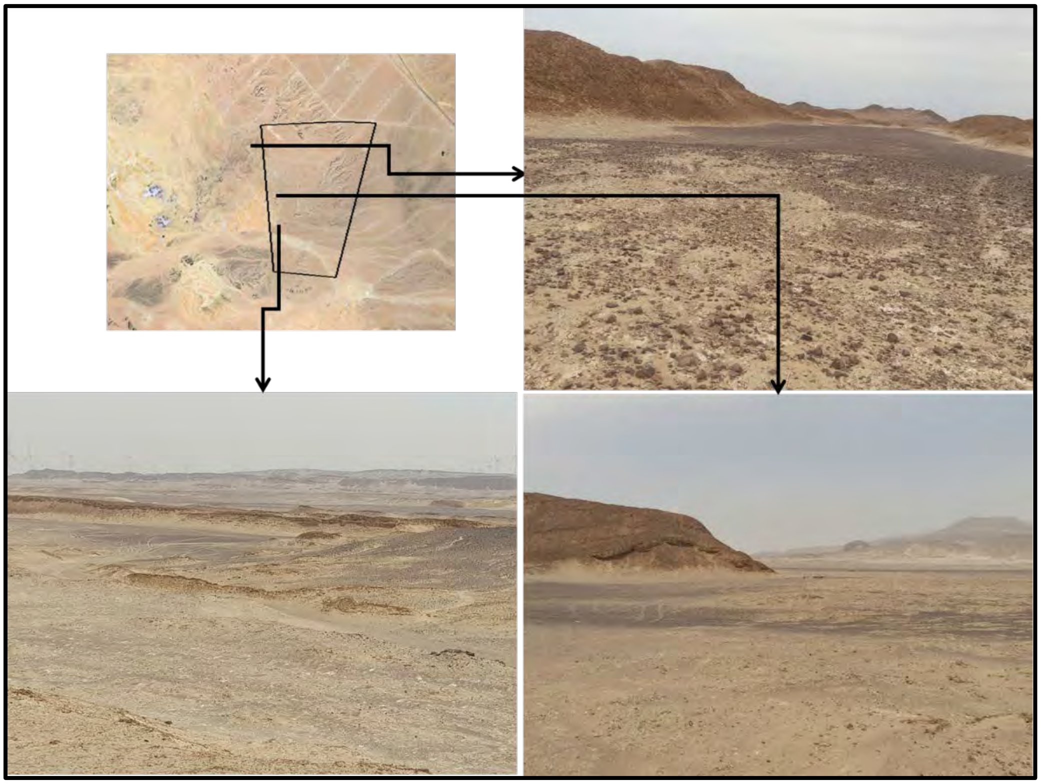


Figure 5-27 The evaporite exposed on the ground surface at the west and southwest

The soil covers almost all the projects and is in the form of chains of alluvium terraces. Three alluvium terraces have been described in the project area and in the surrounding area during the site visit; T1, T2 and T3.

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 west and southwest are located at higher altitudes, and the components are very close to those in the source and their size is large. T1 (the oldest terrace) is located close to the elevated exposures (Red Sea Mountains) either from the west or from the southwest. Going to east and northeast the fine the drainage lines getting very wide and almost disappeared except for the outlet of Wadi Dara at the south. The younger terraces formed on low lying successive levels, T2, T3. The youngest formed terraces (T3) are distributed along the floor of the shallow drainage that crosses the 2 and characterized by a successive layer of different deposits varies in grain size and thin layer of mud transported by sheet flow of rainwater. These terraces will be dealt with in some detail below.

T1

These terraces represent the top of the elevated land and the longitudinal shallow dissected hills at the west and northwest at the watershed area of Wadi Dara. This old terrace has been dissected by numerous shallow and wide tributaries drain eastward to the Gulf of Suez. The maximum elevation of the terraces at the west and southwest part is about 160 m (a.m.s.l).

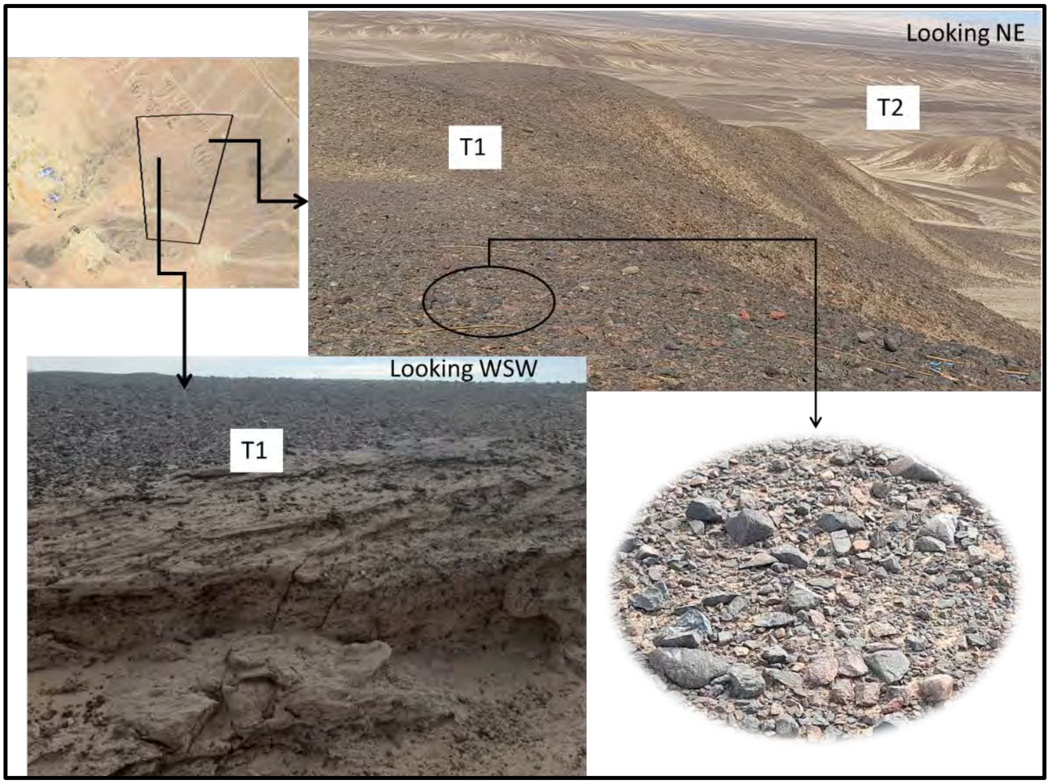


Figure 5-28: Field photographs of the terraces T1, T2

The height of the terrace above the ground level (the level of the following terrace) varies from 1 m to about 2 m at the northwest while it varies from 1 m to about 3 m at the west and southwest. This terrace composed of very coarse chert nodules, cobbles and boulders of granite, basalt, impeded in fine clay and sand.

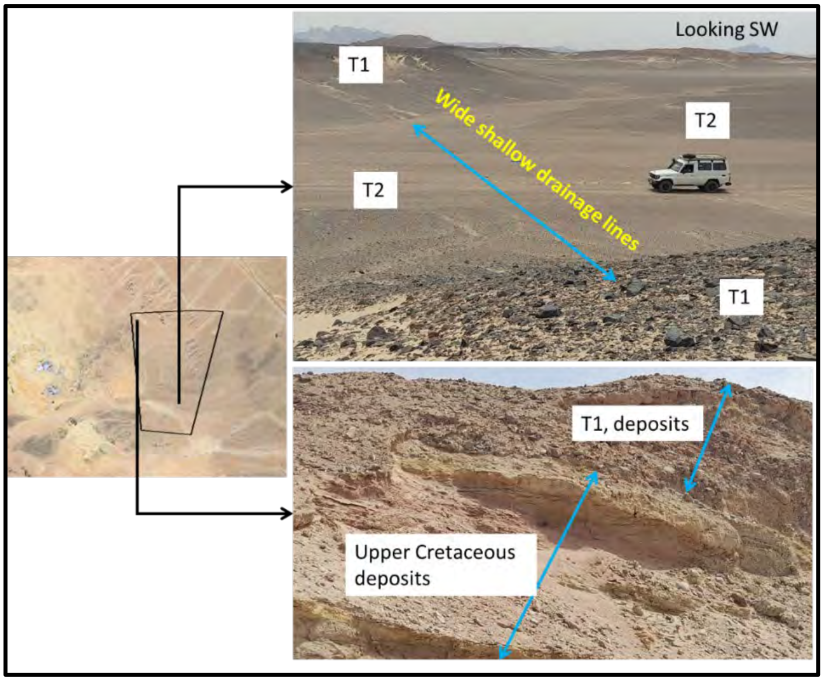


Figure 5-29: Field photographs of the terraces T1, T2

T2

These terraces are exposed along the floor of the tributaries cutting through the terrace T1. The height of the terrace T2 above the ground level (the level of the following terrace) varies from 0.5 m to about 1.5 m at the northwest while it varies from 0.5 m to about 2 at the southwest. This terrace is composed of medium sized chert nodules, fragments igneous rocks impeded in fine clay and sand. The fine clay and sand fraction is greater than that in the previous terrace (T1).

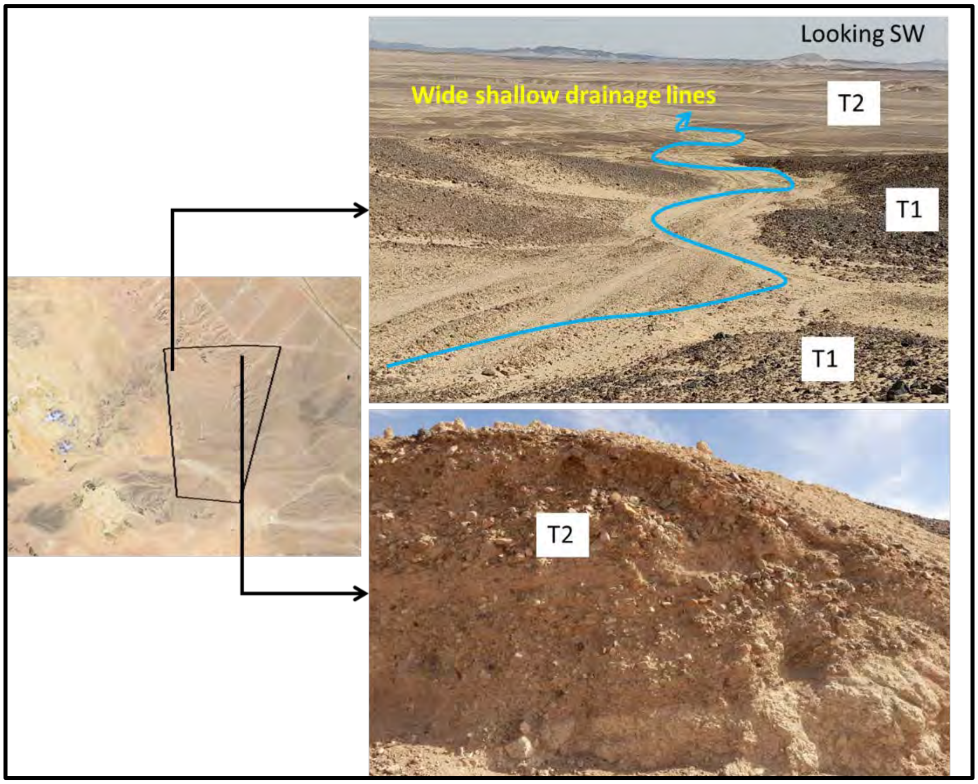


Figure 5-30: Filed photographs of the terraces T1, T2

T3

These terraces are exposed along the floor of the tributaries cutting through the terrace T2. The height of the terrace T3 above the ground level (the level of the following terrace) varies from <0.5 m to about 1 m. at the northeast, while it varies from 0.5 m to about 1 at the middle and southeast. This terrace is composed of small nodules, fragments of igneous rocks impeded in fine clay and sand. The fine clay and sand fraction is greater than that in the previous terrace T2.

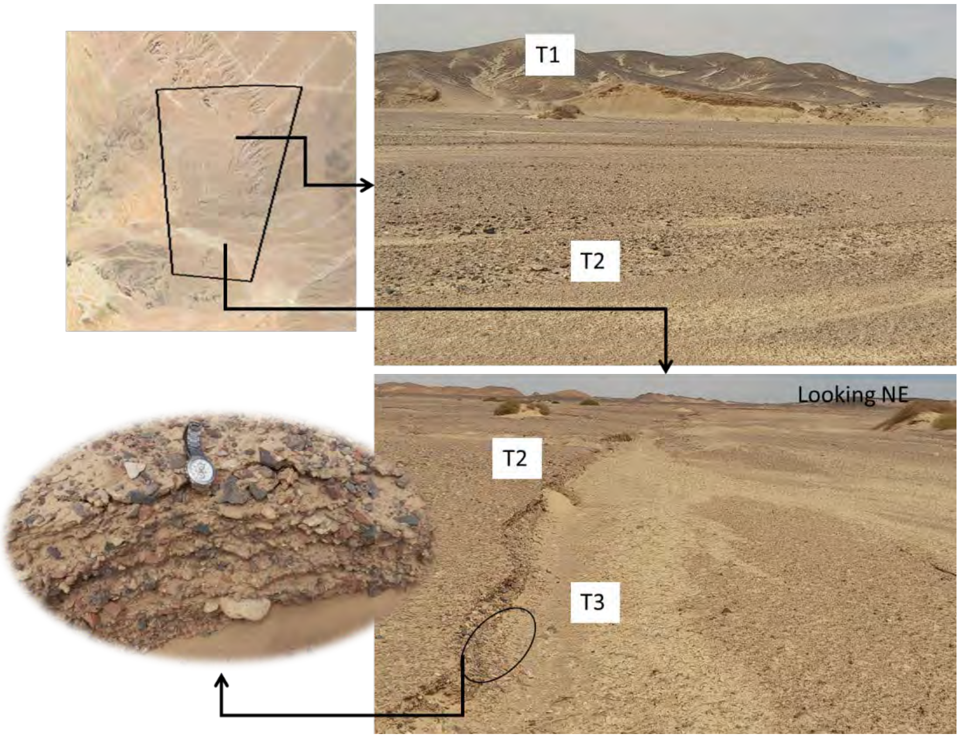


Figure 5-31: Field photograph of the T2 and T3 distribution in the project site

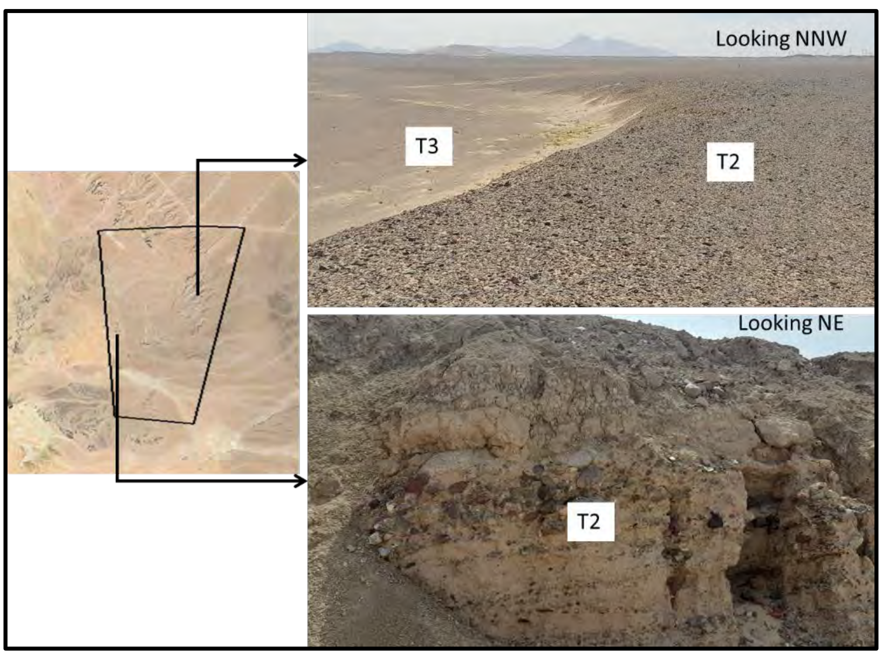


Figure 5-32: Field photograph of the T2 and T3 distribution in the project site

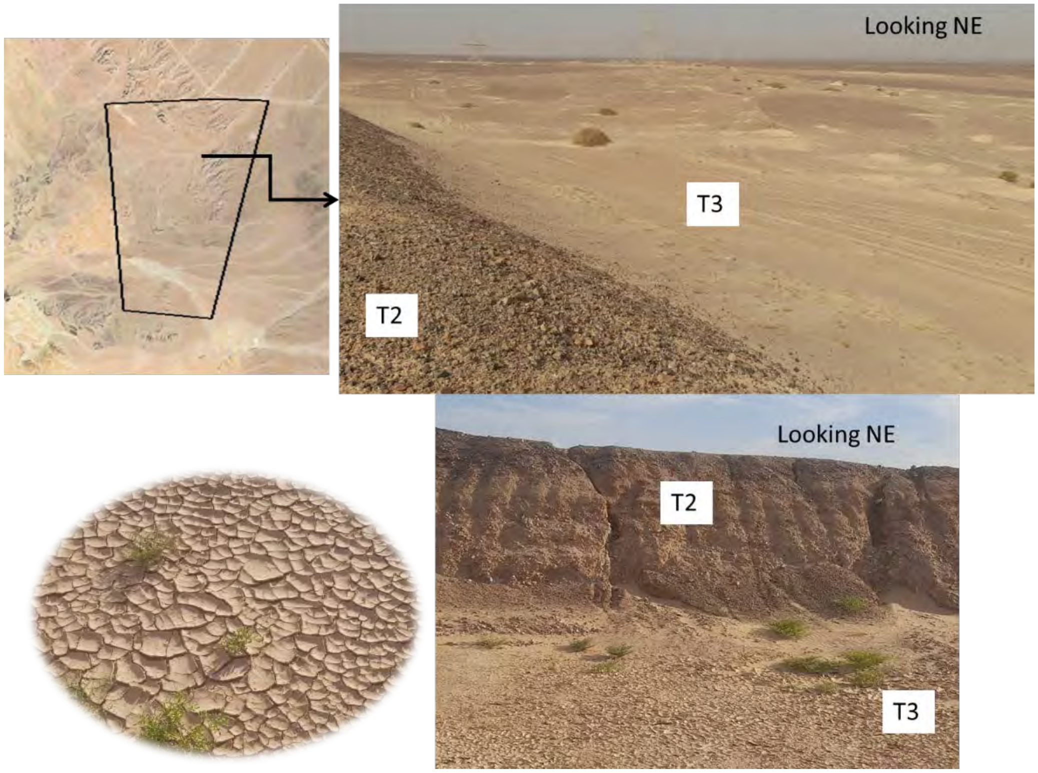


Figure 5-33: Field photograph of the T2 and T3 distribution in the project site. Note the mud cracks on the surface of the T3 terraces related to the last rainfall events. This means that the surface flow is very week.

5.3.3.3 <u>Subsurface Geology</u>

At the project site, the constructed cross-section reveals a topmost geoelectrical unit consisting of a thin layer with high resistivity values, corresponding to gravels, sands, and hard boulders. This aligns with the Quaternary deposits observed in the region, which have accumulated over older formations.

Beneath this, the second unit is thicker due to the sculpturing of the underlying third layer, a characteristic feature influenced by the structural evolution of the basin. This unit has lower resistivity values, indicating its composition of dry sand, consistent with the sedimentary formations found in the central and eastern parts of the Gharib Basin.

The third geoelectrical unit exhibits resistivity values that confirm prevailing dry conditions, similar to the overlying layers. The top three geoelectrical units (> 45 m thick) represent an unsaturated (dry) zone, which reflects the broader hydrogeological conditions of the basin, where groundwater presence is primarily controlled by structural and lithological factors.

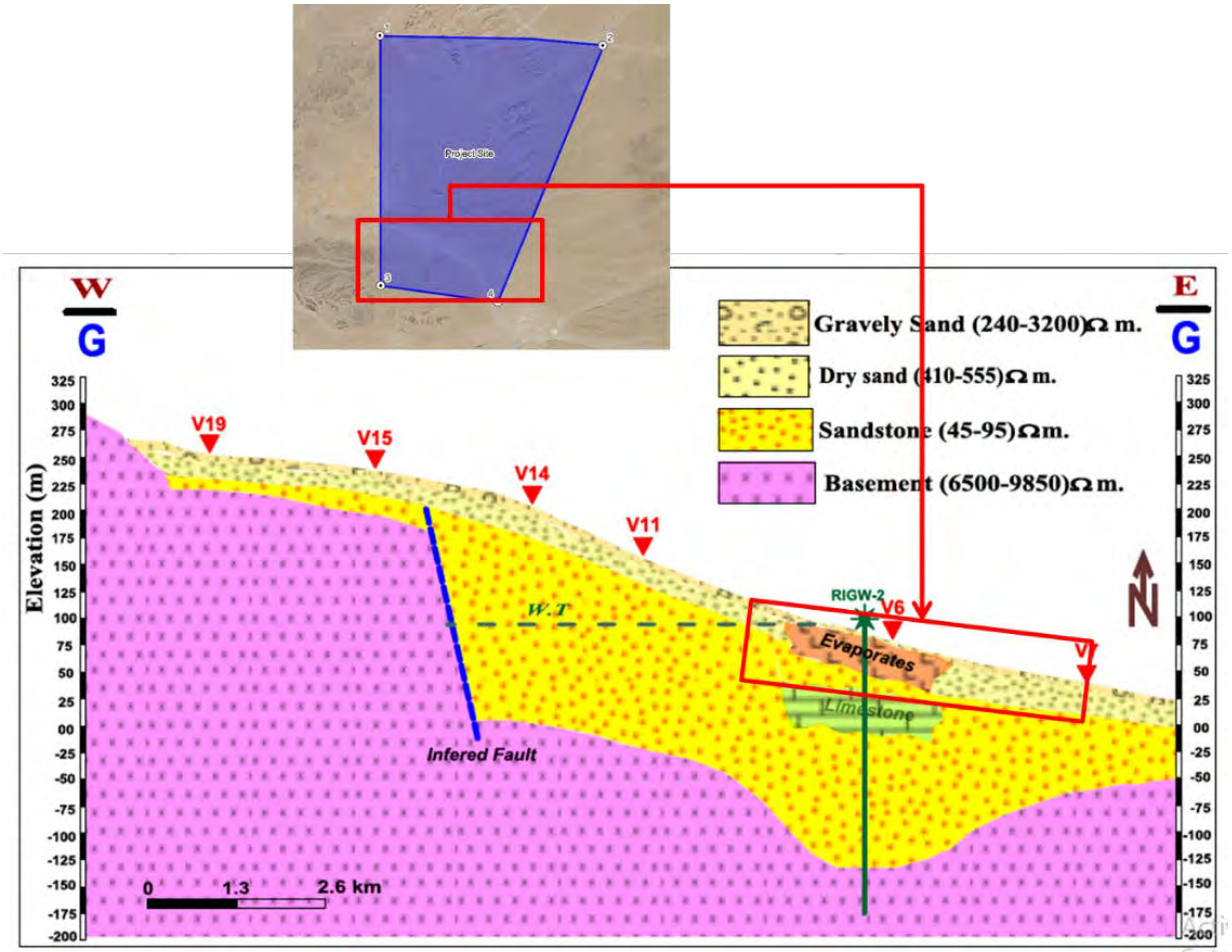


Figure 5-34 Geoelectrical cross section G – G and its lithologic unit at Wadi Dara. (Source, Bedair 2015)

5.3.3.4 Structures

The project is located in the Gharib alluvial plain along the central western margin of the Gulf of Suez, where a broad belt of extensional faults has developed despite the low extension rate. Therefore, it exhibits similar structural characteristics to the wider regional setting.

The location of the site may be observed in the map presented below. Associated surface fault-line scarps are formed in partially lithified sands and gravels. The scarps are largely uneroded except where they are cut by the active wadi systems. The deformed sands and gravels overlie Late Miocene evaporate beds and are themselves overlain by the terraces. Their age is therefore post-Miocene to early-Pleistocene. The deformation appears to have been purely dip-slip although no fault plane kinematic data have been observed. The faults are very straight with an average strike of 145° belt probably developed in a stress field similar to that present.

The Gharib fault today in the Central sub-basin and accommodated rift-normal extension. Because this fault array lies above Late Miocene evaporites it is possible that none of the faults is directly linked to basement structures. However, the straight fault pattern is not suggestive of basin-ward mass wasting or three-dimensional flow above rising salt domes or ridges.

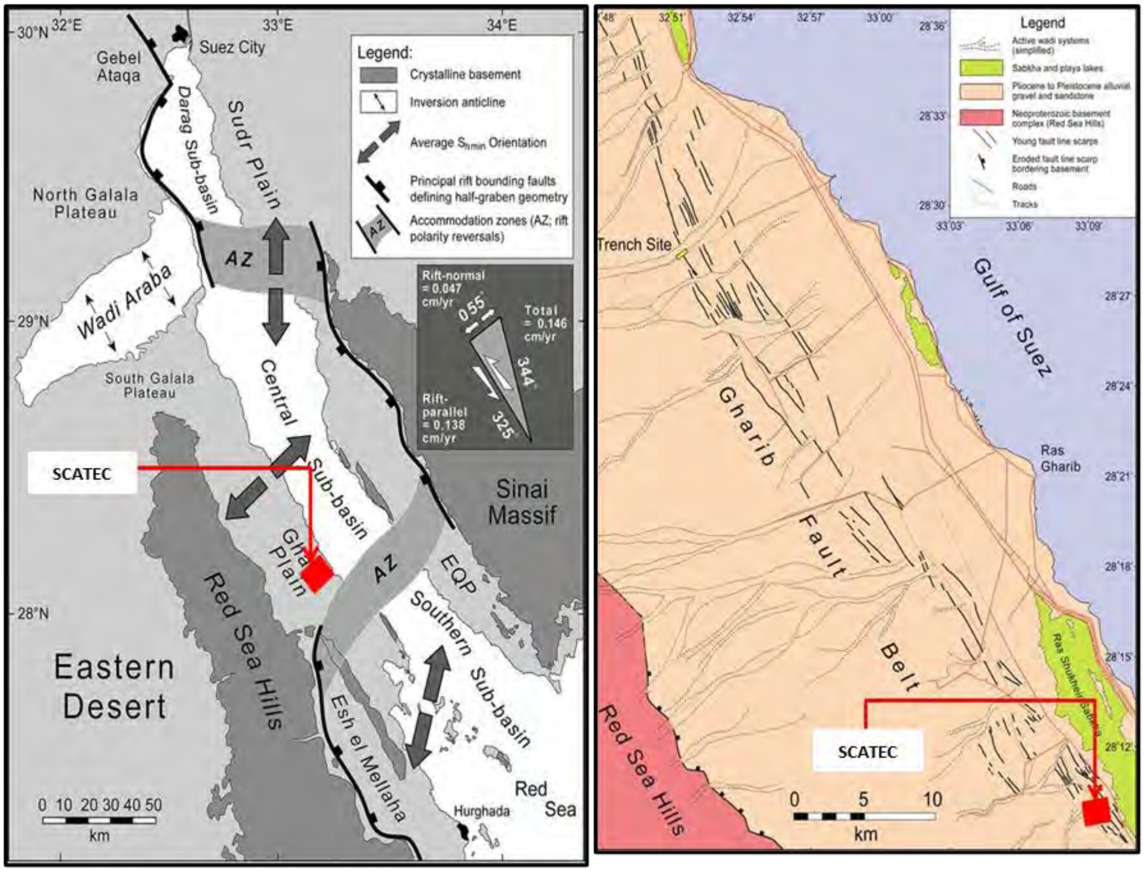


Figure 5-35 (At Left) Average Shmin (minimum horizontal stresses) orientations in the sub-basins of the Gulf of Suez. The Central sub-basin (Gharib plain, where the project is located) presently displays Shmin parallel to the long-term NE-SW extension direction that prevail. (At Right): Young fault-line scarps in Pliocene-Pleistocene alluvium on the west flank of the central Gulf of Suez (Gharib fluvial plain). Faults are straight and most are down-thrown toward the NE (Boswerth etal., in rasil & Stewart, 2019)

5.3.3.5 Hydrology

The Project site located in a tectono-stratigraphic basin called Gharib basin and therefore exhibits similar physiographic features as that in the wider area.

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

- Wide plain with a very gentle slope towards Gulf of Suez.
- Complete absence of any deep drainage lines and or well-developed alluvial fans.
- The main drainage lines traversed the Project site are very weak, shallow and the surface signs of their existence are disappeared in the way to the Gulf of Suez except Wadi Dara at the extreme southern part of the site.
- Gong further west and southwest of the project site, Miocene evaporites are exposed forming wide distance separated dissected hills of highly weathered contrary rock.
- A complete absence of strong and well-developed geomorphic features like deep wadies, depressions, steep slope scarps, conspicuous hill heights. Therefore, the project site is very ideal concerning the accessibility. One can move in the site without any big effort.

Regarding geomorphology, the project is in an area with drainage basins and dry wadis flows to the Gulf of Suez south of Ras Shukeir city. The project area belongs to two drainage basins, namely the Wadi Dara basin, Wadi North Dara (W. Mallaha). Astronomically, the project site extends between latitudes 27 ˚ 47' 47.5 ˚ - 28 ˚ 7' 45.9 ˚ North and longitudes 23 ˚ 44' 19.5 ˚ – 33 ˚ 24' 29.2 ˚East, (Figure 5-37).

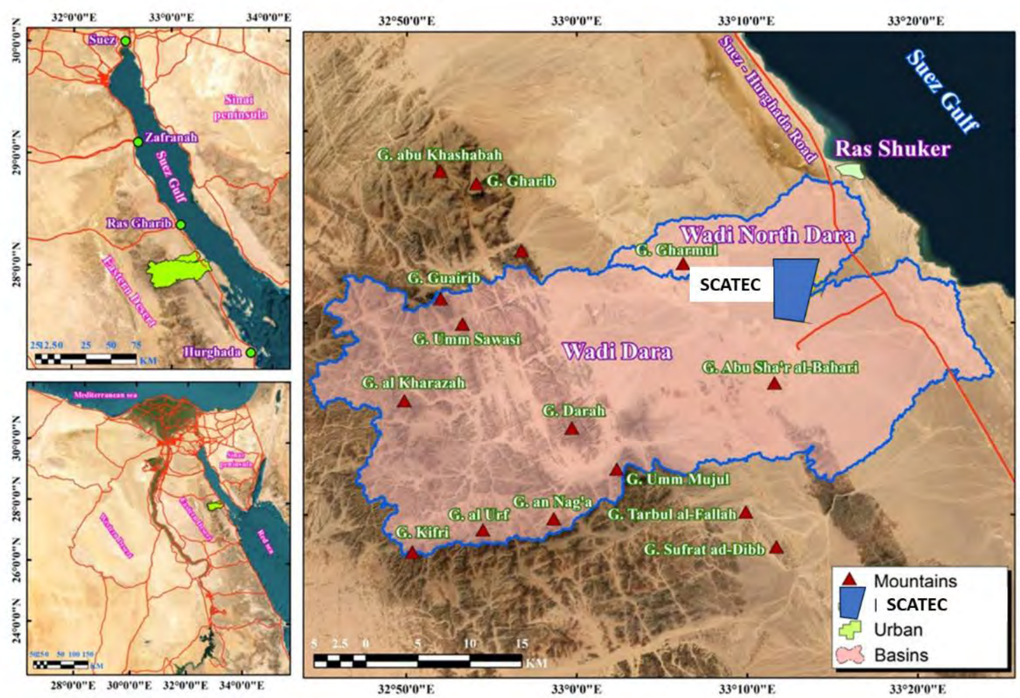


Figure 5-36: Map indicating the location and morphology of the two basins (Wadi Dara and W. Mallaha N. Dara) where the site is located at their downstream parts to the east.

5.3.3.6 Hydrogeology

The project is located within the Middle Western part of the Gulf of Suez, an area extensively studied in literature across geology, hydrology, hydrogeology, and geophysics. As described in the regional setting, groundwater accumulations in this region are primarily controlled by the configuration of underlying clays and faulting, which influences aquifer connectivity and groundwater movement. Existing studies indicate that groundwater in the broader area is mainly used for industrial and tourism purposes, with variable salinity and depths ranging from 9 m to 120 m.

Pumped and observation wells were drilled by Desert Research Institute within the Wadi Dara area south of the project site (Sewidan et al., 1991), in addition to the wells drilled by RIGW, 2005, are the main source of the groundwater information in the study area. The available well data and coordinates are included in the table below and their location respective of the Project site in the figure below.

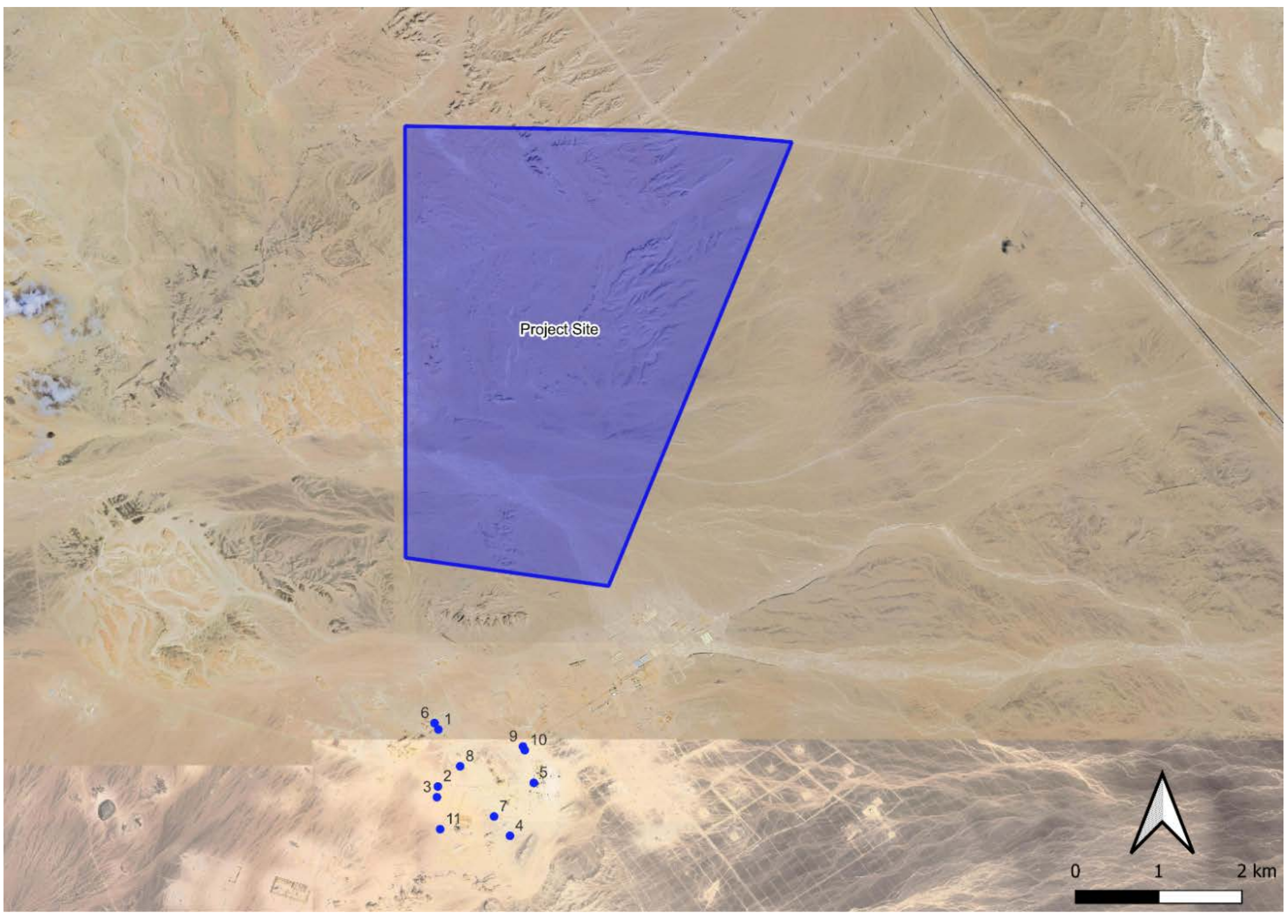


Figure 5-37 Location Map of the Drilled Wells at Wadi Dara

Table 5-5 Available well data in Wadi Dara Area (Bediar 2015)

No	Latitude (N)	Longitude (E)	Ground Level m amsl	Depth to Water m	Total Dissolved Solids gm/l	Water Level m
1	27°58'56.9"	33°12'12.2"	121.9	11.34	3400	110.5
2	27°58'31.8"	33°12'12"	128	16	3650	112
3	27°58'27.1"	33°12'11.57"	135	26.6	2720	108.3
4	27°5810.1"	33°12'43.7"	151	39.2	2675	111.8
5	27°58'33.8"	33°12'54.2"	109	Flowing	6750	105
6	27°58'59.7"	33°12'10.5"	154	44.4	2550	109.5
7	27°58'18.6"	33°12'36.7"	120	93	3250	27
8	27°58'40.7"	33°12'21.8"	97.2	94.9	7630	2.32
9	27°58'49.4"	33°12'49.4"	150.6	9	3400	141.6
10	27°58'47.8"	33°12'50.2"	121.9	7.78	8200	114
11	27°58'13"	33°12'13"	134.5	24	2800	110.5

5.3.3.7 Surface Hydrology

There are no permanent fresh surface water bodies or streams in or close to the site. There are, however, shallow dry drainage lines traversing the site, through which occasional precipitation on the Red Sea Mountains finds its way to the Gulf of Suez as described in 5.3.2.6.

5.4 Climate

The meteorological data utilized for this assessment has been meticulously compiled from a reliable online source; Meteoblue, the data obtained spans over three decades, encompassing hourly weather records from 1985 to the present day. It is important to emphasize that this extensive dataset serves as a solid foundation for characterizing the climate of the project area. The climatic features of the project area could be characterized as follows:

5.4.1 Temperature

Situated at an elevation of 57 m above sea level, Wadi Dara experiences a sub-tropical desert climate characterized by distinct seasonal variations. Winters tend to be warm, while summers can be quite hot. Notably, the highest monthly average for maximum temperatures is typically observed in July and August, reaching up to 42°C, whereas the lowest monthly average occurs in January, at around 23°C. Conversely, the highest monthly average for minimum temperatures occurs during July and August, averaging around 20°C, while the lowest values are recorded in January and February, often dropping to approximately 5°C. Table 5-65-5 shows the average monthly temperature in both areas.

Table 5-6 Average monthly temperatures in the Project Area (based on data from 30 years of observation)

Air Temp.	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Max °C	23	25	29	34	38	41	42	42	40	35	29	24
Min °C	5	5	8	12	16	18	20	20	18	15	10	6
Mean °C	14	15	18.5	23	27	29.5	31	31	29	25	19.5	15

Source: Meteoblue

5.4.2 Precipitation

Rainfall distribution in Egypt exhibits its highest levels along the Mediterranean coast, with a significant decline as one moves southward. Over the past three decades, the mean annual precipitation in the project area has averaged 12 mm, accompanied by approximately 4.2 rainy days each year. The highest precipitation occurs in January, with an average of 3 mm. Conversely, the months of June, July, August, September, and November typically experience minimal to virtually no precipitation. Table 5-75-6 and Figure 5-365-34 show the average rainfall data in the project areas.

Table 5-7 Average rainfall data in the Project Area (based on data from 30 years of observations).

Rainfall	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(mm/ month)	3	1	3	2	1	0	0	0	0	1	0	1	12

Source: Meteoblue

The following figure illustrates the variation temperatures and precipitation in the project site.

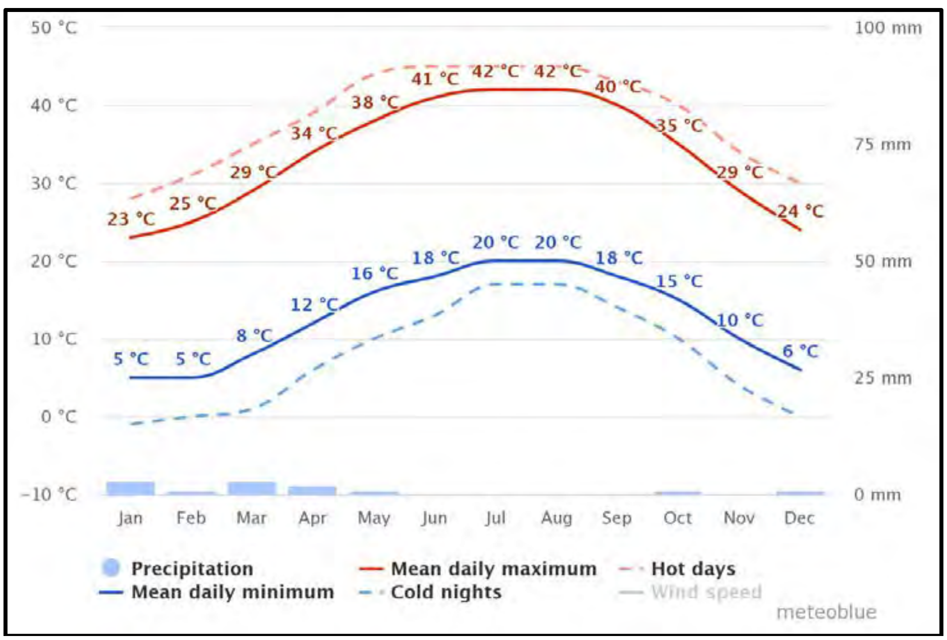


Figure 5-38 Average temperatures and precipitation measured data in the Project Area (based on data from 30 years of observations) Source Meteoblue

5.4.3 Humidity

Wadi Dara, being situated in a sub-tropical desert climate region, maintains an average humidity level of approximately 52.04%. This percentage signifies the amount of moisture present in the air relative to its maximum capacity at a given temperature. Humidity plays a pivotal role in shaping the climate and overall environmental conditions in this area. To provide a more detailed perspective, the following table illustrates the average relative humidity for each month in the Ras Gharib governorate:

Table 5-8 Relative Humidity in Wadi Dara

Humidity	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
%	57.7	54.39	50.48	47.12	44.24	43.79	45.65	47.48	52.45	59.07	61.96	60.15

Source: weather & climate

5.4.4 Wind Speed

According to Meteoblue meteorological data, the average monthly wind speed ranges between 11 Km/h and 15 Km/h. Dry hot dust-laden which blows mainly from south and southeast as Khamasin winds blows occasionally for about 50 days during spring. The prevailing winds at the project area blow from the North West direction.

Table 5-9 Average monthly wind speed in the Project Area (based on data from 30 years of observations)

Wind Speed	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max. (Km/h)	15	17	18	18	18	20	17	18	18	15	14	15
Min. (Km/h)	6	6	7	6	7	11	9	10	10	7	6	6
Avg. (Km/h)	10.5	11.5	12.5	12	12.5	15.5	13	14	14	11	10	10.5

Source: Meteoblue

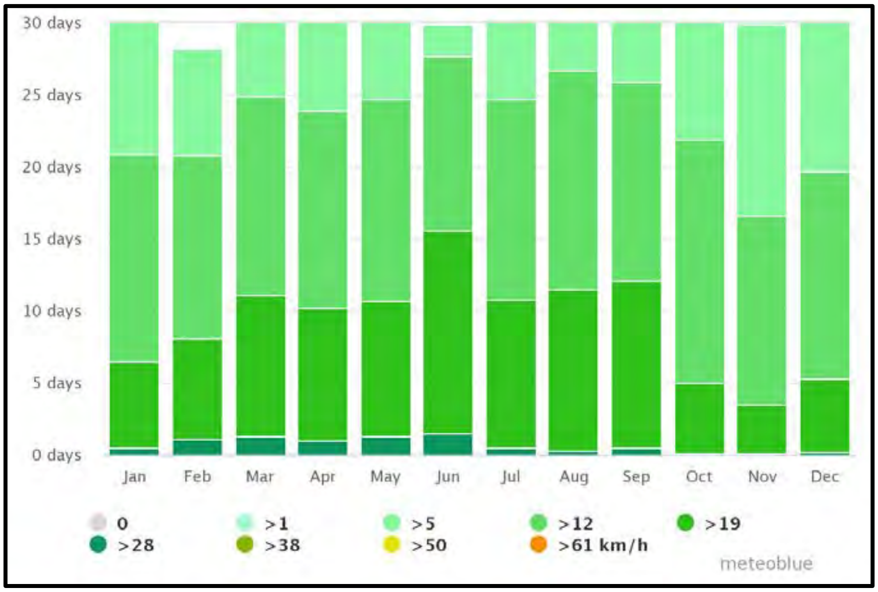


Figure 5-39 Average monthly wind speed and direction in the Project Area (based on data from 30 years of observations) Source Meteoblue

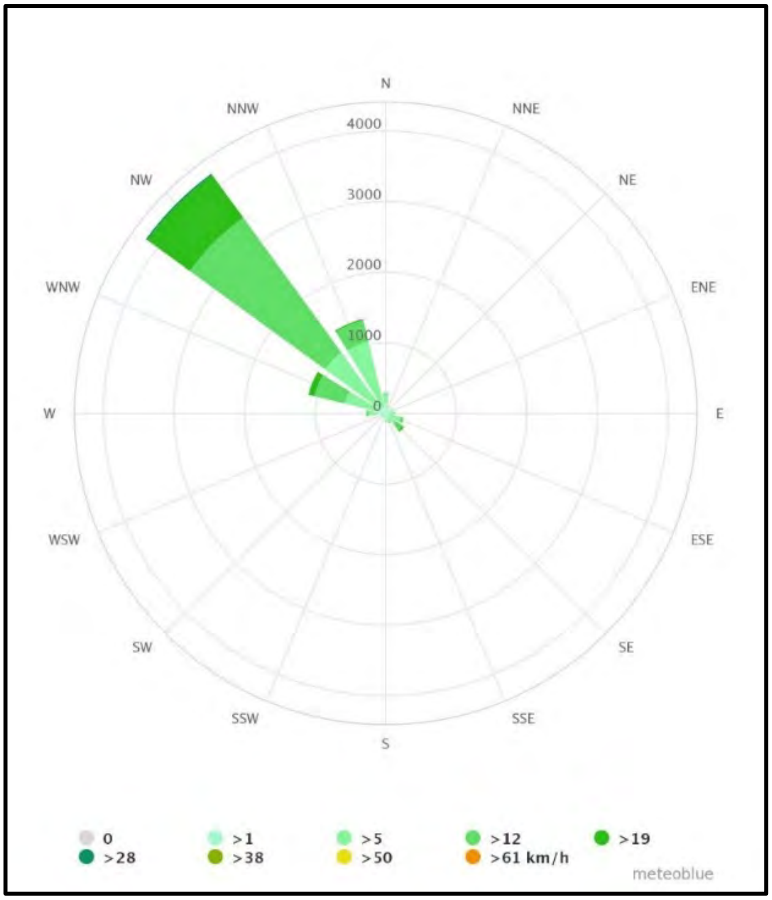


Figure 5-40 Wind-Rose in the Project Area, Source: Meteoblue

5.4.5 Solar Radiation

The average percentage of sunshine hours ranged from 65% to 70% during the winter months and 80% to 85% in the summer months, based on data from the period 1987-1996 at the Suez Marine Meteorological Station. They also noted that the investigated area, including Wadi Dara, experiences high solar radiation intensity, ranging from 1,900 to 2,600 Wh/m²/year.

5.4.6 Relative Humidity

The mean annual Relative Humidity in percentage ranged from 41% to 51% with a total annual average equal 46.67% during the period 1971-2000. The air humidity decreases sharply when the country is exposed to the Khamaseen winds during the period March and June which is hot, dry and dusty that leads to stirring fine sand with a degree that may obscure the vision, in addition to low humidity, and it is associated with depressions from the Mediterranean and North Africa, or associated with the occurrence of weather conditions that are accompanied by instability situations in spring.

5.5 Natural Hazards

The project area is potentially exposed to various natural hazards that may impact infrastructure, ecosystems, and local communities. These hazards include strong winds, rising temperatures and heat waves, as well as flash floods.

5.5.1 Temperature

The observed average trends in surface air temperature over the Red Sea region of Egypt from 1901 to 2023 indicate a consistent increase across mean, maximum, and minimum temperatures as illustrated in the Figures below. The annual average mean temperature has risen from approximately 23°C in the early 20th century to around 25°C in recent years. The maximum temperature follows a similar upward trend, increasing from about 29°C to over 31°C, while the minimum temperature has risen from nearly 17°C to above 19°C.

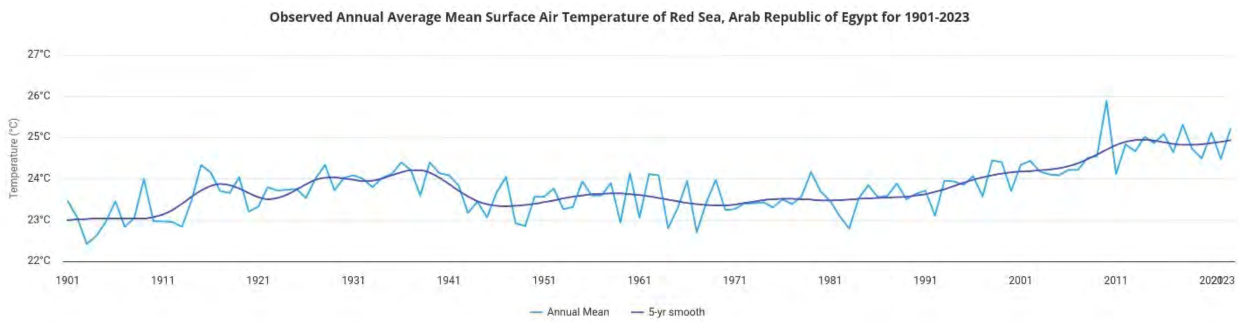


Figure 5-41: Average mean surface air temperature

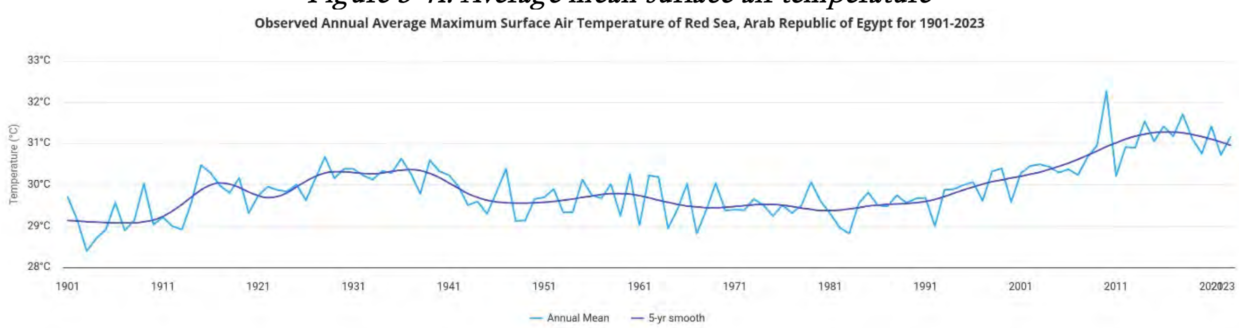


Figure 5-42: Average maximum surface air temperature

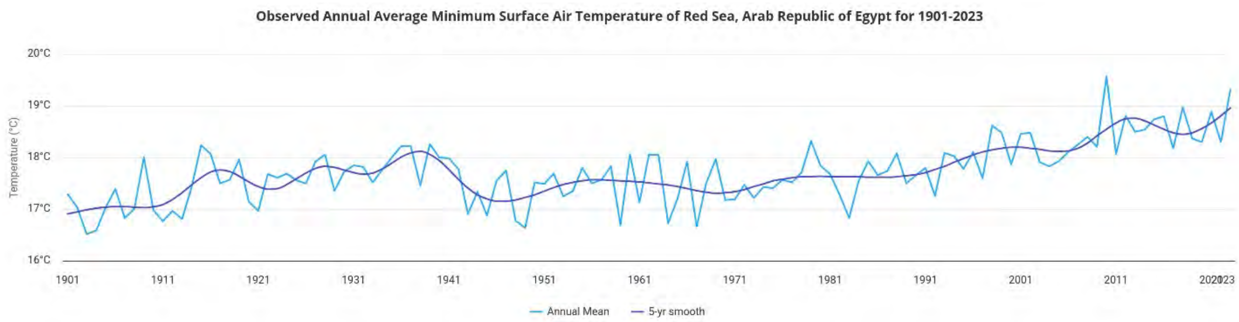


Figure 5-43: Average minimum surface air temperature

The observed seasonal mean, minimum, and maximum temperatures for the Red Sea region recorded over four time periods: 1901–1930, 1931–1960, 1961–1990, and 1991–2020 also recorded an increasing trend over time.

The mean seasonal temperature has risen, with the most recent period (1991–2020) showing the highest values. For instance, the mean temperature in DJF increased from 16.45°C (1901–1930) to 17.07°C (1991–2020), while in JJA, it rose from 29.38°C to 30.7°C over the same period.

The minimum temperature has also increased, particularly in DJF, where it rose from 10.6°C (1901–1930) to 11.12°C (1991–2020), and in JJA, where it increased from 23.15°C to 24.56°C.

The maximum temperature exhibits a similar trend, with JJA reaching the highest recorded values, increasing from 35.66°C (1901–1930) to 36.88°C (1991–2020).

Table 5-10: Observed Seasonal Mean, Minimum, and Maximum Temperatures (°C) for the Red Sea Region Across Different Time Periods (1901–2020)

	1991-2020				1961-1990				1931-1960				1901-1930			
Units:°C	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Observed Average Seasonal Mean Temperature	17.07	23.91	30.7	25.68	16.42	23.2	29.55	24.65	16.78	23.3	29.54	25.09	16.45	23.04	29.38	24.87
Observed Average Seasonal Minimum Temperature	11.12	17.55	24.56	19.72	10.6	16.97	23.52	18.9	10.84	16.85	23.29	19.19	10.6	16.63	23.15	18.96
Observed Average Seasonal Maximum Temperature	23.06	30.33	36.88	31.7	22.3	29.48	35.63	30.46	22.77	29.8	35.85	31.04	22.35	29.5	35.66	30.83

In the **near term (2020–2039)**, the projected temperature increases range from +1.02°C to +2.09°C across all scenarios. SSP1-2.6, shows the lowest differences, while SSP5-8.5, characterized by high fossil fuel reliance, exhibits the largest increase.

In the **mid-term (2040–2059)**, temperature differences increase, ranging from +1.43°C to +2.95°C, with SSP5-8.5 showing the highest increases. This trend continues in the **mid-term (2060–2079)**, where differences range from +1.43°C to +4.51°C, with SSP5-8.5 showing rapid warming compared to SSP1-2.6, which remains the most controlled scenario.

By the **long-term (2080–2099)**, the temperature differences reach between +1.22°C and +4.51°C. SSP5-8.5 consistently records the largest increases across all periods representing high-emission trajectory and underscoring the critical need for mitigation strategies. In contrast, SSP1-2.6 demonstrates the smallest temperature increases.

Table 5-11: Differences between Projected Average Mean Surface Air Temperature and historical reference by SSP Scenario

Scenario	Near term, 2020–2039 (°C)	Mid-term, 2040–2059 (°C)	Mid-term, 2060–2079 (°C)	Long-term 2080 -2099 (°C)
SSP1-2.6	1.02–1.35	1.43–1.81	1.43–1.92	1.22–1.92
SSP2-4.5	1.07–1.64	1.66–2.07	1.66–2.90	1.82–2.90
SSP3-7.0	1.04–1.67	1.84–2.32	1.84–3.71	2.22–3.71
SSP5-8.5	1.14–2.09	2.18–2.95	2.18–4.51	2.92–4.51

The most extreme scenario predicts a temperature rise of 2.18–2.95 to degrees Celsius above pre-industrial levels between 2040 and 2059 and it could reach 4.51 between 2080-2099. Such a scenario could result in irreversible impacts, accompanied by a significant increase in critical extreme events such as floods, droughts, heatwaves, and hurricanes on both global and regional scales.

Rising temperature is considered as one of the main climate hazards in the project area leading to prolonged exposure to extreme heat. According to Think Hazard, the weather in Ras Gharib is at risk of prolonged exposure to extreme heat, that could possibly result in heat stress. Such events are expected to occur at least once in the next five years.[4] In addition, this was confirmed by the projections on the world bank climate change knowledge portal as demonstrated.

More specifically, rising temperatures and extreme heat can result in heat stress to workers as well as damage or interruption of machinery. Prolonged exposure to high temperatures can lead to dehydration, heat exhaustion, and may pose significant occupational health and safety risks. Additionally, excessive heat can impact the efficiency and functionality of machinery, leading to operational disruptions, increased maintenance costs, and potential downtime. Given the expected increase in rising temperatures, the impacts are expected to be of high significance.

5.5.2 Wind

Under the RCP 8.5 scenario, wind speed projections for Egypt show varied trends. While some areas, like the northern coastal zone, are expected to experience a decline in wind speed, the Gulf of Suez is projected to have a slight increase in wind speed. Despite this increase, the overall change in wind speed across Egypt is expected to remain marginal, with relative variations within ±5% by 2065 compared to the baseline period of 1970–2005.

[4] https://thinkhazard.org/en/

In terms of wind energy potential, the Gulf of Suez is one of the regions with relatively high current potential, with wind speeds exceeding 4 m/s. However, according to some study projections, areas in the Gulf of Suez with wind energy potential above 50 W/m² may experience a decrease of approximately 2.5% by 2065 under the same scenario.

For the project duration until 2050, the following key points apply:

- **Wind Speed Stability**: Changes in wind speed are projected to remain within ±5% relative to the baseline (1970–2005). For the Gulf of Suez, wind conditions conducive to energy generation are likely to persist.
- **Wind Energy Potential**: The wind energy potential in areas with high current capacity (e.g., the Gulf of Suez) shows minimal decline, with decreases less significant than those projected for 2065. Specifically, the Gulf of Suez is less likely to see major disruptions in wind energy output during the project duration.

Windstorms may pose risks to worker safety and structural stability. During high wind conditions, wind turbines may experience potential instability or shutdown, affecting energy production and efficiency. Additionally, OHTL are highly vulnerable to strong winds, with potential risks of damage, dewiring, and service interruptions. Strong winds can also create hazardous working conditions, increasing the risk of accidents, falling objects, and worker injuries, particularly for those engaged in elevated tasks such as turbine maintenance or transmission line repairs. However given that wind conditions are not expected to change significantly, such impacts are considered to be of low significance.

5.5.3 Cyclones

Ras Ghareb, situated along the Egyptian Red Sea coast, falls within the broader climatic and oceanic influence of the Indian Ocean and the Egyptian Exclusive Economic Zone (EEZ). While the Indian Ocean basin has a well-documented history of cyclonic activity, historical analyses indicate no recorded occurrences of major cyclones within the Egyptian EEZ. However, given the regional atmospheric and oceanic patterns, any residual effects of cyclones from the Indian Ocean, such as changes in wind patterns, storm surges, or indirect weather disturbances, does however, have some minor implications for Ras Ghareb's coastal conditions.

This trend is further reflected in the simulated data on cyclone frequency and intensity across different regions. The chart below illustrates the relative frequency of various cyclone categories globally, within the Indian Ocean, the Egyptian EEZ, and Egypt's landfall regions from 1951 to 2014. Within Egypt's EEZ, all recorded storms fall under the Tropical Storm category (100%), indicating that higher-intensity cyclones (Categories 1–5) do not occur in this zone. For Egypt's landfall regions, 96.53% of recorded storms remain as Tropical Storms, with only a small fraction (3.47%) classified as Category 1 cyclones. No cyclones of Categories 2–5 make landfall in Egypt.

In contrast, the Indian Ocean and global data reveal a significantly higher occurrence of intense storms, particularly in the Indian Ocean, where stronger cyclones are more frequent. This indicates that as storms approach Egypt, they tend to weaken significantly, with only tropical storms and occasional Category 1 cyclones reaching landfall. This aligns with the broader pattern of cyclone intensity diminishing as storms move from the open ocean towards land, reinforcing the relative protection of Ras Ghareb from severe cyclonic impacts.

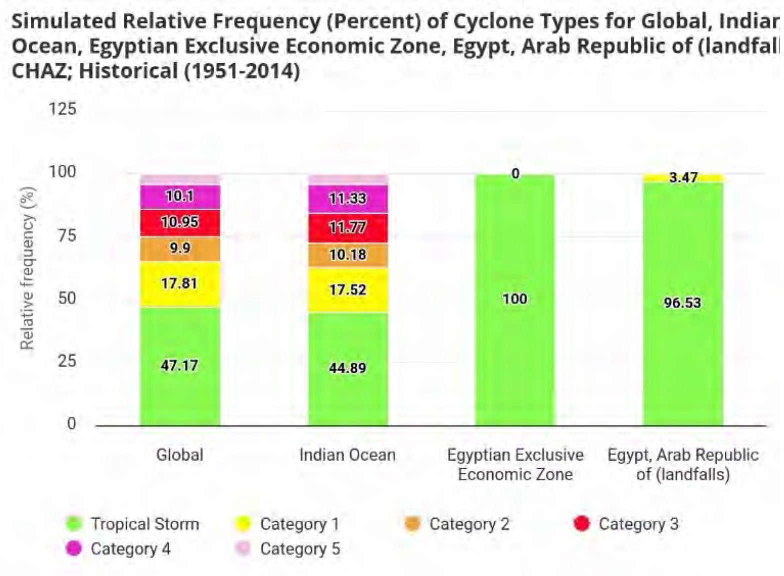


Figure 5-44: Simulated annual time series of cyclone counts in the Indian Ocean for the period 1951–2014

Given that are no major cyclones expected in the project area, there are no significant impacts related to cyclones.

5.5.4 Flash Floods

This section is a summary from the Detailed Risk Assessment Report. A flash flood is defined as a rapidly 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 storm, especially when high-intensity rain falls on steep slopes with shallow, impermeable soil, exposed rocks and poor or sparse vegetation cover (Lin, 1999).

In recent years, flash floods became more frequent, causing life losses and significant damages in Egypt. Destructive flash flood frequently occurred in Egypt between 1972 and 2016.

Table 5-12: Historical records of flash floods along the coastal areas of the Red Sea

Date	Area	Recorded damages & References
Oct. 2016	**Ras Ghareb**	**Local Authorities**
Feb. 2015	**Sinai, Red Sea region**	**Road Damages**
May. 2014	**Zafarana, G. Zeit, Taba, Sohag, Aswan, Kom Ombo Safaga**	**Dam Failure at Sohag, Road Damaged**
2013	**South Sinai**	**Two Deaths, Road Damaged**
2012	**W. Dahab , Catherine area**	**Dam Failure, Destroyed Houses**
17-18 Jan. 2010	**Along the Red Sea**	**Water Resources Research Institute (WRRI)**
Oct. 2004	**W. Watier**	**Road Damaged**
May 1997	**Safaga and El Qusier**	**- Information and Decision Support -- - Center 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, Sohag, Qena, Safaga, El-Qusier**	
Aug. 1991	**Marsa Alam**	**- Reports of Red Sea Governorate, 1994.** **- Red Sea Environmental Profile, 2008**
20 Oct. 1990	**Wadi El Gemal between Marsa Alam and Shalateen**	
23 Oct. 1979	**Marsa Alam and El Quseir**	
Jan. 1988	**W. Sudr**	**5 Deaths**
Oct. 1987	**South Sinai**	**1 Death, Roads Damaged**
May., Oct. 1979	**Aswan, Kom Ombo, Idfu, Assiut, Marsa Alam, El-Qusier**	**23 Deaths. Demolished Houses**
Feb. 1975	**W. El-Arish**	**20 Deaths, Road Problems**
1972	**Giza**	**Houses, Roads and Farms Damaged**

The area of Wadi Dara did not receive any heavy rainfall during October 26–27, 2016 while Ras Ghareb city which is at 35 km north of the sites was severely damaged due to flash flooding.

Figure 5-45: Damaged caused by flooding in Ras Ghareb, October 2016

The intensity and distribution of damage caused by flooding in the study area were controlled by geologic, geomorphologic characteristics prevailed throughout the area. Also, huge amounts of precipitation in short time with uncontrolled and unplanned development increase the impact of the flood. The results indicate the presence of two drainage basins threatening Ghareb area with high possibility of flooding. Accordingly, establishing flood channel around the city, about 38 km long, is vital to protect the city from flood hazards in the future.

Youssef and Hegab (2005) utilized GIS and statistical analysis to develop a database management system for assessing flood hazards in the Ras Ghareb area. Their study identified nine drainage basins, two of which—Wadi Abu Had and Wadi El Darb—pose a threat to areas located north of the project site (Figure 17). Using the hazard degree approach proposed by El Shamy (1992b) and GIS modeling, they created a flood hazard and vulnerability map for the region.

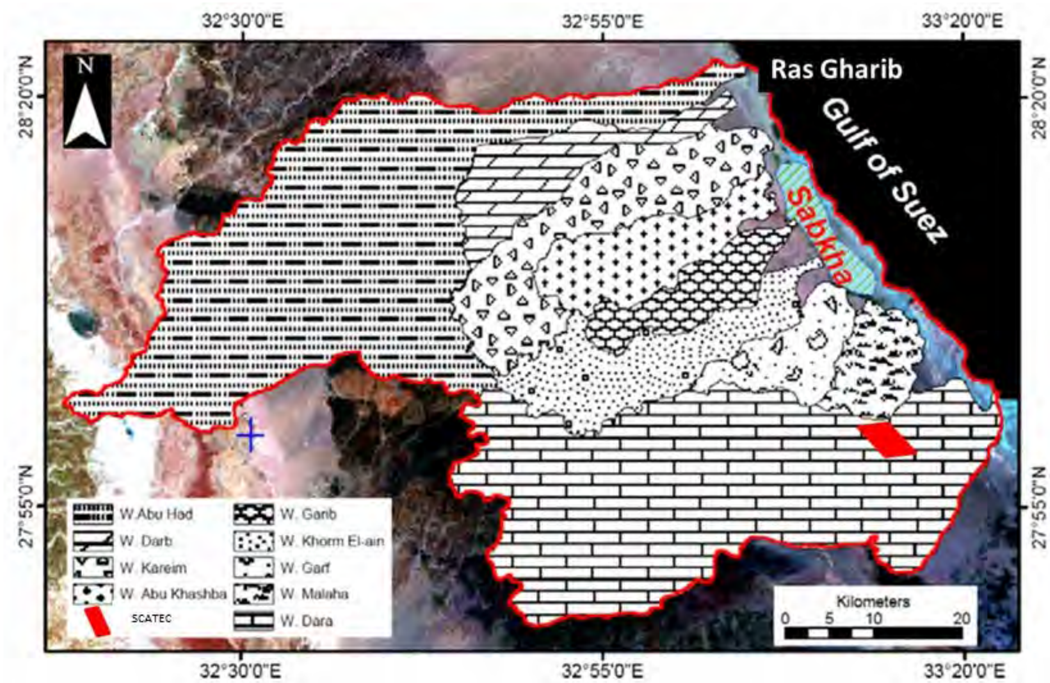


Figure 5-46: The drainage basins delineated in the area. Note that the project site lies within the basin of Wadi Dara. (Modified after Youssef and Hegab 2005).

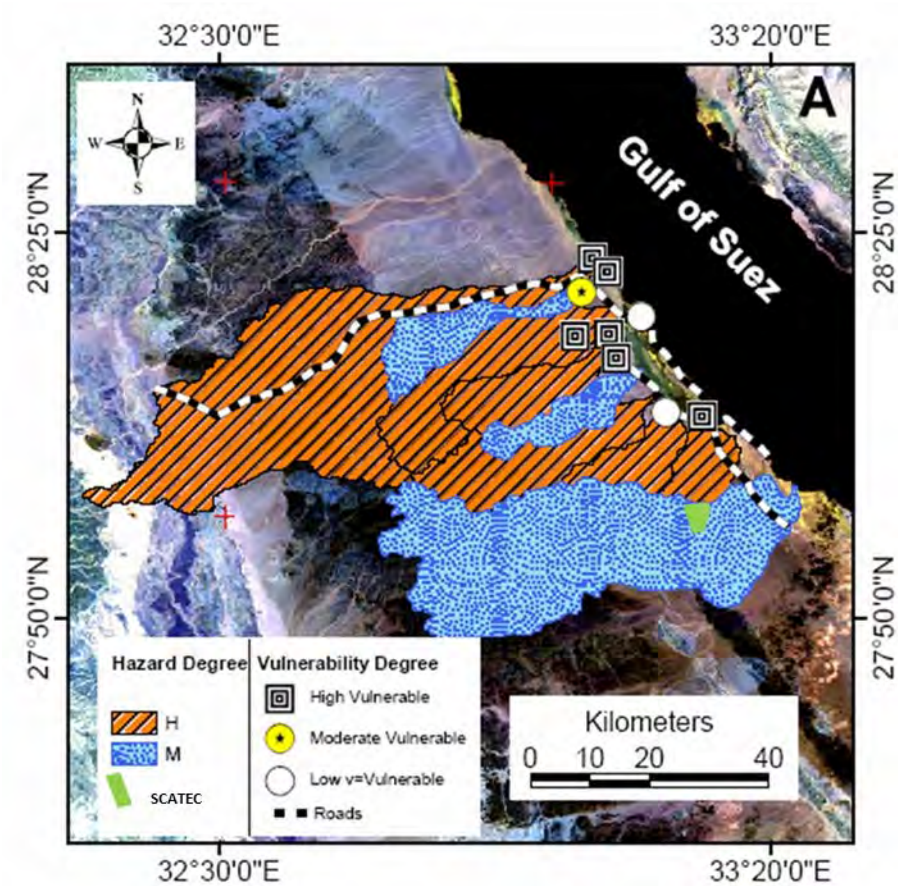


Figure 5-47: Drainage basins hazard and Vulnerability map of the area. The expected degree of flash flood hazard in the site is medium. After, (Youssef and Hegab 2005).

Elnazer et al. (2017) utilized GIS tools to study flash flood hazards impacting Ras Ghareb city. Their findings indicated that during periods of intense rainfall, Ras Ghareb faced significant flood risks from Wadi Abu Had and Wadi Al Darb, with the former affecting the city center and the latter impacting the southern part of the town (Figure 17). To mitigate flood impacts, they proposed constructing a 38 km-long channel directed north of the city (Figure 19). Additionally, Wadi Malaha and Wadi Garf were identified as having high flash flood hazards but low vulnerability, likely due to their small watersheds and drainage into a salt marsh (sabkha) with no residential activities. In contrast, Wadi Dara exhibited a medium flash flood hazard level but without associated vulnerability (Figure 5-465-41).

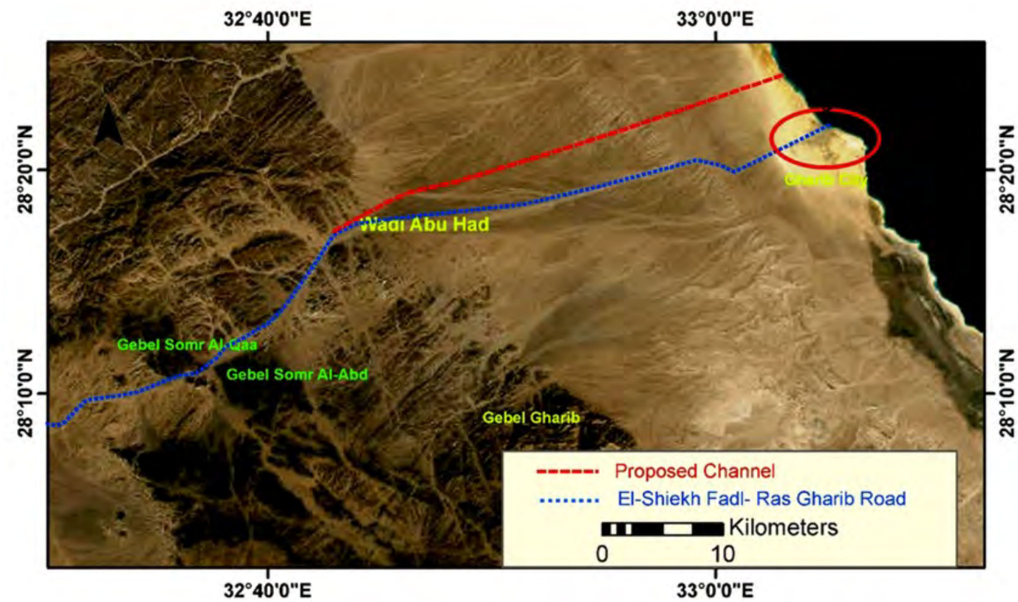


Figure 5-48: Proposed flash flood channel location in the study area. (After Alnazer et al., 2017)

5.5.5 Seismicity

The project area is situated within a structurally complex and tectonically active region influenced by the geodynamics of the Gulf of Suez Rift System. This area has been subject to extensive faulting and tectonic activity, primarily driven by the rifting processes that separate the African and Arabian plates. The geophysical characteristics of the region indicate significant crustal movements, with faulting patterns that align with major regional tectonic trends.

The fault systems affecting the area are primarily categorized into four dominant trends (examples shown in the figures below):

- NW-SE – This is the most prominent fault orientation and aligns with the dominant rift direction of the Gulf of Suez. It is associated with normal faulting and block faulting, creating horsts (uplifted blocks) and grabens (down-dropped blocks).
- NE-SW – These faults are believed to be related to the Red Sea and Gulf of Aqaba transform system, indicating lateral movements and complex structural interactions.
- E-W – This set of faults is less dominant but plays a role in regional tectonic deformation, likely influenced by far-field stresses from the African-Eurasian plate interactions.
- N-S – These structures are associated with deeper crustal movements and reflect the broader rifting mechanics of the East African Rift System.

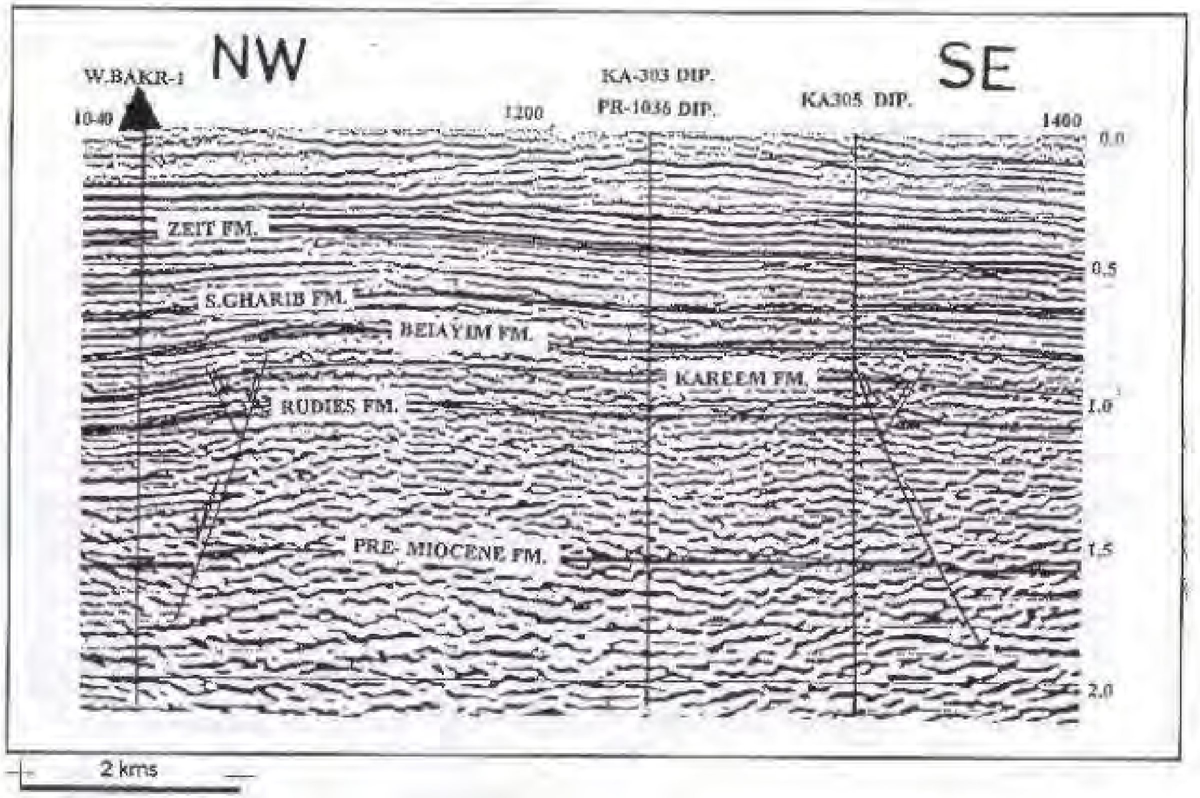


Figure 5-49: Example of NW-SE trending seismic records[5]

[5] A GEOPHYSICAL STUDY ON RAS GHARIB AREA- GULF Of SUEZ-EGYPT, WITH EMPHASIS ON ITS SUBSURFACE STRUCTURE, 1998

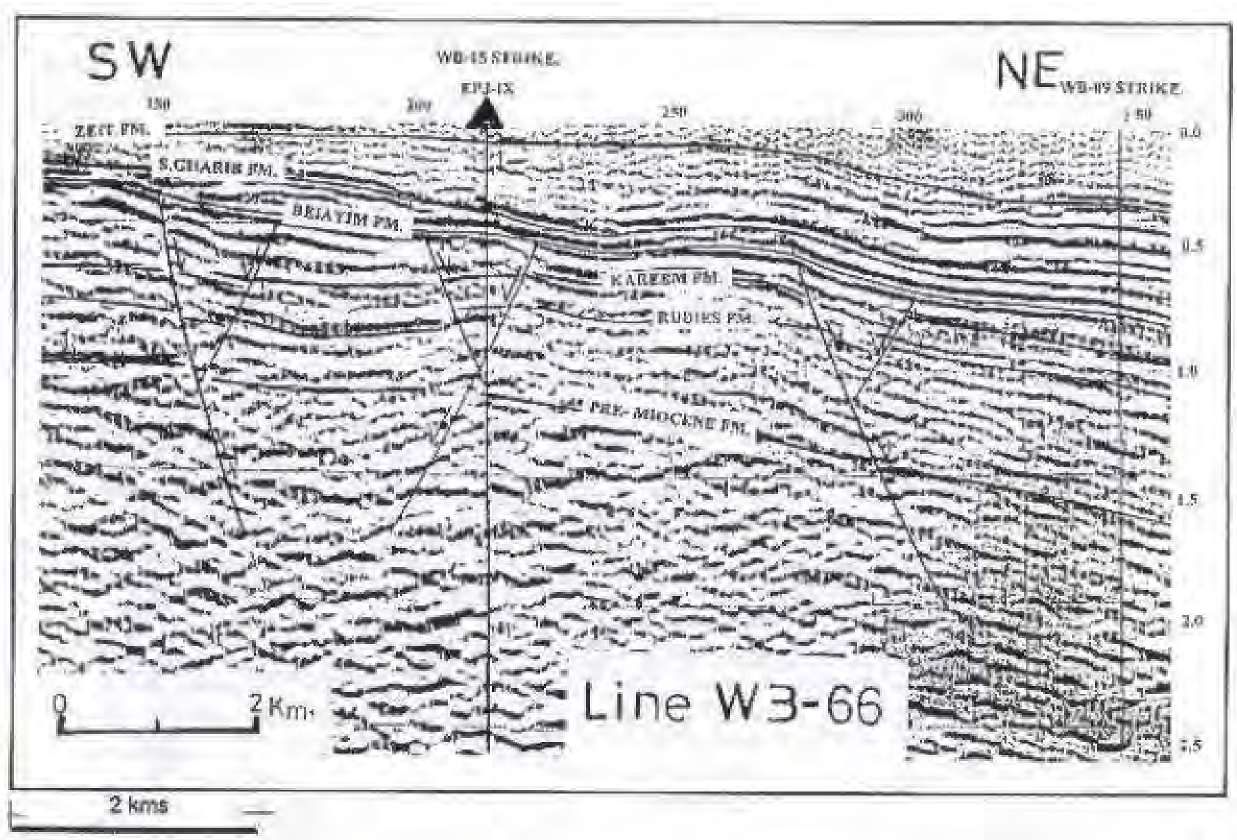


Figure 5-50: Example of NE-SW trending seismic records[6]

[6] A GEOPHYSICAL STUDY ON RAS GHARIB AREA- GULF Of SUEZ-EGYPT, WITH EMPHASIS ON ITS SUBSURFACE STRUCTURE, 1998

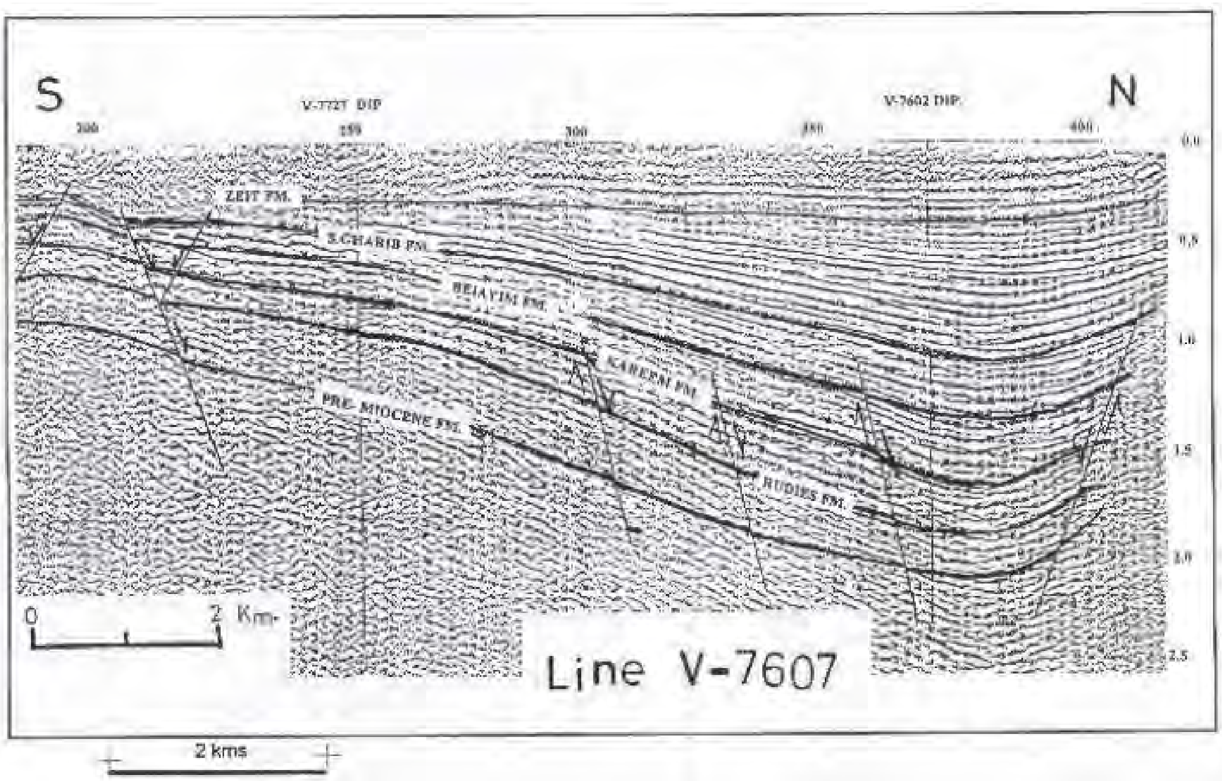


Figure 5-51:Example of N-S trending seismic records[7]

Seismic studies and geophysical data, including gravity, aeromagnetic, and seismic reflection surveys, indicate that the depth to the Precambrian basement complex varies ranging from 1.2 km to 3.6 km in Ras Ghareb. The sedimentary cover, which includes formations from the Pre-Miocene to the Upper Miocene, is structurally controlled by faulting, leading to variations in rock density and mechanical properties. These structural complexities influence seismic wave propagation and ground stability in the area. The region has been subject to multiple phases of tectonic deformation, with evidence of fault rejuvenation and reactivation over geological time. A faulting pattern can be observed in seismic data suggesting that some faults may still be active, contributing to localized seismicity. Structural traps formed by faulted blocks are also prominent, indicating past and ongoing tectonic stress regimes.

In recent decades, Ras Ghareb has experienced relatively moderate seismic activity, with no destructive earthquakes striking the area directly. Small quakes occur offshore or in surrounding areas and are often only lightly felt. For instance, on June 1, 2013, a M 4.7 earthquake struck about 15 km ENE of Ras Gharib. It originated at ~22 km depth and was felt by residents (reports from 21 people), but caused no damage – a typical outcome for a quake of that size. Similarly, in the past few years there have been occasional tremors in the low- to mid-4 magnitude range around the region. Over 50

[7] A GEOPHYSICAL STUDY ON RAS GHARIB AREA- GULF Of SUEZ-EGYPT, WITH EMPHASIS ON ITS SUBSURFACE STRUCTURE, 1998

earthquakes (up to M 4.7) occurred within ~100 km of Ras Gharib from 2021 through mid-2023. Nearly all of these were minor, with only two events above magnitude 4 and a few in the 3–4 range. The most notable seismic effects in recent years have been minor and localized. For example, in July 2014 a pair of magnitude ~4.1–4.2 quakes hit near the northern Gulf of Suez (closer to Suez City), and in December 2022 a M 5.0 earthquake in South Sinai (east of the Gulf) was recorded.

Seismic hazard studies consistently show that the Red Sea coastal region of Egypt has a higher hazard level compared to the interior. In fact, seismic hazard in Egypt is highest at the southern end of the Gulf of Suez and northern Red Sea (as well as the Sinai's Aqaba gulf). Being along the Gulf, Ras Ghareb faces a moderate seismic hazard. Global models (like GSHAP) predict Peak Ground Acceleration (PGA) values that are higher in the area than in Cairo or the Nile Valley on the order of a few **%g** (a few tenths of gravity) for a 10% probability of exceedance in 50 years. This is due to active rift faults nearby.

5.6 Biodiversity

5.6.1 Ecological Impact Assessment Methodology

(i) Ecological Area of Influence

The Ecological Area of Influence (AoI) was determined to include the areas directly and permanently affected by the Project and areas which will be temporarily affected during construction as follows:

- Project Area which encompasses the whole of the Wind Farm territory and at least 500m buffer around the proposed turbines.
- Access Road from the nearest surfaced road to the Project site (yet to be confirmed)
- Internal site roads, internal MV buried transmission lines and communication (yet to be confirmed)
- Internal site facilities including permanent structures such as site offices, sub-stations as well as temporary laydown areas and site worker accommodation (yet to be confirmed).
- The total AoI is currently 52 km^2

The assessment of impacts on valued ecological receptors follows the methodology as set out in Chapter 2.10 of this ESIA. The sensitivity of the identified valued ecological receptors has been determined by the parameters as set out in Table 5-13.

Table 5-13: Criteria for Determining the Sensitivity of Valued Ecological Receptors

Conservation Value (Sensitivity)	Species Criteria	Habitat or Site Criteria
High	IUCN Critically endangered, endangered and Significant populations of vulnerable species. Egypt Red Book Critically Endangered or Endangered species Nationally protected species of significant population size and importance. Local endemic flora species Bird species with elevated conservation concern; species with declining local population; breeding residents.	Internationally designated sites (or equal status). Nationally designated sites (or equal status). Critical habitats of significant international or national ecological importance.
Medium	IUCN Vulnerable or Near Threatened species. Nationally protected species or rare species, but not a significant population size and not of national importance. Regional endemic flora species	Regionally important natural habitats. Priority habitats listed under Annex I of the Habitats Directive. Modified habitats with high biodiversity or under significant threat of loss within the region.
Low	IUCN Least Concern. Widespread species Non-breeding and non-resident bird species	Undesignated sites and habitats of natural habitats of some local biodiversity and cultural heritage interest. Modified habitats with limited ecological value. Other sites with little or no local biodiversity and cultural interest. Modified habitats with limited biodiversity value.
Negligible	Species of no national importance / no relevance to the site	Highly modified habitats of no biodiversity value.

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

5.6.2 Desktop Review

The location of Protected Areas within 50 km of the site boundary were taken from a range of sources including, but not limited to, Protected Planet[8], IUCN[9], Birdlife Datazone IBA[10] and Key Biodiversity Areas[11]. The results of the search are as follows:

- Protected Areas
  - Gebel El Zeit KBA IBA
  - El Qa Plain KBA IBA

[8] https://www.protectedplanet.net
[9] https://www.iucnredlist.org
[10] https://datazone.birdlife.org
[11] https://www.keybiodiversityareas.org

    - Hurgarda Archipelago KBA IBA
    - Red Sea Islands
- Potential Protected Areas
    - Wadi Qena
    - Malahet Ras Shukeir
    - Shaieb El-Banat

Gebel EL Zeit IBA and KBA

Gebel El Zeit is designated as both an IBA and a KBA (with concurrent boundaries) and the project area lies within the protected site. The site consists of a narrow, 100 km long strip extending along the Gulf of Suez and Red Sea Coast. Gebel El Zeit is a mountain reaching 457 m while the IBA/KBA itself extends from Ras Gharib to the bay of Gubbet El Gemsa. Habitats include mountains, coastal plain, saline bays, intertidal mud, saltmarsh and small vegetated wadis.

IBA Designation

The Gebel El Zeit area is a very important migration corridor for soaring migrants, particularly birds of prey and storks. Because of the geography of the Gulf of Suez as a whole and the micro-geographic configuration of the Gebel El Zeit area, which is the narrowest point in the southern part of the Gulf of Suez, over 250,000 White Stork (Ciconia ciconia) and many other migrant soaring birds are funnelled through this stretch of coast on both spring and autumn migrations. Birds of prey, storks and pelicans migrate through and usually land, rest or roost near the coastline and on the surrounding desert plains and hills. Resting and roosting storks, especially, utilize the two bays of Ghubbet El Zeit and Ghubbet El Gemsa and the saltmarsh at Sabkhet Ras Shukheir.

Information on bird species which trigger the IBA Criteria is shown in the table below.

Table 5-14: Populations of IBA Trigger Species

Species		IUCN Category	Season	Year(s) of Estimate	Population at Site	IBA Criteria Triggered
Common Name	**Scientific Name**					
White-Eyed Gull	*Larus leucophthalmus*	LC	Non-breeding	1998	common	A1
Eastern Imperial Eagle	*Aquila heliaca*	VU	Passage	1992-1994	19 Individuals	A1
Pallid Harrier	*Circus macrourus*	NT	Passage	1992-1994	4 individuals	A1
Lesser Kestrel	*Falco naumanni*	LC	Passage	1998	Uncommon	A1
A4iv Species Group – Soaring birds/cranes	*n/a*	n/a	Passage	1989-1998	250,000 individuals	A4iv

In terms of other fauna there are seven species of sea grass in the bay of Ghubbet El Zeit forming one of the most diverse and extensive sea-grass beds in the northern Red Sea. These beds are potential feeding grounds for Dugong (*Dugong dugon*), an IUCN VU species, and endangered marine turtles.

KBA Designation

This site qualifies as a Key Biodiversity Area of international significance because it meets one or more previously established criteria and thresholds for identifying sites of biodiversity importance (including Important Bird and Biodiversity Areas, Alliance for Zero Extinction sites, and Key Biodiversity Areas).

Oil pollution from onshore and offshore oil facilities, as well as passing vessels is the most immediate threat to birds. It is recommended that development in this area is carried out with careful consideration of migratory birds. Information on bird species which trigger the KBA Criteria is shown in the table below.

Table 5-15: Populations of KBA Trigger Species

Taxonomic Group	Scientific name	Common name	IUCN Red List Category	KBA Criteria	Legacy Criteria
Birds	*Aquila heliaca*	Eastern Imperial Eagle	VU		Y
Birds	*Circus macrourus*	Pallid Harrier	NT		Y
Birds	*Falco naumanni*	Lesser Kestrel	LC		Y
Birds	*Larus leucophthalmus*	White-eyed Gull	VU		Y

El Qa Plain IBA and KBA

El Qa Plain lies approximately 35 km east from the project and is both designated as a IBA and KBA.

IBA Designation

El Qa Plain lies across the Gulf of Suez and consists of a wide plain that flanks the South Sinai Mountain massif on the west and separates it from the Gulf of Suez. The IBA is mostly concerned with the coastal portion of the plain, and extends from Wadi Feiran in the north to Ras Mohammed in the south, where migratory birds tend to concentrate and often land in vast numbers. The plain is dissected by many wadis that flow from the mountains of Sinai into the Gulf of Suez. To the north of El Tor a narrow mountain range separates the plain from the Gulf of Suez. This mountain, immediately overlooking the Gulf, is thought to be a very important departure point for many of the soaring birds that attempt to cross the Gulf of Suez in autumn. Sparse scrub vegetation and scattered Acacia trees cover sizeable sections of the plain. The town of El Tor is located within the area of concern and is the only major human settlement in the region.

Information on bird species which trigger the IBA Criteria is shown in the table below.

Table 5-16: Populations of IBA Trigger Species

Species		IUCN Category	Season	Year(s) of Estimate	Population at Site	IBA Criteria Triggered
Common Name	Scientific Name					
Eastern Imperial Eagle	*Aquila heliaca*	VU	Passage	1998	Present	A1
Pallid Harrier	*Circus macrourus*	NT	Passage	1998	Uncommon	A1
Lesser Kestrel	*Falco naumanni*	LC	Passage	1998	Uncommon	A1
A4iv Species Group – Soaring birds/cranes	*n/a*	n/a	Passage	1998	200,000 individuals	A4iv

The mammal fauna present within the IBA is limited to Dorcas Gazelle (*Gazella dorcus*) which is categorized as IUCN Vulnerable and is thought to be the largest remaining population of this species in Sinai.

KBA Designation

This site qualifies as a Key Biodiversity Area of international significance because it meets one or more previously established criteria and thresholds for identifying sites of biodiversity importance (including Important Bird and Biodiversity Areas, Alliance for Zero Extinction sites, and Key Biodiversity Areas).

Threat from tourism and development is the most immediate threat for this KBA, particularly for migratory birds in the Spring. Details on bird species which trigger the KBA are shown in the table below.

Table 5-17: Bird Species that Trigger KBA Designation

Taxonomic Group	Scientific name	Common name	IUCN Red List Category	KBA Criteria	Legacy Criteria
Birds	*Aquila heliaca*	Eastern Imperial Eagle	VU		Y
Birds	*Circus macrourus*	Pallid Harrier	NT		Y
Birds	*Falco naumanni*	Lesser Kestrel	LC		Y

Hurgarda Archipelago KBA IBA

IBA Designation

An archipelago of 22 uninhabited islands which lies 37km south of the project, plus a handful of very small islets, scattered from the Straits of Gubal (at the mouth of the Gulf of Suez) to Hurghada. Most are small or medium-sized and fairly flat coralline islands, such as Tawila and Ashrafi, but some are quite large and hilly. Shadwan is the largest of the Egyptian Red Sea islands, being c.56 km² in area and reaching some 300 m at its highest point. The area of the IBA includes adjacent marine waters.

The Hurghada Archipelago holds the largest known breeding population of White-eyed Gull (*Larus leucophthalmus)* in the world. A total of 6,500 adults was counted attending the sprawling Hurghada city rubbish-dump in May 1996. It is almost certain that all these birds breed on the Hurghada archipelago and, probably, represent only part of the local breeding population. The fact that all birds counted were adults in breeding plumage indicates that the total population of the area, if immatures and juveniles are accounted for, should be much larger than the previous estimate of 1,500–2,000 pairs. The current estimate made here for the Hurghada archipelago is of at least 3,000 breeding pairs, or a total population of some 10,000 birds. In addition, the Hurghada archipelago supports a considerable diversity of other breeding seabirds and waterbirds. At least 15 species are known to breed or to have bred: *Sula leucogaster, Phaethon aethereus, Butorides striatus, Egretta gularis, Platalea leucorodia, Pandion haliaetus, Falco concolor, Charadrius alexandrinus, Larus hemprichii, Sterna caspia, Sterna bergii, Sterna bengalensis, Sterna anaethetus* and *Sterna repressa.*

Table 5-18: IUCN Red List Categories

Species	Current IUCN Red List Category	Season	Year(s)	Population estimate at site	IBA criteria met
White-eyed Gull *Larus leucophthalmus*	LC	breeding	-	3,000 breeding pairs	A1, A4i
Caspian Tern *Hydroprogne caspia*	LC	breeding	-	200 breeding pairs	A4i
White-cheeked Tern *Sterna repressa*	LC	breeding	-	1,500 breeding pairs	A4i
Lesser Crested Tern *Thalasseus bengalensis*	LC	breeding	-	500 breeding pairs	A4i
Sooty Falcon *Falco concolor*	VU	breeding	-	44 breeding pairs	A4ii

KBA Designation

This site qualifies as a Key Biodiversity Area of international significance that meets the thresholds for at least one criterion described in the Global Standard for the Identification of KBAs. The islands south of 27°15 N are protected as part of the Elba National Park, declared by Prime Ministerial Decree 450/1986, adjusted by Prime Ministerial Decree 1186/1986 and Prime Ministerial Decree 642/1995. Islands further north are not protected, but are proposed for protection. Species triggering the KBA designation are shown the Table 5-185-15 below.

Table 5-19: KBA Triggering Species

Taxonomic Group	Scientific name	Common name	IUCN Red List Category	KBA Criteria	Legacy Criteria
Birds	*Falco concolor*	Sooty Falcon	VU	A1b, D1a	Y
Birds	*Larus leucophthalmus*	White-eyed Gull	VU	B1, D1a	Y
Birds	*Sterna bengalensis*	Lesser Crested Tern	LC		Y
Birds	*Sterna caspia*	Caspian Tern	LC		Y
Birds	*Sterna repressa*	White-cheeked Tern	LC		Y

Red Sea Islands

The Red Sea Islands has been a Marine Protected Area and Developing Resources Protection Area since 2006. It lies 30km south of the project and is designated on a national level. Its reported area is 1800.00 km². The reason for designation is not clear. The IUCN category of this site is not reported and accordingly it is assumed to be of lower importance than sites meeting criteria within lenders environmental standards.

Proposed Protected Areas

<u>Malahet Ras Shukeir</u>

Malahet Ras Shukeir has been a proposed Terrestrial and Inland Waters Protected Area since 1999. It lies 20km north of the project and is designated on a national level. Its reported area is 107.19 km². The reason for designation is not clear. The IUCN category of this site is not reported and accordingly it is assumed to be of lower importance than sites meeting criteria within lenders environmental standards.

<u>Wadi Qena</u>

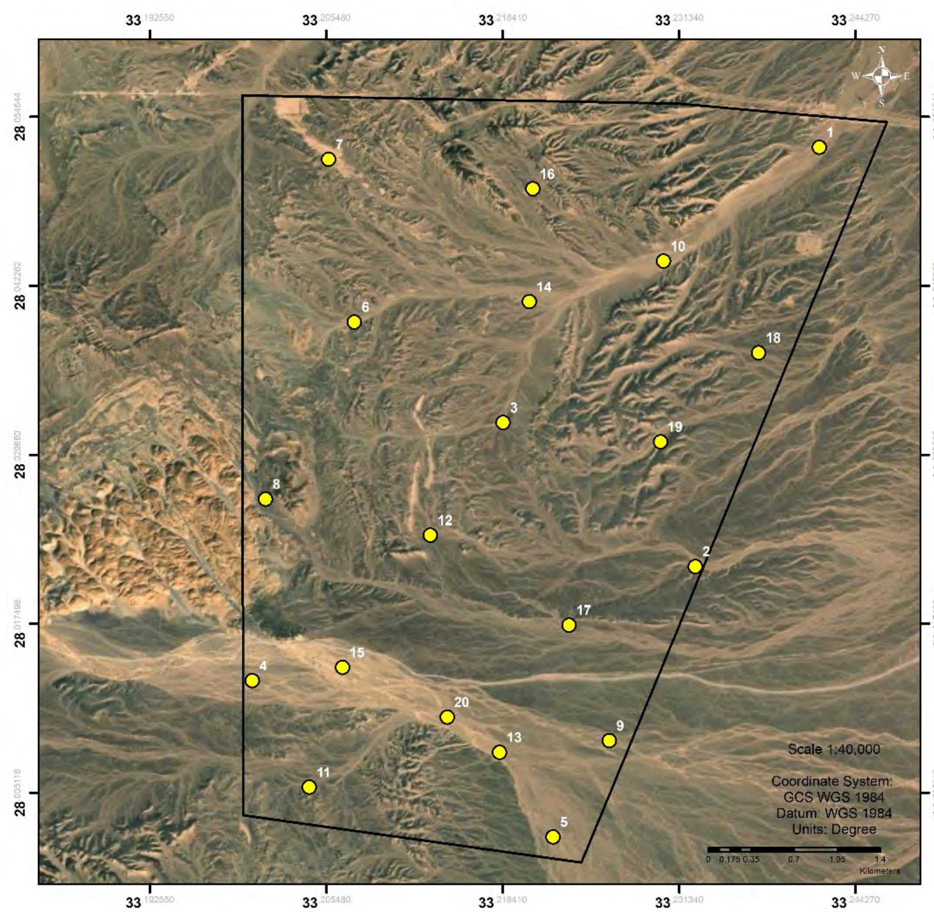
Wadi Qena has been a proposed Terrestrial and Inland Waters Protected Area since 1999. It is 40km west of the project and is designated on a national level. Its reported area is 8006.56 km². The reason for designation is not clear. The IUCN category of this site is not reported and accordingly it is assumed to be of lower importance than sites meeting criteria within lenders environmental standards.

5.6.3 Field Survey

A field survey was undertaken at the Project site during the spring and autumn 2022. Since the autumn season is not the most favorable season for assessing habitats and floral and faunal elements (as opposed to spring), the focus of the field survey during the autumn period was mainly to identify key habitats and identify any outstanding biodiversity taxa and/or elements that could require specific focus, with detailed information gathered during spring. The survey was carried out through visits in April and May 2022, each visit comprising 4 to 5 days, by an environmental experts' team, and was implemented by a team composed of 4 biodiversity experts who carried out day-to-day field surveys.

A standard Sampling method was applied over the whole study region equally in a random influence balanced strategy. Sampling was allocated in proportion with a total effort of 20 sampling points (Figure 5-52) that were distributed in a random way to cover the whole area of the study, bearing in mind a minimum influence area of 1 Km to avoid double sampling. Stratification was not applied as the area was small enough to be considered homogenous on both ecological and topological scales. The same sampling sites were used to collect data for the Flora and Fauna species. Further details of sampling for each particular taxa are detailed below.

Due to the large size of the study area. A combination of different methods was applied to survey the study area to obtain the required data about existing habitats, fauna, and flora of the study area. Habitats of the study area were explored along with their associated biodiversity.



SCATEC 202.5 MW WF

Biodiversity Sampling Design

BD Sampling Design
SCATEC Boundary

Sample Sites Coordinates		
ID	Latitude	Longitude
1	28.052423	33.241628
2	28.021675	33.23254
3	28.032234	33.218441
4	28.01331	33.200054
5	28.001869	33.222102
6	28.039602	33.207545
7	28.051531	33.205645
8	28.026634	33.201023
9	28.008925	33.226226
10	28.044066	33.230205
11	28.005503	33.204247
12	28.02398	33.213117
13	28.008059	33.218187
14	28.041098	33.220369
15	28.014296	33.206668
16	28.049366	33.220621
17	28.017394	33.223283
18	28.037345	33.237186
19	28.030819	33.229987
20	28.010638	33.214348

Safe Soar
Dr. A.Abdallah

Figure 5-53: Sampling Design and Site Influence Area

5.6.4 Habitats and Flora

(ii) Methodology

Walking and driven transects as well as active searching methods were conducted to obtain the required data about existing habitats. Photographic documentation for habitats were applied when possible. Particular attention was drawn to habitats that potentially support species of conservation interest such as protected and threatened species and any invasive species that may have been present in the area.

A flora survey was conducted from the specified sampling point as shown in Figure 5-54 where the experts will survey the section as 10 m X 10m to record the species and abundance of each species present in the quadrates using the data sheet.

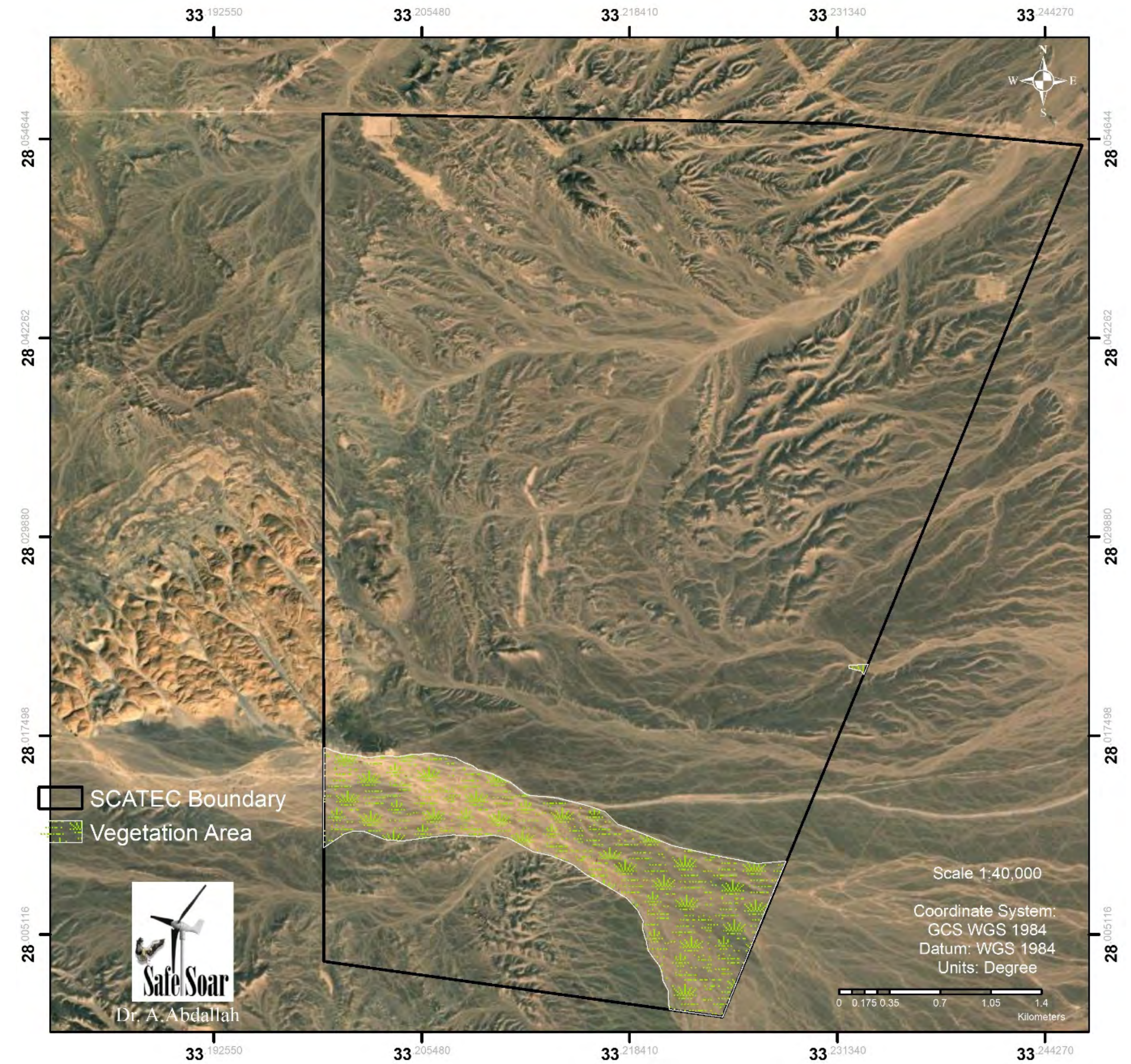


Figure 5-55: Distribution of Flourish and Dry Plants in the Study Area

(iii) Fauna and Flora Species status

All species recorded as part of the literature review and 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 taxa, the regional assessments of the Mediterranean region and North African region were reviewed for any species that could be of conservation value on the regional level.

(iv) Results

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

Vegetation cover in the Project area was found to be extremely sparse and mostly restricted to wadis. 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.

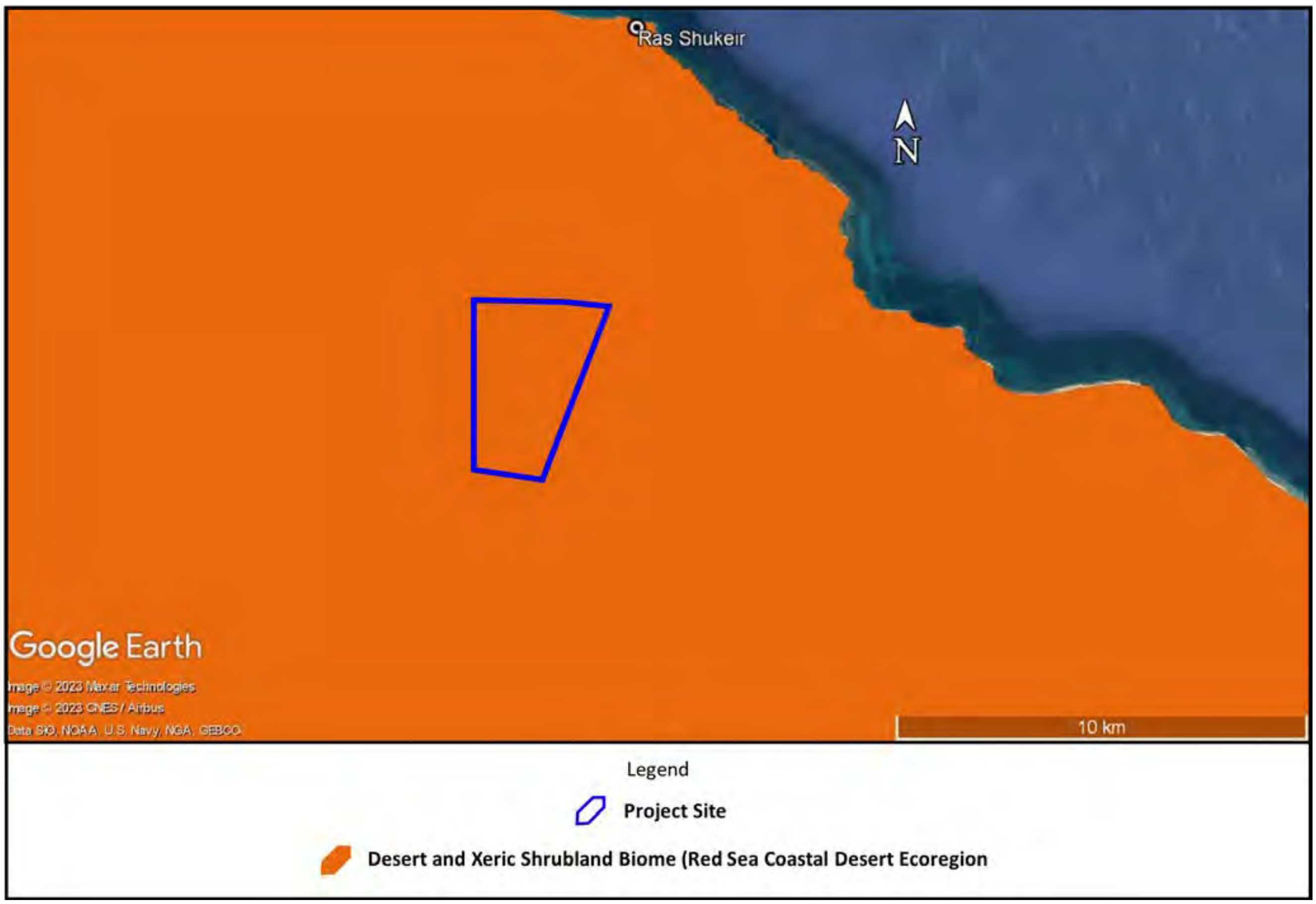


Figure 5-56: Location of Project in Reference to Ecoregions of the World (TEOW)

According to literature review of the flora recorded along the coastal desert of the Red Sea, a total of 69 species were recorded in the Project site and its vicinity (Abd El-Ghani et al, 2014) as noted in the table below. During the field survey, which was carried out in spring and considered the most suitable season to undertake a floral survey, only 5 species (highlighted in blue below) were recorded. Out of the 69 species documented to be recorded in the Project area and its vicinity, only 7 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. No invasive plant species were noted during the survey effort.

Table 5-20: List of Plant Species Recorded from Field Survey (highlighted) and Literature Review

Family	Scientific name	IUCN Red List of Threatened Species (2019)
Ephedraceae	*Ephedra aphylla* Forssk.	Least Concern
Amaranthaceae	*Aerva javanica* (Burm. f.) Juss. ex Schult.	Not Evaluated
	Amaranthus viridis L.	Not Evaluated
Apocynaceae	*Calotropis procera* (Aiton) W.T. Aiton	Not Evaluated
	Leptadenia pyrotechnica (Forssk.) Decne	Not Evaluated
	Pergularia tomentosa L.	Not Evaluated
Asteraceae	*Artemisia judaica* L.	Not Evaluated
	Centaurea calcitrapa L.	Not Evaluated
	Centaurea scoparia Sieber ex Spreng.	Not Evaluated
	Cotula cinerea Delile	Not Evaluated
	Echinops spinosus L.	Not Evaluated
	Ifloga spicata (Forssk.) Sch. Bip.	Not Evaluated
	Iphiona mucronata (Forssk.) Asch. etSchweinf.	Not Evaluated
	Launaea spinosa (Forssk.) Sch. Bip. exKuntze	Not Evaluated
	Limbarda crithmoides (L.) Dumort.	Not Evaluated
	Pluchea dioscoridis (L.) DC.	Least Concern
	Pulicaria incisa (Lam.) DC.	Not Evaluated
	Pulicaria undulata (L.) C.A. Mey.	Not Evaluated
	Reichardia tingitana (L.) Roth	Not Evaluated
	Senecio glaucus L.	Not Evaluated
	Sonchus oleraceus L.	Not Evaluated
Boraginaceae	*Heliotropium bacciferum* Forssk.	Not Evaluated
	Trichodesma africanum (L.) R. Br.	Not Evaluated
Brassicaceae	*Diplotaxis harra* (Forssk.) Boiss.	Least Concern (Europe)
	Farsetia aegyptia Turra	Not Evaluated
	Matthiola longipetala (Vent.) DC.	Not Evaluated
	Zilla spinosa (L.) Prantl	Not Evaluated
Capparaceae	*Capparis spinosa* L.	Not Evaluated
Caryophyllaceae	*Polycarpaea robbairea* (Kuntze) Greuter & Burdet	Not Evaluated
Chenopodiaceae	*Anabasis articulata* (Forssk.) Moq.	Not Evaluated
	Arthrocnemum macrostachyum (Moric.) K. Koch	Not Evaluated
	Atriplex halimus L.	Not Evaluated
	Chenopodium album L.	Not Evaluated
	Halocnemum strobilaceum (Pall.) M.Bieb.	Not Evaluated
	Halopeplis perfoliata (Forssk.) Bunge exAsch.	Not Evaluated
	Haloxylon salicornicum (Moq.) Bunge exBoiss.	Not Evaluated
	Salsola imbricata Forssk.	Not Evaluated
	Suaeda monoica Forssk. ex J.F. Gmel.	Not Evaluated

Family	Scientific name	IUCN Red List of Threatened Species (2019)
Cleomaceae	*Cleome amblyocarpa* Barratte &Murb.	Not Evaluated
	Cleome droserifolia (Forssk.) Delile	Not Evaluated
Convolvulaceae	*Convolvulus hystrix* Vahl	Not Evaluated
Euphorbiaceae	*Ricinus communis* L.	Not Evaluated
Fabaceae	*Acacia seyal* Delile	Not Evaluated
	Acacia tortilis (Forssk.) Hayne	Not Evaluated
	Alhagi graecorum Boiss.	Not Evaluated
	Lotus hebranicus Hochst. ex Brand	Not Evaluated
Fabaceae (cont.)	*Taverniera aegyptiaca* Boiss.	Not Evaluated
Frankeniaceae	*Frankenia hirsuta* L.	Not Evaluated
Geraniaceae	*Erodium glaucophyllum* (L.) L'Hér.	Not Evaluated
Juncaceae	*Juncus rigidus* Desf.	Not Evaluated
Nitrariaceae	*Nitraria retusa* (Forssk.) Asch.	Not Evaluated
Orobanchaceae	*Cistanche phelypaea* (L.) Cout.	Not Evaluated
Poaceae	*Pennisetum setaceum* (Forssk.) Chiov.	Least Concern
	Phragmites australis (Cav.) Trin. exSteud.	Least Concern
Polygonaceae	*Calligonum polygonoides* L.	Not Evaluated
Resedaceae	*Ochradenus baccatus* Delile	Not Evaluated
	Reseda pruinosa Delile	Not Evaluated
Salvadoraceae	*Salvadora persica L.*	Least Concern
Solanaceae	*Hyoscyamus muticus* L.	Not Evaluated
Tamaricaceae	*Reaumuria hirtella* Jaub. & Spach	Not Evaluated
	Tamarix nilotica (Ehrenb.) Bunge	Least Concern
	Tamarix tetragyna Ehrenb.	Not Evaluated
Urticaceae	*Forsskaolea tenacissima* L.	Not Evaluated
Zygophyllaceae	*Fagonia arabica* L.	Not Evaluated
	Fagonia bruguieri DC.	Not Evaluated
	Fagonia mollis Delile	Not Evaluated
	Zygophyllum album L.f.	Not Evaluated
	Zygophyllum coccineum L.	Not Evaluated
	Zygophyllum simplex L.	Not Evaluated

Figure 5-57: Ochradenus Baccatus Plant Recorded in the Study Area.

Figure 5-58: Erodium Glaucophyllum and Zygophyllum Album Plants Recorded in the Study Area.

Figure 5-59: Salvadora Plant Recorded in the Study Area.

5.6.5 Mammals (Excluding bats)

(i) Methodology

The field survey mainly included field observations, where the site was examined carefully for the presence of active animals, animal signs and tracts, active burrows, remains or any other vital signs that indicate the activity of animals. Due to the large size of the study area, it was not possible to cover the entire area in detail. A combination of different methods was applied to survey the study area. Walked and driven transects as well as active searching methods were conducted to obtain the required data about the study area. Habitats of the study area were explored along with their associated biodiversity. The presence of the faunal species was confirmed by direct observation or other associated signs such as tracks, dens, and droppings. Photographic documentation for habitats, species and their signs were applied when was possible. The survey was conducted as follows:

- **Mammalian Species Survey:** Large, medium-sized and small mammals were surveyed adopting different methods include active search, track stations, live trapping (small mammals), and Line transects.
- **Track stations:** Several track stations were created in the expected foraging sites and the tracked passages for mammals. Every track station covered an area of $3m^2$, and any found old tracks and markings were recorded before being wiped off. In addition, added baits (canned salmon with a strong fishy odor used in the middle of each track station to attract scavenging mammals, especially large and medium-sized carnivores, to document and confirm the presence of the species using the recorded fresh tracks. The track stations were created and prepared before dusk to be checked on the next day's early morning to avoid any impact of anthropogenic activities.
- **Line transects:** transects in many areas of the project site of over 500m long, one in each cardinal direction (E, W, S. &N.) will be conducted to provide detailed assessment of fauna species. Observed species will be recorded and photographed as possible.
- **Active search:** during the active search, which were carried out all over the different parts of the area, animal signs such as markings, urine, faces, dens, tracks, trails, burrows, carcasses, remains of preys or even direct observation of mammals were recorded and documented, Live trapping of Small Mammals. Moreover, interviews with locals were also an effective approach to gather more information about the mammals inhabiting the study area.
- **Live trapping of Small Mammals:** Traps were randomly distributed within the study area to cover all habitat types. Baited Sherman traps in different sizes were installed and distributed within the project area, especially places found to have signs of high activity of small mammals. Traps were checked at a regular base to make sure the trapped animal did not last for a long time within the trap. No chemical substances were added to the traps to avoid the killing of trapped mammals. Baits were added to increase the efficiency of traps if found to be feasible. The trapped individuals were identified to the levels of the species, and all morphometric measurements were recorded before releasing the animal back into it original site where trapped.

(ii) Results

The specific outcomes of the faunal assessment are discussed below covering mammalian fauna (excluding bats).

Mammals distribution is linked in all cases to the distribution and density of vegetation cover. Most of the species are found in wadis where plants are spread, where they capable to search of food in the wadi's channels. Many other species inhabit the mountain slopes and rocky hills. The flat gravel plains harbor a limited number of species, and their presence is limited to streams in which there are plant gatherings.

Literature review has shown that 22 mammalian species recorded from this region of the Eastern Desert and the Project site (Hoath, 2004), Table 5-205-17. The list includes 22 species belonging to 7 families. Out of the 22 species listed, 19 are listed as Least Concern according to IUCN's Red List of Threatened Species while 2 are evaluated as Vulnerable; Nubian Ibex (*Capra nubiana*) and Egyptian Gazelle (*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.

The Nubian ibex, *Capra nubiana*, and the Egyptian gazelle, *Gazella dorcas*, are considered large herbivores that are still present in the broad area, but their presence is limited off site to isolated hills and rocky mountainous areas. These animals have suffered from a severe decrease in their numbers as a result of excessive hunting and human invasion of their desert habitats. The condition of the Nubian ibex is better, as it spreads in a vast area that covers the hills and rocky mountainous of the eastern desert.

During the study, only four rodents (*Gerbillus gerbillus, Acomys cahirinus, Meriones crassus and Jaculus jaculus*) were found in the vegetated sandy plains (Figure 5-545-46 & Figure 5-555-47), and red fox carcass *Vulpes vulpes* and carcass of sand fox *Vulpes rueppellii* were recorded near the Project site.

Table 5-21: List of Mammalian Species Recorded from Field Survey (highlighted) and Literature Review

Family	Scientific name	Common name	Global IUCN status
Erinaceidae	*Hemiechinus auratus*	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
	Sekeetamys calurus	Bushy-tailed Jird	Least Concern

Family	Scientific name	Common name	Global IUCN status
	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 vulpes	Red Fox	Least Concern
	Vulpes rueppellii	Ruppell's Fox	Least Concern
	Vulpes zerda	Fennec Fox	Least Concern
	Canis lupaster / Canis aureus	African wolf / Golden jackals	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

Figure 5-60: Meriones Crassus and Acomys Cahirinus Species Recorded Inside the Study Area

Figure 5-61: Gerbillus Gerbillus and Jaculus Jaculus Species Recorded Inside the Study Area

5.6.6 Herpetofauna

A. **<u>2022 Survey</u>**

(i) Methodology

Field studies were carried out according to generally accepted zoological methods for identifying species composition. No amphibian species are known to be present within the AoI. Three survey methods were undertaken for reptiles and these included:

- **Diurnal Active Searching** – thorough searches of suitable basking spots and resting places such as rocks, logs, within soil and leaf litter, soil cracks and holes. Areas surrounding trees and large shrubs were checked for snakes.
- **Nocturnal Searching** – torchlight surveys for primarily nocturnal species such as geckos and snakes.
- **Spiny-Tailed Lizard (Dabb Lizard)** ***Euromastix aygeptia***: Spiny Tailed Lizard are recognized as an IUCN Vulnerable species and therefore dedicated surveys were undertaken for this species along with general reptile surveys. These were deigned to not just be representative but to cover all individuals and burrows in the AOI.

(ii) Results

Reptiles are the most diverse groups of vertebrates at the Project site and consist mainly of traditional desert species. Due to the aridity of the area, no amphibian species are known to be present in the Project area. Reptile's animal group includes both lizards and snakes that are adapted to live in sandy and rocky desert environments. Additionally, according to Baha El Din (2006), there are 34 species of reptile that have been documented, or at least expected, to be present in the Project area and its vicinity (Table 5-215-18).

These species represent five families of lizards (23 species) and three families of snakes (11 species). Eleven of these species are evaluated as Least Concern while one species is evaluated as threatened (Vulnerable); *Uromastyx aegyptia*. The Egyptian Dabb lizard, *Uromastyx aegyptius*, is considered to be threatened with extinction in the medium term (Vulnerable). The greatest threat to this lizard comes from excessive commercial hunting. The Egyptian Dabb lizard has been recorded inside the Project site (2 individuals and 12 burrows) with further evidence recorded in the wider survey area as noted in Table 5-225-19 below.

From literature review, eleven species of snakes are recorded belonging to three families as follows: (i) seven types belong to the family Colubridae and which are among the most common snakes, and they are among the non-venomous snakes of Egypt, which are spread all over the country – only Schokari sand racer *Psammophis schokari* was recorded within the Project site; (ii) two snakes of the family Viperidae are represented in the northern region of the eastern desert by three types of venomous snakes, and where one of these species, *Cerastes cerastes*, was recorded within the Project site; (iii) the remaining two species (*Echis coloratus* and *Cerates vipera*) are the most dangerous Egyptian snakes, but they are generally rare in the eastern desert.

Table 5-22: Reptilian Species Known to Occur within the Project Study Area

Family	Scientific name	Common name	IUCN Red List of Threatened Species (2019)
Gekkonidae	*Cyrtopodion scabrum*	Keeled Rock 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
	Acanthodactylus scutellatus	Nidua Lizard	Not Evaluated
	Mesalina guttulate	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
Scincidae	*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 5-62: Acanthodactylus Boskianus and Mesalina Guttulate Species Recorded Inside the Study Area

Figure 5-63: Uromastyx Aegyptia and Psammophis Schokari Species Recorded Inside the Study Area

Table 5-23: Egyptian Dabb Lizard Records within and Around the Project Study Area

Record	Latitude	Longitude
1st Record	28°02'24.00"N	33°13'33.32"E
2nd Record	28°02'05.42"N	33°12'18.47"E
3rd Record	27°59'14.62"N	33°19'35.37"E

Table 5-24: Egyptian Dabb Lizard Recorded Burrows during the Study

Record	Latitude	Longitude
Burrow 01	28° 1'33.42"N	33°12'41.13"E
Burrow 02	28°00'54.6"N	33°11'06.6"E
Burrow 03	28°01'46.9"N	33°13'04.8"E
Burrow 04	28°00'36.3"N	33°13'03.8"E
Burrow 05	28°02'46.1"N	33°12'48.2"E
Burrow 06	28°03'04.8"N	33°12'53.9"E
Burrow 07	28°03'02.9"N	33°12'53.1"E
Burrow 08	28°00'36.9"N	33°13'22.7"E

Burrow 09	28°00'36.3"N	33°13'03.6"E
Burrow 10	27°59'42.37"N	33°19'7.53"E
Burrow 11	28° 0'16.28"N	33°15'51.86"E
Burrow 12	28° 1'24.62"N	33°14'33.05"E

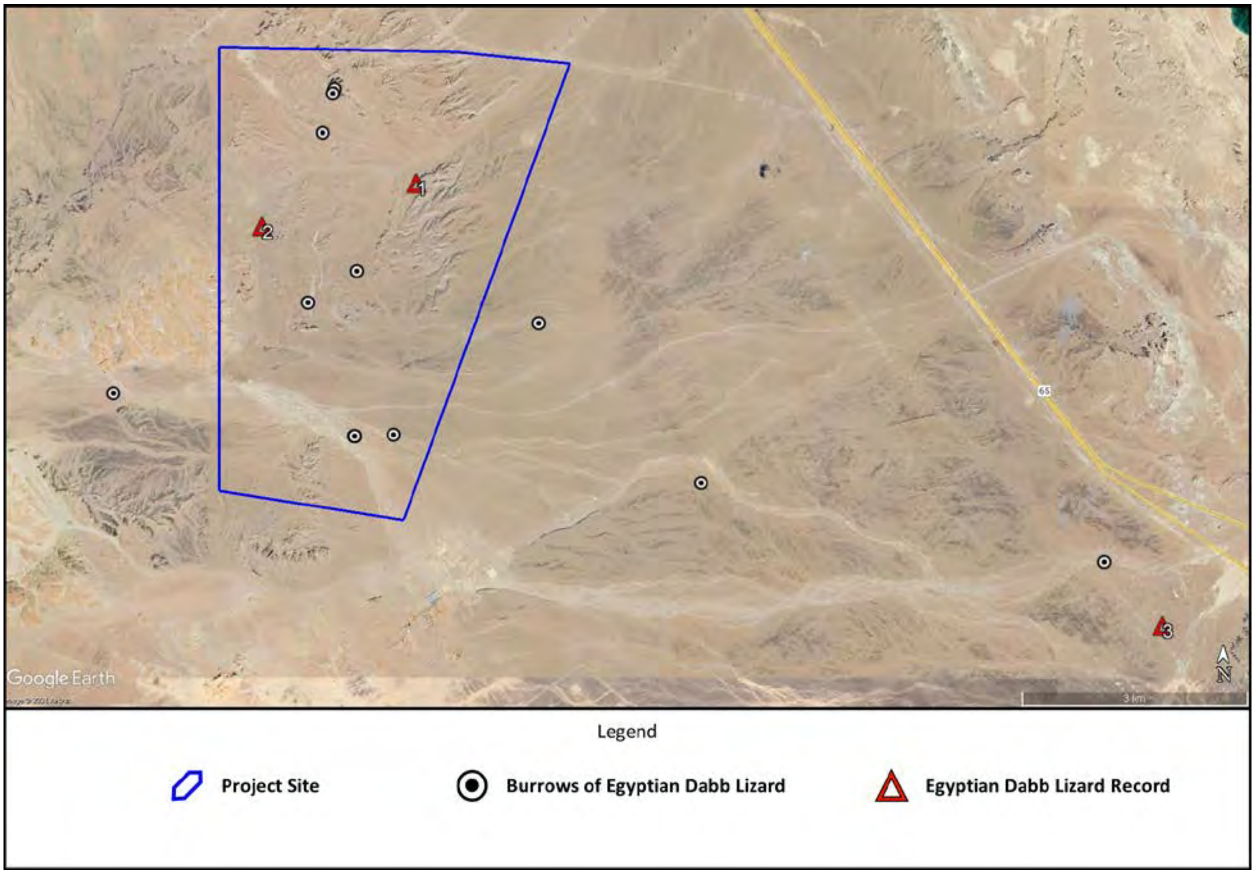


Figure 5-64: Egyptian Dabb Lizard records within Study Area

B. <u>2024 Survey</u>

- Given the importance of the Spiny-Tailed Lizard (Dabb Lizard), another dedicated survey was undertaken in 2024 specifically for this species. The survey aimed to monitor and check the burrows recorded previously during the 2022 survey and also identify and record any potential new burrows / records.

The survey resulted in detecting about 16 active and inactive burrows. These burrows showed variable spatial distribution over the site. Although Spiny-tailed Lizard presence was observed all over the study site, the southern portion of the study site is highly populated with Spiny-tailed Lizard burrows and presence signs compared to the rest of the study site (within areas where no turbines are located as noted within the figure below). In addition, the big wadis running west to east in the north of the study site are remarkably void of burrows or other presence signs. This is probably because this lizard would avoid lower grounds and seek higher grounds for burrows to avoid potential flooding in Wadis.

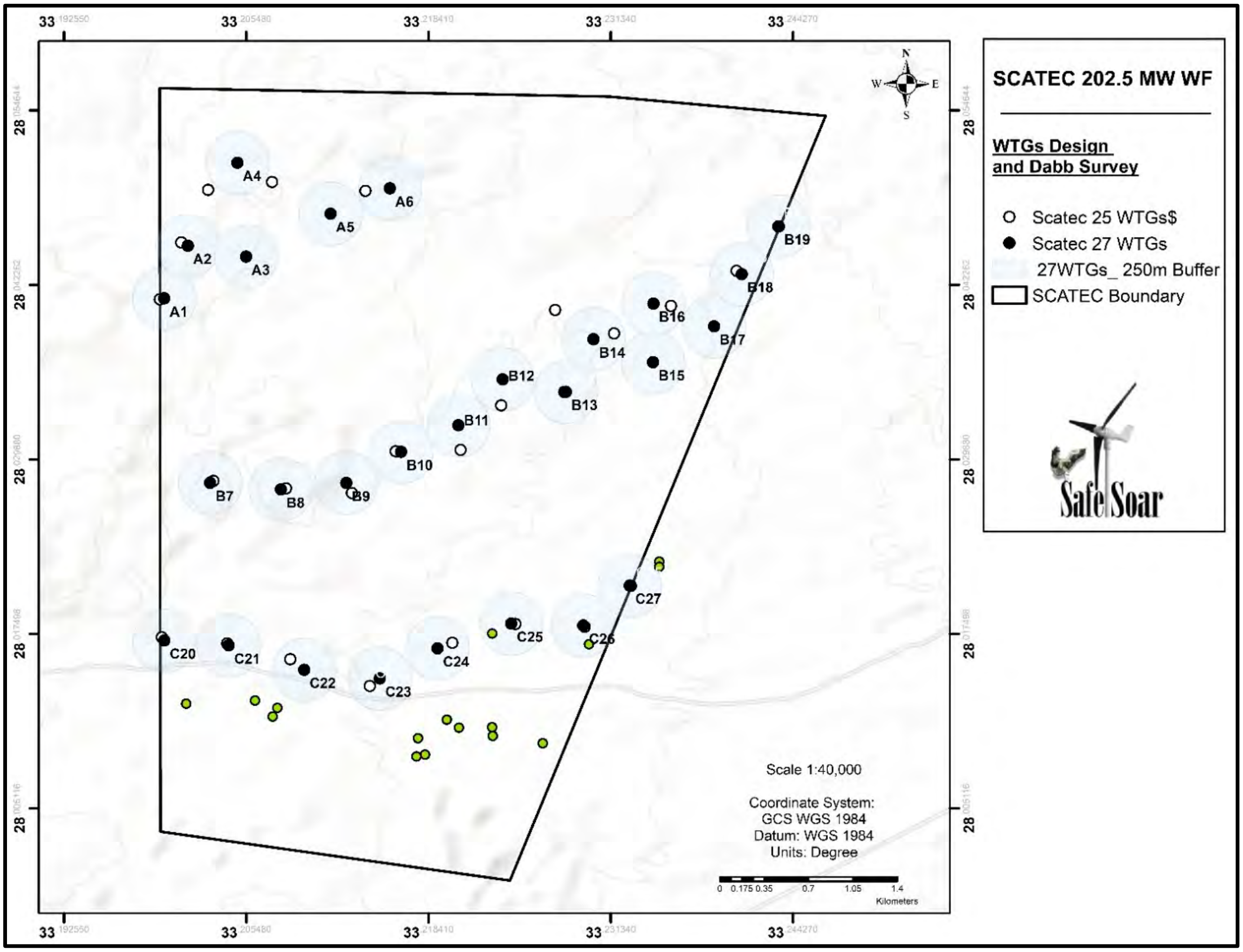


Figure 5-65: Final Active and Inactive Egyptian Spiny tailed lizard.

5.6.7 Invertebrates

(i) Methodology

Surveyors identified invertebrate species using key books, relevant scientific articles as well as consultation with external experts as appropriate.

(ii) Results

The invertebrates that were recorded from the Project site are a typical species that are known to exist in shallow rocky and sandy environments in the northern parts of the Eastern Desert. Insects represent the most numerous, diverse, and widespread group of invertebrates in the project area (Figure 5-605-52). It represents the main component in the diet of many vertebrates such as birds, lizards, and rodent species.

Scorpions comprise a highly successful and diverse of order Arachnida. The scorpion fauna of Egypt is represented by four families; Buthidae, Euscorpiidae, Hemiscorpiidae and Scorpionidae. During the past century, considerable information about scorpion fauna of Egypt and the region, have been complied, reviewed, and synthesized by several authors (Vachon and Kinzelbach, 1987). According to Saleh, et al. (2017) four species of scorpion are restricted in their distribution to Eastern Inland Desert ecoregion (Buthus intumescens, Hottentotta scaber, Microbuthus flavorufus and Parabuthus leiosoma) Table 5-245-21.

Insects from the orders Coleoptera, Homoptera, Hemiptera, Hymenoptera, Orthoptera, Lepidoptera, Neuroptera, Thysanura, Isopterta, diptera and Dictyoptera are present in representative numbers in the appropriate environments at the project site. Scorpions, spiders, and ticks are among the arachnids that were recorded in the project area. These arachnids represent an important level of the local feeding chain. Many species of these arachnids are predators and feed on insects and other arachnids.

Although the invertebrates on the Project site were not fully explored during this study, especially regarding composition and numerical abundance, it is possible to conclude that they do not include any endangered species, whether locally or globally. And all the species that were recorded from the site, are common in most areas of the eastern desert.

Table 5-25: Terrestrial invertebrates Species Known to Occur within Study Area

Family	Scientific name	Common name	IUCN Red List of Threatened Species (2019)
Theridiidae	*Steatoda triangulosa*	Triangulate cobweb spider	Not Evaluated
	Tegenaria parietina	Tegenaria parietina	Not Evaluated
	Hogna radiata	Wolf spider	Not Evaluated
Daesiidae	Bitonupa *ssp.*	Camel spiders	Not Evaluated
Pseudoscorpiones	*Olipum kocki*	false scorpions	Not Evaluated
Buthidae	*Buthus intumescens*	-	Not Evaluated
	Hottentotta scaber	-	Not Evaluated
	Microbuthus flavorufus	-	Not Evaluated
	Parabuthus leiosoma	-	Not Evaluated

Figure 5-66: Different Invertebrate Species Recorded in the Study Area

5.6.8 Overall Summary

In summary, based on the literature review and field survey undertaken, the following could be concluded in terms of the biodiversity of the site:

- The Project site in general is considered of low ecological significance due to its setting that is characterized by having low vegetation cover in an arid environment with low level of diversity.
- The vegetation cover is mainly restricted to Wadis.
- No endemic or near-endemic species were recorded.
- No key or sensitive habitats were recorded within the Project site, and all floral and faunal species recorded were in general considered common and typical to such habitats and generally of least concern except the habitats of Egyptian Dabb Lizard species. Special consideration should be given to this species since the Project site provides a typical habitat for this species, and its individuals were already recorded within the Project site and its buffer area.

5.7 Avifauna

This section presents an assessment of baseline conditions in relation to avifauna. This section presents the methodology and results for the spring and autumn 2022 avifauna assessment.

5.7.1 Methods

Bird surveys have been completed in order to quantify the impact of the project on key avifauna species to subsequently inform final turbine layout, to develop additional mitigation (e.g. turbine shut down, habitat/species management plan) and to form the baseline for any future required supplementary surveys and operational monitoring. Survey information has also been used to inform a Collision Risk Model (CRM).

Bird surveys have been undertaken involving Vantage Point (VP) surveys (Observation Points (OP) for the purposes of this report) and, where necessary, specialist surveys. Whilst specific breeding bird surveys were not carried out across the site coverage during the majority of the year and over the whole site ensured that there is no risk of the presence of breeding birds of international conservation concern being missed during the surveys.

The protocols for surveys at VPs has been based on methodologies from the following documents:

- "Environmental Impact Assessment Guidelines and Monitoring Protocols for Wind Energy Development Projects along the RVRSF with a particular reference to wind energy in support of the conservation of Migratory Soaring Birds (MSBs)" (2013)
- "Strategic Environmental and Social Impact Assessment (ESIA) for an Area of 300 km² of potential wind farms at the Gulf of Suez (2013)"
- Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program for Wind Power Projects in the Gulf of Suez (2019)"

Additionally methodology developed by Scottish Natural Heritage "Survey Methods for Use in Assessing the Impacts of Onshore Wind farms on Bird Communities" (2005, and most recently updated in 2017). However, where appropriate, the protocol has been adapted to be suitable for the location of the site and the additional risks of impacts the project may have on birds.

Wind farms present four main potential risks to birds:

I. Direct habitat loss and disturbance through construction of wind farm infrastructure;

II. Displacement (sometimes called indirect habitat loss) if birds avoid the wind farm and its surrounding area due to turbine construction and operation. Displacement may also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds;

III. Death through collision or interaction with turbine blades and other infrastructure (*i.e.* collision risk);

IV. Interactions with transmission lines associated with wind energy projects which could result in mortality due to collision or electrocution.

For each of these risks, detailed knowledge of bird distribution and flight activity is necessary in order to predict the potential effects of the wind farm on birds.

Vantage Point Monitoring

Vantage Point survey is designed to quantify the level of flight activity and the distribution of birds over the survey area. Its primary purpose is to provide input data for the Collision Risk Model (CRM), which is used to inform the Collision Risk Assessment (CRA) to predict likely mortalities from collision with operational turbines. Data can also be used to provide an overview of bird usage of the site to further inform an assessment of the likely impacts of habitat loss, disturbance, displacement and barrier impacts.

Surveyors

A team of suitably experienced ornithologists undertook the surveys and were able to identify all birds seen and heard within the Project AoI. During the surveys they used the following equipment:

- Field survey sheets;
- Weatherproof Clipboard;
- Binoculars (at least 8x magnification);
- Anemometer;
- First aid kits; and
- Digital camera

VP Selection

Note: Vantage Point (VP) selection process presented below was undertaken for a previous project which had a different project boundary compared to the one presented below. At a later stage the Developer bought the previous project and adjusted the project boundary and which was different from the previous boundary – however, as demonstrated below the new boundary is still fully covered by selected VPs.

Based on a view-shed analysis that was undertaken, five (5) Vantage Points (VP) (or, for the purposes of this report, Observation Points (OP)) were considered sufficient to cover the Project area, based on the site topography. The methodology ensures that the location of the OPs provide the most comprehensive coverage, and also includes a rotational system where 2 OPs, out of the overall 5, were used for monitoring activities every day during the migration seasons.

To avoid double counting, OPs that were undertaken on the same day were selected to avoid overlap. As noted in the figure below, this entails working on Group A (Day 1) of OP1 and OP3 (yellow colored) and Group B (Day 2) of OP2, OP4 and OP5 (blue colored) for monitoring activities. Other measures undertaken to avoid double-counting include: (i) continuous communication between team members onsite at VPs to report key flocks passing through the site to avoid double counting; (ii) daily revision of daily sheets of observers by Team Leader to check for any potential double counting data, which if identified will be removed for the data set accordingly – this includes records that have same or similar number of birds, trajectories and timings.

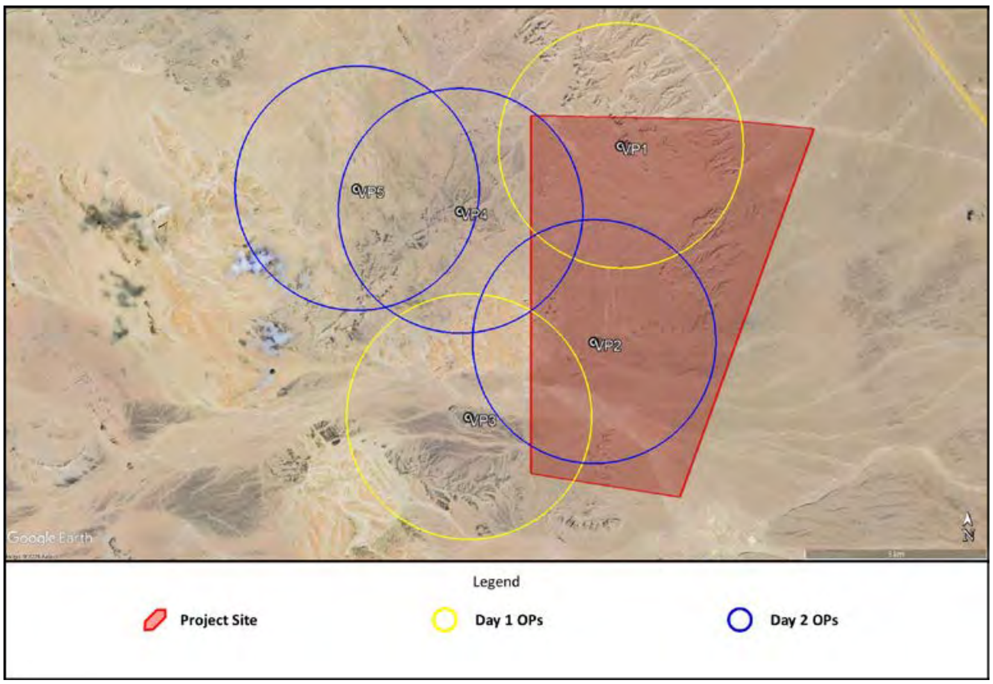


Figure 5-67: Locations of OPs

Table 5-26: Coordinates of OP

Vantage Points	Coordinates	
	Latitude	Longitude
VP 1	28.05180	33.21434
VP 2	28.02292	33.20986
VP 3	28.01186	33.18895
VP 4	28.04218	33.18752
VP 5	28.04548	33.17023

At later stage during the monitoring period (in 20 April 2022), the Developer informed the ESIA Consultant that the Project boundary has changed. Therefore, based on that 2 additional OPs were added as noted in the figure below (OP 6 and OP7), while the coordinates are provided in the table that follows.

The same methodology was followed to that identified above for the remaining part of spring monitoring season for a total of 7 OPs. This now included a rotational system which covered OP 2, OP 4, OP 7 on day 1 and then OP1, OP3 and OP 6 on day 2 and then OP 2, OP 5 and OP 7 on day 3. This sequence was repeated throughout the entire migration duration.

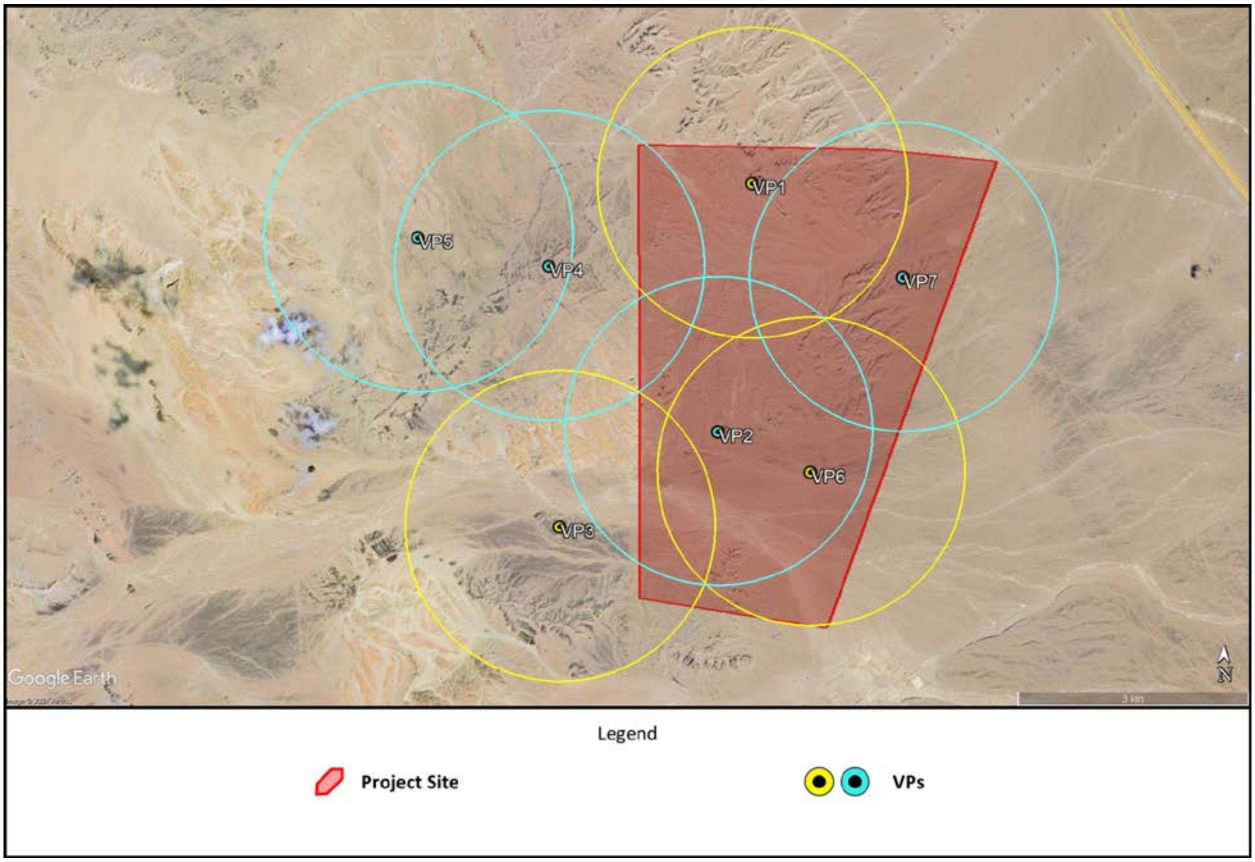


Figure 5-68: Location of Updated Project OPs

Table 5-27: Coordinates for New VPs

Vantage Points	Coordinates	
	Latitude	Longitude
VP 6	28.018214°	33.222068°
VP 7	28.040869°	33.234257°

Target Species and Secondary Species

Target species were all Migratory Soaring Birds (largely made up of birds of prey but also including a range of waterbirds). These species represent the species of greatest sensitivity and/or conservation concern as well as likely impact from WTG.

Focal Bird Sampling

The area in view was scanned until a *Target Species* was detected at which point it is followed until it ceases flying or is lost from view.

The time the target bird was detected, and the flight duration were recorded and the route the bird followed was plotted in the field onto the maps. The bird's flight height is estimated at the time of detection and then at 15 second intervals thereafter.

Following best industry practice and as undertaken for all monitoring campaigns, each OP covers a view of 360° extending for a maximum of 2 km as required. Also, this distance is sufficient for a qualified bird observer to identify the bird into the species level in good visibility conditions. This does not mean birds are counted once they have crossed or are detected after the OP. Covering the 360° allows the observers to track and alert other observation points when individual birds/flocks follow a specific route. Despite being considered as good international industry practice, 360° views are common at some migratory bottlenecks where birds turn around due to several reasons – this could include for example unexpected weather conditions which force a detour or shift during migration. This does not influence the double counts themselves, but avoids them, e.g. a flock detected at one observation point which later joins or splits in two or more smaller groups before reaching the following observation point. In the end, it is the Team Leader daily revision which allows analyzing and determining if it could be or not a double count. In general, this is the practice followed in all GoS avifauna monitoring campaigns. Given that pre-dominant bird flight direction is known during spring and autumn, risk of 360 degree viewing arcs resulting in birds being missed is considered a low risk.

Monitoring from OP was carried out daily following a rotation system to ensure that the 5 OPs are covered regularly, while also covering the various periods of daylight from dawn to sunset.

Generally, observation started a minimum of 1- hour after sunrise and ended by a minimum of 1-hour before sunset. Other studies in the region demonstrated that bird activity out of this interval is minimal or do not exist – this includes for example studies done by RCREEE for other wind farms in the GoS region such as AMUNET (ECO Consult and EcoConserv 2022), Lekela (Environics, 2016) and others such as BirdLife International (2013).

Observation periods from each OP were conducted for a maximum of 4-5 hours in order to ensure that the quality of monitoring does not get affected by the observers' exhaustion. A minimum of a 1-hour was provided between each two observation periods. In total, a maximum of 2 OP were covered every day, where each observation period was covered a minimum of 8-10 hours per day; 4-5 hours in the morning followed by a minimum of 1-hour break and 4-5 hours in the afternoon.

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

Despite potential existing for observer effort biasing results, biases also exist with two observers in place. Falsterbo in Sweden is a renowned site for migratory birds. A study by Kallander and Ryden (1975) measured the observer capabilities when detecting species and individuals. They compared sixteen experienced observers in four occasions who recorded the migration both independently and simultaneously within the same site. None of them recorded the entire migration, even when the weather conditions were good enough. Considering this, there is no reason in the Red Sea-GoS area not to happening the same at project level (different OPs detect different bird numbers and species), but also inter-projects, a subject which has never been explored in many ESIAs based on existing knowledge – to include pre or post-construction wind farm monitoring.

Overall, there are observer, weather, species and site-specific variables affecting the outcomes of any migratory count. All these factors are impossible to be fully and 100% under control during the data collection, and every study in the RVRSF should be aware of that and such limitations.

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

- 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 Collection

Data was recorded on spreadsheets form, as per template shown in the figure below. These spreadsheets were filled on a daily basis by the bird observers.

Information on bird flight activity was collected from VPs. The recording of observations followed the methods described by SNH (2017) but also adapted to migratory sites Band et al. (2007), which are summarized below.

Observers at VPs positioned themselves to minimize their effects on bird behavior. A complete circle of 360 degrees was scanned using a combination of naked and 10x binoculars. If a migratory species was detected, it was followed until it ceased flying or it was lost from view. For each observation of a target species, date collected included the following:

- The time the species was detected
- The flight duration of the species to the nearest 15-second interval
- Estimate of the bird's flight height above ground level at the point of first detection and thereafter at 15-second intervals, where heights to be classified flight based on turbine specifications.
- Risk heights: our data collection covered various risk heights to account for any potential change in turbine heights in the future (as opposed to previous methodologies that only account for 0-120m and above 120m). This ensured that there is no need to repeat any surveys if any turbine change occurs for any reason. The following risk heights were considered: (i) 0-120m; (ii) 120m-150m; (iii) 150m-200m; and (iv) above 200m.

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

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

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

As shown in the data sheet below one sheet was used for targeted species (priority species; MSBs) and another sheet for accidental observations of passerines and non-targeted species.

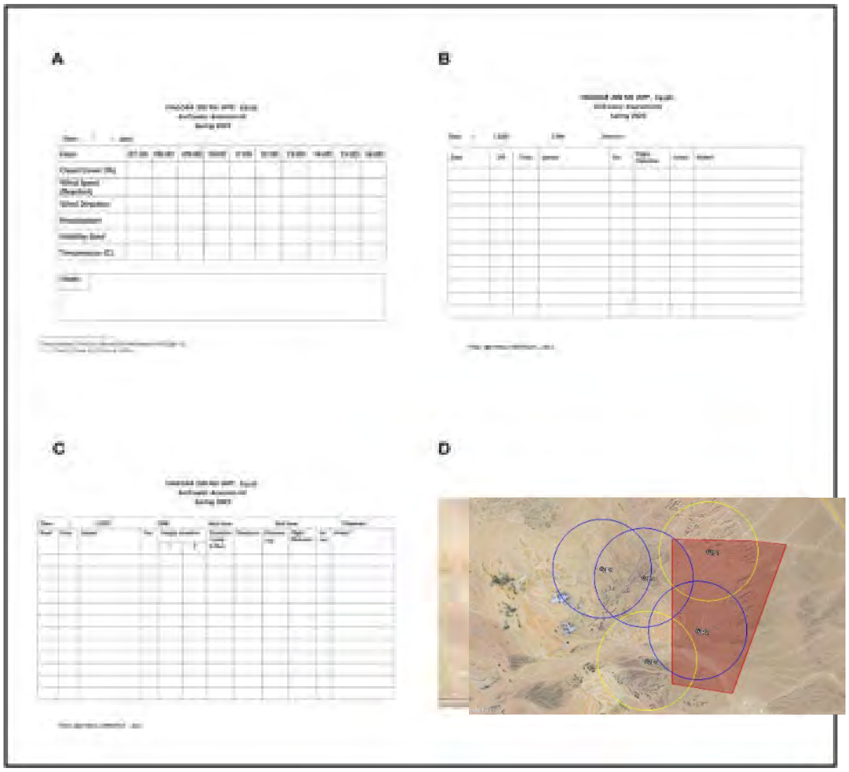


Figure 5-69: Datasheets for the Project

Based on our biodiversity team's extensive experience in pre-construction surveys, our methodology for data collection was adjusted to reflect some key improvements on previous methodologies employed on all pre-and post-construction surveys in Egypt. Such improvements are considered crucial and critical for the CRM as well as the statistical analysis was undertaken. This included the following in particular:

- *Accounting for zero bird count days (days with no records of migrating birds)* were recorded in the datasheets in order to be highlighted in the report. This parameter can help to improve understanding of interactions of birds and their response to changes in weather conditions and limiting factors of crossing the Gulf of Suez, and help to determine the favorable and unfavorable weather conditions of migration generally or specifically for a certain species.

- Ensure observations considered to be out of the Observation Point Radius record the number of birds and distances from observers. This will help to analyze the detectability of migratory birds. The longest distance from the observers the less probability of a bird being detected, also the smaller size the probability decreases.

- *Passage Rates*. Based on all of the above data collected ***passing rates*** (birds/hr.) were calculated which is discussed in additional details below.

- *View sheds*. Observers had a good overview 360º around each OP to detect the bird's approach and assess flying direction.

Data Management and Quality Control (QC)/ Quality Assurance (QA)

- Each observer was provided with sufficient number of data sheets as provided earlier throughout the migration season. Each observer filled out the sheets on a daily basis.
- At the end of each day, each bird observer was required to thoroughly check the data sheet to ensure all required inputs are included. In addition, at the end of each day, the observer was required to undertake a quality check to ensure the data is reasonable, factual, complete, accurate and representative. Any missing items were filled and any detected problems were resolved within the submitted data sheet.
- Through random and periodical inspections, the Team Leader undertook inspections on submitted data sheet by Observers to ensure all required inputs are included in a reasonable, factual, complete, accurate and representative manner. Any missing items or problems were resolved and explained accordingly with the observer responsible for filling the sheet. Any changes were properly documented for future reference.
- Team Leader designated one of the bird observers as a "Data Controller". The Data Controller was responsible for: (i) collection of the data sheets from the bird observer team on a daily basis; and (ii) entering the data into a master database (check sample below).
- Upon completion of data entry for the day, the Team Leader reviewed the data and undertake a check for Quality Control and Quality Assurance purposes on the data including data entry errors. Any discrepancies were identified, highlighted and doubled check with the Data Controller and bird observer accordingly to account for e.g., double counts of the same species/groups. Given the size of the project area the chance of having birds passing through several points successively is high. This exercise was undertaken on a daily basis.
- In addition, the Master Database was also reviewed by the Statistical Analysis Expert on a monthly basis for further Quality Control and Quality Assurance. Similarly, any discrepancies were identified, highlighted and doubled check with the Team Leader and Data Controller accordingly.

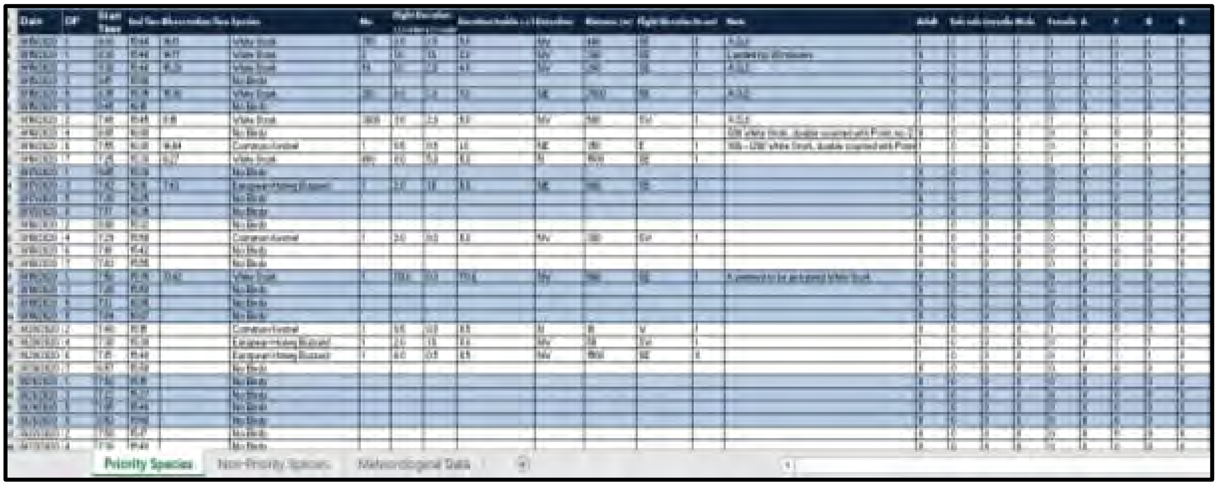


Figure 5-70: Master Database Template

<u>Communication</u>

All team members were provided with a mobile phone including internet connection and WhatsApp phone application. The team in the field were in contact during the monitoring period via mobile phones and a dedicated WhatsApp group for immediate communication for any key issues to include for example: (i) follow up on the migrating flocks and individuals over the project area; and (ii) avoid double count of same flicks/individuals and other as appropriate.

5.7.2 Roosting, Breeding/Nesting and Resting Birds

Porter (2006) should be referenced again on the issues related to **<u>the concept of roosting/resting of birds</u>** in any project proposed in the region and which 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*". Roosting, breeding/nesting and resting birds were identified within the project area or its surroundings. Observations include 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 of any roosting, breeding/nesting and resting birds in the Project area, including the 2 km buffer zone.
- Annotating any roosting, breeding/nesting and resting 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, some species may land or stay grounded for overnight while others might not – this is well known for a long time now. This is not a site-specific issue, and it may occur in any area in the Red Sea coast and adjacent areas, subject to species and weather-specific conditions like sandstorms or a group of birds whatever the species being involved, migrating late in the day. Presence of grounded birds was assessed whilst driving in the early morning and late evening forth and back from the OPs, plus specific monitoring at some other sites at different daylight hours (e.g., Wadi Dara site or the carcass disposal site both of which are discussed in further details below).

5.7.3 Study Design - Accounting for potential environmental constraints

Some MSB and target species may be attracted to particular landscape features as they migrate. Such features may be attractive because they provide a concentrated source of food, such as dump sites for many raptor and vulture species or a water body (permanent or ephemeral) for storks. Such features have the potential to be routinely used by these species and/or serve as an *attractant* within the landscape, altering individual bird behavior during migration, and/or concentrating bird flight activity to/from this feature. Such features could elevate long term risks to these target species if the projects are constructed and, therefore, may be considered potential environmental constraints when assessing risks as part of the planning and consenting process[12].

The Team Manager considered any nearby site-specific conditions that could influence the behavior of those species which could make use them for feeding constituting a constraint or which may require further specific mitigation and mapped these features, which included:

- *Wadi Dara* – poultry farms, the poultry processing facility, livestock farms, residences, landscaped vegetation and other features located in and around the community of Wadi Dara have the potential to attract migratory birds drawn to these landscape features for resting/roosting and/or feeding/scavenging. Wadi Dara is largely situated south of the Project boundary.

Surveys completed during 2022 at the potential environmental constraints are summarized in the table below. Note: no surveys were undertaken during spring season which is considered a limitation – however as required and recommended, the project has considered an appropriate setback from Wadi Dara to account for such constraints.

Table 5-28: Summary of bird observation effort and approach for potential environmental constraints.

	Wadi Dara
Survey method	Site specific visits to Wadi Dara
Spring 2022 dates (from/to)	N/A

[12] It should be noted that such environmental constraints should be considered in the context of both wind turbine and overhead electrical line siting.

Spring 2022 number survey rounds	N/A
Autumn 2022 dates (from/to)	10 Aug – 10 Nov
Autumn 2022 number survey rounds	1 hour per day at various times (e.g., Day 1 1h morning, Day 2 1h midday, Day 3 1h afternoon)

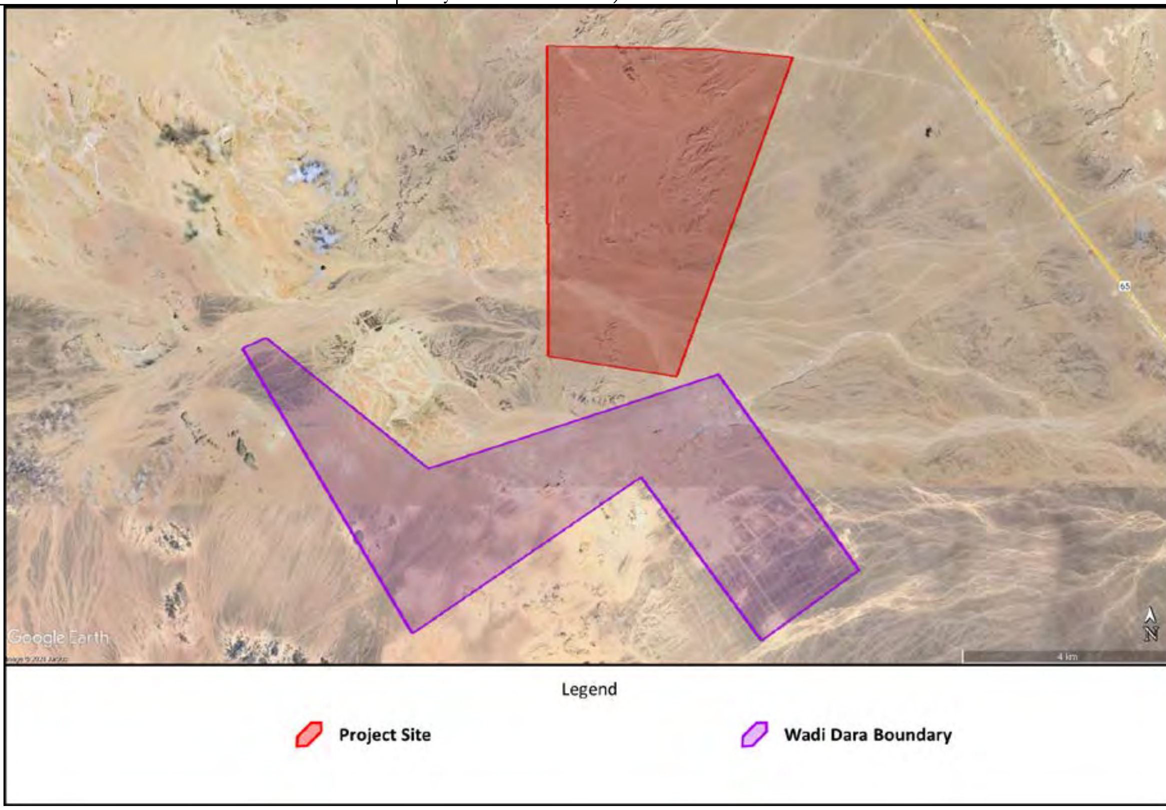


Figure 5-71: Project Site and Wadi Dara

5.7.4 Issues and Limitations

Survey limitations existed during the bird monitoring undertaken for the Project. It is important to note that the below limitations and issues are considered applicable for all VPs and are not limited to certain VPs only. Some of the key limitations and issues include the following:

- The survey technique was based on visual observation, which limits the detectability of birds and getting accurate measurements of flight heights and trajectories.
- The wind farm has not yet been constructed. Without a reference, flying heights could entail some degree of error, especially in the very narrow bands at turbine level and for birds flying at longer distances and heights from observers.
- Poor mobile phones coverage and weak signal causing communication and coordination problems between field observers, especially in coordinating counts during intense migration times when the network connection is lost. It is important to note that no

VHF/radio communication was undertaken or considered for this Project. This requires special army permits and approvals that cannot be obtained.

In addition, projects in sensitive locations (for birds) are expected to undertake two years of flight activity study, in line with Good International Industry Practice (GIIP). However, this project has undertaken one year of survey, which is considered a limitation. Finally, as noted earlier, no specific monitoring was undertaken at Wadi Dara during spring 2022 season.

5.7.5 Results

Spring 2022: Monitoring/Sampling effort

The wind farm was monitored every day during the spring migratory season from February 20th to May 18th for a total time of 1,067 hours and 37 minutes. The start and end time of daily monitoring were adjusted according to length of daylight hours, in order to provide adequate sampling of the whole migration season. The monitoring dates are presented in the table below, while the table that follows presents the total monitoring hours.

There are two preliminary considerations to keep in mind when interpreting the results that are important to highlight and identify at this point:

- The **monitoring times were different between the Vantage Points and months**, as a consequence of weather reasons like sandstorms. In addition, Vantage Points **VP-6 and VP-7 were added in April,** so their monitoring times were lower compared to the other VPs. Due to this, comparisons cannot be done directly among VPs and raw bird numbers but should be based on passing rates (birds /hour) to avoid biases. Comparisons must be made according to a standardized methodology which relates the number of birds of a species with the monitoring time invested.

- In any migratory count, whether it is wind farm related or just migratory count there **is a chance that identification of all birds and/or groups cannot be achieved.** Reasons for this may be multiple but could include for example a short period of time to see the birds, the background does not allow a proper identification, observers are overwhelmed or as Porter (2006) said: "*Counting soaring birds and using the results for monitoring purposes is fraught with problems." … "The identification of many species is challenging and requires much training and practice as birds are often at a distance and several species are very similar. Identification of the Aquila eagles (Steppe, Greater Spotted and Lesser Spotted), buzzards and large falcons is especially difficult. Second, the actual counting can be problematic as birds frequently fly over at heights which make them invisible to the naked eye; they can also be in large mixed flocks - thus making both counting and identification difficult.*" This is a consideration specially related to the spring counts, when more birds could cross at the same time, compared to the autumn migration.

Initial Notes

The figure and table below present the distribution of monitoring hours among the seven (7) VPs. As noted, the uneven distribution of the monitoring time resulted in different monitoring efforts per month and VP, and this in turn results in differences of bird numbers recorded. As explained earlier, these differences are not due to natural reasons (for example due to differences in migration patterns) but rather due to difference in monitoring hours undertaken (i.e., higher number of monitoring hours will increase the chance of observing more birds). As reiterated previously, this reinforces the need of working with passing bird rates (birds /hour rate) instead raw bird numbers throughout the analysis undertake throughout the subsequent sections, unless clearly stated otherwise.

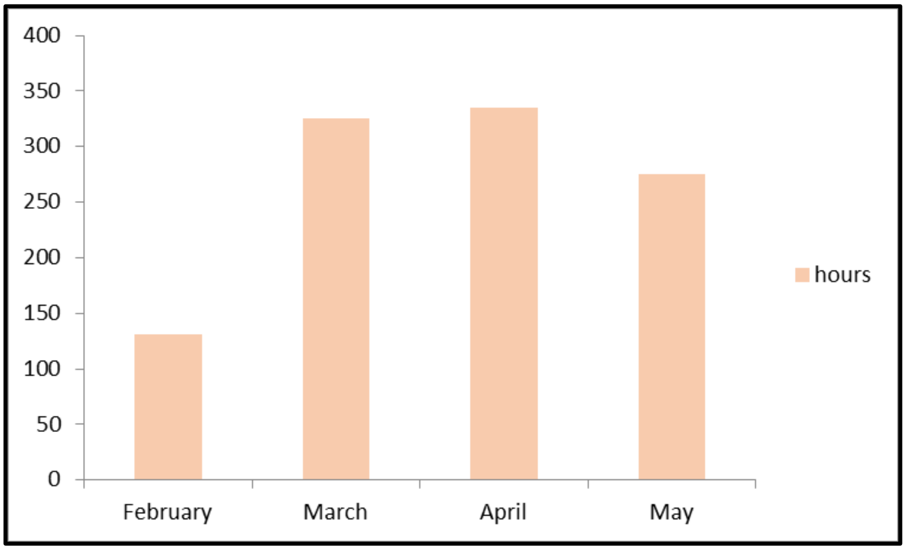


Figure 5-72: Distribution of Monitoring Hours per month

Table 5-29: Total Monitoring Time per OP

OP	Monitoring Time
1	255:10:00
2	208:30:00
3	245:30:00
4	104:25:00
5	116:50:00
6	73:30:00
7	63:42:00
Total	**1,067 hr. 37 min**

Birds and Records Numbers

During the two-year survey period, 25 bird species were recorded during Vantage Point monitoring, including five species with elevated IUCN status. These were:

- Eastern Imperial Eagle (IUCN VU)
- Egyptian Vulture (IUCN EN)

- Greater Spotted Eagler (IUCN VU)
- Pallid Harrier (IUCN NT)
- Steppe Eagle (IUCN EN)

The table below provides a summary of Vantage Point Data for the surveys and includes details of relevant species conservation status, total number of individuals recorded for all flights.

All remaining species recorded during the surveys were classified as IUCN Least Concern (LC).

In spring 2022, a total of 2,856 records belonging to 242,768 birds of twenty-five (25) species were detected in the Project site. In addition, another 2,965 birds remained unidentified (check table below).

One species in particular accounted for around 60% of the birds recorded – the White stork. Eight (8) species accounted for 99.07% of the birds recorded which include the White Stork, plus the Black Kite, Common Crane, European Honey Buzzard, Levant Sparrowhawk, Great White Pelican, Steppe Buzzard, and Steppe Eagle. Note: the proportion of these species represented against their respective global populations has been considered in the Critical Habitat Assessment (CHA) produced as a standalone report to this ESIA.

Finally, two (2) species were classified as Vulnerable (VU) according to the IUCN Red List (Eastern Imperial and Greater Spotted eagles), two (2) are Endangered (EN), the Egyptian Vulture and the Steppe Eagle. A fourth one could be considered of special interest being Near Threatened (NT), the Pallid Harrier.

Table 5-30: Species Recorded for All Flights

Species	IUCN Red List (2019)	National Status	n obs	Individuals
Black Kite	LC	*Pm*	405	5,640
Black Stork	LC	*Pm*	53	1,578
Booted Eagle	LC	*Pm*	80	113
Common Crane	LC	*Pm*	47	19,599
Common Kestrel	LC	*Pm/R*	52	54
Crested Honey Buzzard	LC	*Pm*	1	1
Eastern Imperial Eagle	VU	*Pm*	24	25
Egyptian Vulture	EN	*Pm*	34	38
Griffon Vulture	LC	*Pm*	1	1
Eurasian Sparrowhawk	LC	*Pm*	24	46
European Honey Buzzard	LC	*Pm*	316	11,640
Great White Pelican	LC	*Pm*	57	26,960
Greater Spotted Eagle	VU	*Pm*	4	5

Lanner Falcon	LC	*Pm*		
Hobby	LC	*Pm*	2	2
Lesser Kestrel	LC	*Pm*		
Lesser Spotted Eagle	LC	*Pm*	75	117
Long-legged Buzzard	LC	*Pm/Wv*	84	116
Levant Sparrowhawk	LC	*Pm*	4	18,001
Montagu's Harrier	LC	*Pm*	3	3
Osprey	LC	*Pm*	6	6
Pallid Harrier	NT	*Pm/Wv*	5	6
Short-toed Snake Eagle	LC	*Pm/Sm*	94	123
Sooty Falcon	VU	*Pm/Sb*		
Steppe Buzzard	LC	*Pm*	623	12,713
Steppe Eagle	EN	*Pm/Wv*	694	5,314
Western Marsh Harrier	LC	*Pm*	28	31
White Stork	LC	*Pm*	140	140,636
Subtotal			**2,856**	**242,768**
Eagle species	-	-	145	1,782
Unidentified raptor	-	-	61	966
Unidentified Harrier			4	4
Unidentified Buzzard	-	-	22	205
Falcon sp.	-	-	10	10
Total			**3,098**	**245,735**

Spatial and Temporal Distribution

Despite the different monitoring times per OP, the standardization of the data (birds / hour of monitoring) allows a proper comparison among the passing rates per OP and thus allows checking if there are spatial differences which could suggest preferred sites from crossing.

The analysis has been made on species-specific basis due to two main reasons: i) the contribution of the White Stork to the total counts as seen above and ii) given that each species has its own migration pattern within the season. Adding two additional OPs in April could have influenced the results. Due to that the migration pattern throughout the months and weeks were analysed first, after which potential spatial differences among the five or seven OPs were checked.

Months and Weeks

In the following step, the timing of passage was analysed according to the month and week in the spring season. 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).

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 states, it includes more than thirty years of established monitoring which provides excellent basis for consideration and explanation of behaviours, instead of just accounting for one single season. The authors explain that counts at the Gulf of Suez of migratory birds in both autumn and spring were observed and recorded already in the 80´s and 90`s with specific references there such as Biljsma (1982, 1983), Wimpfheimer et al. (1983), Meininger & Atta (1994), or other counts in the Southern Red Sea Area (Sorensen 1982, Grieve 1996). The authors also provide details on and how migration occurs both in spring and winter along the entire Middle East, from Djibouti to Jordan and Lebanon, from Egypt to Yemen, providing also data from latitudes further north like Bosphorus. The assessment below compared the results with the Shirihai et al. (2000) study in order to understand and compare the migratory patterns recorded within the Project site since it is more focused in the Middle East.

To analyze the migration pattern of the species recorded, only species with enough data, observations and individuals were selected. A basic statistical analysis / knowledge requires sample size to get some conclusions. Thus, species in Table 5-37 that has more than one hundred records, irrespective of their respective bird numbers, were selected and are presented in further details below. This is mainly due to their numbers which would allow meaningful analysis Based on that, the species selected are: Black Kite, Black and White storks, Honey Buzzard, Steppe Buzzard, Great White Pelican, and Steppe eagle.

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 end of April. This pattern is like what is referenced by Shirihai et al. (2000).

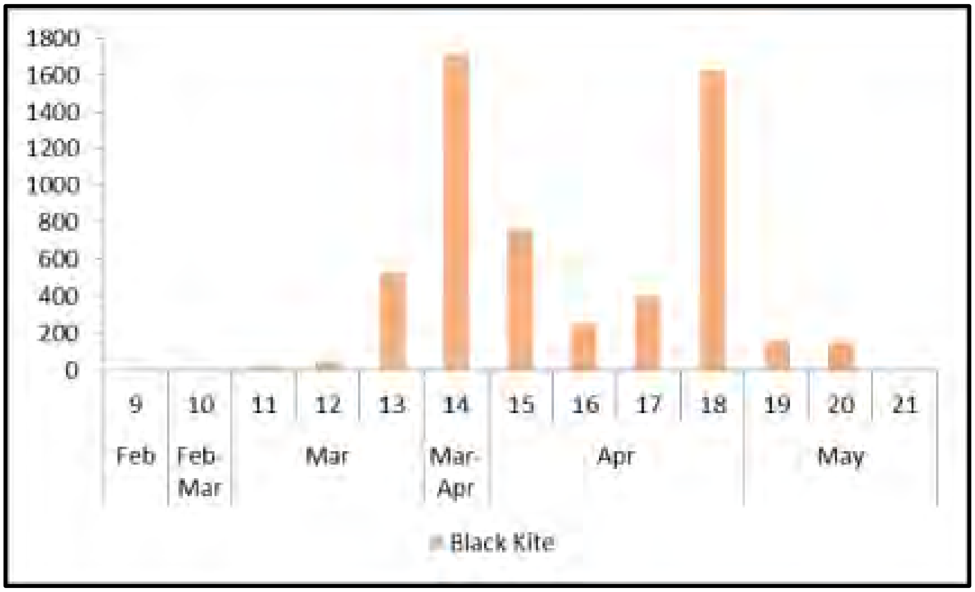


Figure 5-73: Migration Patterns of the Black Kite

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 a peak in the late second half of April. For this species data was compared with those from Arslangndodu et al.(2011) "Spring migration of the Black Stork, Ciconia nigra, over the Bosphorous, Zoology in the Middle East, 53:1, 7-13". Note that the Shirihai et al. (2000) study is related to raptor migration and given that the Black Stork is not a raptor, it is naturally not included. Despite being further north in the Flyway, the data serves for some comparison, as for the Black Stork is a species with not many studies in the region. In the Bosphorous the migration extends from March to end of May. 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.

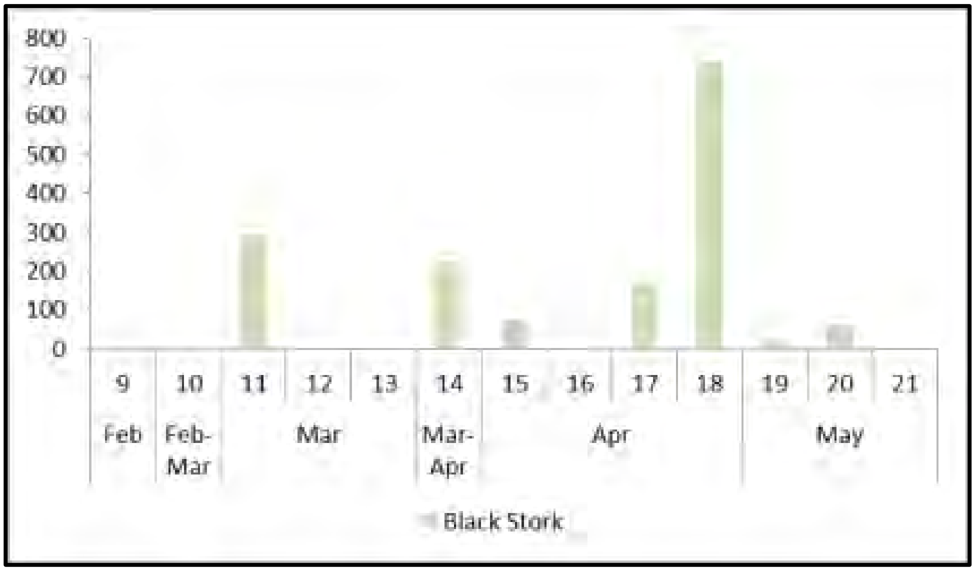


Figure 5-74: Migration Patterns of the Black Stork

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. The observed pattern agrees with that study.

Because of this clear migration pattern, the spatial analysis (presented in the section that follows) was performed only for the seven VP option, as no birds were recorded when five VPs were considered.

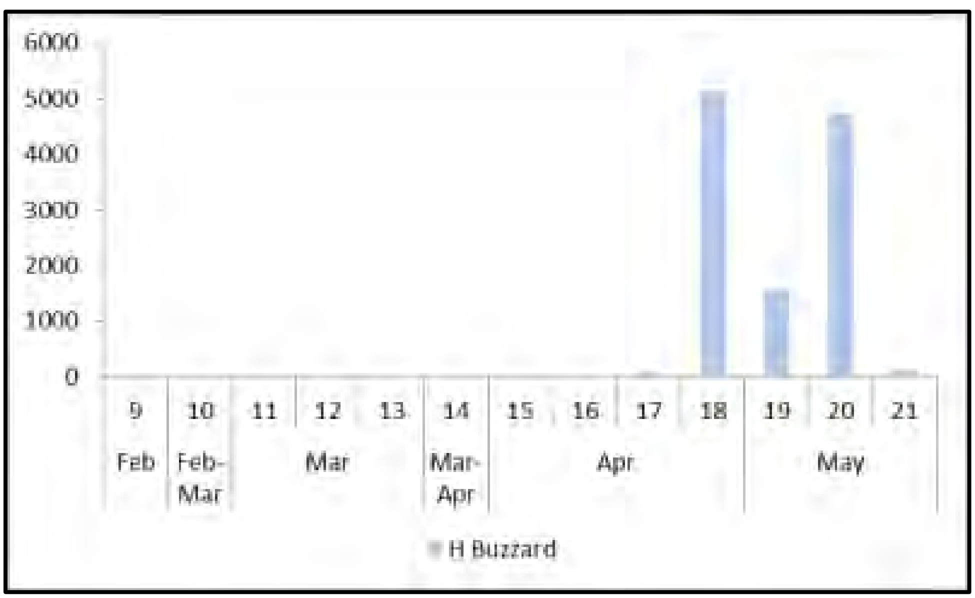


Figure 5-75: Migration Patterns of the Eurasian Honey Buzzard

The next figure presents the migration pattern for the Steppe Buzzard which extends from mid-March to May. However, large numbers start in early-March, peaks by the mid and end of the month, and continuously decreases till late-April. The migration at the site extends over nine weeks, but counts indicate some delay. Shirihai et al. (2000) mentions that 90% of the total numbers passes between 22 March and 15 April. Results generally match this pattern.

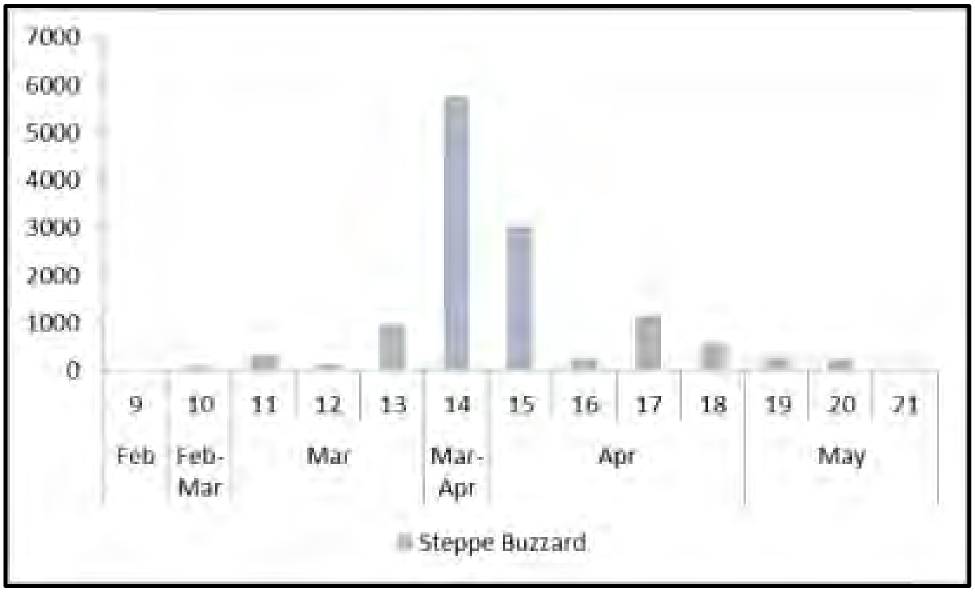


Figure 5-76: Migration Patterns of the Steppe Buzzard

The figure below presents the migration pattern for the White Stork. This species has been recorded from early March to May, with peaks in the first half of March. For the study and comparison of the passage of the White Stork, the work by Van den Bossche (2002) was considered, 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 here.

The Van den Bossche (2002) study refers to smaller flocks in April and May. The site results show a different pattern given that there were big flocks all the time in March and April. However, several variables may affect the migration pattern of this species like the changes over the entire Palearctic, for example that most of the birds here recorded could not be breeding birds which arrive Europe and Asia much earlier. Whatever the reason, the data show a presence all the time in high numbers.

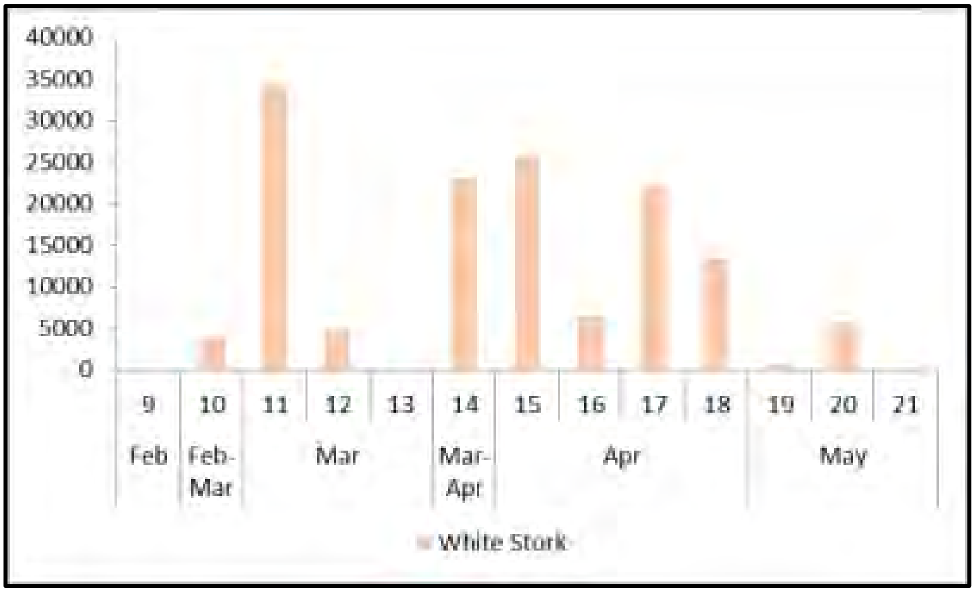


Figure 5-77: Migration Patterns of the White Stork

The figure below presents the migration pattern for the Steppe Eagle. As noted, this species migrated between mid-February and April (a total of 12 weeks), showing its peak between late February-March. 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).

Given the above, for this species, the spatial distribution (presented in the section that follows) was performed only for the five VP option.

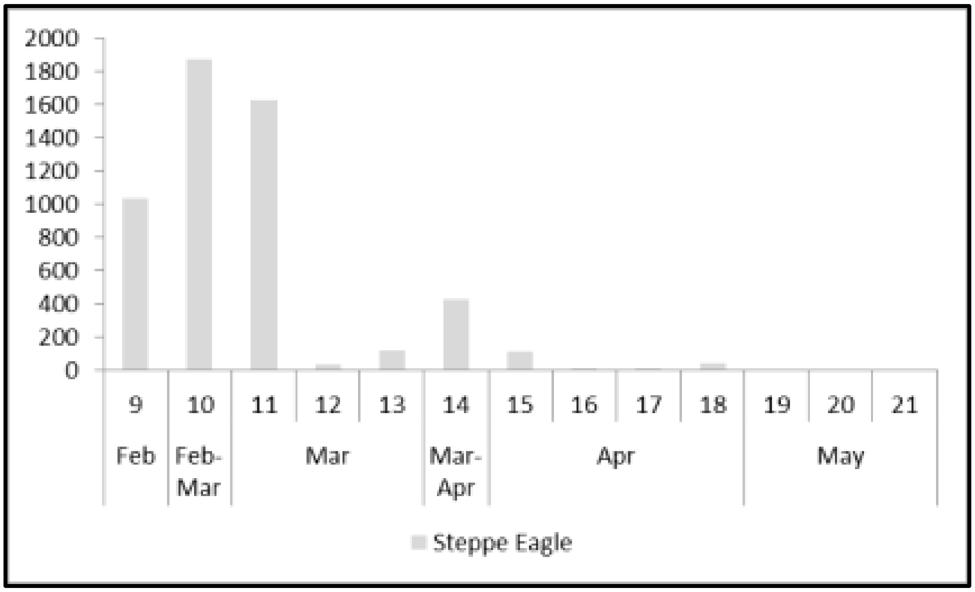


Figure 5-78: Migration Patterns of the Steppe Eagle

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

- **Falcons** like the Sooty and Red-footed falcons. Their numbers recorded for the area all are less than 5 individuals.
- **Harriers**: Western Marsh. Pallid or Montagu´s. They are not true soaring birds but also well known to cross the open sea. Thus, counts in areas like this project are neither accurate nor representative as to draw clear patterns. Numbers recorded for are all are less than 50 individuals each.
- **The Osprey**: it is also a well know species to migrate over water extensions easily using flapping flight. Only six individuals were recorded.
- Finally, there are three species like the **Common Crane,** the **Levant Sparrowhawk,** and the **Great White Pelican** which account for a few numbers of observations but many birds per observation. Patterns cannot be achieved, as a few counts could be considered incidental. Furthermore, and despite being a soaring bird, it can fly over water or even land without restrictions. Thus, it is not limited as the other soaring birds because of the sea-crossing.

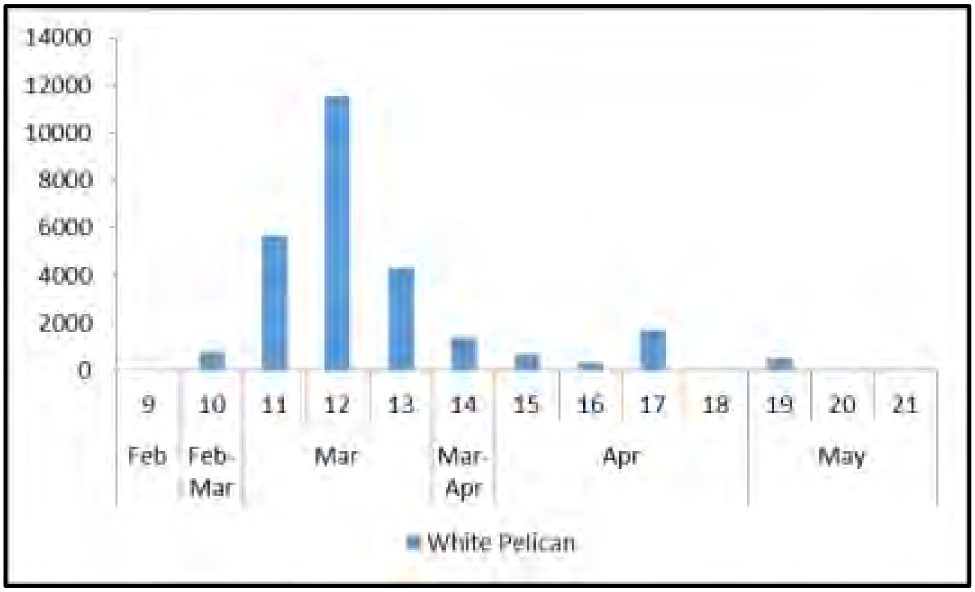


Figure 5-79: Migration Patterns of the Great White Pelican

Despite wind energy being a relatively new development in the region, studies on bird migrations are not, and have been developed for decades now. In general, **what is clear for such studies (e.g. Shirihai et al. 2000) and the results here is that not all the species migrate at the same time**.

Spatial Distribution and Passing Rates

As mentioned above, the monitoring times per OP have been different, and direct comparison of raw bird counts does not allow for a proper assessment. Thus, the calculated passing rate (birds/hour monitoring) and its statistical testing are the correct and robust way to do the assessment.

A second point to keep in mind is that the passing rate is not a fixed value, having a range: the true passing rate moves from zero birds/hr, when observers do not record any bird, to any other value when passage occurs. This is also an important issue in statistics, as median or average values are used for the comparison, and the statistical tests also use such variation (range) when performing the calculations.

For the spatial comparison among observation points the median passage rate must be used, as it has been done in a few studies where long-term migration projects also involve different monitoring times (Istúriz, A., Astráin, C., Ibarrola, I., Milon, É, Castegè, I. (eds). 2019. Oiseaux Terrestres et marins dans les Pyrenées Atlantiques. Changement climatique, migration, et evolution des populations. GAN-NIK/CMB/POCTEFA NaturClima EFA 311/19). Due to the different contribution of each species to the total numbers the analyses were performed for the same species in the earlier section above.

Two analyses were performed for each species either considering five (5) or seven (7) OPs. Only for the Honey Buzzard the test was performed for the 7 OPs situation as discussed earlier. In addition, it is not believed this would affect the overall conclusions of the study as discussed later throughout this section.

The table below shows the results for those species passing in a steady way. ONLY TWO SPECIES, the Honey and Steppe buzzards showed significant differences among the OPs. The table excludes species which are irregular migrants like the Common crane (47 records) or the Levant Sparrowhawk (4 records). Despite the high numbers recorded, these species usually only pass through one or two VPs from time to time but in large numbers. Species like the Osprey, or the small falcons, were also excluded given that they migrate in very low individual numbers. Finally, the analysis was not possible for the Montagu´s Harrier given the low amount of data.

Table 5-31: Results of the ANOVA tests for species specific passing rates among the observation points

Species	Five Observation points		Seven Observation points	
	ANOVA test	Significance	ANOVA test	Significance
Lesser spotted eagle	F(4;60) = 0.91	P = 0.45	F(6;68) = 1.46	P = 0.20
Steppe Eagle	F(4;676) = 0.55	P = 0.45	F(6;687) = 0.57	P = 0.75
White Pelican	F(4;49) = 0.16	P = 0.95	F(6;50) = 0.15	P = 0.98
E. Imperial eagle	F(4;18) = 1.33	P = 0.29	F(5;18) = 1.20	P = 0.34
Short-toed eagle	F(4;79) = 1.10	P = 0.36	F(6;87) = 1.71	P = 0.12
Steppe Buzzard	F(4;573) = 4.70	**P < 0.01**	F(6;616) = 3.94	**P <0.001**
White Stork	F(4;120) = 0.46	P = 0.75	F(6;133) = 0.40	P = 0.87
Black Kite	F(4;346) = 1.18	P = 0.31	F(6;398) = 1.36	P = 0.22
Black Stork	F(4;40) = 0.27	P = 0.89	F(6;46) = 0.32	P = 0.81
Egyptian Vulture	F(4;24) = 2.19	P = 0.10	F(6;27) = 1.70	P = 0.15
Long-legged buzzard	F(4;77) = 1.15	P = 0.34	F(6;77) = 0.88	P = 0.50
Booted eagle	F(4;59) = 1.24	P = 0.28	F(6;73) = 1.23	P = 0.29
Honey Buzzard			F(6;309) = 6.11	**P < 0.001**
Marsh Harrier	F(3,20) = 1.42	P = 0.26	F(5;22) = 1.11	P = 0.38
Pallid Harrier	F(2;2) = 0.72	P = 0.57	F(2;2) = 0.73	P = 0.57
Spotted Eagle	F(1;1) = 0.28	P = 0.68	F(2;1) = 0.34	P = 0.77

Results suggest that significant differences are not related with a preferred passing area through the proposed wind farm, but an effect of the flocking behavior (flock size) in such differences. On the other side, the White Stork is also a species with gregarious behavior; however, no differences were detected.

Such passing rates for these two key species are presented visually and their confidence intervals in the figures below.

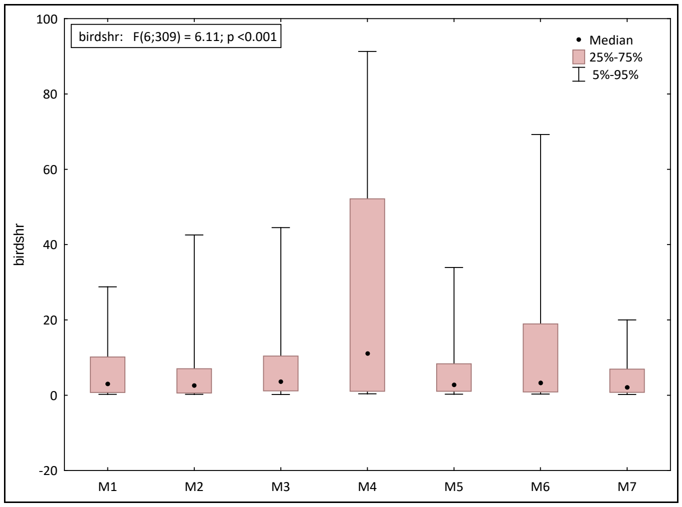


Figure 5-80: Significant passing rates for the Honey Buzzard (results showed only for 7 OPs, see text)

As seen, the highest passing rate for the Honey Buzzard occurs at the OP number four. Before stating that this is a common pattern of passage for this species, the results must be compared against migration rates in a different year for the same sites, which is obviously not possible given that only a single spring season has been undertaken for this site. However, data from other avifauna monitoring projects for wind farms in the GoS area where multiple monitoring seasons have undertaken always demonstrate that there are no similar patterns across years.

The Steppe Buzzard is showed in the figure below. Similar to the Honey Buzzard, the use of five or seven OP does not affect the results, showing a similar trend with major passing rates at OP 2, 3, and 4.

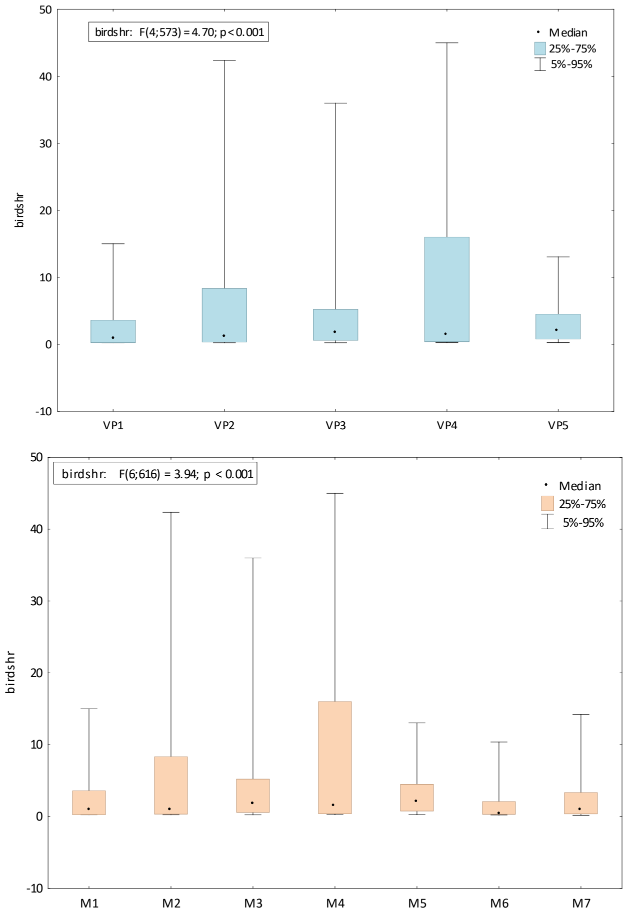


Figure 5-81: Significant passing rates for the Steppe Buzzard

When comparing both species, they only match (have the highest passing rate) at OP 4; whilst another fourteen species do not show any preference for passing through any OP.

From the table above it can be concluded that birds pass randomly through this project area, with no preferred sites (observation points), as the landscape does not force them to follow specific routes once they are within the windfarm.

Migration Patterns: Flocking behaviour

An essential aspect of the migratory behavior which links with the previous discussion and presented figures is the time of passage as presented earlier, but the second is the flocking behavior (group size).

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

The table below presents the average flock size (birds /flock) for all species, its confidence interval ± 95%, the number of records, and their minimum and the maximum values. As noted, by far the Great White Pelican, Levant Sparrow Hawk, White Stork and the Crane had the largest flock sizes.

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 four species do in large ones which are highlighted.

Table 5-32: Average Flock Sizes

Species	Means	Conf -95%	Conf +95%	N	Min	Max
Lesser Spotted Eagle	1.56	1.39	1.73	75	1	4
Steppe Eagle	7.66	6.28	9.04	694	1	273
Crane	**417.00**	257.64	576.36	47	4	2500
Long-legged Buzzard	1.38	1.22	1.54	84	1	5
Short-toed Eagle	1.31	1.15	1.46	94	1	5
Steppe Buzzard	20.41	16.87	23.94	623	1	500
White Pelican	**472.98**	215.00	730.96	57	1	5000
Imperial Eagle	1.04	0.96	1.13	24	1	2
White Stork	**1004.54**	713.22	1295.86	140	1	10000
Kestrel	1.04	0.98	1.09	52	1	2
Black Kite	13.93	10.83	17.02	405	1	320
Black Stork	29.77	17.30	42.25	53	1	160
Egyptian Vulture	1.12	0.97	1.26	34	1	3
Spotted Eagle	1.25	0.45	2.05	4	1	2
Montagu's Harrier	1.00			3	1	1
Marsh Harrier	1.11	0.99	1.23	28	1	2
Pallid Harrier	1.20	0.64	1.76	5	1	2
Osprey	1.00			6	1	1
Booted Eagle	1.41	1.23	1.60	80	1	6
Sparrowhawk	1.92	0.69	3.14	24	1	15
Griffon Vulture	1.00		u	1	1	1
Honey Buzzard	36.84	29.56	44.11	316	1	500
Levant Sparrowhawk	**4500.25**	-1381.61	10382.11	4	1	8000
Hobby	1.00			2	1	1
Crested Honey Buzzard	1.00			1	1	1

Comparing the flock size of the Steppe and Honey buzzards with all the other species, both species have medium size (20-36 individuals/flock) compared to the Levant Sparrowhawk and White Stork (> 1,000 in/flock) and the Common Crane and White Pelican (~400 individuals).

The table below shows the average flock size per OP for the Honey and Steppe buzzards and the number of records. The number of records may also depend on the monitoring time (the more monitoring time the highest number of records), as it appears when comparing with Table 5-285-25. However, it is evident that the larger flock sizes occurred for both species at OP 4. This reinforces the idea that flock size is the reason of the observed significant differences among OPs.

Table 5-33: Average flock size and number of records per observation point

	Honey Buzzard		Steppe Buzzard	
OP	**Aver. Flock size**	**n**	**Aver. Flock size**	**n**
M1	26.17	96	11.32	139
M3	36.46	41	20.51	162
M5	21.21	19	11.53	57
M2	36.99	68	30.80	177
M4	104.00	18	30.19	43
M6	59.03	35	7.63	24
M7	19.92	39	10.81	21

Migration Patterns: Time of Day

The next step was to analyse the time of passage according to the time interval in the day. The monitoring extends continuously from around 7:00 am to 5:00 pm daily.

The first figure shows the overall trend of all bird species pooled together. There is almost a stable trend during the entire day (20-30 birds /hr) which steadily increases around 13:00 hr, reaching a peak at 14:00-15:00

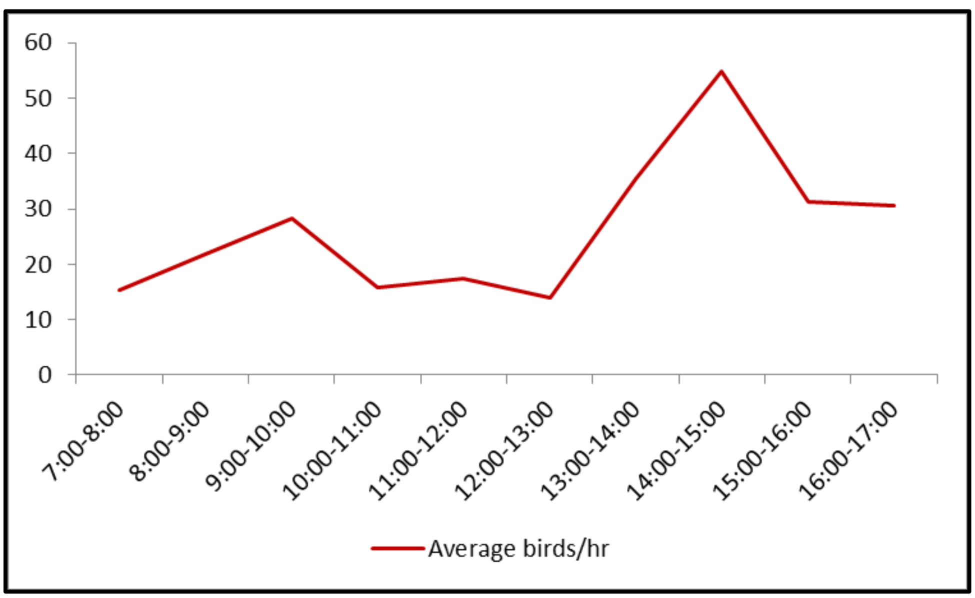


Figure 5-82: Bird numbers recorded at the project site

The analysis below presents the trend that was drawn of the contacts throughout the day. The trend follows a different pattern compared to bird numbers; lower numbers of birds are recorded in the early hours but they come more frequently. The reasons for this are the large flocks of e.g., White Storks, which migrate late in the day. This is critical as it allows observers during the Active Turbine Management Plan (ATMP) implementation to know when to pay more attention for migratory birds. A key trend is noted that suggests the peak of the migration taking place within the mid-daylight hours (8:00 am to 13:00 pm). This indicates that this is the most critical time for the observers to track the birds.

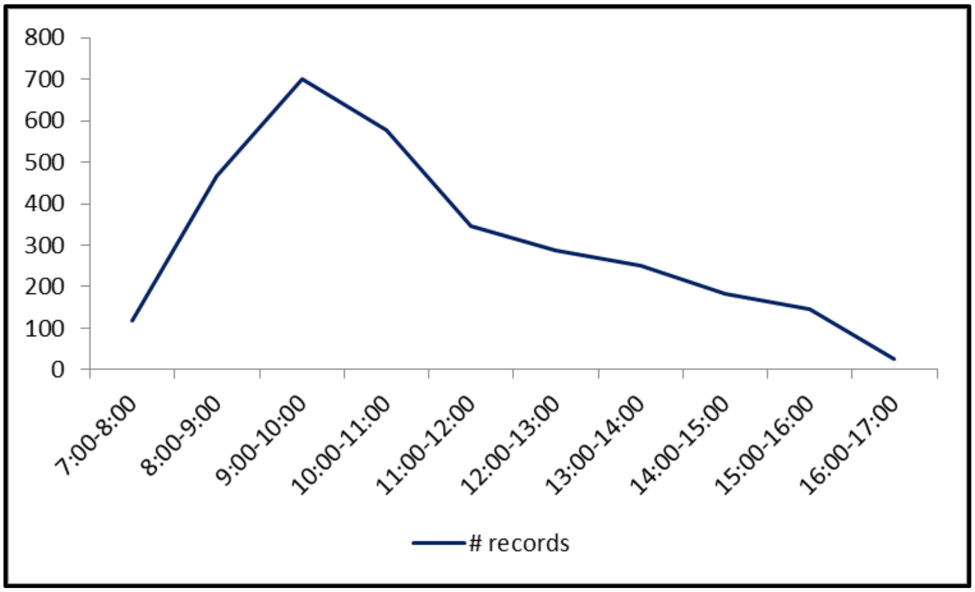


Figure 5-83: Number of records per hour interval

The analysis below investigated further the migration for those key species noted earlier. As discussed before, observations and individuals were selected.

The first species is the Black Kite. As noted in Figure 5-785-70 more bird numbers were recorded in the early morning but, because of the different time monitoring throughout the day, there is a higher passing rate in the afternoon compared to early hours.

For the Honey Buzzard, Figure 5-795-71 shows that the trend differs from that of the Black kite, as it migrates earlier in the day with the higher numbers around 7:00-9:00 am and again another increase in the afternoon, similar to the Black Kite.

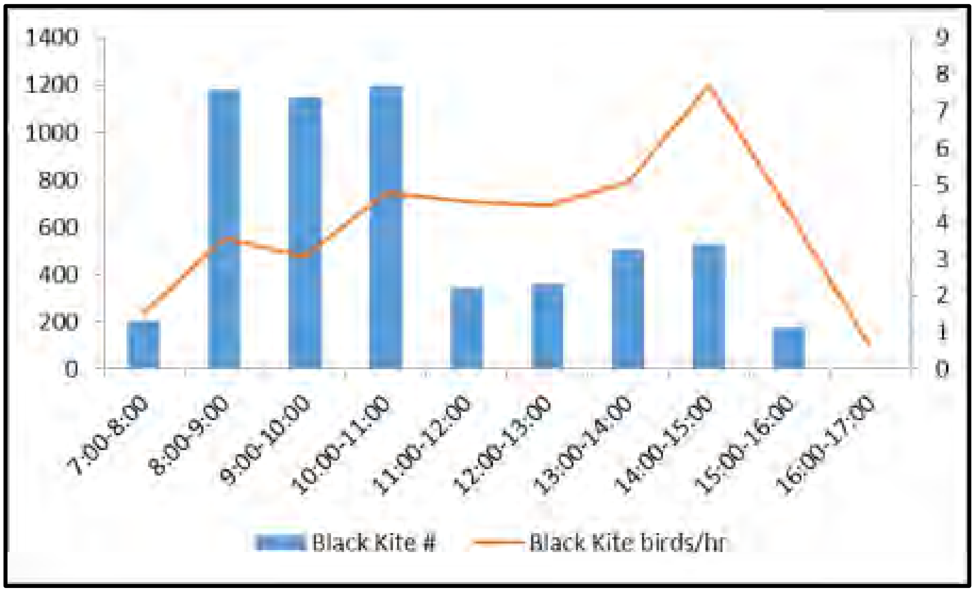


Figure 5-84: Daily migration pattern (hr. of the day) of the Black Kite

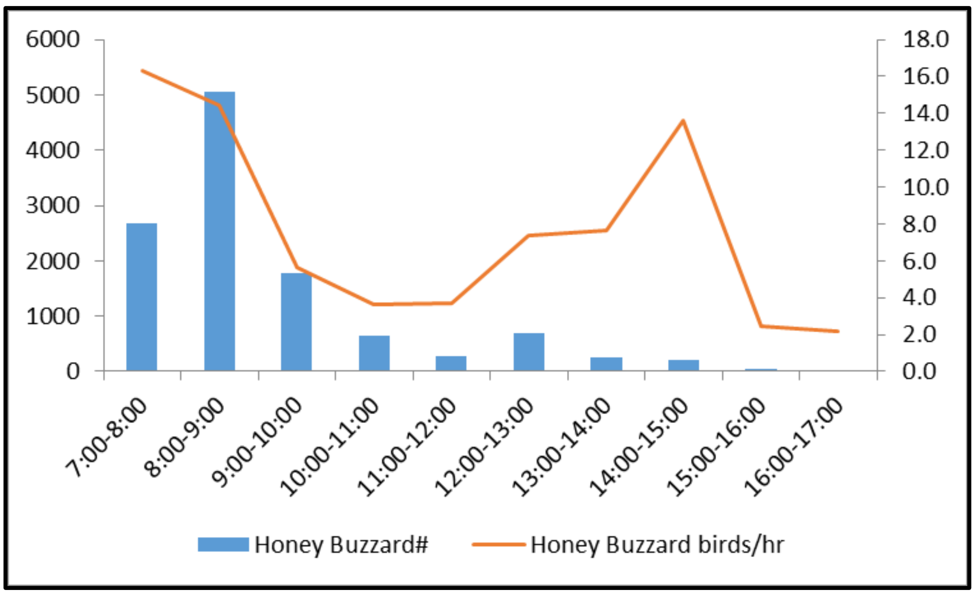


Figure 5-85: Daily migration pattern (hr. of the day) of the Honey Buzzard

The White Stork also shows a similar pattern with high passing rates in the morning (8:00-10:00) and late afternoon (14:00-16:00). The passing rates in this case correspond with the bird numbers recorded in large flocks.

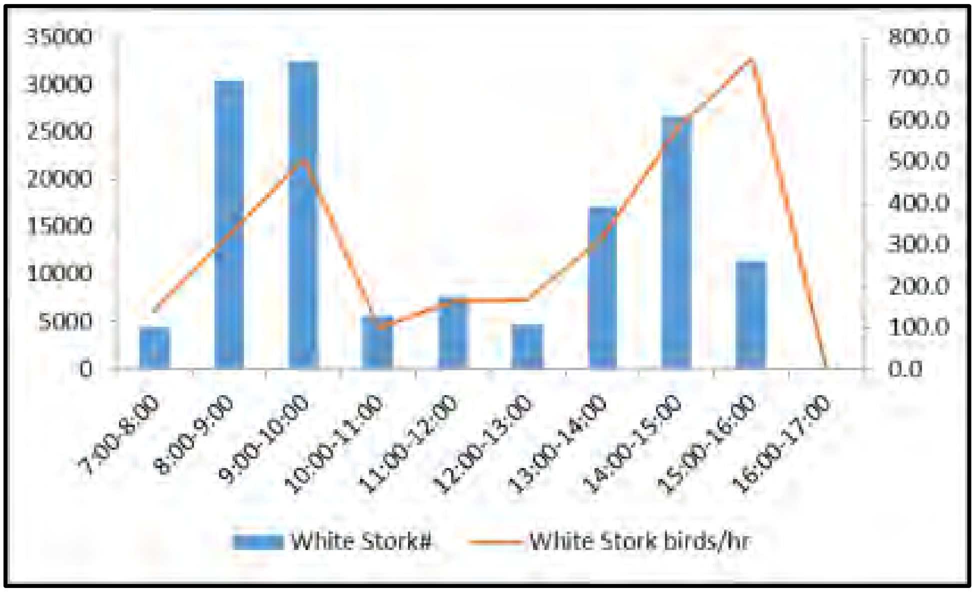


Figure 5-86: Daily migration pattern (hr. of the day) of the White Stork

The Black Stork has no clear pattern, with birds passing in similar numbers throughout the day despite the total numbers not being very large.

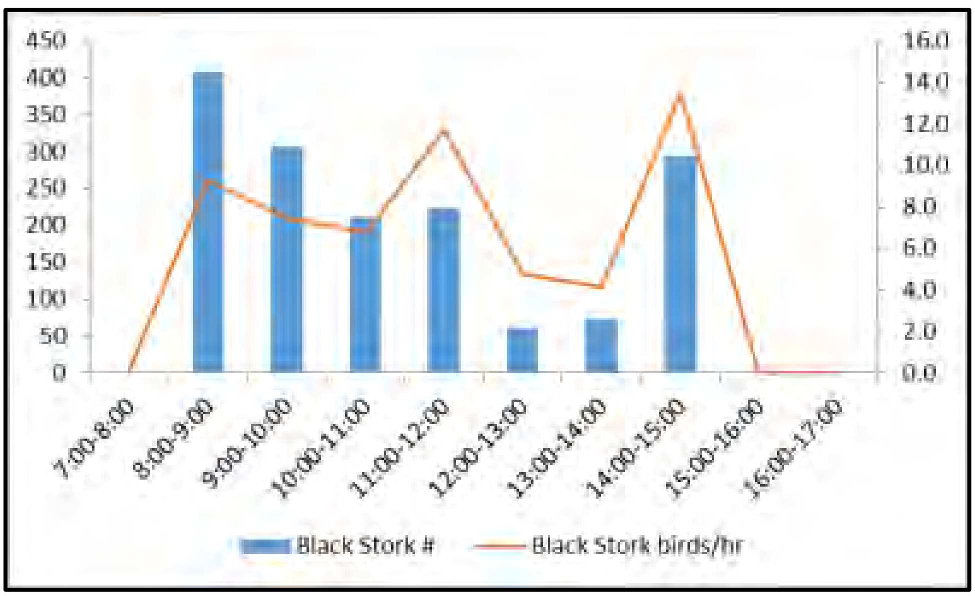


Figure 5-87: Daily migration pattern (hr. of the day) of the Black Stork

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. However, the passing rate is higher between 13:00 and 14:00.

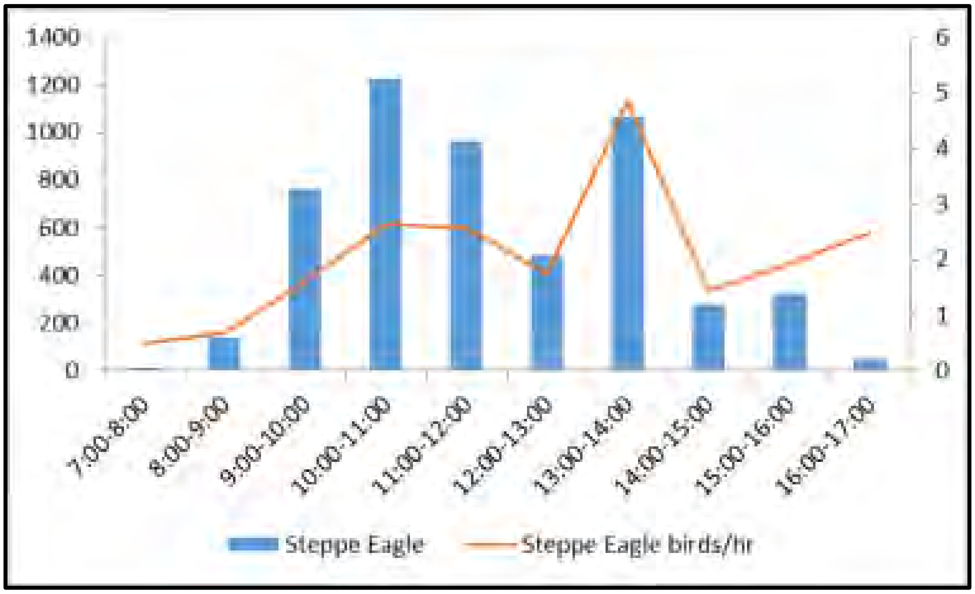


Figure 5-88: Daily migration pattern (hr. of the day) of the Steppe Eagle

Other species forming flocks are the Common Crane and the Great White Pelican. For the Common Crane, the highest passing rate occurred in the afternoon. There is however a different pattern for the White Pelican with a higher pass in the morning and a lower increase in the early evening.

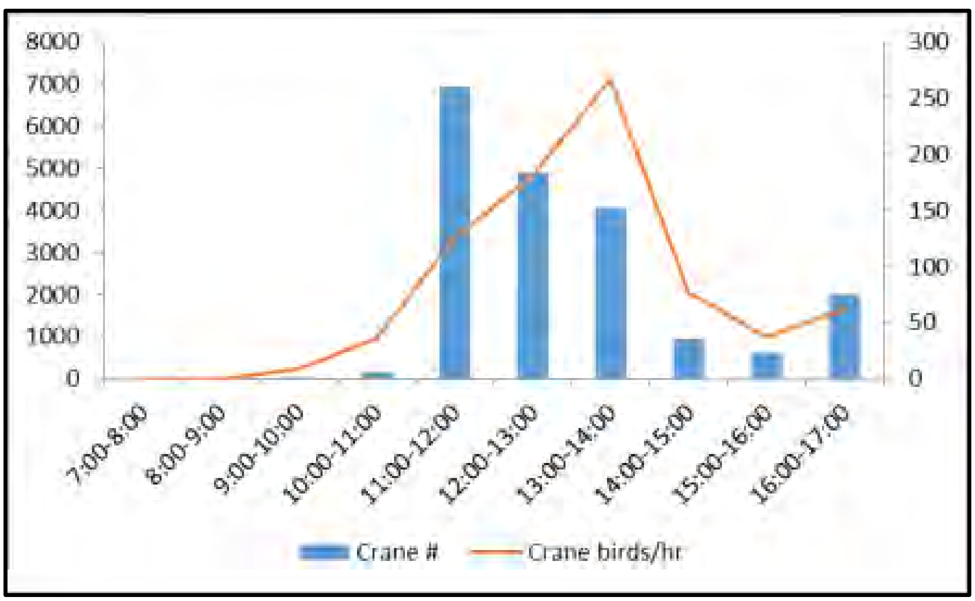


Figure 5-89: Daily migration pattern (hr. of the day) of the Common Crane

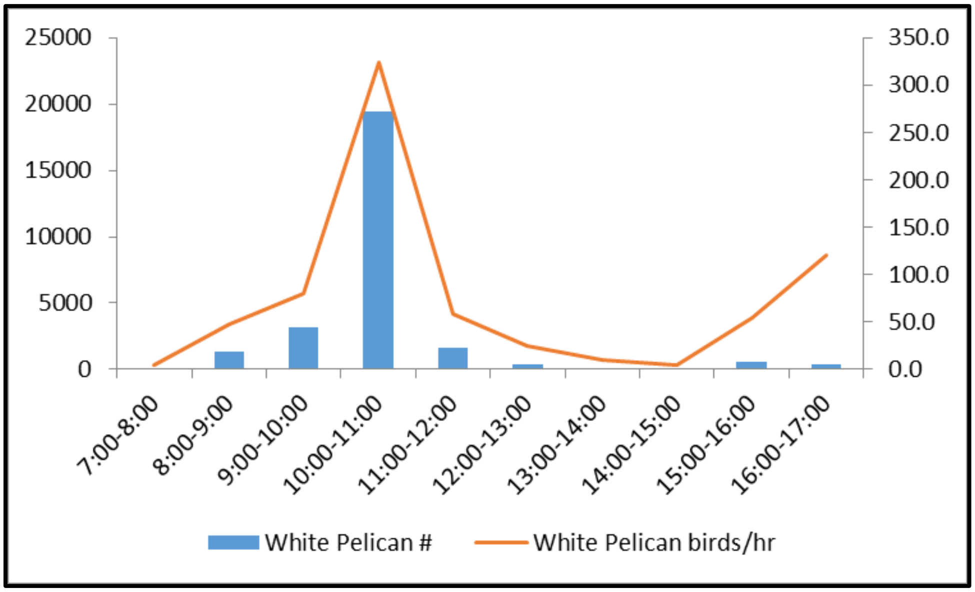


Figure 5-90: Daily migration pattern (hr. of the day) of the Great White Pelican

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

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. In addition, as will be demonstrated below, the results also affect the risk flights.

Flight Direction

The main flight directions for the spring season appears in the figures below. There is a clear orientation to the NW, which could be related to the intention of birds to follow the ridgeline of the mountains surrounding the Red Sea. Such mountains at variable distance from the coast would help the birds to migrate in an easier way, relying on the up-air currents which appear when a mountain slope diverts the winds, causing air currents to climb. This is the so-called slope soaring. Following the mountain range, birds would reach the Gulf of Suez in a much easier way compared to flying over the plain desert and only using the thermal soaring and despite the good conditions of the region for such kind of flight.

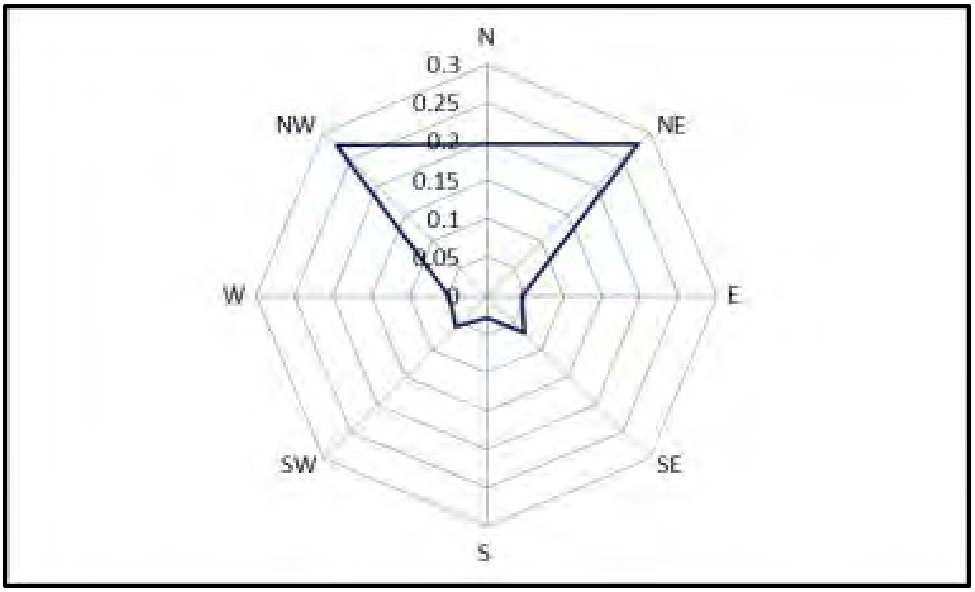


Figure 5-91: Observed flight direction of the migratory soaring birds

Just to confirm potential influence of certain species in the overall directions above, the figure below presents the most abundant species recorded: Black Kite, White Pelican, Honey and Steppe buzzards, and the White Stork, all sorted per cardinal direction. All show a similar pattern of migration with most of individuals being recorded N, NE, W, and NW. This agrees with the main flight direction during the spring season of the most abundant species. The Figure represents in the left Y-axis all the species numbers except the White Stork (right Y-axis).

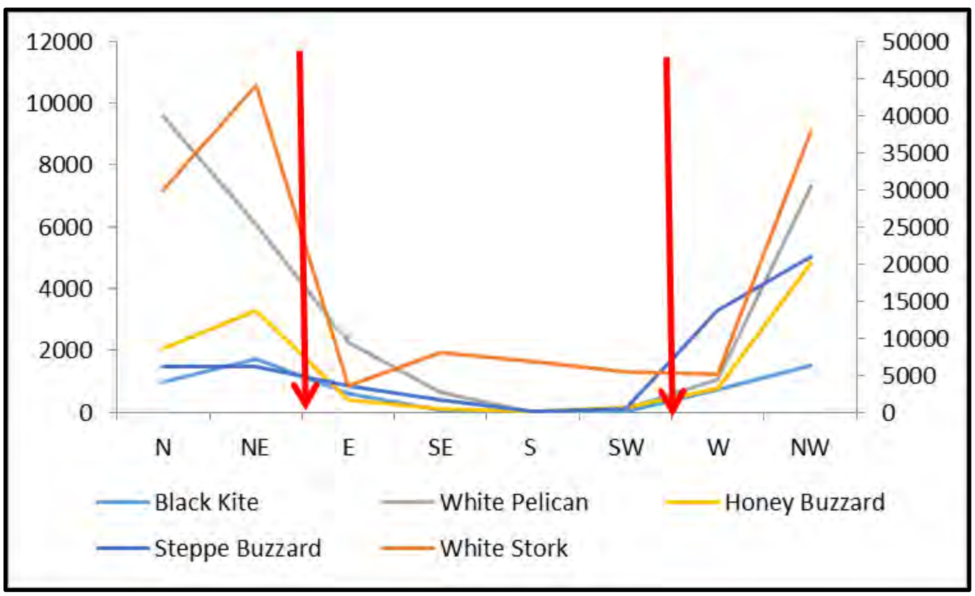


Figure 5-92: Bird number according to their flight directions for the five species with the highest counts

Comparison with Neighboring Site

Due to the change of the Project footprint as mentioned earlier, two additional VPs were added later throughout the season (specifically on 22 April 2022 – VP 6 and VP 7 as noted in the figure below). Due to that, monitoring time at that this area in specific was lower compared to the rest of the Project site, where monitoring had started much earlier in February at the beginning of the spring monitoring season.

To avoid potential biases (lack of information), it was decided to compare the data from the Project with that from a neighboring project. This section presents an addendum analysis undertaken for the two projects jointly ("cumulative") to determine the outcomes of the Project specific monitoring compared to others in the region, and if corrections based in the monitoring gap would be required for this Project. The figure below shows the two projects, the open red outlined area is the Project and the blue is the neighboring project. Note: ECO Consult and EcoConServ has obtained the approval of RCREEE (as the owner of the data) to use such data for the purpose of this analysis presented in the report.

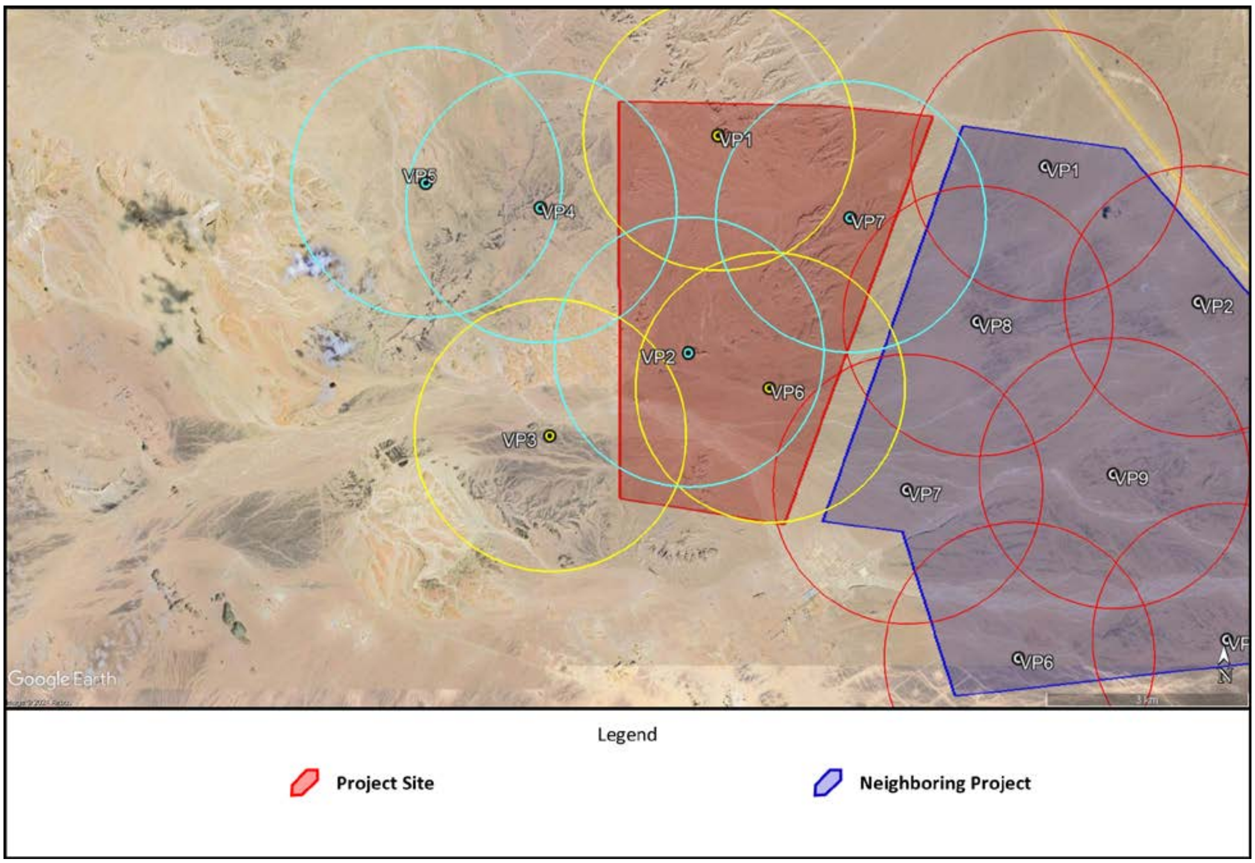


Figure 5-93: Location of Project Site (left) and Neighboring Project (right) and their associated VPs

The table below first provides an overview of the monitoring times of both Projects.

<u>Scatec Project</u>

DATES	2022
Spring	20-Feb to 18-May
Hours	1067 hr 37 min
VPs	7 (2 added on 22 April)

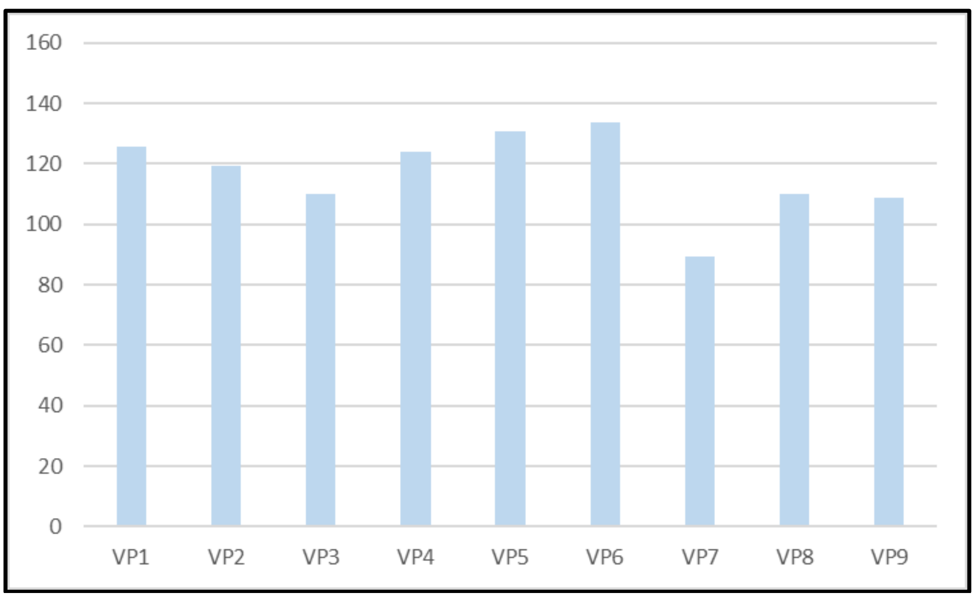
Neighboring Project

DATES	2022
Spring	09-Mar to 19-May
Hours	1052 hr 20 min
VPs	9

1) **Dates**: As the tables show there are differences in the monitoring times, with Project starting earlier (by seventeen days), and finishing just one day earlier.

2) **Hours:** The global monitoring time was nearly similar between the two sites with 15 hr. and 17 min additional monitoring undertaken at the Scatec Project. However, even within a day, monitoring time is not the same with some hours being monitored more than others. The figures below show the monitoring times per VP for the two projects and their differences.

Neighboring Project



Project site

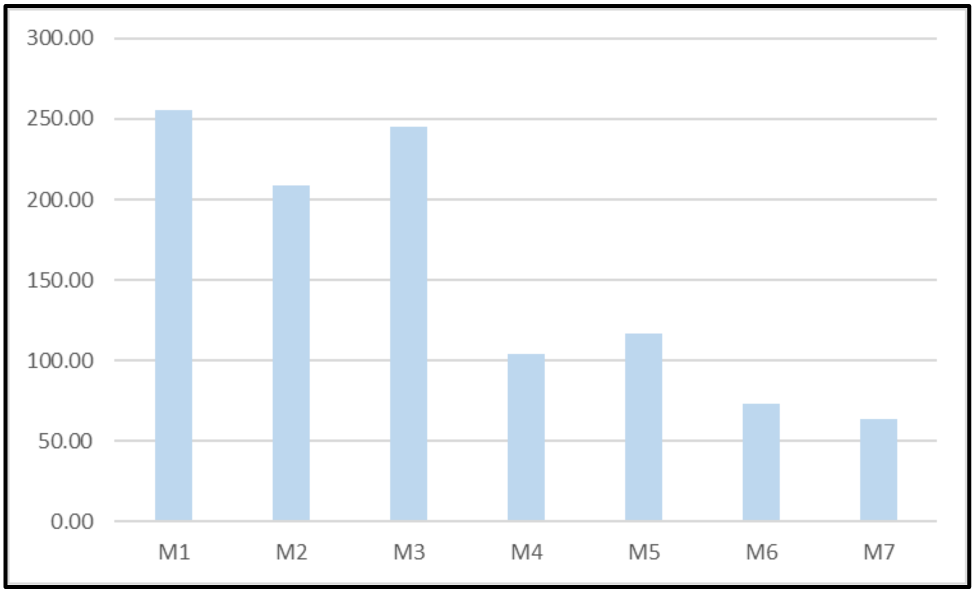


***Figure 5-94:** Monitoring times at the two projects in spring 2022*

3) **Vantage Points**: despite the similar monitoring times, the number of VPs is different between the two sites, five originally at Scatec site (seven after adding additional 2 VPS in April) versus nine at Neighboring Project site. Thus, different monitoring times were spent per VP and thus comparison of the raw numbers recorded may contribute to biases: the more monitoring time may result in more records and individuals detected. Thus, no direct comparisons among projects can be done. It is the passing rate as a variable that needs to be used.

Days of monitoring: Specific coverage of the Vantage points overlapping the two projects

According to the figure above, the overlap of the VPs between neighboring Project and Scatec exists as follows:

- VP7 (Neighboring Project) overlaps with VP6 of Scatec
- VP8 (Neighboring Project) overlaps VP6 and VP7 of Scatec
- VP1 (Neighboring Project) overlaps VP7 of Scatec

How the VPs have been covered at the two sites were checked for data comparisons from April 22nd till the end of the monitoring in May. The results would reinforce the idea of common passage and confirm the hypothesis. The table below shows the monitoring VPs at each project for each day from 22nd April onwards.

Table 5-34 : Vantage points monitored at Scatec and Neighboring projects between 22nd April and 20 May 2022

Day	Scatec	Neighboring	Day	Scatec	Neighboring
22-apr	6	1 and 7	01-may	7	1, 8, and 7
23-apr	7	1 and 8	02-may	6	1 and 8
24-apr	6	7 and 8	03-may	7	7 and 8
25-apr	7	1 and 7	04-may	6	1 and 7
26-apr	6	1 and 8	05-may	7	1 and 8
27-apr	7	7 and 8	06-may	6	7 and 8
28-apr	6	1	07-may	7	1 and 7
29-apr	7	1 and 8	08-may	6	1 and 8
30-apr	6	??	09-may	7	7 and 8
			10-may	6	1 and 7
			11-may	7	1 and 8
			12-may	6	7 and 8
			13-may	7	1 and 7
			14-may	6	1 and 8
			15-may	7	7 and 8
			16-may	6	1 and 7
			17-may	7	1 and 8
			18-may	6	7 and 8
			19-may	7	1 and 7
			20-may	6	8

The day-by-day analyses showed no clear pattern of relationship between the days the monitoring was performed at Scatec or Neighboring Project, neither for VP7 (Neighboring Project) overlaps and VP6 of Scatec nor VP1 (Neighboring Project) and VP7 of Scatec. The multiple factors involved in bird monitoring and the methods used, only allow a large-scale analysis and a not so fine-tuned one as we would like on a vantage point basis.

Important to note is what was mentioned above about the Falsterbo observatory (Sweden) and the biases by experienced observers. Such controversy about the different numbers recorded and differences between OPs also applies here.

Due to the above and potential for biases in the outcomes, the following is considered:

- Passing bird rates will be considered (birds /hour of observation) instead of the raw bird numbers or records throughout the analyses.
- Groups detected at Neighboring Project may split or join once they cross and before arriving Scatec site and being recorded. Unless individuals be marked with e.g., readable rings or wing tags.
- For a proper comparison, the data collected for the weeks where monitoring took place at both

Neighboring Project and Scatec (weeks 11 to 21) will be used. All the records from February till March 9th (weeks 9 and 10) will be excluded. Table 5-34 shows that there are no simultaneous counts at joining OPs within the same day, so it should be assumed that birds recorded are different.

Hypothesis

it is considered that birds passing through Neighboring Project could pass later over the Scatec Site. Thus, the observers at the above-mentioned VPs would record nearly the same bird species and passing rates. These coincidences would be at different project level:

- **Spatial analysis**: The joint spatial analysis of Neighboring Project and Scatec reveals complexity and many guesses not achievable with the existing data:

  a) At Scatec, the spatial pattern has been discussed in detail previously; only two species showed some spatial significant differences (Honey and Steppe buzzards).

  b) The spatial boundaries of both projects appear in the figure below. The geographic orientation of the Neighboring Project related to Scatec suggest that birds flying in parallel to the coast, do not need to fly over Scatec; in other words, not all birds passing Neighboring Project should pass Scatec as well. This reinforces the idea of the temporal analysis between the two projects (months and weeks, and hourly trends.)

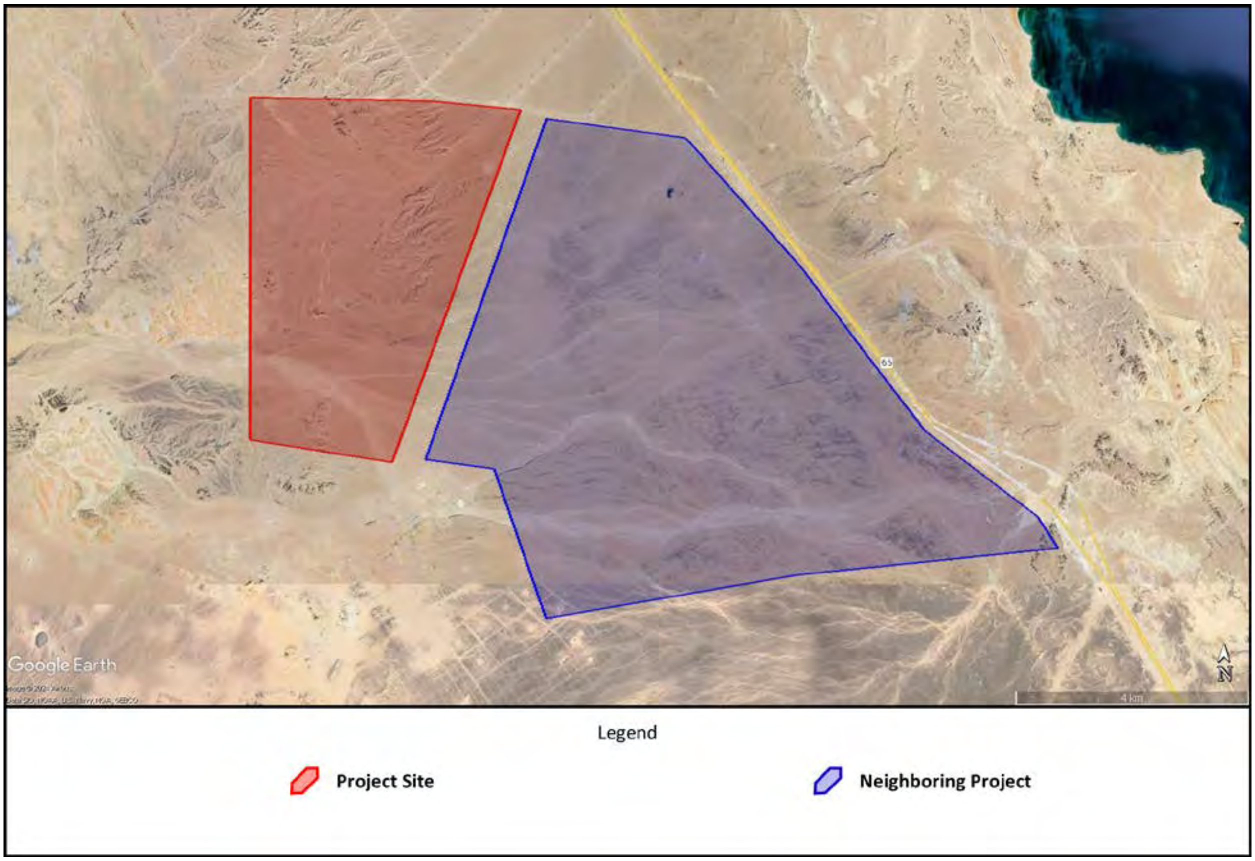


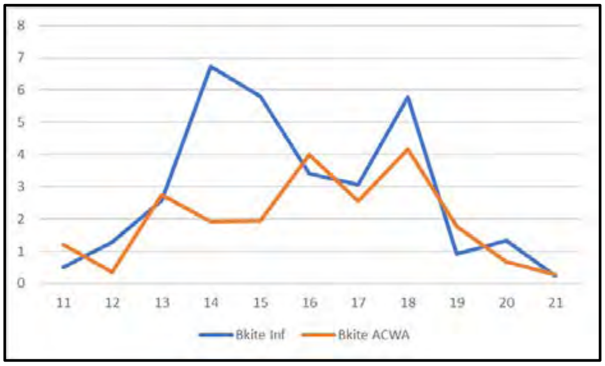
Figure 5-95: Location of both Project Site (left) and Neighboring Project (right)

- **Passing times** (weeks) **and passing rates** (birds/hr.) would not differ between Neighboring Project and Scatec globally (considering the VPs altogether).

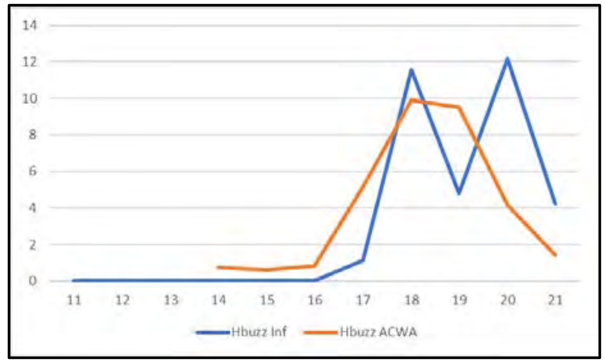
Results

The figures below present the passing rates at the two projects for ten of the species present at both sites, between Week #11 (March 9th), Week #14-18 (April) and Week #19-21 (May).

The blue lines in the figures below present the Scatec project while the orange lines presents the neighboring project.

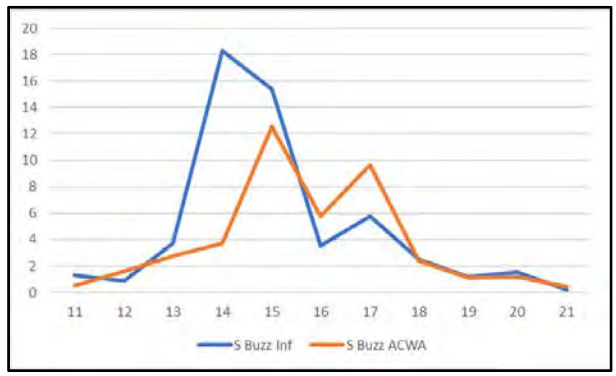


Black Kite



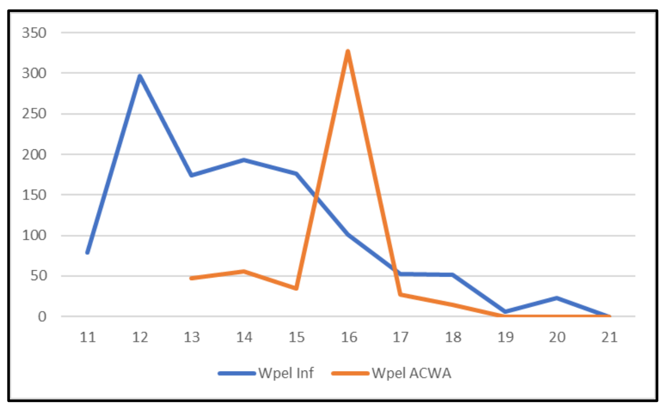
Honey Buzzard

Short-toed Eagle

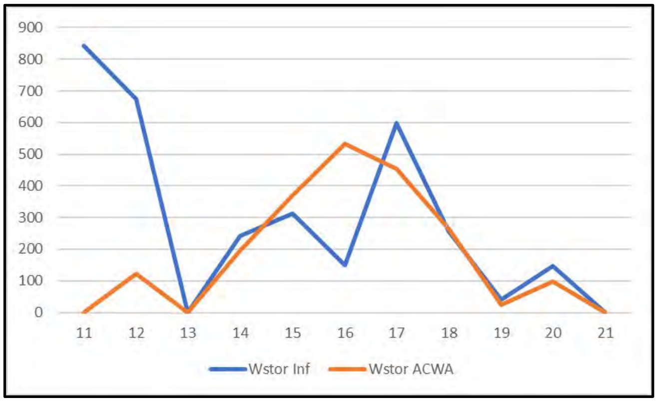


Steppe Buzzard

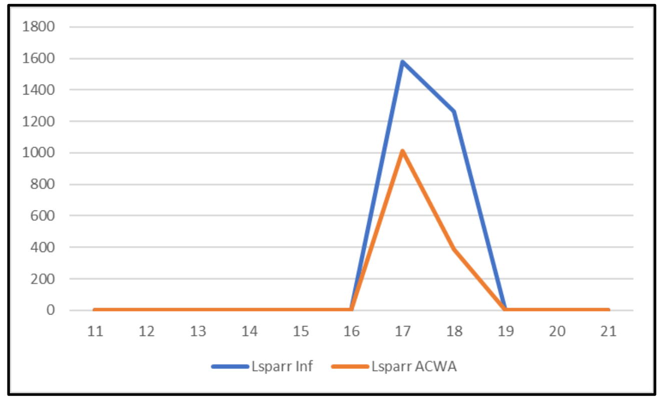
Steppe Eagle



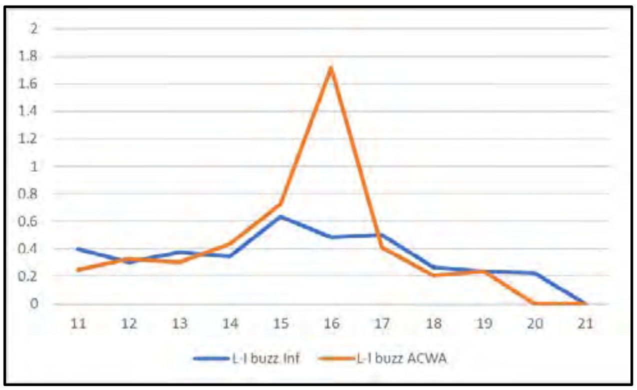
Great White Pelican



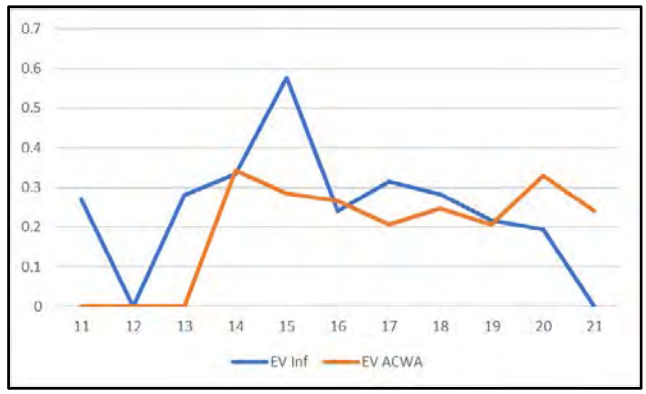
White Stork



Levant Sparrowhawk



Long-legged Buzzard



Egyptian Vulture

From the figures it can be concluded that there are species for which the passing times match very well both at Scatec and Neighboring Project. These are the Black Kite, Honey Buzzard, Steppe Buzzard, Steppe Eagle, Levant Sparrowhawk, and Long-legged Buzzard. They are a total of six out of the ten species presented above. It is noteworthy to mention the pattern of the Levant Sparrowhawk, which appears exactly at the same time at the two projects. A further insight into the databases showed that the days of passage were the same three ones in April where large flocks were noticed. The two records that did not matched both projects were of a few individuals.

The other four species Egyptian Vulture, Short-toed eagle, White Stork, and Great White Pelican, exhibit two different behaviours. Both the Egyptian and the eagle migrate in small numbers of less than five individuals, usually 1-3. This could have implications for the observers, making the birds less detectable. On the contrary, the Storks and the Pelicans form large flocks. These species cross the Red Sea in their migrations, even the Pelicans may land on water. The differences could be related to a different strategy during the migration, where these two could fly into the sea rather than fully following the coast of the GoS.

Taking the above into account, the patterns are clear. However, it is important to also investigate how strong the association of the passing rates among the two projects, and if the same can be done with the remaining species like the spotted eagles, Booted eagle, Black Stork, Eastern Imperial Eagle, or the harriers.

For that, a simple correlation analysis for the weekly /monthly passing rates has been done. This measures how strong and if such association in the passing rates is significant (the birds passing Neighboring Project would be nearly the same passing Scatec afterwards).

Table 5-35: Correlation coefficients between the species-specific passing rates at Neighboring and Scatec sites

Species	Correlation coef. Pearson	Significance (p value)
Black Kite	**0.69**	**<0.05**
Honey Buzzard	**0.84**	**<0.05**
Short-toed eagle	0.28	n.s.
Steppe Buzzard	**0.86**	**<0.05**
Steppe Eagle	**0.90**	**<0.05**
Great White Pelican	**0.88**	**<0.05**
White Stork	0.31	n.s.
Levant Sparrowhawk	**0.85**	**<0.05**
Long-legged Buzzard	**0.84**	**<0.05**
Egyptian Vulture	0.32	n.s.
Black Stork	0.17	n.s.
Booted Eagle	**0.86**	**<0.05**
Lesser Spotted Eagle	**0.73**	**<0.05**
Eastern Imperial Eagle	0.42	n.s.
Marsh Harrier	0.30	n.s.

The results of the correlation coefficients support the hypothesis that the species pass at the same time over the two projects. The passing rates are similar for nine out of fifteen species considered. Those not included did not have enough data for comparisons. Among the significant results, seven species migrate in flocks, and those migrating in individual numbers may pass either overlooked for the observers in such a wide and open areas, or birds passing through Neighboring Project do not necessarily need to cross Scatec as well.

Conclusions

1) Passing rates (birds/hr. seen) were used instead of raw numbers (total numbers of birds seen). This avoids potential biases when comparing the two projects. Not taking the preliminary considerations (e.g. monitoring times per VPs, dates, hours of the day) contributes to mistakes in the analyses and, more importantly, getting wrong conclusions for the management of the mitigation strategy.

2) It is encouraged to work with passing rates at any project in the region to avoid biases, especially when comparing different projects. The use of the raw numbers may have implications for other matters such as the Critical Habitat definition. It could be the case that a project with a lower monitoring or VPs, would never classify as Critical Habitat despite it being so. Otherwise, adjustments are required to calculate the raw bird numbers before any analysis.

3) The results show a relationship between the passing rates among the two projects. These relationships vary between species, being some significant (showing clear association) and others not. Reason for this lack of association could be related with the migratory behaviour of such species. Both Neighboring Project and Scatec are related at several levels: species passing through are the same, the timing of passage is also the same, but the passing rates might differ. However, no further additions to the results other than those presented in the Bird Monitoring study for Scatec is required, as passing rates are used.

4) There are no landscape features which constrain the birds during the passage. This entails that they can move freely along the route, changing from one site (VP) to another, depending on the weather conditions, making the detectable or not among projects and VPs. Migration is flexible along the route.

5) There are external factors which can influence the different passing rates at the two projects, as it could be the imperfect detection by observers if birds pass far away from the VPs (See Porter 2006 for further insight into this matter).

6) At finer scale (VP level) further analyses were not possible due to the rotational VP monitoring which took place in 2022 among the VPs both at Neighboring Project and Scatec (not the closest VPs were monitoring the same days and the same times). The comparison was not possible for the first three weeks where no monitoring took place.

Autumn Avifauna 2022 Season

This section presents the key outcomes and results of the autumn 2022 avifauna monitoring results.

Monitoring/Sampling effort

The wind farm was monitored every day during the autumn migratory season from August 10th to November 10th for a total time of 2,542 hours and 55 minutes. The start and end time of daily monitoring were adjusted according to length of daylight hours, in order to provide adequate sampling of the whole migration season. The monitoring dates are presented in the table below, while the table that follows presents the total monitoring hours. In autumn the seven OPs were monitored since the beginning. In autumn it also remains valid the statement regarding the chance that identification of all birds and/or groups cannot be achieved, despite the lower numbers recorded compared to spring.

Initial Notes

The figure and table below present the distribution of monitoring hours among the 7 VPs. As noted, the uneven distribution of the monitoring time resulted in different monitoring efforts per month and VP, and this in turn results in differences of bird numbers recorded. As explained earlier, these differences are not due to natural reasons (for example due to differences in migration patterns) but rather due to difference in monitoring hours undertaken (i.e. higher number of monitoring hours will increase the chance of observing more birds). As reiterated previously, this reinforces the need of working with passing bird rates (birds /hour rate) instead raw bird numbers throughout the analysis undertake throughout the subsequent sections, unless clearly stated otherwise.

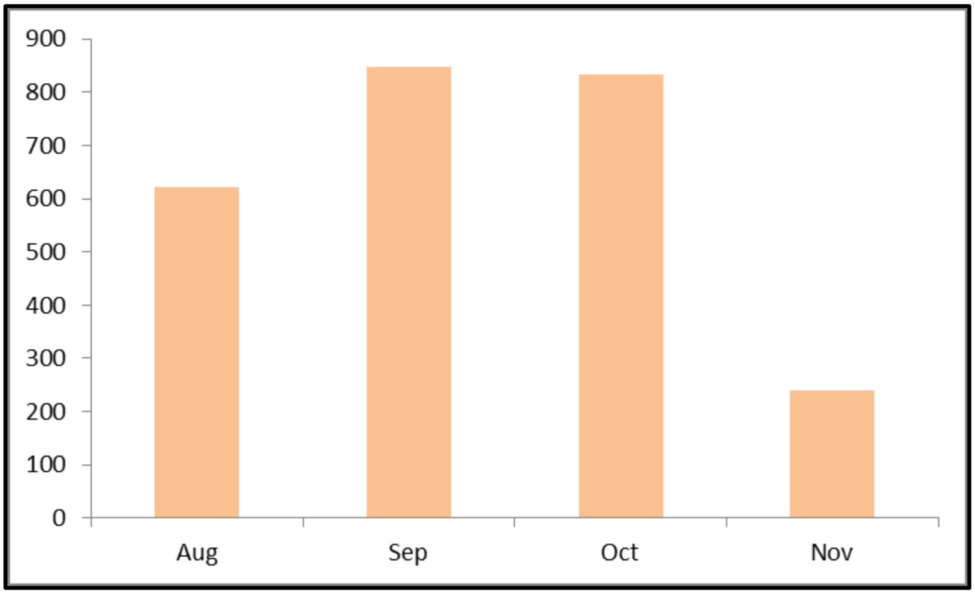


Figure 5-96: Distribution of Monitoring Hours per month

Table 5-36: Total monitoring times per OP

OP	Monitoring time
M1	421:50
M2	425:45
M3	421:50
M4	214:50
M5	210:55
M6	421:50
M7	425:45
Total	2,542:45

Birds and Records Numbers

In autumn 2022, a total of 470 records belonging to 202,279 birds of fifteen (15) species were detected in the Project site. In addition, another 93 birds remained unidentified, see table below.

One species in particular accounted for around 92% of the birds recorded – the White stork. Three (3) species accounted for 99.83% of the birds recorded which include the White Storck, European Honey Buzzard and the Great White Pelican. The proportion these species represent against their respective global populations has been considered in the Critical Habitat Assessment (CHA), which is provided as a standalone report.

Finally, two (2) species were classified as Endangered (EN), the Egyptian Vulture and the Steppe Eagle. A fourth one could be considered of special interest being Near Threatened (NT), the Pallid Harrier.

Table 5-37: Species Recorded

SPECIES	IUCN Red List (2019)	National Status	n obs	Individuals
Black Kite	LC	*Pm*	53	210
Black Stork	LC	*Pm*	3	11
Booted Eagle	LC	*Pm*	3	3
Common Crane	LC	*Pm*		
Common Kestrel	LC	*Pm/R*	9	9
Crested Honey Buzzard	LC	*Pm*		
Eastern Imperial Eagle	VU	*Pm*		
Egyptian Vulture	EN	*Pm*	5	13
Griffon Vulture	LC	*Pm*		
Eurasian Sparrowhawk	LC	*Pm*	1	1
European Honey Buzzard	LC	*Pm*	169	2080
Great White Pelican	LC	*Pm*	6	13847
Greater Spotted Eagle	VU	*Pm*		
Lanner Falcon	LC	*Pm*		
Hobby	LC	*Pm*		
Lesser Kestrel	LC	*Pm*		
Lesser Spotted Eagle	LC	*Pm*		
Long-legged Buzzard	LC	*Pm/Wv*	1	1
Levant Sparrowhawk	LC	*Pm*		
Montagu's Harrier	LC	*Pm*	11	11
Osprey	LC	*Pm*		
Pallid Harrier	NT	*Pm/Wv*	4	4
Short-toed Snake Eagle	LC	*Pm/Sm*		
Sooty Falcon	VU	*Pm/Sb*		
Steppe Buzzard	LC	*Pm*	17	23
Steppe Eagle	EN	*Pm/Wv*	8	15
Western Marsh Harrier	LC	*Pm*	33	41
White Stork	LC	*Pm*	86	186010

Subtotal			**470**	**202,279**
Eagle species	-	-	1	1
Unidentified raptor	-	-	4	4
Unidentified Harrier	-	-	7	8
Unidentified Buzzard	-	-	12	75
Falcon sp.	-	-	5	5
Total			**499**	**202,372**

Spatial and Temporal Distribution

Despite the different monitoring times per OP, the standardization of the data (birds / hour of monitoring) allows a proper comparison among the passing rates per OP and thus, checks if there are spatial differences which could suggest preferred sites to cross.

The analysis has been made on species-specific basis due to two main reasons: i) the contribution of the White Stork to the total counts as seen above and ii) because each species has its own migration pattern within the season. Due to that, migration pattern throughout the months and weeks were analysed, and later potential spatial differences among the OPs were considered. Due to the amount of individuals most of the species involved (< 50 individuals), only the White Stork, the Great White Pelican and the Honey Buzzard were analyzed as discussed in further details below.

Months and weeks

In the following step, the timing of passage was analysed according to the month and week. 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 autumn monitoring period undertaken. Please refer to the spring season for additional details on the comparison references that were utilized for this section in specific.

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 September, despite an incipient migration in the last week of August (Shirihai et al. 2000)).

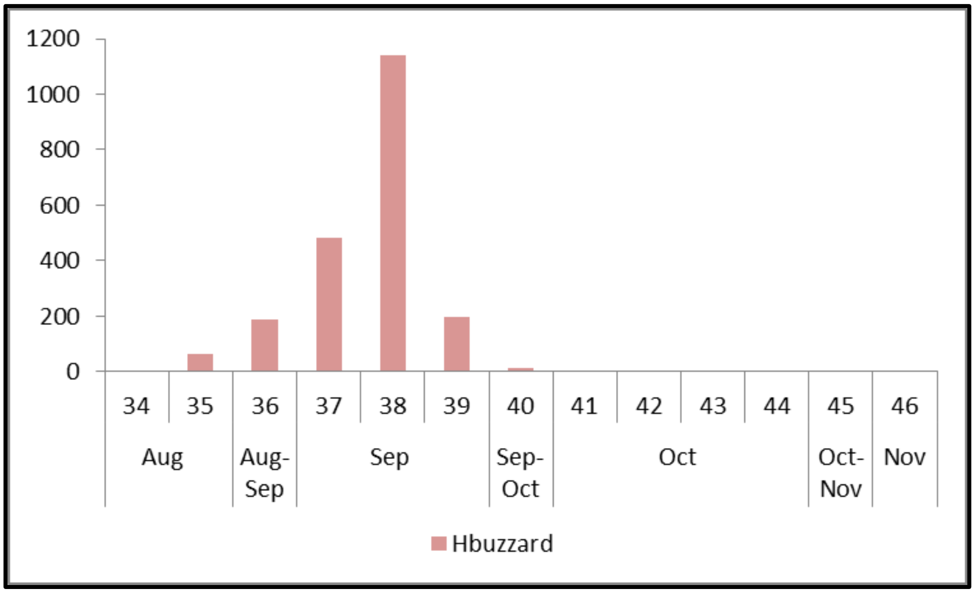


Figure 5-97: Migration pattern of the Eurasian Honey Buzzard

The figure below presents the migration pattern for the White Stork. This species has been recorded in late August and early September. This is the known passage pattern of the species in the Palearctic, and which is also similar with other projects in the GoS region. This species accounted for the highest amount of birds compared to any other species in the spring and autumn migration.

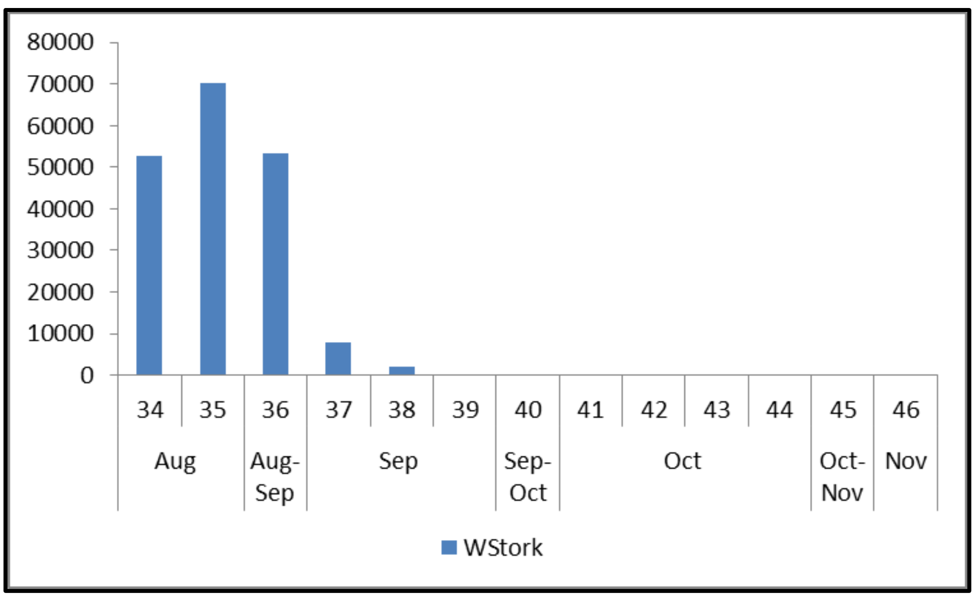


Figure 5-98: Migration pattern of the White Stork

Finally, the Great White Pelican shows the most different passage pattern compared to any other project in the region. Reasons are unknown, as it has not been a species subject to extensive scientific research. For the first time in the projects in the GoS region, the passage is continuous (every week), with a peak in late September-early October. It is a soaring bird, but does not need thermals all the time, e.g. it crosses large open body waters. The project is near the coast but far enough as to note if such birds come directly from the opposite side of the Red Sea or from the northern region, following the west coast from Suez downwards.

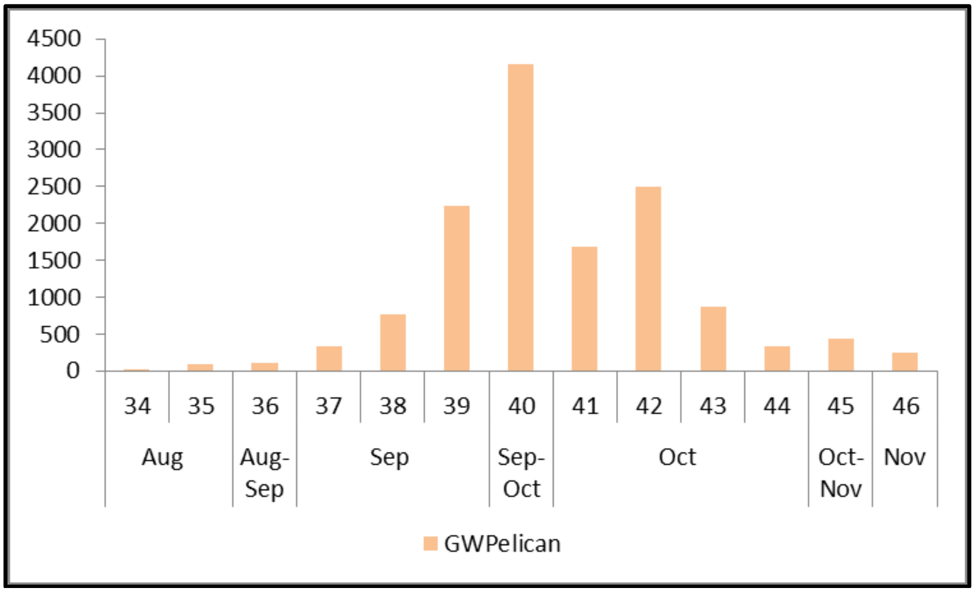


Figure 5-99: Migration pattern of the Great White Pelican

Spatial distribution and the passing rates

The monitoring times per observation point have been different, and direct comparison of raw bird counts does not allow a proper assessment. Thus, the calculated passing rate (birds/hour monitoring) and its statistical testing are the right and robust way to do so.

A second point to keep in mind is that the passing rate is not a fixed value, but rather has a range: the true passing rate moves from zero birds/hr, when observers do not record any birds, to any other value when passage occurs. This is also an important issue in statistics, as median or average values must be used for the comparison, and the statistical tests also use such variation (range) when performing the calculations.

For the spatial comparison among OPs the median passage rates were used, as it has been done in a few studies where long-term migration projects also involve different monitoring times (Istúriz, A., Astráin, C., Ibarrola, I., Milon, É, Castegè, I. (eds). 2019. Oiseaux Terrestres et marins dans les Pyrenées Atlantiques. Changement climatique, migration, et evolution des populations. GAN-NIK/CMB/POCTEFA NaturClima EFA 311/19). Due to the different contribution of each species to the total numbers, the analyses was undertaken for the same species in the earlier section.

The table below shows the results for those species passing in a steady way. NONE OF THE THREE SPECIES showed significant differences among the OPs. The table excludes most of the species, as the sample size was too small (< 50 individuals globally for seven OPs). Whatever map is drawn, it would not reflect the fact that, despite observed different amounts of birds at the OPs, when controlling for the different effort invested in monitoring the differences do not exist.

Table 5-38: Results of the ANOVA tests for species specific passing rates among the observation points

Species	Seven Observation points	
	ANOVA test	Significance
White Pelican	F(6;60) = 1.07	P = 0.39
Honey Buzzard	F(6;162)= 0.31	P =0.92
White Stork	F(6;79) = 0.82	P=0.55

The passing rates and their confidence intervals are presented in the figures below.

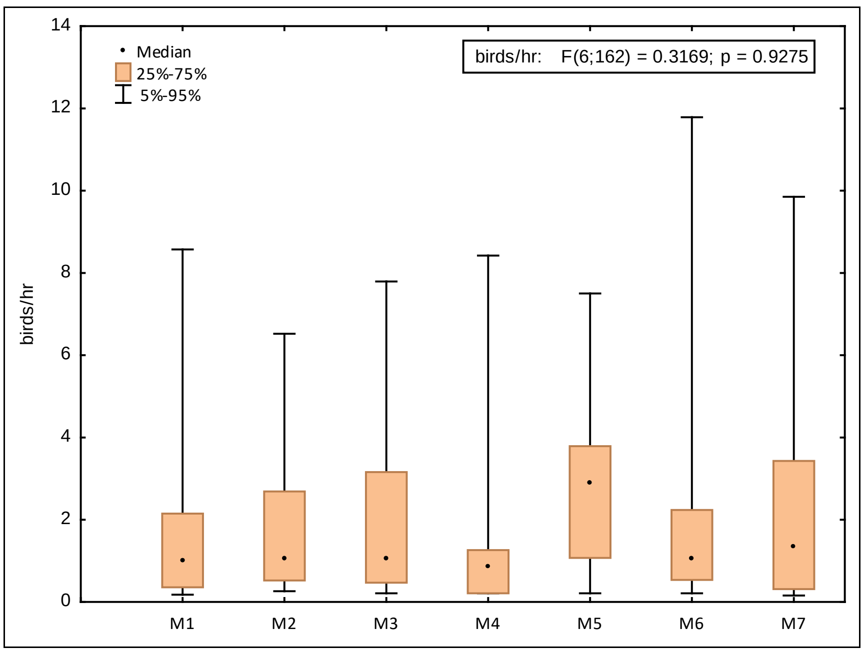


Figure 5-100: Significant passing rates for the Honey Buzzard

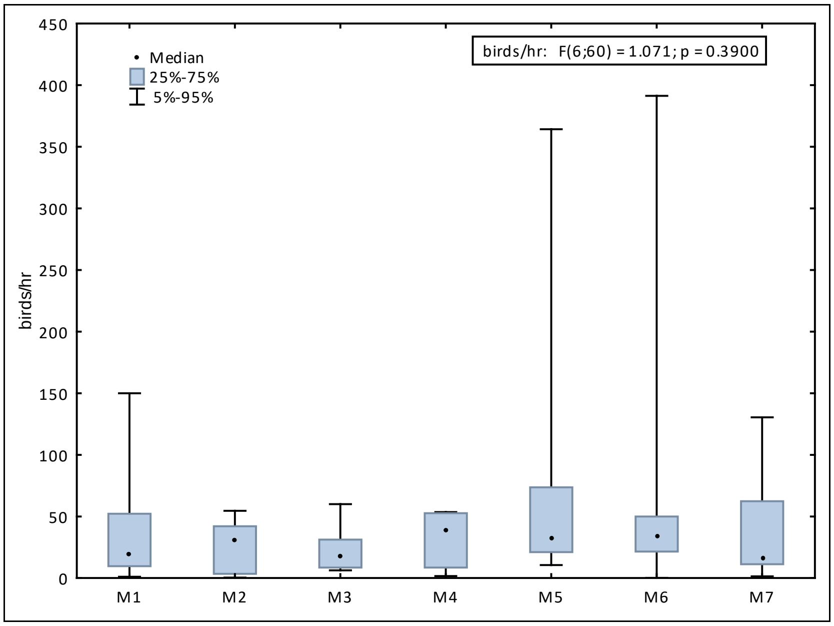


Figure 5-101: Non-Significant passing rates for the Great White Pelican

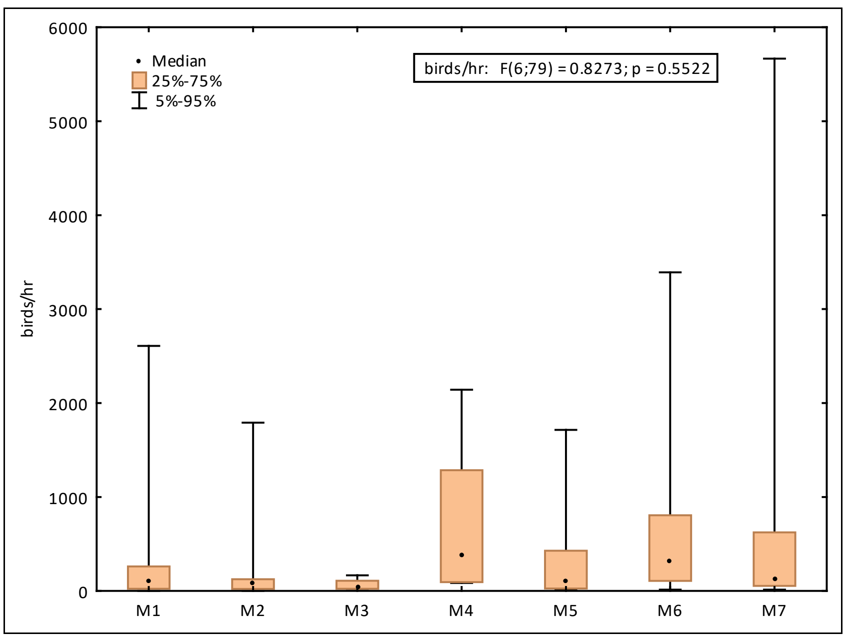


Figure 5-102: Non-Significant passing rates for the Great White Stork

From the table above it can be concluded that birds pass randomly through this project area, with no preferred sites (observation points), as the landscape does not force them to follow specific routes once they are within the windfarm.

Migration Patterns: Flocking behavior

An essential aspect of the migratory behaviour which links with the previous discussion and presented figures is the time of passage as presented earlier, but the second is the flocking behaviour (group size).

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

The table below presents the average flock size (birds /flock) for all species, its confidence interval ± 95%, the number of records, and their minimum and the maximum values. As noted, by far the Great White Pelican, Levant Sparrow Hawk, White Stork and the Crane had the largest flock sizes.

Despite being the three most abundant species in autumn, the average flock size also greatly varies among them, as shown in the table below.

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 four species do in large ones which are highlighted.

Table 5-39: Average Flock Sizes in autumn 2022

Species	Mean	Conf. -95%	Conf. +95%	N	Min	Max
Egyptian Vulture	2.6	0.717	4.483	5	1	5
White Stork	2162.90	1395.51	2930.30	86	1	17000
White Pelican	206.67	137.768	275.57	67	1	1700
Honey Buzzard	12.30	9.887	14.72	169	1	88
Black Kite	3.96	2.399	5.52	53	1	35
Steppe Buzzard	1.35	0.91	1.79	17	1	4
Monagu's Harrier	1			11	1	1
Marsh Harrier	1.24	1.088	1.39	33	1	2
Booted Eagle	1			3	1	1
Long-Legged Buzzard	1			1	1	1
Black Stork	3.66	-3.92	11.25	3	1	7
Kestrel	1			9	1	1
Sparrowhawk	1			1	1	1
Pallid Harrier	1			4	1	1
Steppe Eagle	1.87	0.93	2.81	8	1	4

Migration Patterns: Time of Day

The next step was to analyse the time of passage according to the time interval in the day. The monitoring extends continuously from around 7:00 am to 5:00 pm daily.

The first figure shows the trend for the Honey Buzzard. There is almost a stable trend during the entire day (2-3 birds /hr) which steadily increases around 16:00 hr, up to 5-6 birds per hour. On the contrary, the number of records increases in the early morning, decreasing at around 12:00PM. These trends suggest that larger groups reach the site late in the day, possibly roosting somewhere. The birds coming arrive in the early morning, once they spent night somewhere on route. It must be pointed out that the wind farm monitoring in the entire GoS, has never paid attention out of the boundaries of the project under study, so no roosting areas have been described in the scientific literature or detected during this type of monitoring.

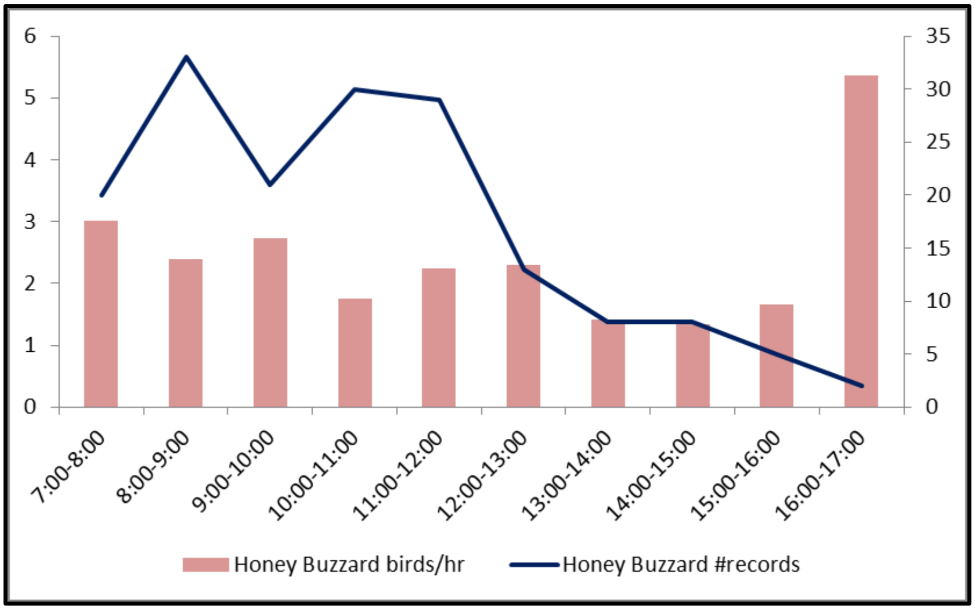


Figure 5-103: Honey Buzzard passing rate (birds/hr) number records

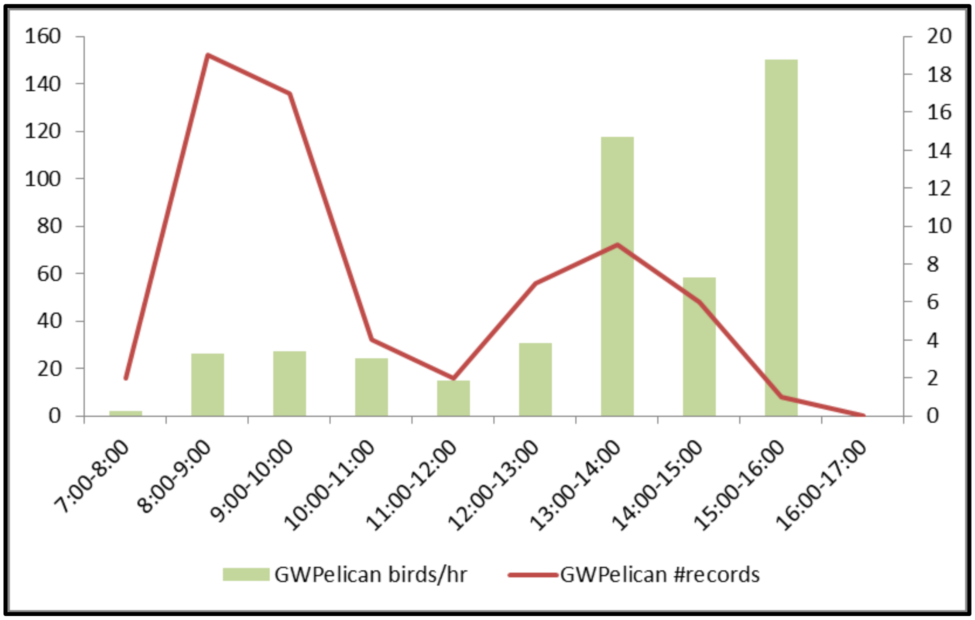


Figure 5-104: Passing rate and number of records according to time of the day for the G White Pelican

Slightly different is the case of the White Stork. There is an increasing passing rate and number of records as the day reaches the evening. Passing rate reaches its peak around 14:00 PM, at the same time the number of records does. This could be related with birds crossing the sea but should be supported with field data.

The analysis below presents the trend that was drawn of the contacts throughout the day. The trend follows a different pattern compared to bird numbers; lower numbers of birds are recorded in the early hours but they come more frequently. The reasons for this are the large flocks of e.g., White Storks, which migrate late in the day. 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 that suggests the peak of the migration taking place within the mid-daylight hours (8:00 am to 13:00 pm) for the Honey Buzzard and Great White Pelican, but late in the evening for the White Stork. This indicates that this is the most critical time for the observers to track the birds.

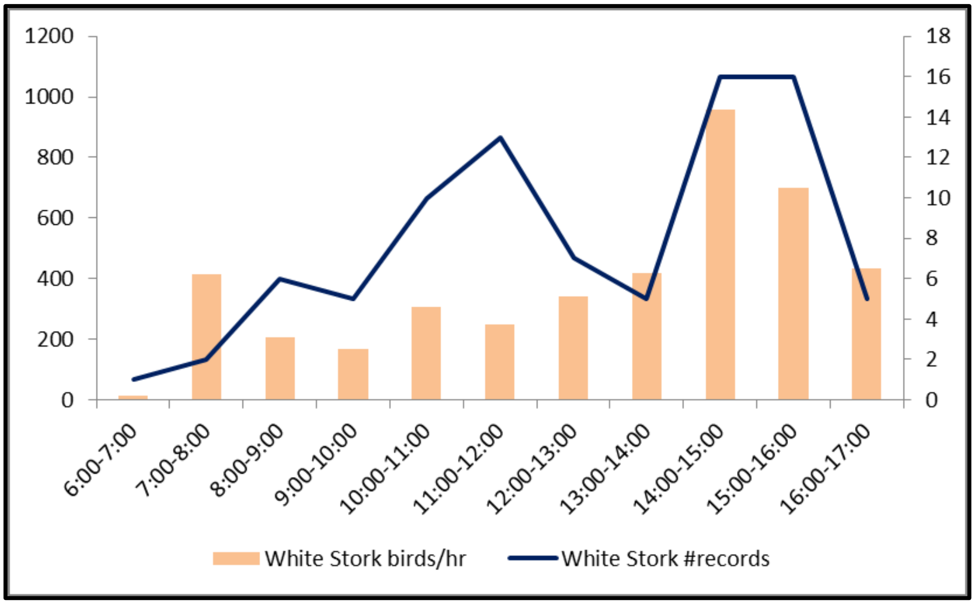


Figure 5-105: Passing rate and number of records according to time of the day for the White Stork

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

Flight directions

Finally, the flight direction of the birds recorded were checked. As in previous steps, graphs have been made only for the three most abundant species. From the figures below it is clear that the common flight trend is to go south. However, the Pelicans showed a south-eastern movement. No further analysis can be performed other than confirming that birds are moving southward according to what expected from an autumn migration.

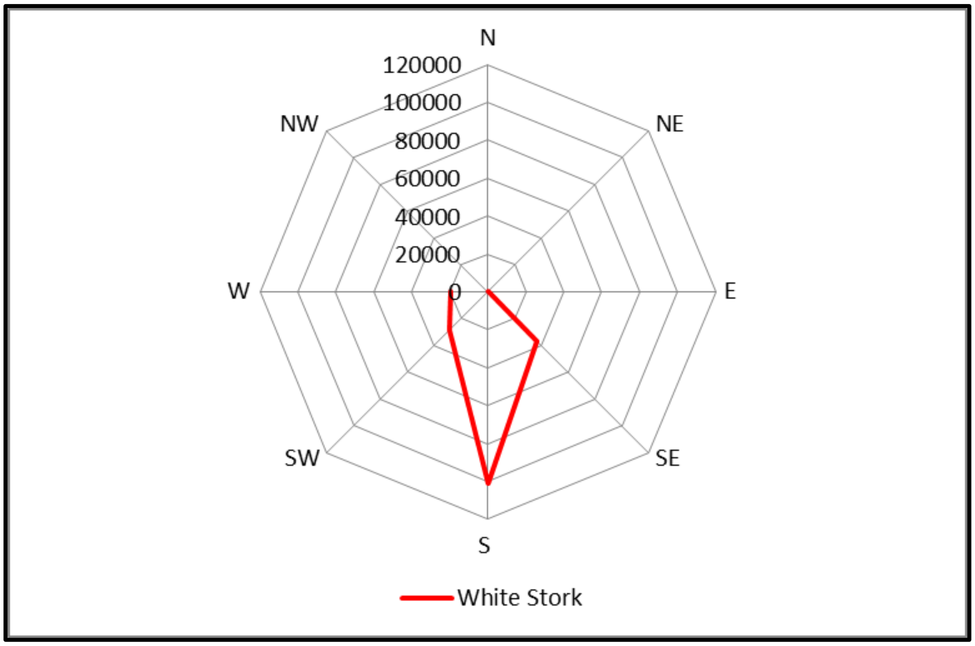


Figure 5-106: Migration direction of the White Storks

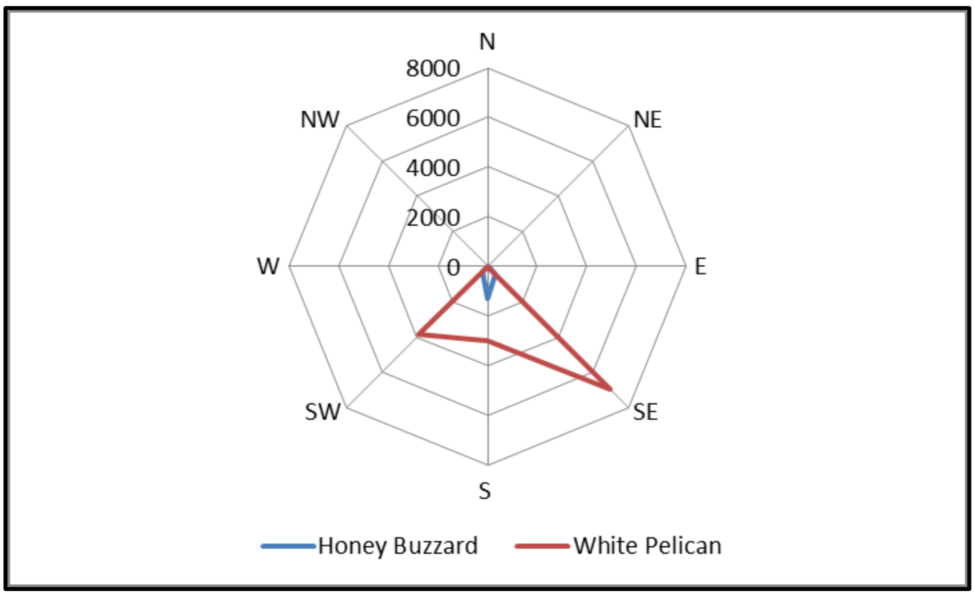


Figure 5-107: Migration direction of the White Pelican and the Honey Buzzard

5.7.6 Wadi Dara

White storks were recorded in relatively high numbers at Wadi Dara (11,300 birds), though the distribution of these observations roosting or overflying the settlement is not clear from the data provided.

A potential environmental constraint was identified for the Wadi Dara community. However, additional monitoring of this site should be undertaken to determine if the site serves as an important stopover site for some birds of prey, and whether it increases the risk profile for the spring and the autumn migration periods. **At this point, and as a precautionary requirement, a 2-km buffer from Wadi Dara is proposed**. This could be revised upon completion of the additional monitoring.

5.7.7 Additional bird monitoring 2021-2024

As noted earlier, the assessment above is based on 1 year of monitoring data undertaken in spring and autumn 2022. This section aims to provide an additional analysis based on updated and relevant survey data within the GoS area

For this assessment, data from a neighboring wind project was used (known as NREA-JICA) which is located just near the Project site to the north as noted in the figure below.

<u>Note: ECO Consult and EcoConServ has obtained the approval of RCREEE (as the owner of the data) to use such data for the purpose of this analysis presented in the report.</u>

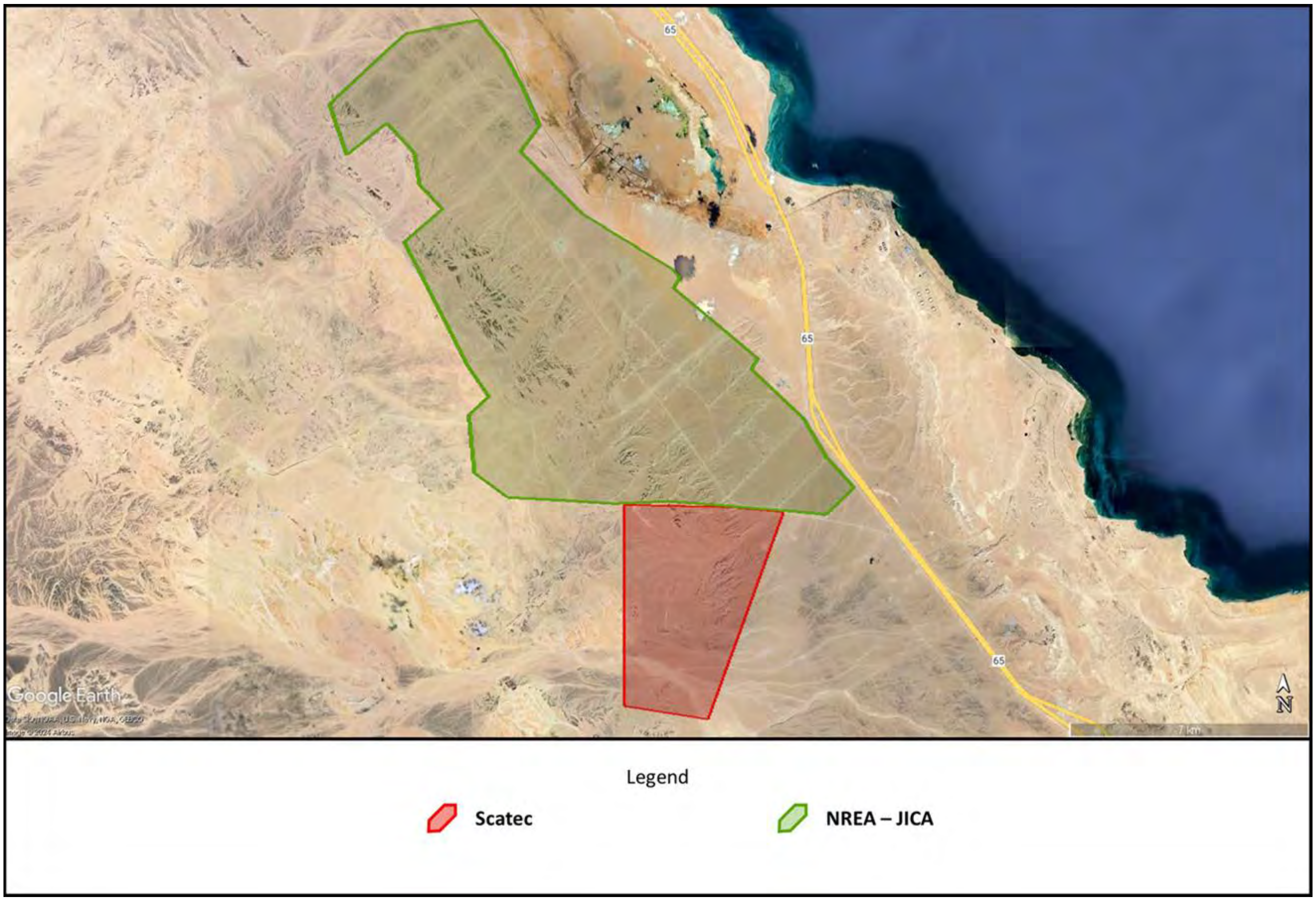


Figure 5-108: Neighboring Wind Farms

However, there are some general limitations in the data when doing the comparisons:

- **Monitoring time and bird numbers**: the monitoring time invested in the respective 2021 to 2024 seasons at the NREA-JICA project is not known. Thus, showing bird numbers (quantitative assessment) is not relevant for the purpose of this section. However, the bird passing rate (birds/hr) of observation was used in order to allow fair comparison of migration within the site throughout the years.

- **Flying heights**: the databases does not provide information about flying heights, **so it is not possible to compare risk heigh**t. Measures of flight height at the NREA-JICA project are based on a smaller size of turbines, without providing numerical height ranges as to perform a CRM.

- **Potential mistakes in the databases**: databases have been used as they are, however there is different data presentation between years, so it was assumed that what was provided was correct. It is also noteworthy to mention that for 2022, when this project was simultaneously assessed and NREA-JICA was undertaking the monitoring, there was no coordination between the two projects due to proximity; NREA-JICA Point 3 is just 550 m from VP1 in this project.

- **Number of contacts:** As happens with the bird numbers, and because of the lack of monitoring time provided, the number of bird contacts may be skewed, so it is not indicative of "abundance" of birds passing.
-

Spring 2021-2024

The table shows the bird species recorded in 2021-2024, and their respective passing rates. The species are the same as in other projects in the region. They are also subject to the inter-annual variations due to the nature of the species involved (large groups solitary species, etc.). Those in bold are the species which showed significant variations between years, e.g. exhibit real changes in the migration rates between years.

Table 5-40: Median passing rates (birds/hr) for the spring seasons 2021 to 2024 at the NREA-JICA project (Vantage Point J3)

Species	2021	2022	2023	2024
Barbary Falcon	-	0.136	-	-
Black Kite	**1.103**	**1.414**	**1.776**	**2.463**
Black Stork	2.381	1.590	1.908	1.548
Booted Eagle	0.135	0.114	0.107	0.129
C. Crane	**14.915**	**31.518**	**2.178**	**27.149**
Crested Honey Buzzard	0.198	0.100	-	-
Egyptian Vulture	**0.256**	**0.176**	**0.108**	**0.101**
Griffon Vulture	-	0.102	-	-
Hobby Falcon	-	-	0.104	-
Honey Buzzard	**2.690**	**5.594**	**8.369**	**6.236**
Imperial Eagle	0.102	0.115	0.125	0.119
Kestrel	0.102	0.116	0.112	0.101
Lanner Falcon	0.099	0.105	-	-
Lesser Spotted Eagle	2.359	0.221	0.162	0.131
Levant Sparrowhawk	28.921	6.555	104.963	44.466
Long-legged Buzzard	0.117	0.127	0.103	0.100
Marsh Harrier	**0.109**	**0.115**	**0.102**	**0.094**
Montagu's Harrier	-	0.099	0.100	0.102
Osprey	0.098	0.104	0.101	0.101
Pallid Harrier	-	0.103	0.103	-
Short-toed Eagle	0.102	0.184	0.112	0.129
Sooty falcon	-	0.102	-	-

Sparrowhawk	**6.659**	**0.141**	**0.119**	**0.166**
Spotted Eagle	**0.105**	**0.106**	**0.101**	**0.101**
Steppe Buzzard	**2.917**	**2.341**	**3.114**	**3.225**
Steppe Eagle	**0.743**	**1.115**	**0.578**	**0.887**
White Pelican	13.788	14.565	27.276	13.595
White Stork	57.706	57.462	54.488	167.711
Unidentified Buzzard	0.958	-	-	-
Unidentified Eagle	0.655	0.106	0.102	-
Unidentified Falcon	0.112	0.099	-	-
Unidentified Harrier	2.443	0.152	0.102	-

There are nine (9) species which showed the significant passing rates. However, not all the species had higher passing rates within the same year, such as the Common crane in 2022 and 2024, or the Steppe eagle in 2022. Overall, there have been 28 species, a number very similar to other projects in the region. The number is slightly high due to the contribution of the Falcon sp. Group (Sooty, Hobby, Lanner and Barbary), which were recorded at a certain year.

Results also show that the most abundant species is the White stork, as expected. The same pattern for bird species is similar to other projects, such as the Steppe and the Honey buzzards. When considering all four seasons together, the weekly passage abundances show two main trends in bird migration:

1. The species-specific passage according to the week in the season for those with precise timing every year, like the Steppe eagle and the Honey buzzard (Figure 5-1035-95 and Figure 5-1045-96); and
2. Those showing variations among weeks and years, e.g. not tightened to a fixed time, spreading over the migratory season, such as the Black stork or the White pelican (Figure 5-1055-97 and Figure 5-1065-98).

This does not change with the results obtained previously by the different team monitoring the project.

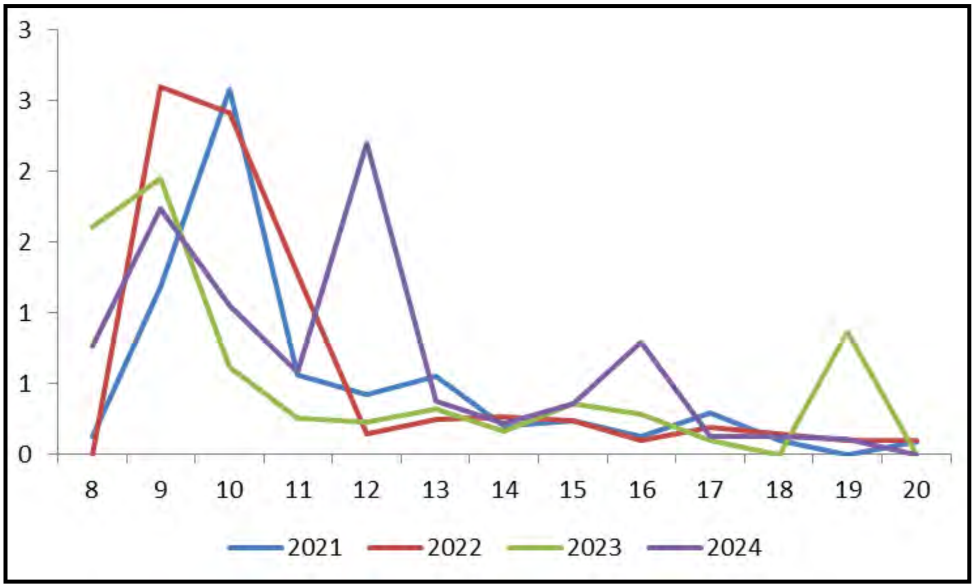


Figure 5-109: Weekly timing of the spring passage (average median birds/hr) for the Steppe eagle in 2021-24.

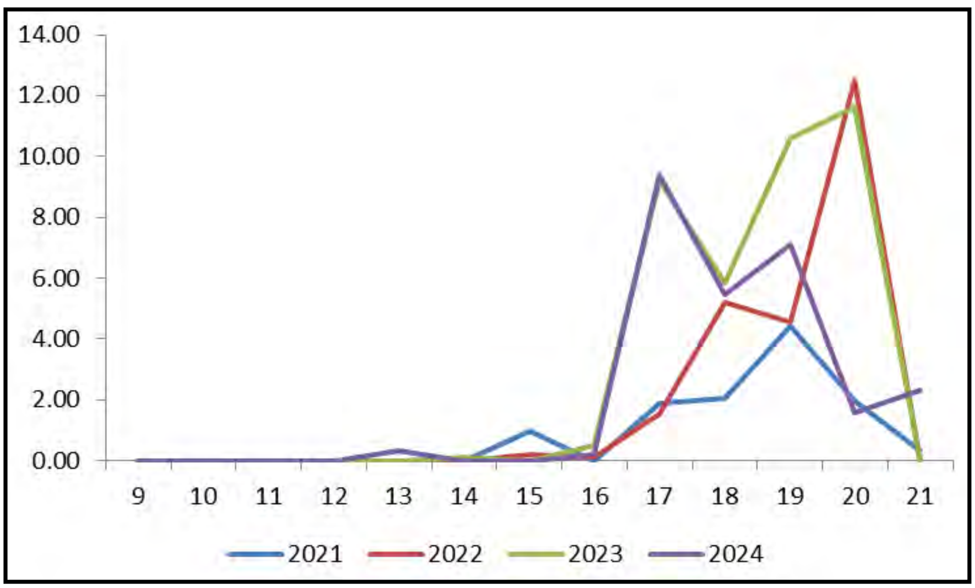


Figure 5-110: Weekly timing of the spring passage (average median birds/hr) for the Steppe eagle in 2021-24.

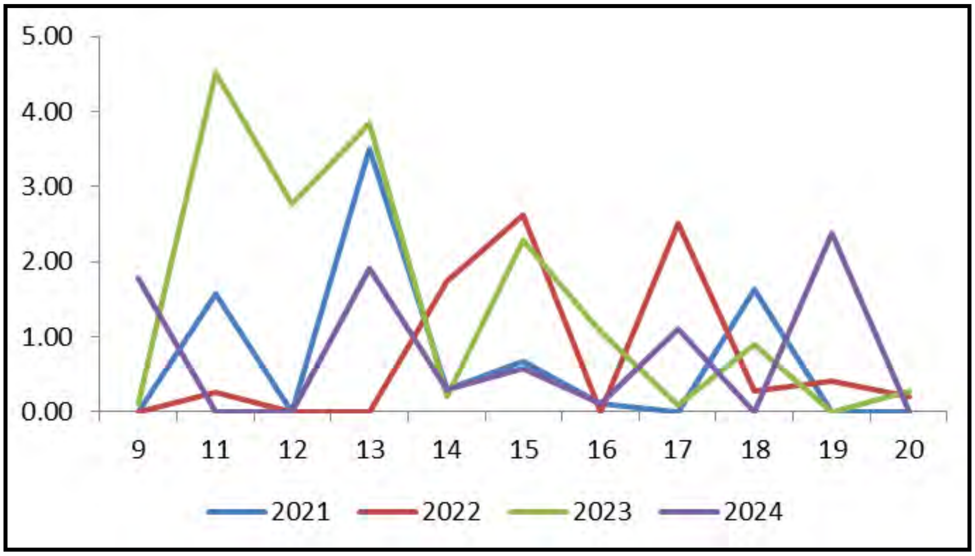


Figure 5-111: Weekly timing of the spring passage (average median birds/hr) for the Black stork in 2021-2024

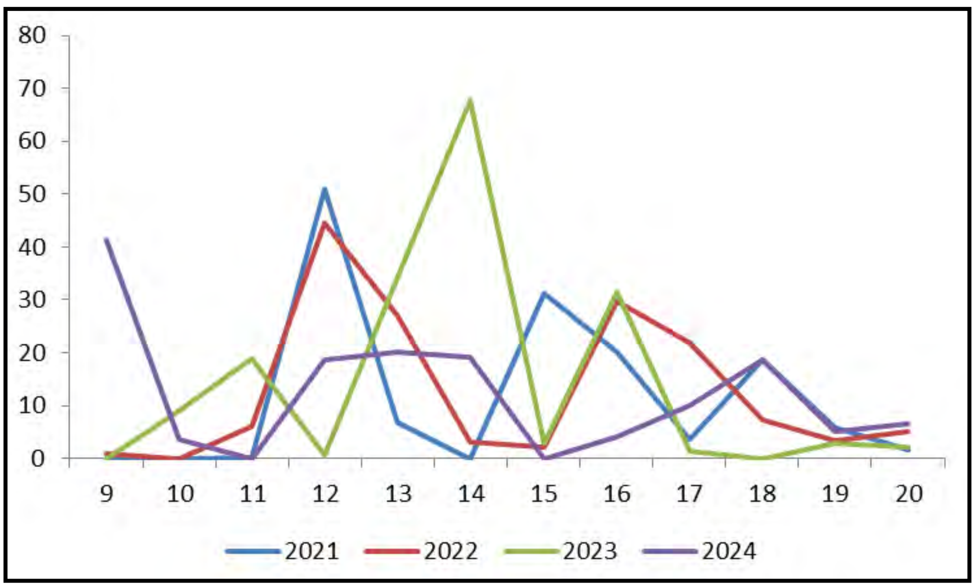
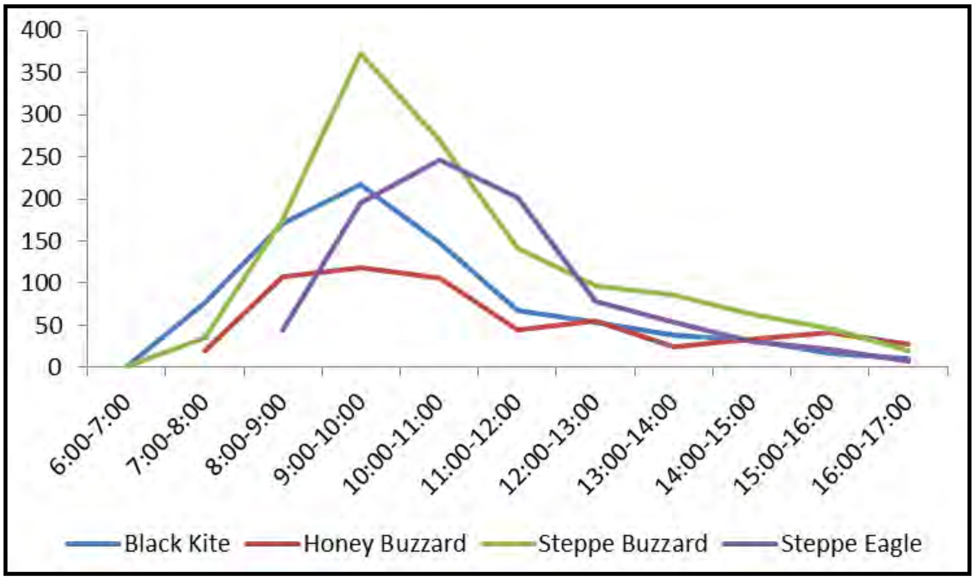


Figure 5-112: Weekly timing of the spring passage (average median birds/hr) for the Great White pelican in 2021-2024

These patterns are important when the mitigation criterion apply. There are no specific times (weeks) in the season where the shutdown on demand can be relaxed or reduced.

However, there was a clear trend in the daily passage according to the time hours, as seen in the figure below. This also happened in the data analysis from 2022, with most of the birds passing between 8:00 am to 13:00.

The same applies to the average group size, which falls within the findings from the assessment of 2022, as shown above. This confirms that different time data for the same site behave similarly. Thus, the findings and measures to take should be the same, particularly regarding species protection against the potential impact of a wind farm.



Autumn 2021-2023

The same general limitations above described apply to the autumn seasons. There have been 25 species over the three years with the passing rates showed in the table below. As done for the springs, the significant differences only appeared for five (5) species; three are rare in autumn when considering their bird numbers (Egyptian vulture, "kestrel", and Osprey), and another two, expected in such those differences because of the variation in their flocking behavior (White stork and Great White pelican). All the remaining showed no difference.

Table 5-41: Median passing rates (birds/hr) for the autumn seasons 2021 to 2023 at the NREA-Jica project (Vantage Point J3)

Species	2021	2022	2023
Black Kite	0.881	1.018	0.948
Black Stork	0.714	0.272	0.292
Booted Eagle	0.096	0.100	0.114
Common Crane	1.951	0.100	0.341
Egyptian Vulture	**0.367**	**0.267**	**0.169**
Honey Buzzard	5.550	2.647	2.474
Kestrel	**0.109**	**0.098**	**0.092**
Lanner Falcon	-	0.178	-

Lesser Spotted Eagle	0.128	0.100	0.096
Levant sparrow hawk	0.900	-	-
Long-legged Buzzard	0.114	0.100	-
Marsh Harrier	**0.118**	**0.117**	**0.117**
Montagu's Harrier	0.094	0.095	0.073
Osprey	**0.100**	**0.100**	**0.068**
Pallid Harrier	0.096	0.096	0.000
Pergrine Falcon	-	0.100	-
Red-footed Falcon	-	-	0.000
Short-toed Eagle	0.100	-	0.030
Sooty Falcon	0.097	-	-
Sparrowhawk	0.117	-	-
Steppe Buzzard	0.209	0.194	0.223
Steppe Eagle	0.099	0.100	0.165
Unidentified Buzzard	0.099	0.099	-
White Pelican	**11.581**	**10.678**	**16.331**
White Stork	**72.720**	**105.630**	**53.949**
Unidentified Eagle	0.106	0.000	-
Unidentified Falcon	0.111	0.082	-
Unidentified Harrier	0.095	0.142	-
Unidentified Raptor	-	0.104	-

The Honey buzzard, Great White pelican, and the White stork, are the three species which clearly outnumber all the remaining ones. Thus, we will focus on their weekly and hourly passages through the site as they are the only with data enough.

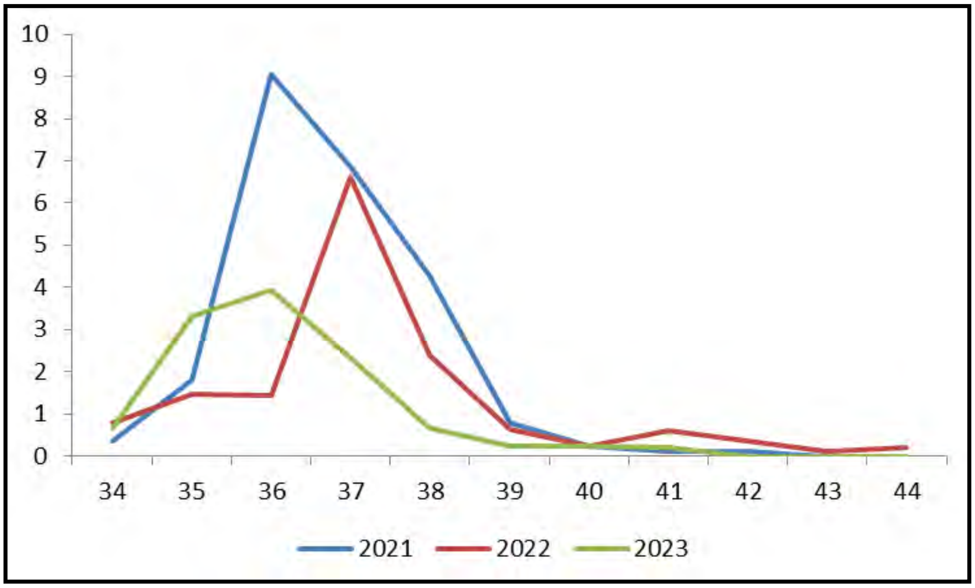


Figure 5-113: Weekly rate passage (median birds/hr) for the Honey Buzzard between 2021-2023

The Honey buzzard concentrates the migration along six weeks from late August till late September. This is a very similar pattern as that of the White stork below.

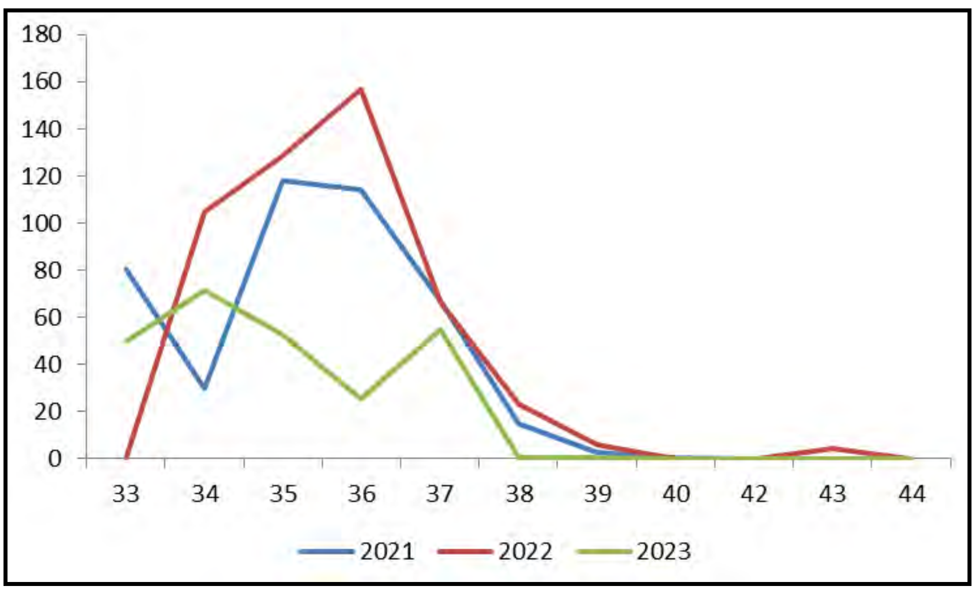


Figure 5-114: Weekly rate passage (median birds/hr) for the Honey Buzzard between 2021-2023

Finally, the Great White Pelican shows more variation, especially in the autumn of 2022, with two peaks. It is important to note that despite being a "soaring bird", pelicans may rest on water and take off from the sea. That is contrary to the remaining species, so its migration may have different constraints through the Flyway.

The hourly passing rates show different trends according to each species. All the three species involved a large number of birds. The Honey Buzzard exhibited the lowest rate, which rapidly increased at the end of the day. When examining the data in more detail, such a high passing rates was only in the autumn of 2021. This could likely be due to a major migration event during those hours compared to the more stable patterns seen in 2022 and 2023. These variations highlight the variability in the migration over the region, and the lack of specific times for birds to cross, as their behavior largely depends on weather conditions.

The Great White Pelican reached its peak in the afternoon. On a year-by-year basis, such a higher rate occurred in the autumn of 2023. Finally, the White Stork peaked during the autumn of 2022. This exemplifies the variation in migration through the Gulf of Suez, depending on the circumstances faced by the bird species along the route. These circumstances are not project dependent but rather reflect overall patterns within the Flyway.

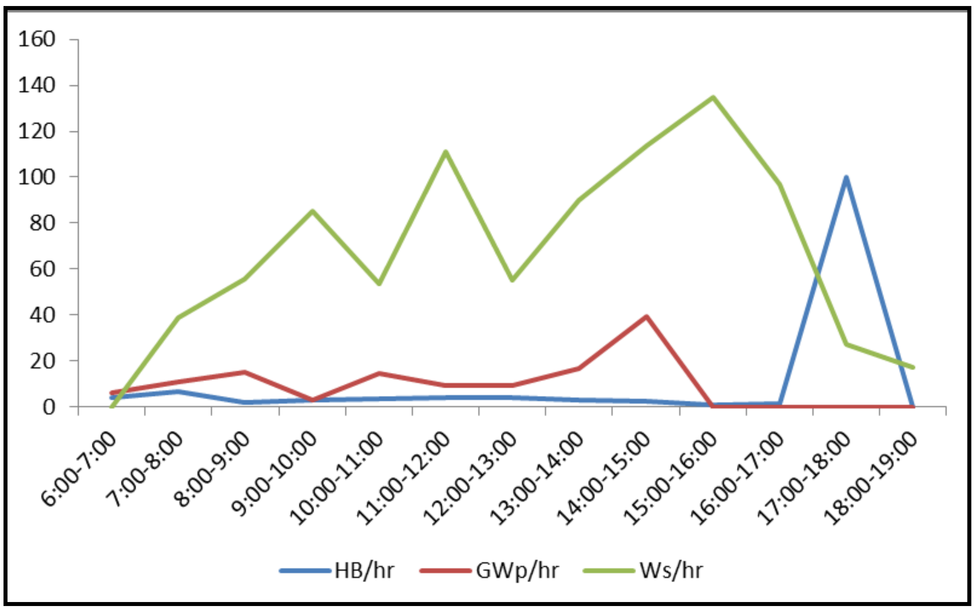


Figure 5-115: Passing rates for the Honey buzzard, Great white pelican, and White stork per hour interval at J3, all the three 2021-23 seasons pooled

5.8 Bats

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

5.8.1 Baseline Assessment Methodology

(i) *Literature Review*

Literature review was undertaken that included review on previous studies, data, surveys, and records available in published scientific papers, books, and journals on bats of Egypt and the Gulf of Suez.

The objective was to identify the potential for bat activity within the area and the significance of such activity.

(ii) Site Assessment

A site survey was undertaken at the Project site that included the use of a bat detector. The detector used was the Song Meter SM4 Acoustic Recorder as noted in the figure below.

Figure 5-116: Song Meter SM4 Acoustic Recorder Used in the Study Site

The survey was based on route transects where two (2) transects have been surveyed that run throughout the Project area in east-west direction (refer to figure below). The survey was undertaken from the months of May until September as this is regarded as the most suitable period of the year to assess bat activity as bats become active after the hibernation which may last from December to March.

The survey was undertaken for a period 1 night per month to cover both transects. The survey started after sunset and continued to more than eight (8) hours including commuting times between monitoring points after that, where this was considered the most active period for bats, as bats usually rest and sleep during the day and are active during night as they search for prey to feed on.

With regards to the transect, along each route transect, ten (10) points were spread out based on land topography and vegetation, where each point was spread out approximately at a distance of 200m. At each point, the bat detector was used to document any bat activity. Each point lasted for 10-15 minutes. If bat activity is encountered, the data was recorded automatically by the bat detector for further in-depth desktop analysis.

At least four (4) hours were spent at each transect. All transects presented in the figures below were covered at least once per month for five (5) consecutive months – therefore each transect was covered at least five (5) times during the study period.

The route-transects are presented in the figure below. In addition, the table presents the dates and coordinates for the route transects.

Table 5-42: Dates and Coordinates for Route Transects

Point	Coordinates		Time		Dates
	N:	E:	Start	End	
1	28.017915°	33.237475°	20:07	20:22	27 May 2022 30 June 2022 2 July 2022 31 August 2022 29 September 2022
2	28.017752°	33.229766°	20:26	20:41	
3	28.018197°	33.222466°	20:46	21:01	
4	28.018354°	33.215094°	21:05	21:20	
5	28.018747°	33.208771°	21:23	21:38	
6	28.018911°	33.202495°	21:41	21:56	
7	28.019096°	33.196210°	21:59	22:14	
8	28.018955°	33.189397°	22:18	22:33	
9	28.035786°	33.244753°	22:43	22:58	
10	28.036030°	33.237522°	23:30	23:45	
11	28.036477°	33.230971°	23:49	0:04	
12	28.036403°	33.222166°	0:09	0:24	
13	28.036836°	33.214401°	0:35	0:47	
14	28.037192°	33.206729°	0:51	1:06	
15	28.037533°	33.198875°	1:10	1:25	
16	28.037553°	33.191345°	1:28	1:34	
17	28.037849°	33.183199°	1:47	2:02	
18	28.038117°	33.175813°	2:05	2:20	
19	28.038854°	33.168681°	2:24	2:39	
20	28.019558°	33.182853°	2:42	2:57	

In addition, the methodology also considered any nearby sources of attraction which could affect bat activity onsite. As discussed earlier, within Wadi Dara there are areas for poultry, livestock and agricultural farming. Some of these farms have small scale water reservoirs that are used as a source for water supply requirements. Such water reservoirs could be an important attraction site for bats, as water and insect sources.

Therefore, the methodology also included the installation of the bat detector device at an appropriate height at an existing structure right next to the pond area. Similar to the above, the device was installed for an entire night per month between the months of April until September.

The location of the water reservoir is presented in the figure below.

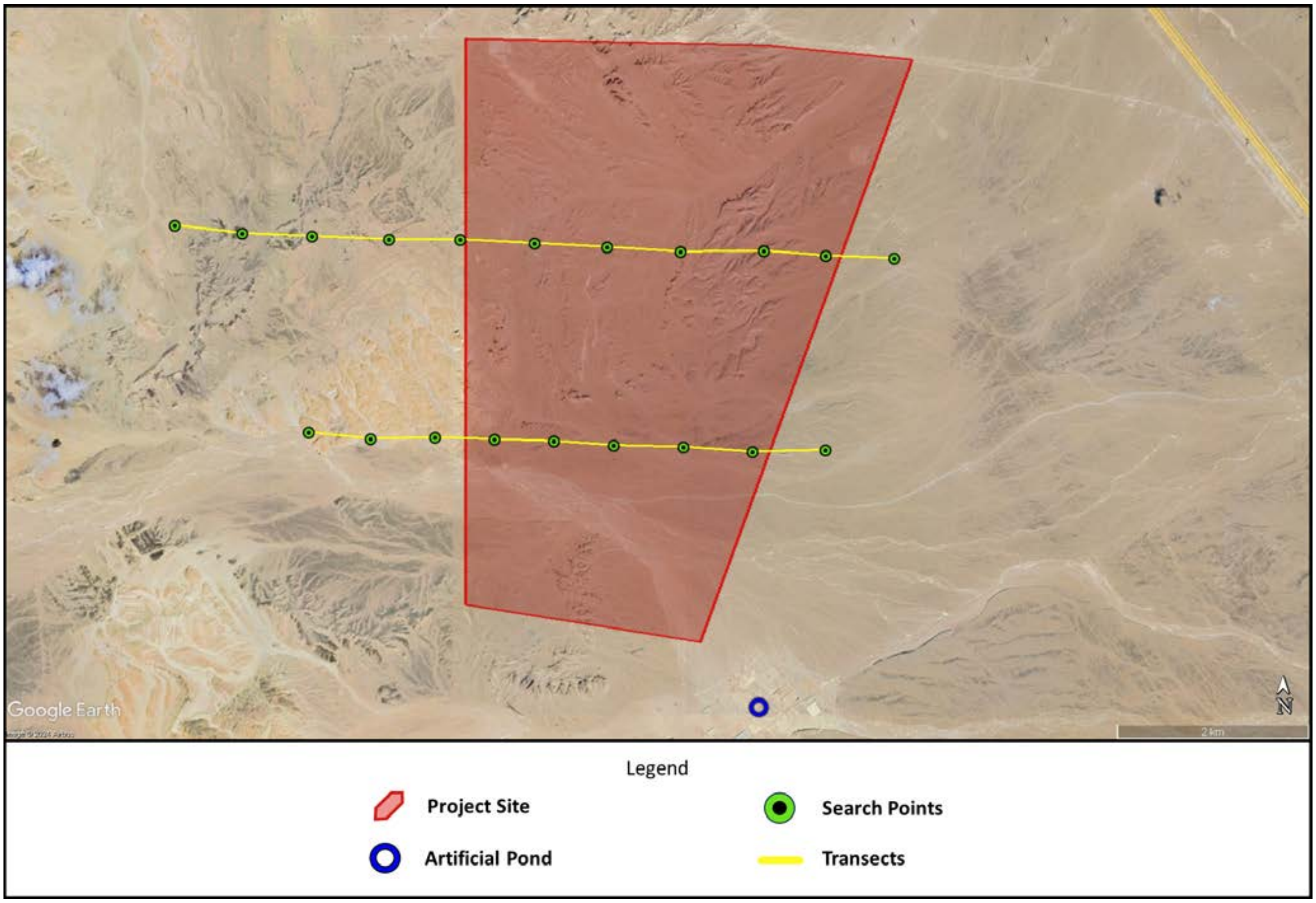


Figure 5-117: Two transects and Water Reservoir for Bats Assessment

Figure 5-118: Water Pond within the Vicinity of the Study Site

Based on the above, recordings of the sound waves were then analysed and compared with a comprehensive bat detection software / database (Kaleidoscope and Batexplorer) for the sound waves of all bats species known to match and determine the species of the recorded bat accordingly.

Should bat recordings be confirmed, the assessment aimed to 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).

Finally, the methodology also included visits within the Project site and surrounding areas to locate any potential rooting sites for bats. This included inspections through field observations for potential roosting sites. 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 fecal remains).

5.8.2 Constraints

The site was surveyed from May to September 2022, using a transect methodology. Although this doesn't provide constant data from the Project Area, there have been additional projects in the region that provide thorough bat data, such as the disclosed neighboring project which provide current information to support this project.

The CEA reports that although the survey results were void of bat species, there are three species of bat likely to be in the local area. The ESIA takes in to account the local data (particularly as we were involved in the previous study finding bat data in the area) and accordingly this information is not unexpected within the ESIA assessment. Whilst there will be some bat use it is certainly very low given reference to the effort put in at the local project. Given bat use on sites is known to change following construction the main aim is to undertake appropriate monitoring to ensure there is no significant impact on any bat species. This will be adaptively monitored by post construction fatality monitoring to international best practice. The use of methods in accordance with the Post-construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries – Good Practice Handbook and Decision Support Tool (2023) will ensure adaptive management is possible from the results of the monitoring

5.8.3 Results

This section presents the results of work that was undertaken for the bats assessment for the Project site. This includes a literature review and a site assessment both of which are discussed in further details below.

(i) *<u>Literature Review</u>*

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 the table below. 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 5-43: 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 the table below.

Table 5-44: Bat Species and 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) Information from other Wind Farms

The adjacent Wind Farm, which is in disclosure, undertook bat detector surveys across a six month period. In this project, Eight Wildlife Acoustic SM4BAT detectors were deployed across 24 locations, one of which (the wadi watering locations) overlaps with this Project Site. Detectors were deployed a total of six times per location between 25th May 2023 and 15th November 2023. Three species of bat were recorded over, on 38 occasions, which were Botta's Serotine (*Epitesicus bottae*), a Long-Eared species (*Plecotus sp.*) and a Nyctalus species (*Nyctalus sp.).*

(iii) Site Assessment

Based on the site assessment, no defined calls were detected from all the recordings throughout the study period duration covering all transects as well the water reservoir area. Some recorded waves were noted but those were considered to represent blowing winds.

The CEA reports that there are potentially three species of bat within the survey area, although they were not recorded during surveys. This information has come from nearby windfarms and is not unexpected.

In addition, no potential roosting sites within the Project area and nearby areas were noted or recorded.

(iv) Conclusion

Based on the outcomes of the site assessment, the surveys were void of bat activity however there are bat species known to be in the local area. Absence of activity is likely to be attributed to the following:

- 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 which could attract flying insects and in turn bats to the Project site.
- Lack of any potential close roosting sites within the Project area and nearby areas.
- It is considered that some activity may occur at low levels when considering the detailed surveys undertaken at the adjacent site, however this would also likely be a very low level.

5.9 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.

5.9.1 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 database of the Geographic Information Systems Department at the Ministry of Tourism and Antiquities.

(ii) *Field Survey*

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

5.9.2 Results

Based on the literature review through desktop research, it is concluded that there are no registered archaeological sites with the Project area itself. The closest sites that are considered of great archaeological, historical and cultural heritage value are described in the table below and presented in the figure that follows. In addition, the field survey indicated the following:

- No archaeological evidence was found
- No key issues of concern noted in relation to archaeology and cultural heritage
- Field observations and driving across site boundaries did not show any significant archaeological sites or indications of archaeological remains
- No restrictions to consider.

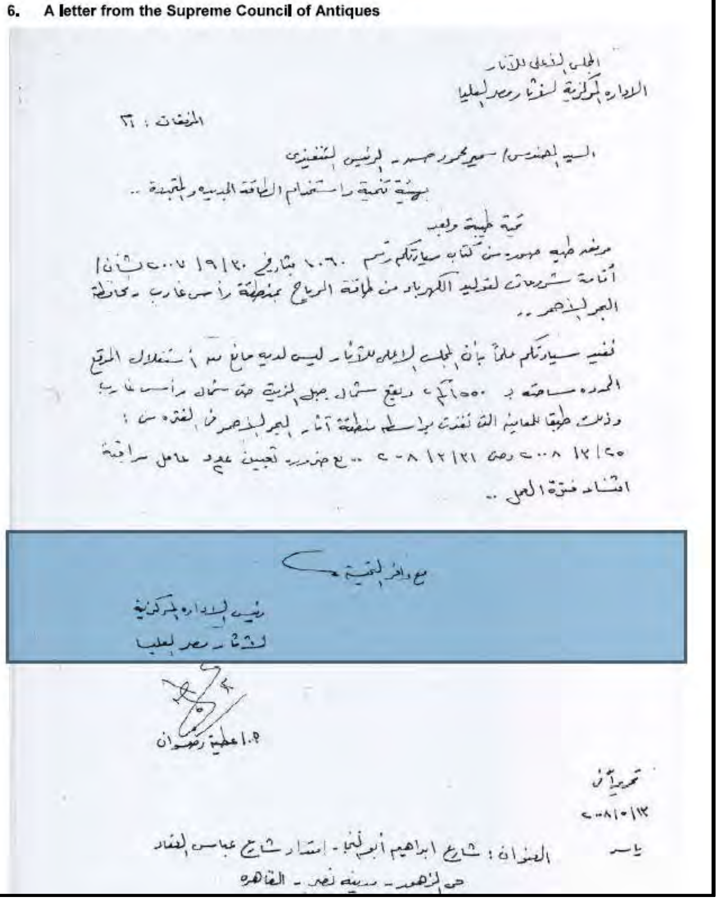
It is important to note that in 2008, an official letter has been issued by the Supreme Council of Antiquities (SCA) to NREA which states that the SCA has no objection on the development of wind farms within the NREA land plots allocated for wind energy developments. The official letter is presented in the figure below.

Table 5-45: Nearest Archaeological Sites

Site	Description	Distance to Project
Wadi Jarf / Red Sea coast	A harbor 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 labor under the supervision of their leader Merer who recorded the diary of the mission on a long papyrus sheet.	106 km to the north
Saint Anthony Monastery	Saint Anthony's disciples founded the monastery between 361 and 36 (Starkey.2012:205)	128 km to the north
Saint Paul Monastery	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).	107 km to the north

Figure 5-119: Location of Closest Archaeological Sites to the Project Area

6. A letter from the Supreme Council of Antiques



المجلس الأعلى للآثار
الإدارة المركزية لآثار مصر العليا

المرفقات : ٣٦

السيد المهندس / سمير محمود حسن - الرئيس التنفيذي
بهيئة تنمية واستخدام الطاقة الجديدة والمتجددة ..

تحية طيبة وبعد

مرفق طيه صورة من كتاب سيادتكم رقم ١٠٦٠ بتاريخ ١٩/١٢/٢٠٠٧ بشأن إقامة مشروعات لتوليد الكهرباء من طاقة الرياح بمنطقة رأس غارب - محافظة البحر الأحمر ..

نفيد سيادتكم علماً بأن المجلس الأعلى للآثار - ليس لديه مانع من استغلال الموقع المحدد مساحته بـ ١٥٠٠ كم٢ ويقع شمال جبل الزيت جنوب شمال رأس غارب وذلك طبقاً للمعاينة التي نفذت بواسطة منطقة آثار البحر الأحمر في الفترة من : ٢٠/١٢/٢٠٠٨م وحتى ٢١/١٢/٢٠٠٨م .. مع ضرورة تعيين عدد عامل مراقبة أثناء فترة العمل ..

مع وافر التحية

رئيس الإدارة المركزية
لآثار مصر العليا

أ.د/ عطية رضوان

تحريراً في
١٣/١٠/٢٠٠٨م

ياسر

العنوان : شارع ابراهيم أبو النجا - امتداد شارع عباس العقاد
حي الزهور - مدينة نصر - القاهرة

Figure 5-120: Letter Issued by SCA

5.10 Air Quality and Noise

Assessment of baseline conditions was based on an onsite air quality and noise monitoring program conducted during July 2022. Additional details are discussed below.

5.10.1 Baseline Assessment Methodology

(i) *Selection of Parameters*

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

- Such parameters are likely to be present within the Project site given its characteristic and attributes. Suspended particulate matter is expected given the barren nature of the site. On the other hand, pollutants (such SO_2, NO_2,) are expected onsite but rather at minimal concentrations as the site is relatively in a remote area; nevertheless, motor emissions particularly from vehicles passing casually through the site (or from the main road) could be a source of such pollutants. Finally, noise levels are expected from vehicular movement and to some extent from onsite and surrounding areas and activities.

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

(ii) *Methodology and Instruments Used*

The methodology adopted for baseline air quality measurements included continuous sampling for key pollutants using certified analyzers. The measurements were performed over a representative period to capture variations in pollutant concentrations due to meteorological and local activity fluctuations.

The monitored parameters and their corresponding measurement techniques are:

- **Sulfur Dioxide (SO_2):** UV Fluorescence (ISO 10498, equivalent to U.S. EPA EQSA-0486-60)
- **Nitrogen Oxides (NO, NO_2, NO_x):** Chemiluminescence (ISO 7996, equivalent to U.S. EPA RFNA-1289-74)
- **Carbon Monoxide (CO):** Infrared Gas Filter Correlation (ISO 4224, equivalent to U.S. EPA RFCA-0981-54)
- **Particulate Matter ($PM_{2.5}$, PM_{10}, and TSP):** Low-volume samplers (EPA Reference Method)

The air quality measurements were conducted using the following certified instruments:

- **SO_2 Analyzer:** Thermo Scientific Model 43 (USA)
- **NO_x Analyzer:** Thermo Scientific Model 42 (USA)
- **CO Analyzer:** Thermo Scientific Model 48 (USA)
- **Particulate Samplers:** AirMetrics low-volume samplers (certified by U.S. EPA, UBA/TÜV, Sira Certification Service)

The noise quality measurements were conducted using a CASELLA Mediator, Integrating Sound Level Meter (Type I, IEC 1672 Class 1).

(iii) *Selection of Locations*

To assess the air quality and noise baseline conditions of the Project area, 2 monitoring points were selected as shown in the figure below – one within the northern parts of the site and the second at the southern part of the site. As identified within the land use mapping undertaken under "Section 5.2" earlier, there are no key sources of pollutant emissions within the Project site and surrounding areas.

Monitoring was undertaken for 24 hours at each point respectively. The coordinates for the monitoring points and location are presented in the table and figure that follows.

Table 5-46: Location of Monitoring Points

Locations	Latitude	Longitude
M1	27° 59.900'N	33° 13.762'E
M2	28° 3.283'N	33° 12.474'E

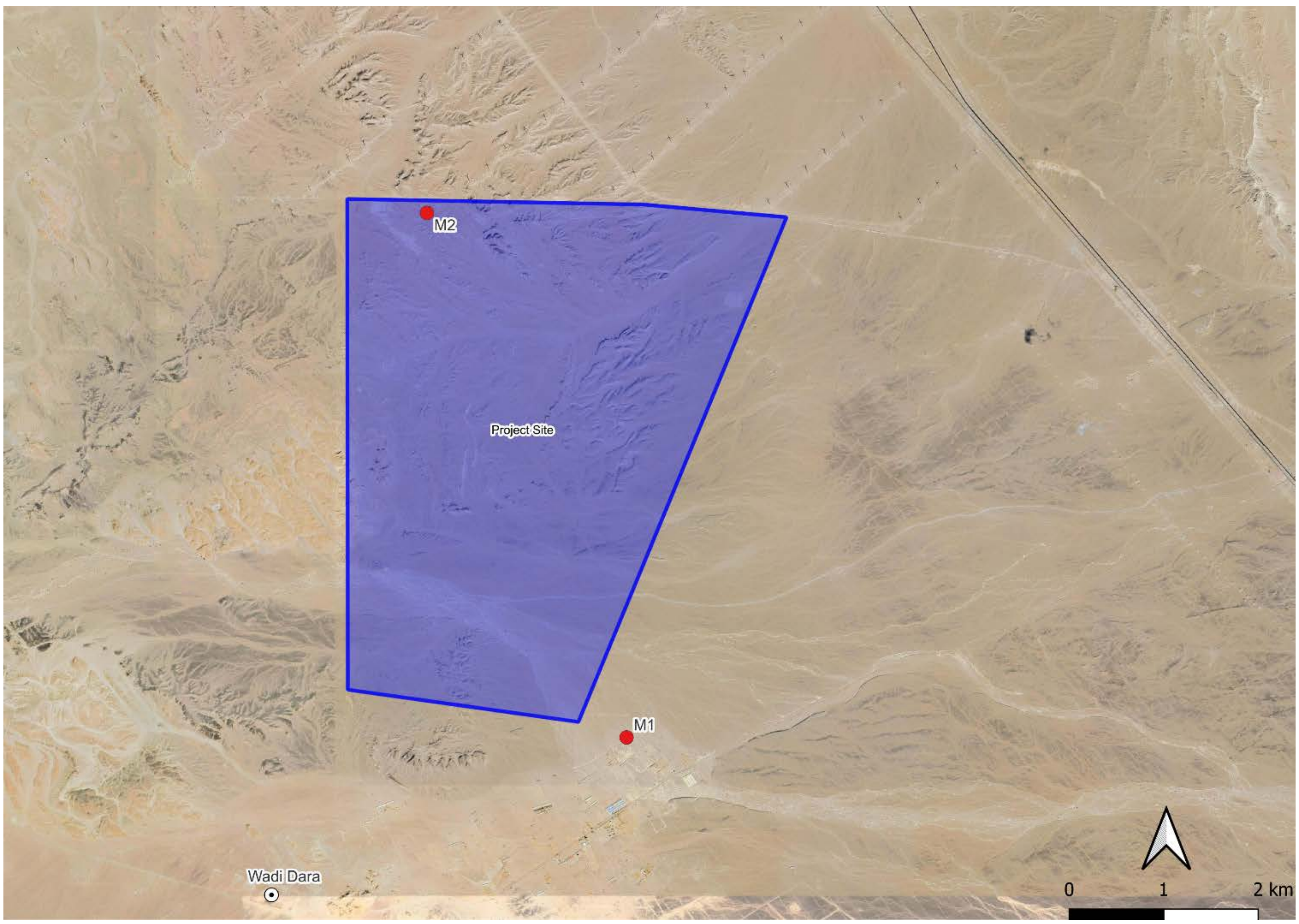


Figure 5-121: Location of Monitoring Points

(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 (D1095/2015) 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 in general and wind farms.

In addition, the table also identifies the ambient air quality limits as included within the IFC General EHS Guidelines.

Table 5-47: Applicable National Ambient Air Quality Permissible Limits (Annex 5 of the Executive Regulation (D1095/2015) for ambient air quality)

Pollutant	Maximum Limit (µg/m³)				IFC General EHS Guidelines
	1 Hour	8 Hours	24 Hours	1 Year	
Sulfur Dioxide (SO_2)	350	---	150	60	125 (24h)
Carbon Monoxide (CO)	30 mg/m³	10 mg/m³	---	---	N/A
Nitrogen Dioxide (NO_2)	300	---	150	80	200 (1h)
Total Suspended Particles (TSP)	---	---	230	125	N/A
Thoracic Particles (PM_{10})	---	---	150	70	150 (24h)
Thoracic Particles ($PM_{2.5}$)	---	---	100	70	75 (24h)

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 applicable permissible limits for noise. The limits included for 'industrial' areas were used for comparison given the industrial nature of the site that includes petroleum activities in general and wind farms. In addition, the IFC General EHS Guidelines also identify a limit of 70dBA for industrial areas.

Table 5-48: 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

5.10.2 Results

Air Quality

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

Table 5-49: Ambient Air Quality Measurements Results (24 hours)

Parameter in µg/m3		(CO) mg/m³	(SO_2)	(TSP)	(PM_{10})	(PM2.5)	NO_X
Concentrations (µg/m³)	M1	2.51	36.74	61.2	52.2	41.3	69.32
	M2	3.53	37.1	62.2	53.1	44.1	66.55
National Maximum Permissible Limits (µg/m³)		**10 mg/m³**	**150**	**230**	**150**	**100**	**150**
International Maximum Permissible Limits (µg/m³)		**-**	**125**	**-**	**150**	**75**	**-**

Noise

The following table presents the overall results for the noise monitoring that were undertaken and their corresponding national and international permissible limits. As noted in the table below, all results are within allowable limits set

Table 5-50: Ambient Noise Measurements Results

Maximum permissible noise level limits		
Point #	**Day Time (7:00am-10:00pm)**	**Night Time (10:00pm-7:00am)**
M1	54.06	54.32
M2	54.71	53.63
National limits (LAeq/dBA)	70	60
International limits (LAeq/dBA)	70	70

5.11 Infrastructure and Utilities

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

5.11.1 Baseline Assessment Methodology

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

5.11.2 Existing Roads and Networks

The Cairo-Hurghada (Highway 65) runs adjacent to the Project site. Stretching from the highway is a gravel road leading to the northern edge of Wadi Dara Village running at the southernmost part of the Project site. A service road, passing through to the site's northern corner, leads around the southern and eastern boundaries of a neighboring wind farms of Kreditanstalt fur Wiederaufbau Development Bank (KfW) and Fondo para la Internacionalizacion de la Empresa (FIEM) within the NREA Area's Zone 3. The following figure displays the existing roads surrounding the project site.

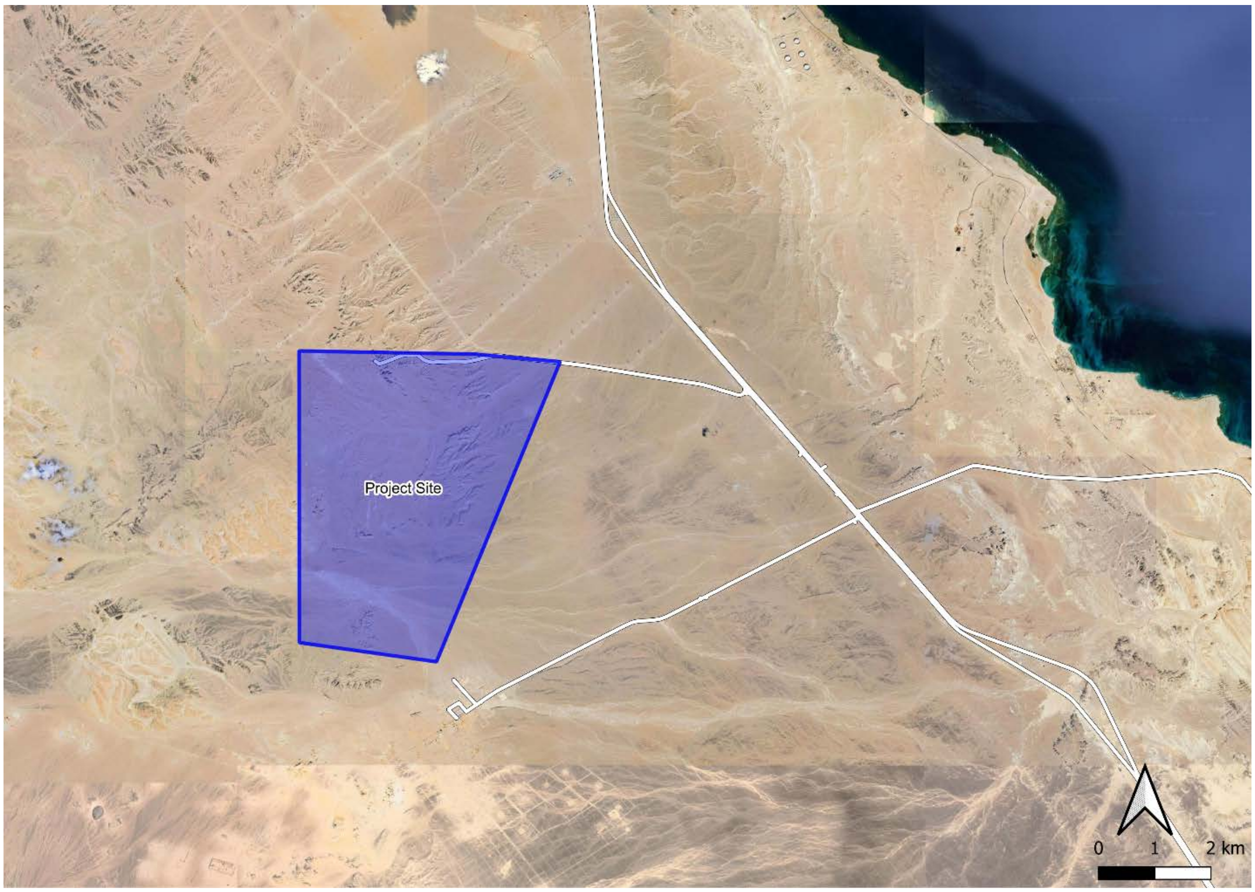


Figure 5-122: Road Network Surrounding the Project Site

5.11.3 Water Management

Wadi Dara Village is not connected to the National Water Network and is 11 km from the Kuraymat-Zaafarana-Gharib water feeding line. The village council buys drinking water from Ras Gharib, then, transports it using the village council's tank truck.

Groundwater is available and is utilized in irrigation through 15 wells. However, the high salinity of the ground water makes it detrimental for crops, farmers stated.

After water is collected in basin-shape reservoirs, it is then transferred to water treatment machines for desalination. With the completion of this process, groundwater can be used for irrigation.

Table 5-51 Coordinates of the Desalinization Plant

Location Activity	Latitude (N)	Longitude (E)
Desalination Plant	28.080108	33.256719

Figure 5-123: Desalination Plant

Consultations with Ras Ghareb Water Company informed the team that there are no existing or planned water connections to the Project area. During both the construction and operation phases, developments in such areas, have to rely on water trucks and tanks from Ras Ghareb to deliver water requirements to the site while the drinking water is mostly bottled water.

The total potable water consumption throughout construction is estimated at 12,500 m³, averaging approximately 14 m³/day in a 2.5 construction period. The potable water consumption during operation is considered insignificant.

The supply of water will be done via a licensed water supplier and will be stored in polyethylene and/or steel tanks on site. Two 25 m³ tanks (total 50 m³) or one 50 m³ tankwill be provided to allow for thestorage of a minimum of 3 days' worth of water demand.

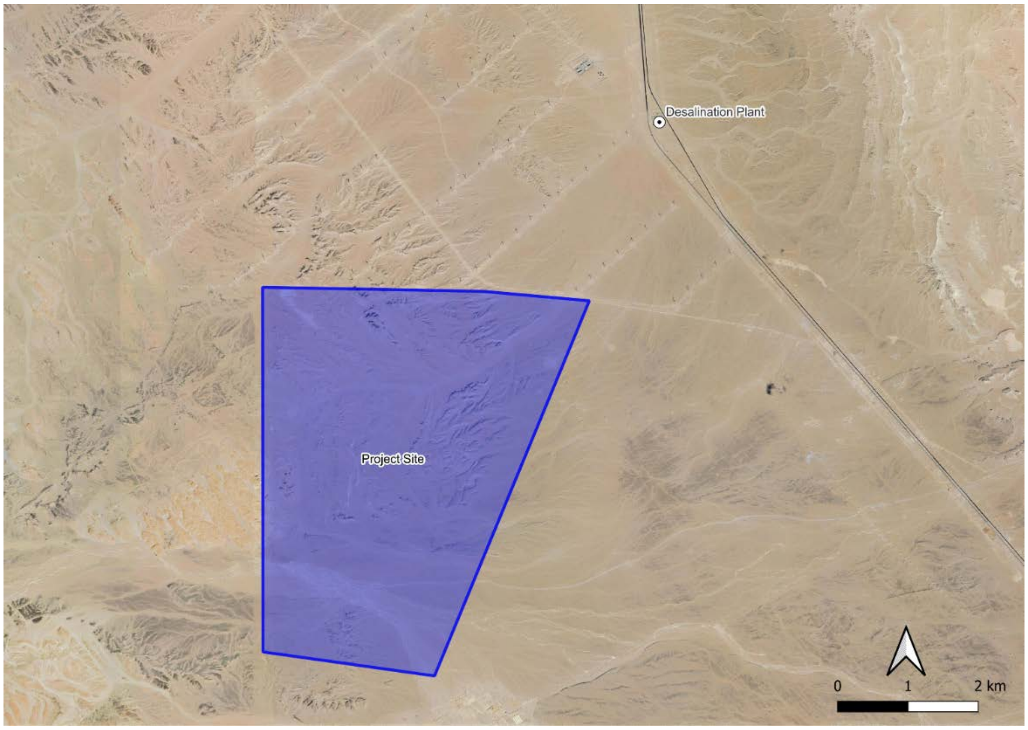


Figure 5-124: Location of Desalination Plant with respect to the Project Site

5.11.4 Waste Management (Solid Waste, Wastewater and Hazardous Waste)

The assessment is based on literature review as well as site visit undertaken for the Project site's location to identify waste management characteristics in and around the Project site.

Regarding solid waste management, the Red Sea Governorate has only one controlled dumpsite for the disposal of solid waste - the Ras Gharib Public dumpsite, owned and operated by the Ras Ghareb City Council. There is no sewage nor sanitation network in the village. Wastewater is collected and disposed of at the Ras Ghareb Wastewater Treatment Plant (WWTP).

Figure 5-125: Ras Ghareb Wastewater Treatment Plant (WWTP)

In addition, concerning waste recycling, there are facilities available for collecting and recycling various waste streams. One such facility is HEPCA, located in Hurghada, which specializes in recycling materials such as cardboard, plastic, metal, and glass. Another entity, Geocycle, operates a processing facility in Sokhna, where they recycle diverse waste streams, including both hazardous and non-hazardous materials.

There are currently two (2) approved hazardous waste disposal facilities in Alexandria and Helwan which are about 450 and 300 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 Environmental Services.

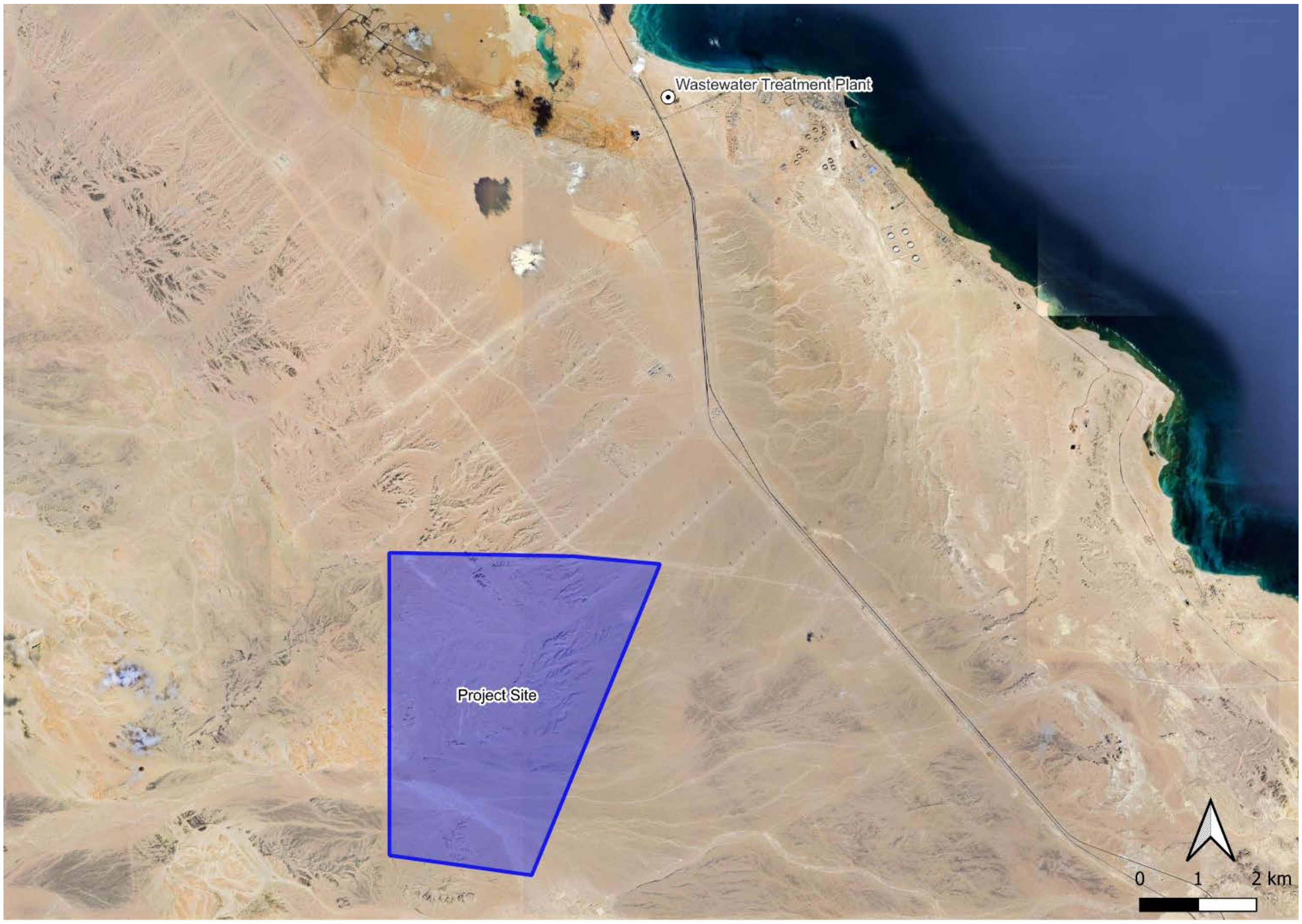


Figure 5-126 Location of WTP in relation to the Project Site

Table 5-52 Coordinates of Waste-Related Unites in relation to the Project Site

Location Activity	Latitude (N)	Longitude (E)
Wastewater treatment plant	28.135661	33.247981

With regards to the project is the following waste streams during the construction and operation phases are expected to be generated:

- During the construction phase, the following are expected: Wastewater during construction and operation is 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 Project can be assumed by taking into account an 80% wastewater generation factor for potable water requirements which will amount to around 10,000m3 throughout the construction phase. Wastewater generated 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. The septic tanks will be fully enclosed, leak-proof, and regularly maintained.

- Solid waste during construction and operation from the Project will include
    - General municipal waste (such as food, paper, glass, bottles, plastic, etc.).
    - Construction waste from excavated material for the foundations. Assuming a footing diameter of 20 meters and depth of excavation of 1m, a total of 13,000 tonnes is expected to be generated. [13] Other construction waste such as concrete and cement waste (spillage, overordering, demolition) and packaging waste (plastics, insulation, packaging, general debris) are considered insignificant.
- Hazardous waste during construction and operation will include routine waste generated from such activities to include spent oil, lubricants, paint cans, solvents and wastewater from equipment and machinery cleaning/washing. Quantities of these materials is expected to be minimal.

Throughout both the construction and operation phases, hazardous waste will be collected by contractor for safe disposal while non-hazardous waste will be recycled whenever possible or otherwise disposed of in approved landfills.

The EPC Contractor during the construction phase and the Project Operator during the operation phase respectively will be responsible for the following:

- In line with the waste hierarchy (reduce, reuse, recycle, dispose), efforts will be made to minimize excavation waste by reusing as much of the excavated soil as possible for backfilling, road construction, and other suitable applications within the project. Any excess material that cannot be reused will be managed appropriately to ensure responsible disposal.
- Coordination with the Red Sea Water and Wastewater Company and obtain list of authorized contractors for collection of wastewaters from the site to the Ras Ghareb WWTP.
- Coordination 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.
- Coordination 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.

During the operation phase, the following quantities of waste are expected:

- Hazardous Waste: Oils, lubricants, and hydraulic fluids: 2-5 tons/year.
- Nonhazardous Waste: Metal scraps, insulator parts, general maintenance debris: 5-10 tons/year.

[13] Volume of excavation for 20m diameter footings for 25 wind turbines at a 1 meter depth of excavations has been calculated using $V=\pi r^2 h= 3.1416x10^2x1x25= 7,854\ m^3$
Assuming soil density of around 1.7 t/m^3, the quantity of excavated material is estimated to be around 13,000 tonnes.

5.11.5 Civil and Military Radars and Aviation Infrastructure

Based on a survey undertaken for the Project area and its surrounding, five (5) military posts were identified; none of which are in the immediate vicinity of the Project site (located around 50 km from the project site). Additional details could be obtained regarding the radar systems nor civil aviation radars in the area. The military units are described as follows (in the table and graphic in order to illustrate their distance from the Project site):

- Army Unit 1 (M1) –Inactive military unit
- Army Unit 2 (M2) – Inactive military unit that was in the process of being demolished at the time of the field survey
- Army Unit 3 (M3) – Active military unit
- Army Unit 4 (M4) – Active military unit
- Army unit 5 (M5) – Active air defense unit

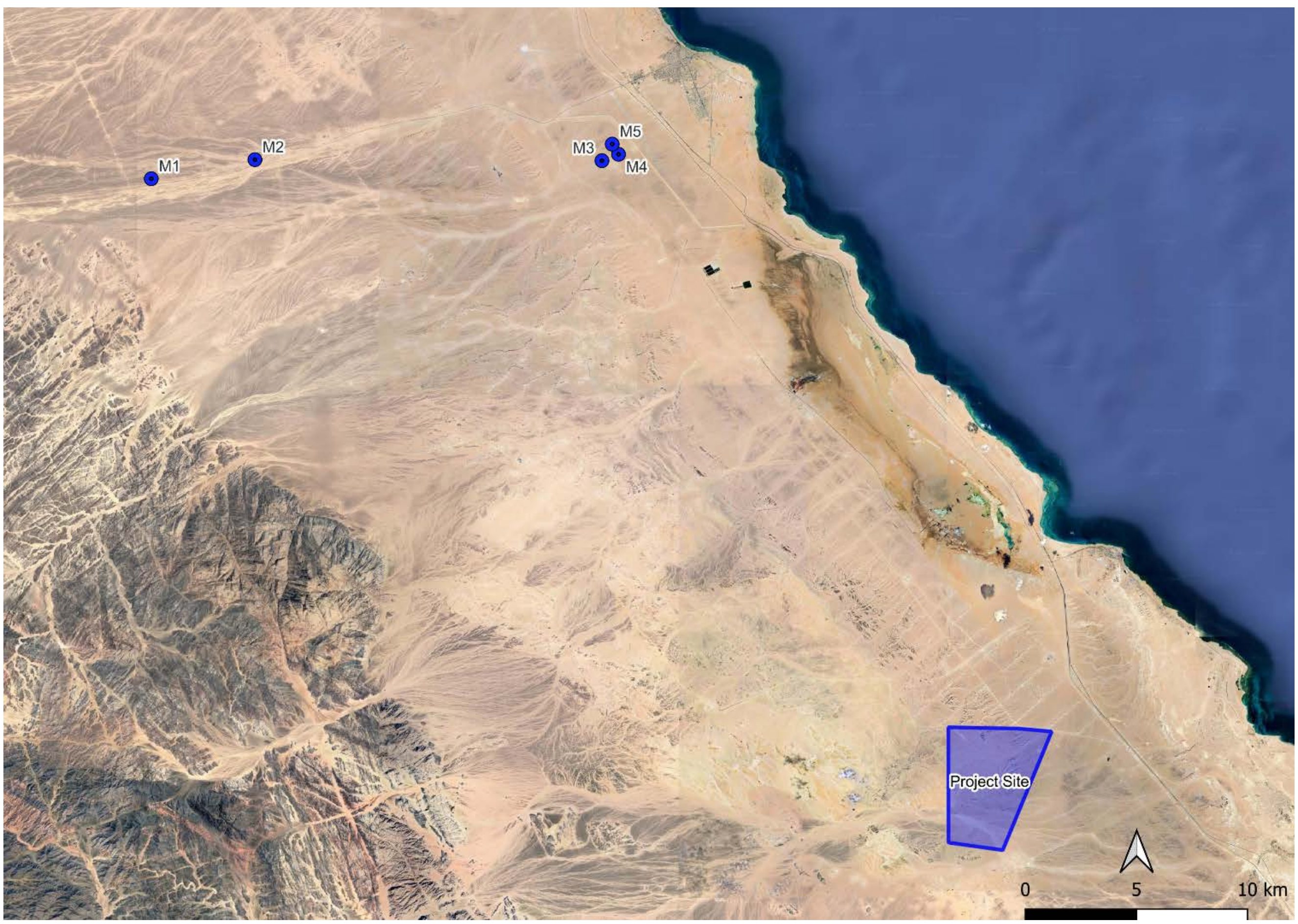


Figure 5-127 Location of Military Units respective of the Project Site

5.11.6 Radio, TV and Telecommunication Infrastructure

There are several communications towers in the vicinity of the Project site along the route of the Cairo-Hurghada Highway and the project's eastern boundary. In total, there are six (6) individual towers at three (3) locations as indicated in the figure below and accompanying table.

Table 5-53: Coordinates of Communication Towers

Point	Latitude (N)	Longitude (E)	Description of the land use
1	28.121103	33.249242	Communication Tower 1 (C1)
2	28.019947	33.306800	Communication Tower 2 (C2)
3	27.984447	33.345492	Booster & Communication towers (C3)

Figure 5-128: Project Site and Communication Towers

The following photographs display the communication towers found in the vicinity of the site.

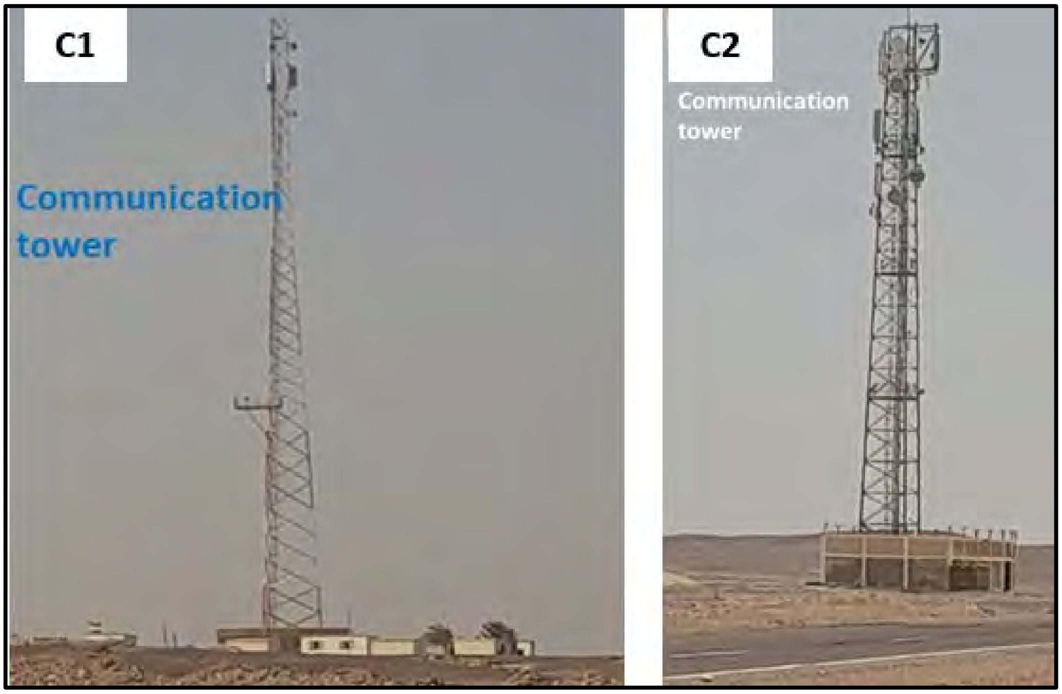


Figure 5-129 Communications Towers 1 (C1) and 2 (C2)

The ESIA consultant established formal communication with the Radio and Television Union in Cairo on the matter of impacts of wind farm operations on communications' signals performance. In response, the Union indicated that they have studied the site and had little-to-no indications of negative impacts resulting from wind farm projects on radio and TV infrastructure in the area.

Figure 5-130 Communication Tower 3 (C3)

5.11.7 High Voltage Power Line

Based on the site survey undertaken for the Project area, a high Voltage Overhead Transmission Line (OHTL) that belongs to EETC is located within the Project area and runs in the north-east section of the Project area. The location of the OHTL is presented in the figure below in relation to the proposed wind turbines. Inappropriate planning and design of the Project and the turbines could impact and affect such existing infrastructure elements within the Project area.

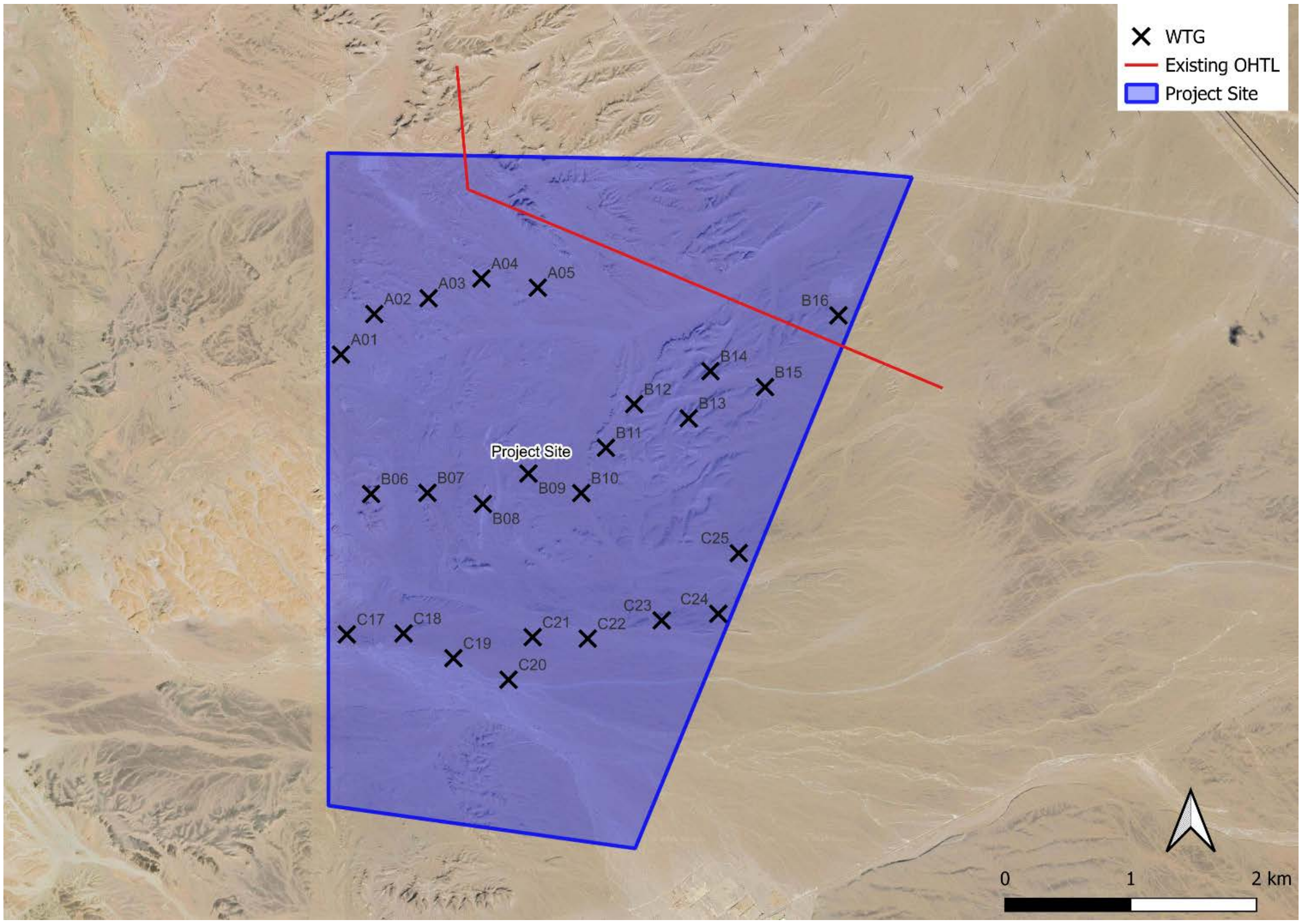


Figure 5-131: Preliminary Wind Turbine Distribution and the existing OHTL

5.11.8 Petroleum Facilities

Informed by consultations with the General Petroleum Company (GPC) in addition to the field survey of the Project area and its surroundings, petroleum units and excavation areas are features in the vicinity of the Project site.

The consultation held with GPC in Ras Gharib informed the team that there are exploratory wells near the Project site. Coordination with GPC should take place prior to construction on aspects reflecting the topics of the Work Coordination Agreement between GPC and NREA (2005) included below.

The Work Coordination Agreement between NREA and the GPC encompasses an area of 300km^2, in which wind farm developments are taking place (including the Project site). The Agreement includes several articles for the development projects to include:

- The General Petroleum Company has agreements for oil exploration and utilization within concession areas located within the agreed area.
- Wind turbines are to be allocated in rows with a distance of 1km between each row and the next
- A distance of around 260m are to be respected between each wind turbine
- The tower height of the turbines should be around 100 m above ground
- The dimensions of the concrete foundation should be around 20m×20m and depth of 4m below ground
- Cables should be lain out next to the rows of turbines at a depth ranging from 1.5-2m and enclosed within special pipes with a diameter of around 15cm that connects to a substation that are to be constructed on an area of 500m×500m
- Within the same trench, communication cables are to be included that are to connect with a control room in the main administrative building
- The wind rows are to be serviced with internal roads with a width of 4m located adjacent to each row and these roads should be designed without an asphalt layer and should be able to withstand a load of 15ton/axle
- Other requirements are to include an administrative building, service buildings, accommodation facilities, etc.

  General Petroleum Company has the right to undertake surveys, measurements or any other exploration activities along with any other company associated with it. The agreement identifies several provisions that should be met for any well drilling or survey activities some of which include: (i) ensure appropriate areas are available within the wind farms for installation of equipment and machinery to undertake required surveys; (ii) turn off turbines when required for security reasons or reduce noise impacts on survey results; (iii) provide the General Petroleum Company with final, detailed and accurate as built drawings for all infrastructure elements above and underground (e.g. cables, roads, etc.).

The Table and Figure below present the location of the petroleum units close and within the Project site. The map was based on satellite image review and verification as conducted during site visits.

Figure 5-132 Petroleum Units in the vicinity of the Project site

Table 5-54 Coordinates of Petroleum Units

Location Activity	Latitude (N)	Longitude (E)
Gas compression station	28.131661	33.245547
GPC oil tanks	28.129064	33.249242
GUPCO oil tanks	28.125508	33.272486
Levelled area for construction	28.047119	33.250103
Levelled area for construction	28.044897	33.240706
Excavated and levelled area	28.055106	33.202894

5.11.9 Other Wind Farms

There are three (3) other existing wind farms present in the surrounding area of the proposed Project location that includes the Japan International Cooperation Agency (JICA), KFW and Fondo para la Internacionalizacion de la Empresa (FIEM) wind farms. The closest wind farm is located on the northern border of the Project site as noted in the figure below. Moreover, a new wind farm plot is under development also shown in the figure below.

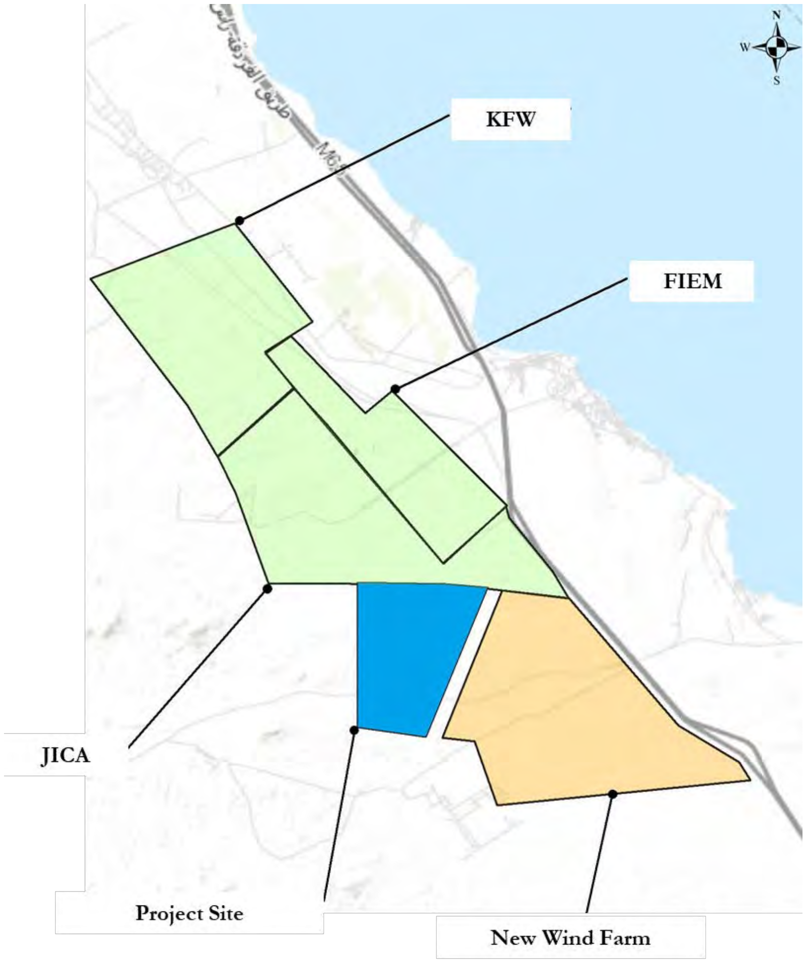


Figure 5-133: Wind Farm Projects in the Project Site's Surroundings

5.12Occupational 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 EPC Contractor has not been selected and therefore no details are available on the worker accommodation strategy.

5.13 Socio-economic

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

5.13.1 Baseline Assessment Methodology

Socioeconomic conditions were assessed mainly through collection of secondary data on key socio-economic indicators of local communities as available – such as Central Agency for Public Mobilization and Statistics, Red Sea Governorate Information Centre and other. Such baseline was also verified through consultations with relevant stakeholders to include Red Sea Governorate official and Ras Gharib City Council officials.

This section will be targeted mainly for Ras Gharib given that it is the closest official local community to the Project site. Other local communities were discussed in further details in "Section5.2".

5.13.2 **Basic Demographic Characteristics**

5.13.2.1 Administrative Division:

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

Administratively, the Red Sea Governorate is divided into 7 Cities (also known as Districts), each headed by a Local City Council. The capital of the Governorate is Hurghada that is located around 100km south of the Project site.

The Project site is located within the Ras Gharib City (or District) and therefore administratively is under the Ras Gharib City Council. The Ras Gharib District is further divided into Ras Gharib town as well as 2 rural (village) local units (Zaafarana and Wadi Dara). The closest community settlement to the Project site is Ras Gharib city (located 35km 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 300km^2 area that has been allocated by the GoE to NREA for development of wind farms. Within this, a land area of 50 km^2 has been allocated to the Developer by NREA for the development of this Project.

Figure 5-134Administrative Borders of the Red Sea Governorate, Source: The official website of the Red Sea Governorate

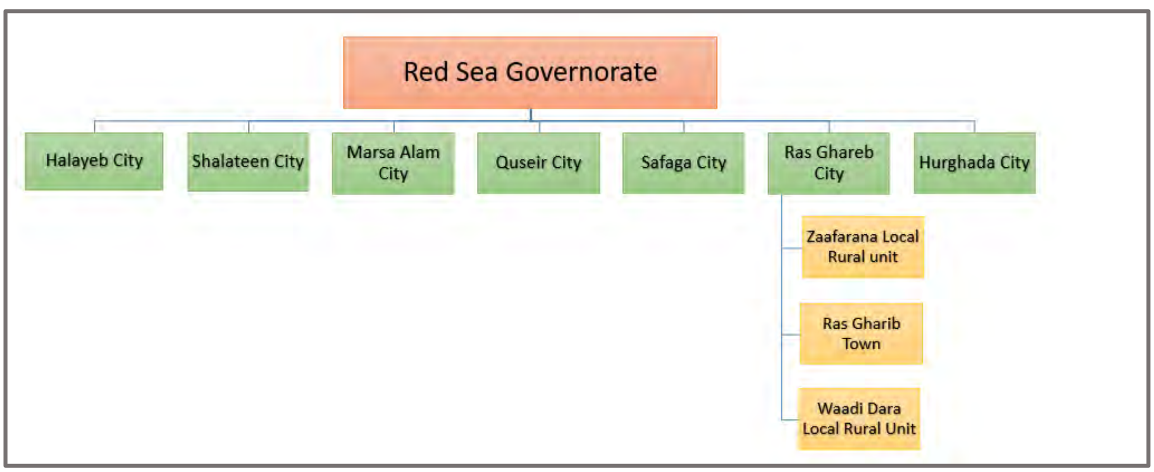


Figure 5-135 Administrative Division of Red Sea Governorate

5.13.2.2 Population Profile:

Based on information from the Statistical Yearbook2022, the total population of the Red Sea Governorate was 396,000, which represents around 0.4% of the total national population. Further information about the population in the Project area is presented in the following table. As noted, the population of Ras Gharib in particular was estimated at around 68,020.

Table 5-55Population (Red Sea Governorate Information Centre, 2022)

Area	Households	Population		Total Population
		Male	Female	
Red Sea Governorate	100,500	205,583	190,417	396,000
Ras Gharib	16,125	35,987	32,033	68,020
Hurghada	25,930	52,138	49,875	102,013
Safaga	18,500	37,444	36,136	73,580
Quseir	18,644	72,806	36,541	74,579
Marsa Alam	5,500	11,509	9,294	20,903
Shalateen	7,777	15,700	13,656	29,556
Halayeb	7,196	14,465	12,683	27,348

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.

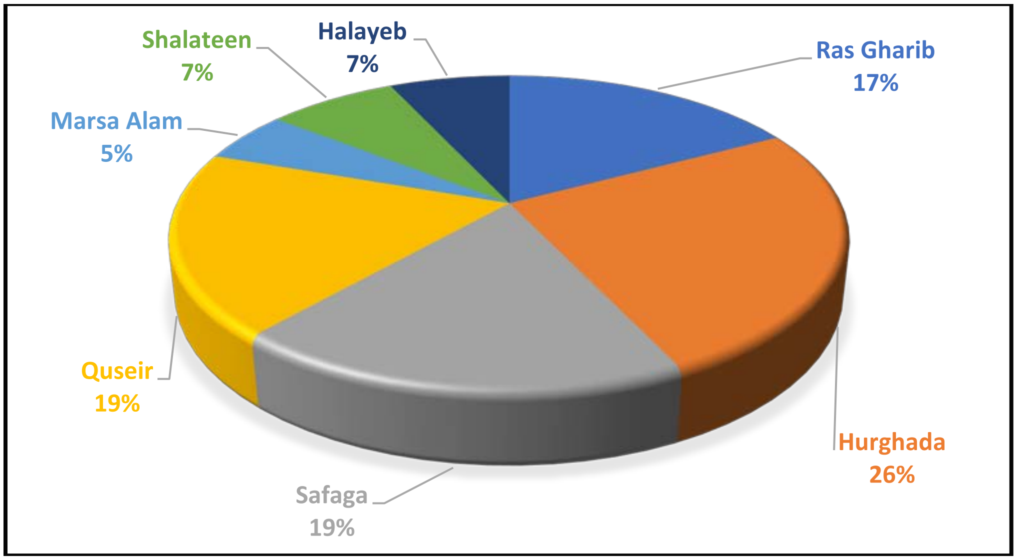


Figure 5-136 Distribution of Population Density According to Districts in the Red Sea Governorate

Bedouin communities in Ras Gharib are mostly unsettled[14], and live deep in the desert, away from the city and the villages. They currently settle permanently in Ras Gharib city, 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 are provided throughout this section).

The demographic trend also includes migrant workers from neighboring 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.

5.13.2.3 Age and Gender Distribution

Data from CAPMAS Statistical Yearbook 2020 indicate that the population in the Red Sea Governorate is predominantly young. Based on the outcomes of the 2020 population consensus, up to 79 % of the population of the Red Sea Governorate are under the age of 45. With respect to gender, statistical data indicates a male/ female ratio in the Governorate (205,583: 190,417).

[14] The results of field visits to the project sites showed that they are devoid of any stability or activities of the Bedouin communities in the area, and the consultant team did not monitor any settlement of the Bedouin communities within 10 km radius of the project sites. In addition, there are no indications showing the marginalization of Bedouin communities in the city of Ras Gharib or the imposition of determining their settlement areas or their access to available facilities and services. Also, during the scoping consultation activities that took place with Bedouins, they did not mention or raise any concerns related to Contested land rights, Social and cultural discrimination, Vulnerability to environmental change.

5.13.2.4 Rate of Natural Increase

The total population in the Red Sea Governorate has grown by 21.00/1000 (*Red Sea Governorate Information Centre, Statistical Yearbook of Red Sea Governorate, 2020-2022*). The growth rate in the governorate decreased from the previous rate in 2020, but despite this, the current growth rate is considered one of the highest rates during the past five years in terms of the rate of natural increase. However, it is considered one of the 10 lowest governorates in terms of birth rate.

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

Table 5-56 Demographic Trends (Statistical Yearbook of Red Sea Governorate, 2019-2020)

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)	28.70
Mortality Rate (Deaths per 1,000 persons)	4.10

5.13.2.5 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 5-57 Workforce Research (CAPMAS, Workforce Research Results for the Second Quarter of 2018)

<table>
<tr><th rowspan="2">Workforce [15]</th><th colspan="2">Total No. of Employed Persons 26.161 Million</th><th colspan="2">Total No. of Unemployed Persons 2.875 Million</th><th colspan="2">Unemployment Rate 9.9%</th><th colspan="3">Labour Force (by Occupation)</th></tr>
<tr><th>Males 80.8%</th><th>Females 19.2%</th><th>Males 53.1%</th><th>Females 46.9%</th><th>Males[16]</th><th>Females [17]</th><th>Agriculture</th><th>Industry</th><th>Service</th></tr>
<tr><td>29.036 Million</td><td>21.138 Million</td><td>5.023 Million</td><td>1.527 Million</td><td>1.348 Million</td><td>6.7%</td><td>21.2%</td><td>28.2%</td><td>24.7%</td><td>47.1%</td></tr>
</table>

15 Including the number of employed and unemployed persons.
16 Out of the total number of males (15 years of age and above) nationwide.
17 Out of the total number of females (15 years of age and above) nationwide.

Regarding child labor, there is no statistical data showing the percentage of child labor in the city of Ras Gharib or the affiliated villages, the consultant team did not notice any indicators of child labor during site visits and field surveys.

- 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 5-58 The Distribution of the Project Area's Population by Work Status & Sex - Red Sea Governorate (Directorate of Manpower in the Red Sea Governorate, 2018-2020)

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

- According to the Statistical Yearbook 2018 of the Red Sea Governorate, the service sector constitutes 60.3% of the Governorate's workforce. Hurghada City represents the largest proportion of employment, due to the presence of coastal touristic areas, followed by Safaga City.
- According to Ras Gharib City Council officials, the majority of the workforce can be divided into three main categories: Government/Public Sector, Oil and Gas (O&G) Petroleum Sector, and Fishing.
- There is also a percentage of wageworkers. Agricultural activities are relatively minor, compared to petroleum-related activities. In addition, tourism-related activities are limited in Ras Gharib, even though some residents work in the tourism sector in other cities in the Governorate, such as Hurghada and Safaga.
- Based on discussions with City Council officials, it was indicated that there is a rise in the unemployment rate in Ras Gharib City due to the limited tourism in the Governorate during recent years, which increased the lack of employment opportunities.

Table 5-59 Labour Status of Ras Gharib & Zaafarana (CAPMAS Poverty Map, 2018)

Employment Information	Ras Gharib City	Zaafarana Village
Male Workforce (aged 15+) from Total Population	46%	57%
Female Workforce (aged 15+) from Total Population	25%	12%
% of Employed Adults (aged 24+) from the Total Workforce	57%	58%

Employment Information	Ras Gharib City	Zaafarana Village
Distribution of Workforce by Sector		
Self-Employed Males	49%	19%
Self-Employed Females	24%	33%
Male Workers in the Agricultural Sector	1.6%	37.2%
Female Workers in the Agricultural Sector	0.05%	84.2%
Workers in the Public Sector	57%	19%

Ras Gharib City attracts many migrant workers from neighboring 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 on poultry farms, as construction workers, and in agriculture 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, in addition to agricultural reclamation activities, poultry and livestock farms in the Wadi Dara region. According to a Ras Ghareb City Council representative, tourism is not a major economic activity in the city compared to other areas in the Red Sea Governorate.

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.

The division of land in Wadi Dar village (the village closest to the project site) includes lands allocated for agricultural reclamation projects. The number of existing farms at the time is approximately (50) farms. The status of these farms varies in terms of agricultural production and continuity in agriculture because the majority of them are still trying but facing obstacles with arable water due to the high salinity in groundwater in the area.

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.

The coastal area in Ras Gharib is not designated for fishing. There is no fishing port in Ras Gharib because the area is designated for oil exploration, therefore there is no scope for the fishing activates on the coast near the project site.

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.

According to the site visits and consultation activities that took place in the Wadi Dara area, there are some livestock and poultry breeding farms in Wadi Dara, some of which have begun production and others are still in the construction stage. In addition to 3 factories under construction to produce feed.

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, 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 2018 shows that 20.23% of males and 21.14% 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 19% and 15% respectively. The following table details the educational status of inhabitants of Ras Gharib and Zaafarana.

Table 5-60 Education Mapping of Ras Gharib & Zaafarana (CAPMAS Poverty Map, 2018)

Education Information	Ras Gharib City	Zaafarana Village
University Degree Holders/Males	19%	9%
University Degree Holders/Females	15%	0%
Male School Enrolment/Males (age: 6-18)	99.28%	72.2%
School Enrolment/Females (age: 6-18)	99.45%	74.3%
School Drop-outs/Males	0.21%	0%
School Drop-outs/Females	0.23%	0%

According to CAPMAS Poverty Map 2018, the illiteracy rate in Ras Gharib City is estimated at 20.4% for males and 16.1% for females, while the illiteracy rate in Zaafarana was 37.15% among males and 45% among females.

Table 5-61 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 5-62 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. The central hospital serves all the areas and villages administratively affiliated with Ras Gharib Local Government Unit (LGU). The hospital is equipped with an Emergency room section, and has outpatient clinics. There is an ambulance unit on Zaafarana--Ras Gharib Road north of Ras Ghareb city, near the Project site; these is the nearest ambulance unit to the project area.

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

Table 5-63 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 and Services

According to the data available in the statistical yearbook, Red Sea Governorate, a brief summary of the extent to which access of basic infrastructure services available in the Red Sea Governorate and to the project's area is given in the following tables.

- **Potable Water & Sanitation**

Table 5-64: Access to potable water and sanitation in the Red Sea Governorate

Item	Unit	Value
Production of potable water	Thousand m^3 /Day	107.57
Consumption of potable water	Thousand m^3 /Day	81.96
Per capita water consumption	Liter. day/ Person	249.24
Capacity of sanitation	Thousand m^3 /Day	16.57
Per capita sanitation capacity	Liter. day/ Person	50.39

Source: Red Sea Governorate- Egypt Description by Information, 2020

- 18.00 thousand m3/ day is the total capacity of sanitary drainage treatment plants in the Red Sea Governorate in 2018/2020.
- 92.06 % is the actual capacity of total capacities of sanitary drainage treatment plants in Red Sea Governorate in 2018/2020.
- 76.19 % is the amount of potable water consumption to average produced water in the Red Sea Governorate in 2018/2020.

All houses and facilities in Ras Gharib are connected to water and sanitation services from the local network. There is a limited number of houses (10%) in the city are not connected to the sewage network. They rely on septic tanks that are drained periodically.

- **Electricity**

Access to electricity in Upper Egypt Governorates is 99.0% (Egyptian Human Development Report 2020). Even squatter areas have access to electricity regardless of their legality.

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

Table 5-65: Access to Electricity in Red Sea Governorate

Item	Unit	Value
Total electricity production	Million k.w.h yearly	730.00
Total electricity consumption	Million k.w.h yearly	621.90
Electricity consumption for lighting	Million k.w.h yearly	424.27
Electricity consumption for industrial utilization	Million k.w.h yearly	197.63
No. of subscribers in the electrical grid	Thousand subscribers	157.05
Per capita share of electricity used for lighting	k.w.h yearly/ Person	1290.21

Source: Red Sea Governorate- Egypt Description by Information, 2020

All houses and facilities in Ras Gharib are connected to electricity services from the local network.

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 5-66 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 productions 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.

<table>
<tr><th>Item</th><th>Red Sea Governorate</th><th>Ras Gharib</th></tr>
<tr><td rowspan="3">Touristic Investment</td><td>The General Tourist Planning of the Red Sea Governorate
Red Sea Governorate contains a number of planned touristic zones.</td><td>- Zaafarana Sector
- Gamsha Sector</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2">▪ 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.
▪ 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</td></tr>
</table>

Item	Red Sea Governorate	Ras Gharib
	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.	

5.13.2.6 Vulnerable Groups

The vulnerable groups are defined as groups that are expected to be disproportionally affected by project impacts due to their race, color, sex, language, religion, political opinion, national or social origin, gender, ethnicity, culture, physical or mental disability, and other. Vulnerable groups are project-specific and depend on a range of issues which must be understood such as project location, socio-economic and demographic context, as well as the nature of the development and type of impacts anticipated.

The vulnerable groups within this context were identified to include:

- Women groups of the local community. Cultural norms in Egypt and within the local communities, in specific, could limit their participation in decision-making in general as well as their employment opportunities as opposed to their male counterparts.
- Disabled Groups: are considered vulnerable groups mainly due to physical disability which could limit their access to information on the Project.
- Elderly Groups: are considered vulnerable groups mainly due to age limitations which could limit their access to information on the Project.
- Casual workers and day labourers: are considered vulnerable groups mainly due to a lack of labour contracts - typically not offered to these categories - any health & safety issues, violation of worker rights, or substandard working conditions will affect these categories disproportionately.

Given the nature and location of the Project there are no additional groups considered as vulnerable that would require special consideration throughout the consultation process.

- **Children with Special Needs in Ras Gharib**

There is a growing demand for specialized education for children with hearing, visual, and cognitive disabilities, including autism. Local NGOs, government programs, and support initiatives from existing developers have started offering assistance, but resources remain limited. Access to specialized teachers and learning materials presents a significant challenge.

- **Health Concerns Related to the Petroleum Sector**

Long-term historical exposure to pollutants from the petroleum industry has contributed to respiratory diseases and chronic illnesses among some workers in Ras Gharib. Awareness campaigns and health monitoring programs have been implemented but remain limited in coverage.

- **Healthcare Challenges for Bedouin Women**

Some Bedouin families have settled in Ras Gharib and Hurghada, where healthcare services and facilities are available. However, maternal and child healthcare services remain scarce in remote and nomadic Bedouin communities (such as the Khoshman tribe), particularly in Wadi Dara and the surrounding mountainous areas, where families frequently relocate based on seasonal rainfall.
Transportation barriers and long distances to urban healthcare centers make pre- and postnatal care difficult. Some Bedouin women rely on traditional birth attendants, which may not always align with modern medical safety standards. This situation increases their vulnerability to health risks.

5.13.3 Waste Collection and Local Management Systems

- **Local Waste Collection Systems**

The waste management system in Ras Gharib and Wadi Dara follows a combination of formal and informal waste collection systems. As for Ras Shukeir, it is considered a residential compound for employees of Shukeir Petroleum Company and is therefore managed by the General Petroleum Company (GPC) and Petrojet, which is responsible for waste management at GPC-operated sites in the Red Sea Governorate.

- **Formal Waste Collection**
  - Managed by the local municipality, specifically the Environmental Affairs Department of Ras Gharib City Council, under the Red Sea Governorate.
  - The municipality oversees the entire waste management system, from collection to disposal at an official dump site.
  - The primary dump site is located near Sheikh Fadl Road, approximately 40 km from the project site.
  - The system involves waste collection trucks operating in urban areas, with waste transportation and disposal carried out by an authorized contractor hired by the city council.
- **Informal Waste Collectors**
  - Operate on a very limited scale, primarily in remote areas where formal waste collection services are insufficient.
  - Play a role in the recycling of plastic, metals, and other materials, but in a very limited scale.
- **Challenges**
  - Irregular waste collection schedules.
  - Lack of waste sorting at the source.
  - Limited disposal sites, particularly in remote areas.
  - Ras Gharib has only one official landfill site to manage waste disposal for the entire city.

- **Waste Management at Wind Farms in the Area**

The existing wind farms in the region follow different waste management approaches based on company-specific policies and regulatory compliance.

- On-site waste separation: Most wind farms separate waste at designated collection points at the site.
- Collection at the gate: Industrial waste, including hazardous waste (e.g., used oils, turbine components), is handled through licensed waste management companies.
- Off-takers and waste tracking: Companies contract approved waste handlers to ensure proper off-site disposal and recycling.
- Monitoring to prevent illegal dumping: Some developers implement tracking systems for waste disposal to ensure compliance with environmental laws and avoid unregulated waste disposal.

This additional information enhances the project's understanding of local and industry waste management practices and has been incorporated accordingly

6 Analysis of Alternatives

6.1 No-Project Alternative

The 'no Project' alternative assumes that the 200 MW 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 and social impacts discussed throughout this ESIA would be averted. Nevertheless, should the Project not move forward; the significant and crucial positive economic and environmental benefits would not be realized. Such benefits include the following:

- This development allows for more sustainable development and shows the commitment of the GoE to realizing the energy strategy;
- Contribute to increasing energy security through development of local energy resources and reducing dependency on external energy sources;
- The clean energy produced from renewable energy resources is expected to reduce consumption of alternative fuels for electricity generation, and will thus help in reducing greenhouse gas emissions, as well as air pollutant emissions; and
- Project is expected during the construction and operation phase to generate local employment and commit to other social responsibilities. As such, this is expected, to a certain extent, to 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 concludes that the 'no Project' alternative is not a preferable option.

6.2 Site Selection Alternatives

The GoE has allocated to the NREA through "Presidential Decree No. 116 of the year 2016" land for development of renewable energy projects through usufruct rights.

The area was proposed by the National Centre for Land-use Planning and was approved by the Council of Ministers. In line with the decree, 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 km2 for solar energy projects (25% share), This includes an area of 1,220 km2 in the GoS with a total capacity of 3,550 MW for wind power projects (IRENA, 2018).

Of the 1,220 km2 area in the GoS, currently an area of around 300km2 is being developed for multiple wind farm projects as noted in the figure below. The key factors taken into account for selection of this area include the following:

The land area is under governmental ownership and therefore does not require any land acquisition measures

- The area is mostly free from competing uses;
- The area is presumed to be one of the areas in Egypt with the highest wind power potential;
- The area mostly consists of vast desert grounds;
- The geomorphology of the area is favorable 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 200 MW Wind Farm Project. Therefore, taking the above into account, there are no site alternatives that were considered by the Developer in this case.

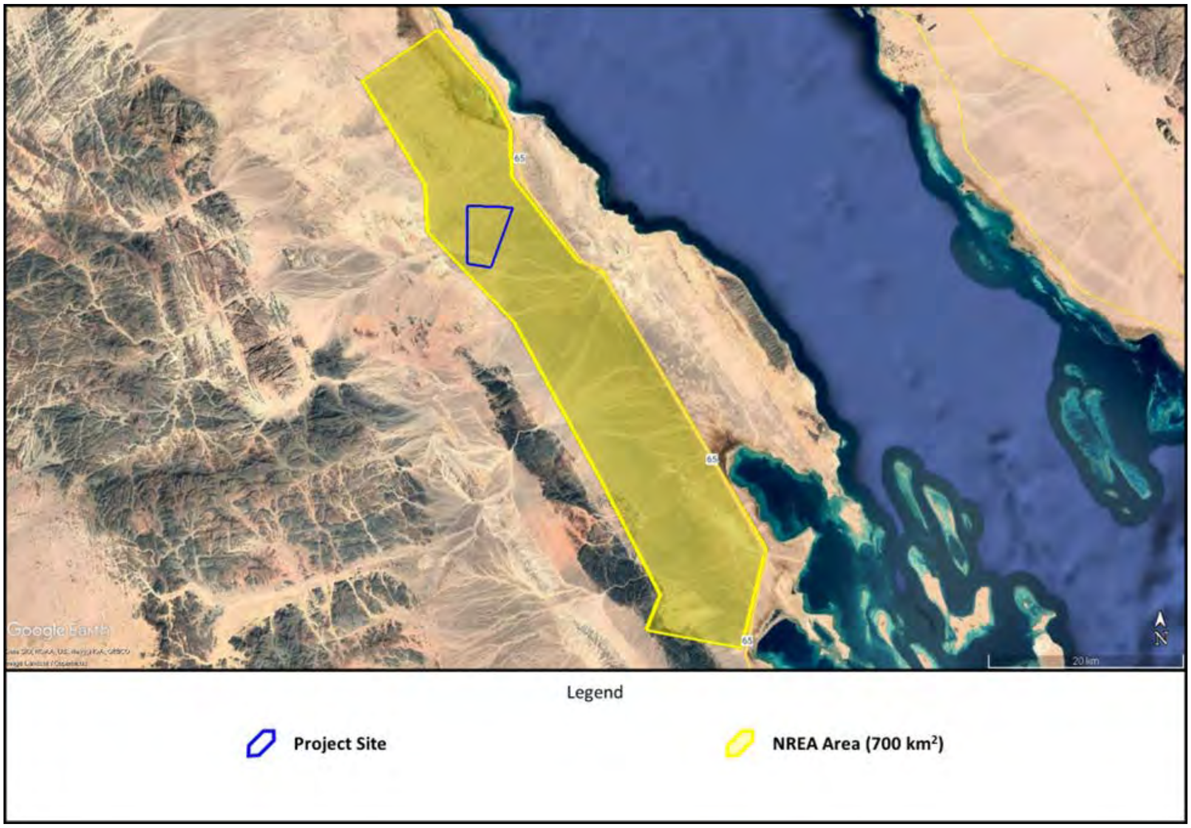


Figure 6-1: Project Site as Part of the 300km2 Area Allocated for Wind Farm Developments

6.3 Technology Alternatives

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

6.3.1 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 2022, through hydro, wind, and solar.

Egypt enjoys favorable 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 favorable 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 Nile River, with the highest potential in Aswan where a series of power stations are located. Within this context, several projects have been realized and several other hydroelectric plants are being developed.

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

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

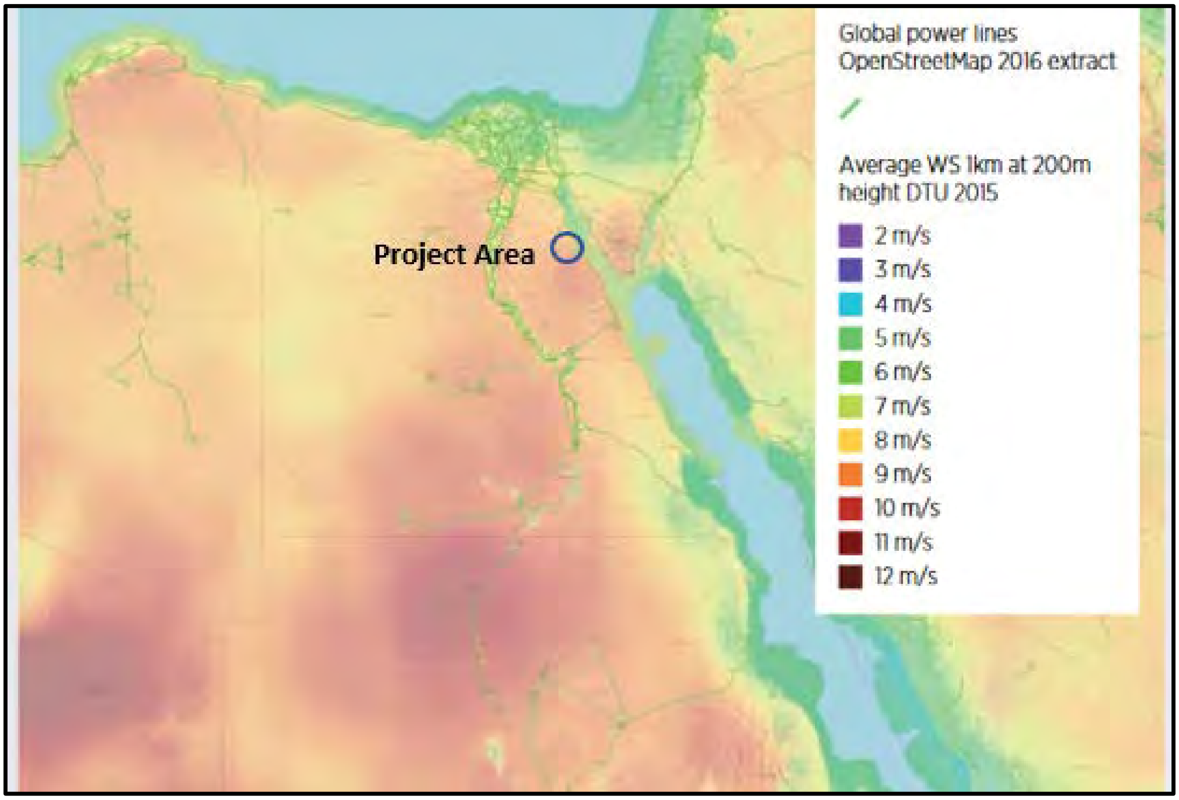


Figure 6-2: Egypt's Wind Atlas (Source: IRENA, 2018)

6.3.2 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 plants 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 2022.

6.4 Design Alternatives

6.4.1 NREA Concessionary Area

Among the objectives of this ESIA is to build on the outcomes of the Environmental Impact Assessment study (2007) undertaken to determine the potential environmental impacts of wind power development in the 656 km^2 NREA Concessionary Area, which is to be utilized for the development of wind power amounting to 3,000 MW. The corresponding EIA informing the NREA Concessionary Area on impacts of wind turbine development identifies site-specific E&S constraints to be taken into account by the Project developer throughout the planning and design phase of the Project.

The NREA Concessionary Area was zoned according to the weight of the expected environmental impact among competing environmental interests: renewable energy development and conservation, particularly avi-fauna populations. The area starts about 20 km in the south of Ras Gharib and reaching up to the Gulf of Zayt (about 60 km in the North of Hurghada). The wind power target capacity for the area is between 2,000 – 3,000 MW by 2026/2027.

The following environmental surveys were carried out for the "NREA concession area":

- Reconnaissance survey to assess the present land use in the area
- A survey on the fauna (others than avifauna) and flora
- An autumn and spring monitoring of bird migration and bird habitat
- A geological survey

The assessments evaluated the possibility of environmental impacts brought on by the development and operation of wind farm development in the NREA Concession Area and its corresponding Feasibility Study for a Large Wind Farm at Gulf of Zayt (DECON, 2007). The results of the assessments affirmed that, overall, environmental and social impacts would be negligible due to the remoteness of the area, lack of residences and native ecosystems. However, concerning risks posed to migrating avifauna, they (perceived potential impacts) were determined to be significant.

In order to find a middle ground within the NREA Concessionary Area between the area's exceptionally high wind power potential and the land's inherent significance to the migration flyway for avifauna, three zones were defined to elaborate on requirements for development:

- *Zone 1:* While this zone comprises nearly 60 % of the Concessional Area, wind park construction is banned.
- *Zone 2:* Wind Park development is permitted yet subject to further ornithological monitoring and verification. Based on the results of the ornithological monitoring and verification exercise, the proposing wind farm initiative may be permitted.
- *Zone 3:* Any wind farm installation in this zone would require technical avoidance and mitigation measures exemplary of the best practicable standard. A post-installation monitoring programme

would need to be executed to assess the impacts of the wind park and whether additional measures are required.

The Project is situated within Zone 2 (below figure).

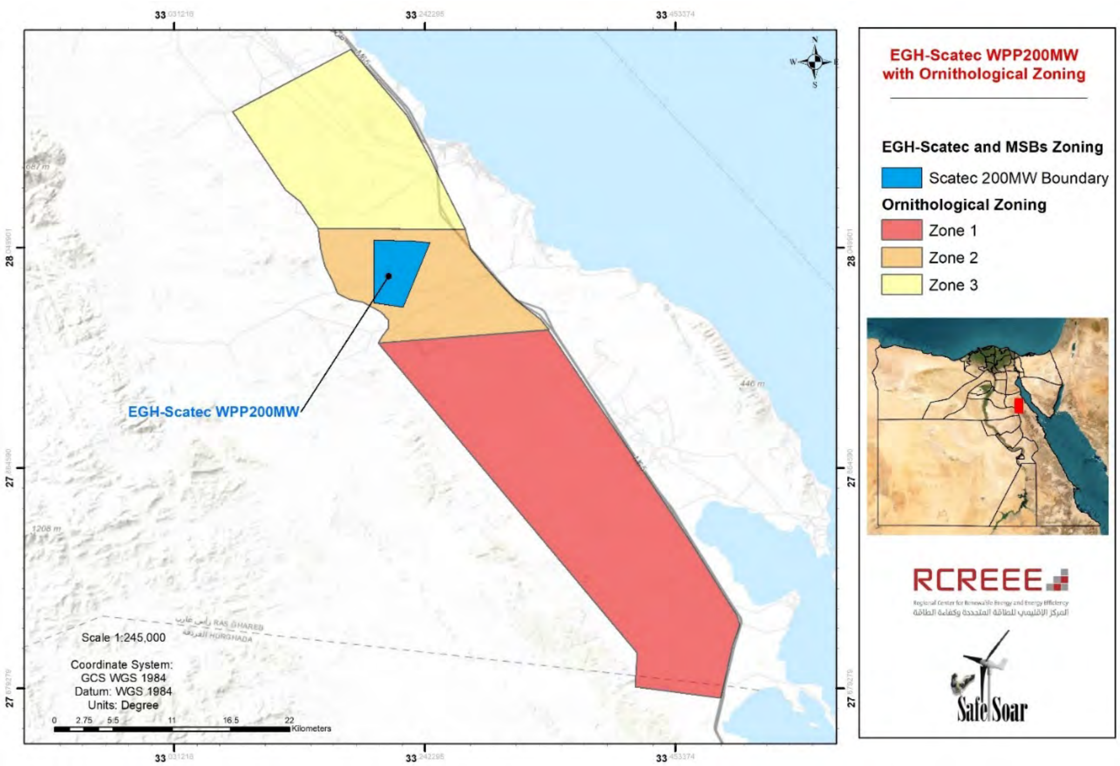


Figure 6-3: NREA Concessionary Area's 3 Zones with the Project site overlain in Zone 2

Table 6-1: Summary Outcomes of NREA's Feasibility Study for a Large Wind Farm in the Gulf of El Zayt (2008)

E&S Attributes	Outcomes of Strategic ESIA	Additional Requirements in Strategic ESIA
Landscape and Visual	No concerns reported as the landscape is sparce (desert plains) of sensitive receptors as well as ecological elements.	No additional requirements to be considered
Landscape and Use	Area is mostly desert landscape (compacted gravel or rocky) and not ecologically sensitive. Very little deterioration expected.	Site-specific mitigation and housekeeping procedures.
Geology, Hydrology, Hydrogeology	Negligible impacts on groundwater and surface water.	Turbines should be installed at a distance of 150m from existing groundwater wells of Ras Shukheir water supply.

E&S Attributes	Outcomes of Strategic ESIA	Additional Requirements in Strategic ESIA
	A minimum distance of 150 m from wind turbines to existing groundwater wells of the Ras Shukheir water supply is required. Within the NREA Concession area, there are plans to construct service buildings, such as store, control and apartment buildings, of which will be connected to the existing water pipeline and equipped with an appropriate waste water treatment system (e.g. septic tank with underground seepage and regular sludge collection).	
Biodiversity	No serious impacts on biodiversity anticipated. The landscape is sparce in vegetation. Animals that were recorded are not included in the Red List of Threatened Species, both internationally or nationally.	Site-specific mitigation and monitoring requirement.
Birds (avi-fauna)	As the NREA area is located next to an registered Important Bird Area (IBA), the Gabal el Zayt IBA area, and near or partially in a major flyway area of migrating birds, impacts of wind power utilisation on migrating birds were likely to be significant. The disturbance on the flyway against the heavy wind during spring were determined to be critical.	Regarding Zone 2, in which the Project area is defined, wind farm installation is subject to further ornithological study in order to commence.
Archaeology and Cultural Heritage	None reported	Precautionary Principle to be applied and coordination with the Ministry of Antiquities
Air Quality and Noise	Some additional dust will occur locally during construction works; however, it is not anticipated to be critical due to the absence of population or wildlife, that would otherwise be affected. Similarly for noise, the closest sensitive receptors reported are in Wadi Dara. The noise emissions from wind turbines were significantly below 30 Decibel.	Site-specific mitigation and monitoring requirement.

E&S Attributes	Outcomes of Strategic ESIA	Additional Requirements in Strategic ESIA
Infrastructure and Utilities	Water supply: Wind farms' water requirement not to affect the overall water supply in the region Transport: Wind power development is not anticipated to cause traffic bottlenecks in the greater area	Domestic waste water originating from the construction yard facilities or permanently constructed service buildings shall undergo simplified treatment (septic tank) and infiltrated to the sandy underground for further natural treatment. Site-specific mitigation (waste gathering and proper disposal) and monitoring requirement. A co-operation with the Rhas Gharib waste collection system is recommended. Turbines shall not be installed in wadis. The wind park internal grid shall be made by underground cables. Any wind park, which would be erected on the NREA area, shall be connected to a substation to be built by EEHC/ETC. The interconnections shall be either by underground cable or built according to accepted bird protection guidelines Co-operation with the Rhas Gharib waste collection system is recommended, as well as mapping of local off-takers of waste for recycling purposes. Regarding construction related transport of materials from port to site, identify public safety hotspots along the route and design mitigation measures (from Ain Sokhna traffic will pass by Zaafarana, Ras Gharib, and Ras Shukeir; from Safaga traffic will pass by Hurghada and El Gouna).
Worker Rights and General Working Conditions	General risks associated with the employment of workers in wind farm development projects	The lender's requirements regarding labor go beyond just occupational health and safety. The developer must oversee labor issues at the contractor and subcontractor level, given the potential presence of certain vulnerable categories of workers (migrant workers and day laborers) during construction. Employment contracts, timely payment of wages and overtime, social insurance, temporary worker accommodation, worker grievance mechanism, etc. must be monitored.

E&S Attributes	Outcomes of Strategic ESIA	Additional Requirements in Strategic ESIA
Occupational Health and Safety	General risks associated to persons involved in construction, operation and decommissioning of wind farms.	Adhering to international standards of health and safety guidelines.
Socio-economics	Few people reside in the immediate surrounding of the NREA area, who may be affected by wind power development. Windpark construction will create employment.	Besides local employment, Project will also aim to maximize local supplier opportunities during the construction and operations phase.

Overall, the following mitigation measures are strongly recommended as part of the EIA Study of the NREA Concessionary Area pertaining to the mitigation of wind turbines' potential impact on avi-fauna:

- Avoid wind turbines with a maximum height of more than about 100m, because the majority of birds migrate well above 100m
- Avoid turbines with lattice towers in order to reduce suitable perching sites.
- Avoid lighting of turbines. If lighting of turbines is absolutely required, use the minimum number of intermittent flashing white lights of lowest effective intensity
- Paint turbine blades to increase blade visibility according to HODOS (2003): a single, solid black blade or a single blade with thin stripe patterns paired with two white blades.
- Avoid small turbines with high-speed rotors and with turbines closely packed together.
- Maintain a corridor aligned with main flight directions (south-southeast in autumn and north-northwest in spring) with a breadth of more than 1 km between wind farms at reasonable distances.
- Implement a detailed post-construction monitoring programme in order to:
  - verify the assumptions gathered within the impact assessment and determine significant
  - deviations from predicted impacts;
  - determine the weight and significance of proposed impacts (especially collision rate);
  - examine behavior of migrating birds in the vicinity of the proposed wind power plant;
  - examine the conditions in which collisions occur and the cause-and-effect chain of collisions;
  - test the effectiveness of mitigation measures;
  - (if so) identify critical wind turbines;
  - (if necessary) maintain further mitigation measures (acoustical deterrents, temporal
  - shutdown of critical turbines);
  - (if necessary) remove problem turbines associated with unacceptable mortality

<u>*NOTE: all of the above requirements have been considered within this ESIA as applicable. However, for requirement: (i) are outdated (e.g. requirement related to maximum top height of 100m where the GoE not allow developments up to 220m) or (ii) will be updated based on the updated environmental permit that will be issued by EEAA for this project (e.g. maintaining a 1km corridor)*</u>

7 Analysis of Impacts & Mitigation Measures

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

7.1 Overview of Strategic Environmental and Economic Impacts

7.1.1 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 Integrated Sustainable Energy Strategy (ISES) 2015 – 2035, which outlines the nation's roadmap to increase the contribution of renewable energy to 42% of the country's electricity mix by 2030.

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

7.1.2 Environmental Benefits

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

In addition, 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 350,000 metric tons of CO_2 annually.

The above has been calculated based on statistics obtained from Egyptian CAPMAS. Carbon Dioxide (CO_2) 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, CO_2 emissions (Tones) per kWh is around 479g per kWh.

In addition, there is an important benefit related to water conservation because unlike certain power generation methods, wind projects do not require significant amounts of water for cooling or steam generation. Conservation of water is particularly important in arid regions like Egypt, where water scarcity is a significant challenge.

7.2 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.

7.2.1 Potential Impacts during the Construction Phase

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

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

As discussed in "Section 5", Wadi Dara Village (less than 1 km from the boundary of the Project site) represents several sensitive visual receptors in the surrounding vicinity. While there are a number of structures (as indicated in Section 5.2 the majority represent commercial – agricultural establishments; Wadi Dara Village, overall, hosts about 4-5 families. Visual impacts will be observable from the main road leading into and from the Village.

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 sensitive visual receptors that would be affected in the vicinity of the Project site, the receiving environment is determined to be of a moderate sensitivity. Although the sensitive receptors are located close to the Project site, the impact is considered minor due to the low number of full-time occupants and the absence of significant landscape features.

Mitigation Measures

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

- Ensure proper general housekeeping and personnel management measures are implemented which could include:
    - Ensure the construction site is left in an orderly state at the end of each work day.
    - To the greatest extent possible construction machinery, equipment, and vehicles that are not in use should be removed in a timely manner and kept in locations to reduce visual impacts to the area.
- Ensure proper storage, collection, and disposal of waste streams generated
- Implement restoration and rehabilitation measures to restore the site's visual quality through for example re-contouring the land and removing temporary structures (e.g. batching plant).

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

Monitoring and Reporting Requirements

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

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

7.2.2 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 (185.5 m for this 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:

- The only potential sensitive receptors would be Wadi Dara. However, As explained earlier, Wadi Dara Village does not have a large permanent community with majority of population being workers and guards employed at the various poultry, livestock and agricultural farms within the settlement (mainly at a rotational basis). Based on this, aesthetical value for such a receptor loses some importance. Finally, based on consultations undertaken with Wadi Dara (refer to "Section 9") such impacts were explained but no issues were raised.
- Project area is considered a barren and desert area and in general is located within an industrial area with petroleum activities for which its aesthetical value loses some importance.
- There are several existing and under construction wind farm developments in the area as well as several electricity distribution and transmission lines so the addition of this Project will not be a significant impact to the visual and landscape characteristics of the area.
- Being visible is not necessarily the same as being intrusive. Aesthetic issues are by their nature highly subjective. For some viewers, a Wind Farm could be regarded as manmade structures with visual burdens while to others it represents a positive impact in the sense that they introduce a break in the otherwise dull and monotonous view.

In addition to the above, the rotating blades will be visible from vehicles passing across the Hurghada - Cairo Highway as well as the main road leading into Wadi Dara Village which also intersects the Project Site. The turbines can attract visual attention and potentially distract drivers passing along the highway.

Given all of the above, the potential impacts on landscape and visual are of a <u>long -term duration</u> throughout the Project operation phase. The impacts will be of a <u>negative nature</u>, and <u>medium magnitude</u> given that such elements of the Project will be visible. However, given the key visual receptors in the project route and its surroundings the receiving environment is considered of <u>moderate sensitivity</u>. Given all of the above, such an impact is considered of <u>moderate significance.</u>

<u>Mitigation Measures</u>

The following identifies the mitigation measures to be applied by the Project Operator during the operation phase and which include:

- In coordination with the Traffic and Transport Authority, install clear and informative signage in Arabic and English language at Hurghada – Cairo Highway and on the road leaving the highway and into Wadi Dara Village to alert drivers of the wind farm ahead and provide guidance on safe driving practices.

Following the implementation of these mitigation measures, the significance of the residual impact is categorised as minor.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by Project Operator during the operation phase:

- Inspections on highway to ensure signage is installed.

7.3 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.

7.3.1 Potential Impacts during the Planning and Construction and Operation Phase

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

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

- The Project site itself in general is uninhabited and vacant and does not include any physical or economical land use activities. Therefore, physical and economical displacement impacts are considered irrelevant.

- The Project site is owned by NREA and will be utilized for the Development of the Project. However, as discussed earlier, Bedouin Groups in general implement the Ghafra system in such land areas to include the Project site. Therefore, the Developer should be aware of Al-Ghafra system, and other aspects of Bedouin culture. The Developer's understanding of Bedouin culture plays a major role in regulating the relationship between them and the tribes in the region. Inappropriate management of such issues could result in potential conflicts with such groups.

Nevertheless, should the above issues not be taken into account as part of the planning phase of the Project, it could result in impacts that are considered of long-term duration, of negative nature, and of medium magnitude and high sensitivity given that it could result in land use impacts and disputes with both Bedouin Groups. 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 as part of the employment and procurement procedure.
- Implementation of SEP that includes specific references for engagement and coordination with Bedouin groups. Please refer to SEP for additional details.
- Exchange know how and practical experience on coordinating with Bedouin communities with the E&S manager of the West Bakr Wind Farm - or any other wind farms in the area. WBWF carried out an extensive socio-economic and cultural study on the local Bedouin to underpin its engagement strategy with them.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as insignificant.

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:

- Monitoring the effectiveness of the grievance mechanism that allows the Bedouin community to raise concerns, provide feedback, and seek resolution for any perceived impacts or conflicts. Regularly review the mechanisms' accessibility, transparency, and responsiveness.
- Submission of employment and procurement procedure that includes references for Bedouin groups; and
- Submission of proof of coordination and agreement with Bedouin groups as part of the SEP such as engagement records.

7.4 Geology, Hydrology and Hydrogeology

This section identifies the anticipated impacts on geology, 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.

7.4.1 Flood Impacts

7.4.1.1 Potential Impacts from Flood Risks on the Project Site

A detailed flash flood risk assessment was carried out as a standalone study. Based on the comprehensive review of previous studies on flash flood hazards in the area surrounding the project site, combined with a detailed field visit to investigate and document the actual signs of flash flooding, the following conclusions can be summarized regarding the extent of dangerous floods that may occur on the site:

1) **Increased Flood Risks Due to Climate Change**: Over the past 15 years, Ras Ghareb region has experienced an increase in the frequency and intensity of floods due to global warming and climate change, particularly during the rainy seasons. This shift has affected surrounding areas but has had limited direct impact on the project site.
2) **Surrounding Wadi Flooding**: In 2016, rainwater collected in dry wadis to the north of the site, particularly in Wadi Abu Had and Wadi Al Darb, which affected the city of Ras Ghareb. However, these flood events did not impact the Dara area or the project site directly.
3) **Downstream Characteristics of the Site**: The site lies at the downstream end of the Wadi Dara basin and the small Wadi N. Dara basin at the northeastern border. The rainwater collected through small tributaries creates weak surface flow that converges at the outlets of these wadis south of Ras Shukeir city. The flow remains relatively mild until reaching the site.
4) **Soil Permeability and Infiltration**: The site is characterized by soils with high porosity and permeability, which allows for substantial sub-surface infiltration of rainwater. This reduces surface runoff and minimizes the intensity of flow at the site, preventing significant flooding.
5) **Gentle Relief and Shallow Drainage Lines**: The site has a simple, gently sloping relief towards the east and southeast. The drainage lines are wide and shallow, with no evidence of significant surface flow or vertical erosion of tributary paths. This further suggests a low risk of flooding from surface runoff.
6) **Higher Elevations in the North**: The northwestern part of the site contains elevated hills, representing the watershed area for Wadi N. Dara. The drainage lines here are deeper than those in the southern and central parts of the site. However, these features do not significantly affect the risk of flooding within the project site.
7) **Surface Flow in Wadi N. Dara**: The surface flow along the mainstream of Wadi N. Dara appears to be faster compared to other areas, which is why simple flood mitigation measures, such as culverts, have been implemented near the site to protect infrastructure.
8) **Sediment Characteristics and Surface Flow**: The surface sediments on the site vary in size, from fine particles to large rocks. However, the surface runoff is weak and unable to transport larger sediments. As the runoff reaches the main wadi course, the flow intensity

decreases significantly, leading to the deposition of fine sediments like clay and silt along the wadi course.

9) **Absence of Deep Wadis or Large Alluvial Fans**: There are no deep dry wadis or large alluvial fan deposits on the site that would indicate strong historical surface flow or significant erosion. This supports the conclusion that flood risk is low.

10) **Short, Shallow Drainage Lines**: The drainage lines that run through the site are short, wide, and shallow, further reinforcing the absence of significant flood risk. The only potential area for flooding could be at the outlet of Wadi N. Dara at the northeast of the site, but even this would be a low-impact event under typical conditions.

Therefore, taking the above into account there is no evidence to support the cause of serious flooding in the Project area under the current climate conditions and therefore the impact is considered as insignificant. The following measures are to recommend:

1. Given the possibility of extreme rainstorms exceeding the maximum calculated estimates (i.e., events that might occur once every hundred years), it is recommended to construct a one-meter-high concrete fence around critical facilities, especially turbines or any infrastructure located within the mainstream of drainage lines. These areas are more susceptible to surface runoff, and this fence would provide an additional layer of protection against unexpected floods.
2. The site's access roads, whether paved or asphalt, cross wide and shallow drainage lines. These areas exhibit weak to moderate surface runoff that does not concentrate in narrow, specific paths, meaning the impact on the roads is not significant. However, to further minimize any potential disruptions, it is recommended to install simple cement culverts (with a maximum diameter of one meter) beneath roads that cross these drainage lines at identified points. This will allow surface water to flow through without blocking or damaging the road infrastructure.
3. As for the electricity cables, they must be buried under the ground at a depth of about a meter, while taking all measures for insulation and protection against subsurface infiltrated water.

7.4.1.2 Potential Impacts of Project on Floods

The construction phase includes various activities, primarily the movement of heavy vehicles such as cranes and tractors for lifting and installing turbines and power line towers. To facilitate vehicle movement within the site, the ground is leveled along the turbine and power line tracks.

A potential impact of these activities on surface runoff and flooding is the compaction of the surface layer along the road paths, which can alter its porosity and permeability. This, in turn, affects the amount of water that infiltrates into the ground, reducing natural water absorption and increasing surface runoff along these paths.

However, this risk is minimal due to the site geological characteristics, i.e. the nature of the soil, which consists of weathered products of igneous and metamorphic rocks, primarily gravel, rock fragments of various sizes, and fine sand, as detailed in the report. These sediments have high permeability and are unlikely to be affected by leveling or vehicle movement.

During the operational phase following the installation of all turbines and power transmission lines, the primary components that may impact soil permeability and reduce water infiltration after rainfall are the turbine bases and high-voltage towers, particularly those located within drainage channels where fencing around the base is required for flood protection.

However, the likelihood of these bases significantly reducing the total area available for underground seepage is low for the following reasons:

- The volume of surface runoff within the project's drainage basins does not reach levels of severe flooding, as indicated in the study. Additionally, no serious flooding has been previously recorded in these basins.
- Turbine bases are installed either on the underlying bedrock or on concrete foundations, part of which extends below the surface. Since groundwater is at significant depths, all foundations remain within the unsaturated zone. Water infiltration is not entirely obstructed; rather, its downward movement may be redirected by any structural obstacles.
- Most turbines will be installed on elevated terrain between drainage lines, ensuring that areas with substantial surface water flow remain unaffected by construction. As a result, subsurface seepage can continue without disruption.

<u>Mitigation measures</u>

To ensure that construction activities do not impact surface runoff or flooding, low-permeability materials such as clay or mud should not be introduced for leveling. Instead, coarse sand and gravel should be used.

7.4.2 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 as described in Section 7.5.1 and the general health and safety of workers (from being exposed to such waste streams). In addition, it is possible that pest species appear within the Project as a result of increased littering or poor waste management as well as the propensity of certain species (e.g. rats, cats and dogs) to associate with human habitation.

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 insignificant.

(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 EPC Contractor during the construction phase and the Project Operator during the operational phase unless stated otherwise:

- Coordinate with Ras Gharib City Council for the collection of solid waste from the site to the municipal approved dumpsite (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;
- Adhere to waste hierarchy principles with associated mitigation measures to include prevent, minimize, reuse, recycle, recover and dispose.
- A Waste Management Plan will be prepared by the EPC Contractor
- Waste Management will be included in the Site Induction so that all site workers understand their responsibilities to maintaining a clean and tidy site. Where possible all materials than can be recycled will be.

- Implement proper housekeeping practices on the construction site at all times and enforce Zero tolerance to littering on the works site and within the worker compound. This zero-tolerance approach should also be applied to smoking and workers must use appropriate smoking areas (supplied with 'butt bins') at all times, even when on construction sites. Litter must not be thrown out of vehicle windows when driving to and from or around the site.
- Daily inspections of working areas and worker compound should be completed, and corrective actions applied, where necessary.
- EPC Contractor only - during construction, distribute a sufficient number of properly contained containers clearly marked as "Construction Waste" for the dumping and disposal of construction waste.
- EPC Contractor only – during construction, it is recommended that recycling measures are implemented. It is recommended that recycling is undertaken in the following approach: (i) separation and disposal of recyclables in a separate container (cardboard, paper, glass, metal, etc.); and (ii) separation and disposal of non-recyclable materials in a separate container (e.g. food waste). Each container must be clearly marked. In addition, EPC Contractor must seek ways to reduce construction waste by reusing materials (for example through recycling of concrete for road base coarse);
- 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.
- Conducting audits
- Selecting authorized waste facilities for recycling, recovery and disposal.
- The waste delivery/transportation shall be done properly and registered through forms and the facilities/waste managers authorizations shall be kept onsite during both construction and operation phase.
- The need to properly manage waste. The waste shall always be properly accumulated, labelled, segregated per categories, protected from weathering and often delivered to the waste management facilities.

Monitoring and Reporting Requirements

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

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

(ii) ***Wastewater Generation***

Wastewater is mainly expected to include black water (sewage water from toilets and sanitation facilities), as well as grey water (from sinks, showers, etc.) generated from workers during the construction and operation phase. Wastewater quantities are expected to be minimal. It is expected that wastewater will be collected and stored in fully contained septic tanks and then collected and transported by transportation tankers to be disposed at the closest Wastewater Treatment Plant (WWTP) (being Ras Gharib WWTP).

Mitigation Measures

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

- EPC contractor or operator will coordinate with Ras Gharib Water Company to hire a private contractor for the collection of wastewater from the site to the closest authorized disposal site /WWTP (being Ras Gharib WWTP); Private contractor will be required to provide receipts from authorized facility.
- Prohibit illegal disposal of wastewater to the land;
- Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the WWTP. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas;
- EPC Contractor only - ensure that constructed septic tanks during construction and those to be used during operation are well contained and impermeable to prevent leakage of wastewater into soil; and
- Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing.
- The need to properly manage waste. The waste shall always be properly collected and protected from weathering and often delivered to the waste management facilities.

Monitoring and Reporting Requirements

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

- Inspection of wastewater management practices onsite;
- Review of records and manifests for volume of wastewater generated to ensure consistency; and
- Regular environmental reporting on implementation of the wastewater management practices discussed above.
- The need to properly manage waste. The waste shall always be properly accumulated, labelled, segregated per categories, protected from weathering and often delivered to the waste management facilities.

(iii) <u>Hazardous Waste Generation</u>

Hazardous waste is expected to be generated throughout both the construction and operation phases 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.

<u>Mitigation Measures</u>

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

- Coordinate and hire a private contractor for the collection of hazardous waste from the site to the approved hazardous waste disposal facilities;
- Ensure that hazardous waste is disposed in a dedicated area that is enclosed; of hard surface; with proper signage and suitable containers as per hazardous waste classifications and that they are labelled for each type of hazardous waste;
- Ensure hazardous waste storage area is equipped with spill kit, fire extinguisher and anti-spillage trays and a hazardous waste inventory is available;
- Prohibit illegal disposal of hazardous waste to the land;

- Possibly contaminated water (e.g. runoff from paved areas) must be drained into appropriate facilities (such as sumps and pits). Contaminated drainage must be orderly disposed of as hazardous waste;
- Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing; and
- Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the hazardous waste disposal facilities. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas.

Monitoring and Reporting Requirements

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

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

(iv) Hazardous Material

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

Mitigation Measures

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

- Ensure that hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of hard impermeable surface, flame-proof, accessible to authorized personnel only, locked when not in use, and prevents incompatible materials from coming in contact with one another;

- Maintain a register of all hazardous materials used and accompanying Material Safety Data Sheet (MSDS) must present at all times. Spilled material should be tracked and accounted for;
- Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.);
- Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refuelling) must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material;
- Ensure 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.

<u>Monitoring and Reporting Requirements</u>

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

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

7.4.3 Potential Impacts from Erosion and Runoff during the Construction Phase

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

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

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

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

Mitigation Measures

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

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

Monitoring and Reporting Requirements

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

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

7.5 Biodiversity

This section identifies and assesses the anticipated impacts from Project activities on identified ecological receptors during the construction and operation 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.

All mitigation measures contained in this section has been included in a Project specific construction Biodiversity Management Plan (BMP) which has been prepared as a separate document including details of pre-clearance, pre-construction, and during-construction monitoring.

Biodiversity assessed in this section excludes birds (avi-fauna) and bats, which are discussed separately in the sections that follow.

Receptor	Conservation Status		Justification	PBF (yes or no)	Sensitivity
	IUCN				
Natural Habitat	--		Not listed in Annex I or included as a Priority Habitat. No plant species present of international or national conservation concern and no endemic or range-restricted species present. However, not modified heavily by human activity such as farming and native species are present and the habitat is largely performing its natural function.		Medium
Spiny-Tailed Lizard	VU		Present across the AoI in high population density. Species is IUCN VU	Yes	Medium
Rodent Species	LC		Some species present across the site in low densities. All species are IUCN VU	No	Low
Reptile Species	LC		Some species present across the site in low densities. All species are IUCN VU	No	Low
Mammal Species	LC		Some species present across the site in low densities. All species are IUCN VU	No	Low

Species and habitats which are considered PBFs have been decided from the CHA and given specific mitigation measures to ensure no harm comes to the species as individuals or to their population viability. Species that have not been categorised as PBF still have best practice measures to ensure no harm to individuals.

7.5.1 Potential Impacts during the Construction Phase

Habitat Loss, Fragmentation and Degradation

Site clearance and subsequent construction activities will result in the direct loss of areas of natural habitats over the full construction footprint of the Project including internal site roads, turbine bases, crane pads, substations, and permanent site structures (e.g. offices). The CHA found that the Project is in an area of primarily Natural Habitat (per PS6) Natural habitats are valued as being of Medium Sensitivity but have low as they are not listed as Priority Habitats. There is also likely to be temporary habitat loss and degradation of habitats as a result of temporary lay-down areas and other temporary facilities (e.g. worker accommodation) as well as cabling and communication routes.

Habitat loss has been discussed with respect to habitat, with flora in genera having been scoped aout as of insufficient value. The list of terrestrial fauna present on site from surveys is presented below.

With the exception of Spiny-Tailed Lizard (Vulnerable) which has specific individual mitigation measures in place to ensure the population viability during works, all other species are IUCN Least Concern as shown in the list below.

- Lesser Egyptian Gerbil (LC)
- Lesser Egyptain Jerboa (LC)
- Cairo Spiny Mouse (LC)
- Sundevall's Jerbil (LC)
- Red Fox (LC)
- Ruppell's Fox (LC)
- Horned Viper (LC)
- Schokari Sand Snake (LC)
- Small Spotted Lizard (LC)
- Bosc's Fringe-toed Lizard (LC)
- Spiny-Tailed Lizard (VU)
- Invertebrates (typical assemblage for region – all LC)

Habitat loss of terrestrial species can lead to a negative impact on overall population viability. In the situation here the impact is reduced due to the nature of the development meaning that habitat loss is spread in small areas over a wider project site. This means that connectivity is maintained through the area and no barriers to movement put in place or wide areas of specific interest will be lost. Given habitats are found through the area the small loss of habitat (1.5% of the project area) it is considered that there will be no impact on conservation status of these species.

Despite this there will be mitigation for all these species in the form of provision of alternate habitat due to the enhancement of around 1.15 km² using appropriate, native planting in suitable parts of the Project Area. This will ensure no net loss in the area available to use for these widespread species. Planting within these areas is to be monitored and accordingly the success of habitat provision will be ensured. Details of habitat loss associated with infrastructure other than WTG bases cannot be fully assessed at this stage due to no confirmed infrastructure layout. It is assumed that habitat loss associated with access from the main road will be minimized by following existing vehicle access routes. Assumed areas for infrastructure are provided at this stage in order to best asses the project impact.

Any species recorded during surveys, but which are not listed as sensitive receptors are considered to be of Low/lower value.

- The impacts on Low/Lower value species is not expected to exceed minor significance; and
- Mitigation for higher value receptors will also alleviate impacts on these lower value receptors.

Therefore, these Low/lower value species have not been listed out in detail and the impact assessment section will not include assessments on these receptors, other than best practice measures to prevent harm.

The potential impacts on habitat loss, fragmentation and degradation would be negative in nature yet short-term in duration. Such impacts would be low magnitude yet deemed irreversible. Considering the ecology of the site, the receiving environment is determined to be of medium sensitivity. Given the above, the impact is considered overall of minor significance.

Mitigation Measures

The following mitigation measures will be employed to reduce the significance of habitat loss, fragmentation, and degradation during the construction period. Mitigation measures are largely based on avoidance of impact through selection of the working areas to favour areas of degraded natural habitat or those areas where habitats have been modified. Where impacts cannot be avoided the following will be completed

- All site workers will undertake a Project induction before working on site. The induction will include a comprehensive biodiversity element where the baseline ecological value and sensitivity of the site will be discussed.
- Prior to construction works, working areas will be clearly demarked (using temporary fencing (e.g. orange netting attached to wooden posts)) so that site workers fully understand the working area. Encroachment into areas outside of agreed working areas will be prohibited and working areas will be subject to regular check by the EPC Ecologist to check enforcement of working areas.
- On completion of phased construction works the EPC Contractor will be responsible for habitat rehabilitation works in all areas that have been subject to temporary disturbance and a habitat condition score metric will be provided in the BMP..
- Following construction, an area of around 1.15 km^2 will be enhanced using appropriate, native planting in suitable parts of the Project Area, this will ensure that no net loss of habitat as a result of the works. Any areas of additional planting will be monitored as part of the biodiversity monitoring program and any species which do not establish will be replaced. This will be fully detailed in the BMP.

Direct Impacts on Sensitive Receptors (Habitats and Flora) – Non-native Species and Introduced Flora

It is possible that non-native or introduced flora could be imported in to the AoI on vehicles or within any imported soil material. The impacts of non-native and introduced flora could be moderately significant in absence of any mitigation as these species could become established and out-compete native flora.

Impacts associated with non-native, invasive or introduced flora could result in long-term negative impacts, irreversible (if allowed to become established). Considering the ecology of the site, the receiving environment is determined to be of medium sensitivity. Given the above, the impact is considered overall of potentially significant.

Mitigation Measures

- Prior to construction works, working areas will be subject to a botanical walkover survey to identify areas of non-native or invasive species. Any specimens will be clearly marked, and the area avoided and if this is not possible the specimen will be removed and disposed of.
- Areas of soil in proximity to these species will be stored separately and not used further on the site. It will be collected from the site and disposed of or used as deep sub-soil fill (to reduce the chance of seed germinating).
- Areas of non-native or invasive species will be mapped and a programme of mechanical control will be completed over the construction period in order to remove these species from the AoI. Chemical control will be avoided however if necessary, will be used but in accordance with national and international guidelines as well as those applied by the Lenders (e.g. specific risk assessment and Lender agreement prior to use).
- Soil imports to be taken from local quarries or borrow pits to avoid importing non-native and invasive species.
- Adequate wheel-washing facilities to be constructed at the entrance to the site (e.g. at the eastern end of the access road) and any wastewater will be disposed of correctly to prevent spread of undesirable species.
- Regular site walkover surveys throughout the construction period by a suitably qualified botanist to check to the presence and abundance of non-native or invasive species.

Direct Impacts on Sensitive Receptors (Vertebrates) - Site Clearance and Earthworks

As well as impacts to habitats, site preparation works and construction activities could negatively impact sensitive ecological receptors (e.g. reptiles, mammals, breeding birds) as a result of direct mortality.

Egyptian Spiny Tailed Lizard (IUCN VU) are likely to be particularly exposed to impacts during construction as they are a diurnal species meaning they will be mobile while site works are active. Unmitigated impacts on Egyptian Spiny Tailed Lizard could potentially be negative, <u>medium-term,</u> <u>medium magnitude</u> and <u>irreversible</u> (e.g. loss of breeding habitat and mortality). Given the above, the impact is considered overall of <u>high significance</u>

<u>Mitigation Measures</u>

A summary of mitigation measure to avoid and mitigate for direct impacts on sensitive vertebrate receptors is included below. These measures will be included (and expanded upon) in a Construction Biodiversity Management Plan/Biodiversity Action Plan.

- Mitigation for the Egyptian Spiny Tailed Lizard will be guided by the successful case studies that were implemented in other projects in the Gulf of Suez region, particularly the successful mitigation program which is the Translocation of threatened individuals of *Uromastyx aegyptia* from APWC farm as a pre-construction measure at the Gulf of Suez October 2023.
- All site workers will undertake a Project induction before working on site. The induction will include a comprehensive biodiversity element where the baseline ecological value and sensitivity of the receptors within the AoI will be discussed.
- Prior to construction works, working areas will be clearly demarked (using temporary fencing (e.g. orange netting attached to wooden posts)) so that site workers fully understand the working area. Encroachment into areas outside of agreed working areas will be prohibited and working areas will be subject to regular check by the EPC Ecologist to check enforcement of working areas.
- Working areas should avoid trees / shrubs as these are likely, due to their sporadic distribution across the AoI to be of importance to breeding birds (e.g. passerines, raptors).
- A pre-construction walk-over survey will be undertaken of all working areas to check for the presence of ground nesting birds. Surveys will be completed by an appropriately qualified ecologist and surveys will be undertaken in the hours after sunrise (up to 10:00). The surveyors will aim to identify behaviour indicative of breeding activity (e.g. carrying food / nesting material / faecal sacs, presence of nests, eggs or chicks (both nidifugous and nidicolous).
- Where nests are found they will be recorded in full and their locations mapped, with the data transferred to Excel master sheets and Google Earth. Mapping will then be circulated to the project team along with details of a works exclusion zone. Exclusion zones will be dependent on

the species of bird nesting along with its conservation status and be agreed with the qualified Project Ecologist.

- Mitigation during construction will include timing work to remove suitable nesting habitat outside of the most sensitive times of year for ground nesting species, and for all clearance work within this time period to be done under the supervision of an on-site ecologist.
- Pre-construction surveys for sensitive species (i.e. those qualifying Priority Biodiversity Features) of herpetofauna have taken place. The locations of known/active burrows used by Egyptian Spiny-tailed Lizard have been marked throughout the Project Area.
- Prior to the start of construction, suitable sites for the release of relocated Egyptian Spiny-tailed Lizards will be identified and mapped. A suitable translocation receptor site must;
  - Be within 10 km of the Project site. Contain appropriate vegetation (both for food and cover).
  - Have suitable soil types to allow animals to dig and create new burrows.
  - Not already be close to carrying capacity for this species.
- Capture and movement of Spiny-tailed Lizards will only be completed as a last resort. All works will aim to be completed at least 50 m from active burrows. Locations where burrows are present between 50 and 100 m of construction will be monitored throughout the construction period and if significant negative impacts (i.e., abandonment of burrows or increased mortality) are observed the remaining burrows in closest proximity will be excavated and the animals translocated to holding areas in accordance with the below protocols for the duration of the construction window in that location.
- Detailed design for the final infrastructure layout will take into account the results of the pre-construction surveys and Project infrastructure will be sited to avoid the identified burrows. Where this is not possible, or where fresh burrows are identified at the commencement of clearance works, these burrows will be excavated by hand and the animals captured and translocated, details of this are provided below.
- Prior to work in an area containing Spiny-tailed Lizard burrows any remaining burrows within 50m of proposed works will be re-checked by the Ecologist using an endoscope and if empty dug out and destroyed. If any animal is found back in the working areas the burrow will be dug out carefully by hand and the animal captured and placed in a secure box before taking to a cool location ready for translocation to the receptor site. Once the lizard is removed from the burrow the hole will be collapsed and made unsuitable for future use.
- If areas suitable for translocation exist within the Project Area these will be prioritized as this minimizes the impacts of transporting animals away from the Project site.

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

- After the relocation period, a report will be prepared which will include the following information:
  - Survey dates and timing of capture and release
  - Weather conditions during survey and relocation effort
  - Location of captured individuals
  - Number of captured individuals during each relocation effort
  - Number of juveniles, mature males and mature females
  - Release sites used for relocation of each effort
  - Number of males and females released at each site
  - Number of mortalities during relocation effort

Direct Impacts on Sensitive Receptors (Vertebrates) – Vehicle Collisions

Vehicle related collision is possible for all vertebrate species present within the Project's AoI and this will result in direct mortality on receptors of low to high sensitivity. Any such impact would be <u>negative</u>, <u>long-term</u> and <u>irreversible</u> and would be <u>of medium to high magnitude</u> and therefore of <u>minor to major significance</u> (depending on the receptor killed).

Both small and large vertebrate species are at risk of vehicle collisions throughout construction. Species such as Egyptian Spiny Tailed Lizard are at higher risk of collision with vehicles and machinery as they are active in the day.

It is possible that carcasses on the road could attract scavenging animals, including birds of prey which in turn would increase their risk of collision with vehicles and machinery.

<u>Mitigation Measures</u>

- Appropriate speeds limits will be enforced by the EPC Contractor
- Regular signage will be installed along the site access roads and internal roads informing all drivers

of the speed limit

- A gated entrance will be staffed and any visitors or locals using the site roads will be informed of the speed limits and that there are regular checks of vehicle speeds
- A ban of driving at night will be enforced and if absolutely necessary the speed limit will be reduced to 15kph
- Ban against off-road driving at all times of the day
- Regular checks of the road for carcasses and if found these will be moved to at last 10m from the road to reduce the likelihood of hitting scavengers, including birds of prey.
- A incidental / chance find procedure will be included in the BMP so that all workers report any road collisions so that any such incident can be investigated in full.

Direct Impacts on Sensitive Receptors (Habitats, Vertebrates) – Poaching, Collection etc.

It is possible that site worker may poach or take plants and animals from the site, either for firewood or in the case of the Spiny-Tailed Lizard for food, trophy or to be sold. Species such as Red Fox could also face persecution.

The identified receptors are potentially at risk from this long-term, irreversible negative impact. The likelihood of this occurring is possible and the magnitude of this impact ranges from Low to Moderate depending on the receptor affected.

Mitigation Measures

- The Project will enforce strict controls on hunting, gathering, poaching and otherwise disturbing flora and fauna within the Project AoI. Any breaches of this ban will be strictly enforced, and any workers found in breach of this control measure will be subject to disciplinary procedures.
- The ban on hunting etc. will be included in the site induction along with discussions about the sanctions for breaches of this control measure.
- A chance find procedure will be implemented should any site worker find a wild animal, especially one that has become a nuisance (e.g scavenger in the works camp, presence of small mammals in worker accommodation, presence of snake or scorpion on the works site) and the EPC Ecologist will arrange for an appropriately qualified person to capture and relocate. Where scavengers have been identified within the works site additional housekeeping measures may be required.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Disturbance

The presence of site workers and machinery can result in disturbance related impacts to all terrestrial ecological receptors present within the AoI. These impacts are not certain, and the magnitude of such impacts will vary depending on the sensitivity of each receptor to disturbance. The significance of any such disturbance impacts is likely to range from minor to Moderate / Major, depending on the sensitivity of the affected receptor. The impacts will be low to medium magnitude and the duration of impact will also likely vary from very short-term (e.g running away from a vehicle using the access road) to short to medium term in areas adjacent to construction areas or worker accommodation. It is likely that any disturbance impacts, irrespective of duration will be reversible once the disturbance event has passed.

The main features of interest within the AOI were previously the two known potential feeding locations at dumping areas. These have however stopped being used due to local government intervention and accordingly are no longer a concern. Whilst this is the case monitoring will continue to ensure no illegal dumping takes place and the project will work with the local government if such a case arises to ensure tight control as well as clear any potential feeding materials.

Mitigation Measures

- Site wide induction to include information regarding disturbance of ecological receptors.
- Chance find procedure to report sightings of potentially sensitive receptor and investigation of any such sightings by the EPC Contractor in order that additional buffer areas can be agreed, where necessary.

- Continued monitoring of dump area to ensure no further use

Direct and Indirect Impacts on Sensitive Receptors (Protected Sites)

The proposed project is within Gebel El Zeit IBA Protected site. The site is designated for its migratory bird species (as well as non-breeding White-eyed Gull). The protected area is designated because of its use to soaring birds based on its topography and location as a staging area for birds to cross the Gulf of Suez or to continue up the eastern coast of Egypt.. Impacts on individual birds are covered within other sections.

In addition, a project specific SESA-CIA study has been undertaken which investigates impacts from the Project on avifauna within the IBA. The study is provided as a standalone document. Please refer to the study for additional details.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Reduced Air Quality / Dust

The habitat across the AoI is very sandy. It is likely that constructed related ground disturbance will likely increase the amount of dust in the air which in turn could result in negative impacts on plants and vertebrate receptors. In addition, air pollution from site vehicles from the concreate batching plant could also result in negative impacts on valued receptors. These impacts are low magnitude, medium in sensitivity, short-term and reversible and are considered to be of minor to moderate significance.

Mitigation Measures

Mitigation measures specified for air emissions mitigation in Section 7.9.1 will be followed.

Direct Impacts on Sensitive Receptors (Vertebrates) – Noise

Noise as a result of construction can result in direct impacts on vertebrates due to acoustic masking, disturbance and displacement thereby reducing survivorship and reproductive success.

Any impacts are likely to be short- to medium term (for the duration of construction) and reversible. The magnitude of impact ranges from low to medium and is likely to be of low to moderate significance.

Mitigation Measures

Mitigation measures specified for noise mitigation in Section 7.9.1 will be followed.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Littering, Waste Management

Unmitigated it is possible that poor waste management could result in the proliferation of litter across the Project AoI including plastic containers, plastic bags and glass. This waste could result is negative impacts to sensitive receptors through ingestion or entanglement. Any such impact could be long-term and irreversible, low magnitude and the significance of this impact would be minor to moderate depending on the receptor effected.

In addition, poor management of other solid wastes, including food waste could result in the presence of pest species such as rats and mice, which could outcompete wild rodents and feral cats and dogs which could increase the risk of predation of wild rodents and other prey species.

Mitigation Measures

- Adhere to all mitigation measures indicated in Section 7.4.2 on waste management.
- Additional mitigation measures for pest species, including feral cats and dogs are included below.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Pest Species

An increase in pest species as a result of improper waste management and littering could result in long-term negative impacts on wild animals through direct and indirect competition for food resources, direct mortality through predation, and direct impacts as result of disturbance impacts. Such impacts could be reversible or irreversible, will be between low to high magnitude and as such significance will vary from minor to major depending on the receptor being affected.

Mitigation Measures

- EPC contractor will adhere to waste management measures specified in section 7.4.2.
- Where pest species are identified the EPC Contractor / Ecologist will be notified and an appropriate course of action taken. For small mammal pest's live traps will be used, in order to reduce the risk of by-catch. Poison baits should be avoided, unless it can be certain that non-target species will be affected, and any such use should be in accordance with national and international best practice. If poison baits are to be used it must be certain that any poisoned animal cannot move out on to the wider AoI to reduce the risk of natural predators eating poisoned animals. Any chemical control of pest must only be undertaken in accordance with national and international guidelines as well as following Lender guidelines including risk assessment and prior agreement with the Lender.

7.5.2 Potential Impacts during the Operation Phase

Direct Impacts on Sensitive Receptors (Vertebrates) – Vehicle Collisions

Vehicle related collision are possible for all vertebrate species present within the Project's AoI and this will result in direct mortality on receptors of low to high sensitivity. Any such impact would be negative, long-term and irreversible and would be of medium to high magnitude and therefore of minor to major significance (depending on the receptor killed).

Species such as Egyptian Spiny-Tailed Lizard have a high risk of collision with vehicles due to their diurnal nature.

It is possible that carcasses on the road could attract scavenging animals, including birds of prey which in turn would increase their risk of collision with vehicles and machinery.

Mitigation Measures

- Appropriate speed limits will be enforced by the O&M Contractor
- Regular signage will be installed along the site access roads and internal roads informing all drivers of the speed limit.
- A gated entrance will be staffed and any visitors or locals using the site roads will be informed of the speed limits and that there are regular checks of vehicle speeds.

- A ban on driving at night will be enforced and if absolutely necessary the speed limit will be reduced to 15 km/h
- Ban against off-road driving at all times of the day, and if necessary, the works area will be subject to a walkover by the Project Ecologist.
- Regular checks of the road for carcasses and if found these will be moved to authorized dumping areas to reduce the likelihood of hitting scavengers, including birds of prey.
- Incidental / chance find procedure included in the BMP will be adhered to so that all workers report any road collisions so that any such incident can be investigated in full.

Direct Impacts on Sensitive Receptors (Vertebrates) – Lighting

Lighting could potentially result in negative impacts of a range of ecological receptors.

Any impacts are likely to be short- to medium term and reversible. The magnitude of impact ranges from low to medium and is likely to be of low to moderate significance.

Mitigation Measures

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

Direct Impacts on Sensitive Receptors (Habitats and Flora) – Non-native Species and Introduced Flora

It is possible that non-native or introduced flora could be imported in to the AoI on vehicles or within any imported soil material. The impacts of non-native and introduced flora could potentially be significant in absence of any mitigation as these species could become established and out-compete native flora.

Impacts associated with non-native, invasive or introduced flora could result in long-term negative impacts, irreversible (if allowed to become established). The impacts are considered to be low in magnitude and considering the ecology of the site, the receiving environment is determined to be of medium sensitivity. Given the above, the impact is considered overall of potentially significant.

Mitigation Measures

- Post-construction monitoring will be completed across the AoI to record the presence and distribution of non-native and invasive plant species and a programme of mechanical control will be completed over during the operation period to remove these species from the AoI. Chemical control will be avoided however, if necessary, will be used but in accordance with national and international guidelines and will also be subject to risk assessment and approval from the Lenders. The programme of control will continue until the species are absent from the Project AoI.
- A programme of regular monitoring will be completed with surveys completed in Years 1, 2, 5, 10, 15 to survey for the presence of non-native and / or invasive species and relevant control of these species will be completed, where necessary.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Pest Species

It is possible that pest species become established within the Project as a result of increased littering or poor waste management as well as the propensity of certain species (e.g. rats, cats and dogs) to associate with human habitation.

An increase in pest species could result in long-term negative impacts on wild animals through direct and indirect competition for food resources, direct mortality through predation, and direct impacts as result of disturbance impacts. Such impacts could be reversible or irreversible, will be between low to high magnitude and as such significance will vary from minor to major depending on the receptor being affected.

Mitigation Measures

- Waste management practices will be adhered to as described in section 7.4.2.
- Where pest species are identified, the O&M Contractor / Ecologist will be notified, and an appropriate course of action taken. For small mammal pest’s live traps will be used, to reduce

the risk of by-catch. Poison baits should be avoided, unless it can be certain that non-target species will be affected, and any such use should be in accordance with national and international best practice and will also be subject to risk assessment and approval from the Lenders. If poison baits are to be used it must be certain that any poisoned animal cannot move out on to the wider AoI to reduce the risk of natural predators eating poisoned animals.

Monitoring

Long term monitoring of the Project AoI will be completed as set out above and will include:

- Habitat and Flora monitoring within the AoI to measure the success of habitat rehabilitation work to reasonably demonstrate no net loss of Natural Habitat as well as to record the presence of invasive / non-native flora. Monitoring will be completed in Years 1, 2, 5, 10 and 15. Full site walkover surveys as well as quadrat surveys will be completed.
- Monitoring of mammal and herpetofauna assemblages across the AoI. Repeat of baseline surveys will be completed in Years 1, 2, 5, 10 and 15. Population densities recorded in Year 5 will be compared to baseline levels and if required additional work will be completed.

- All of the above monitoring requirements will be included within Construction and Operational Biodiversity Management Plans which will include KPIs against which the results of the monitoring will be assessed.
-

7.6 Birds

This section identifies the anticipated impacts on birds 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.

7.6.1 Potential Impacts during the Construction Phase

Direct Impacts on Sensitive Receptors (Breeding Birds) – Site Clearance and Earthworks

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

Construction activities could disturb existing habitats of birds breeding and within the Project site. However, as noted within baseline section, no key roosting, breeding, or resting habitats have been recorded within the Project site. Such potential impacts are created during the construction phase only and thus are short-term duration. The impacts are considered of negative nature and of a low magnitude given that the construction activities' actual area of disturbance is relatively minimal. In addition, given that breeding activities are likely within the Project site, the receiving environmental is determined to be of a medium sensitivity. Given all of the above, such an impact is considered to be minor significance.

Mitigation Measures by the Developer/EPC Contractors

- Undertake a pre-construction breeding bird survey prior to commencement of construction activities to verify that there are no breeding, roosting or resting habitats within the Project site.
- 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.
- Implementation of proper waste management practices to prevent attraction of birds to the site as included in Section 7.4.2.
- Implement adequate noise control measures as indicated in Section 7.9.1.
- 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 summarizes 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, should pre-construction survey demonstrate any breeding activities (although highly unlikely).
- Submission of dead animal handling protocol

7.6.2 Potential Impacts during the Operation Phase

Direct Impacts on Birds – Turbine Collisions

Wind turbines are associated with impacts on birds from risks of collision and electrocution for both migratory soaring birds (which could pass over the site during the spring and autumn migration seasons) and resident soaring birds in the area.

Egypt is one of the main crossroads for migratory soaring birds (MSBs) crossing from breeding grounds in Europe and Asia to their wintering areas in Africa. High wind energy potentials in the Gulf of Suez (GoS) stimulated rapid development of wind energy facilities, which poses additional risk to migratory birds using the area. Principal risks to these species are from fatal collisions with turbines and with overhead powerlines and disturbance/barrier effects.

A. *Collision Risk Modelling and Flying at Risk for Spring 2022*

The Collision Risk Model (CRM) is a simplified model developed to predict the potential impact of wind turbines on birds. There are several CRM models developed / improved around the world. One of the most used is known as the Band model (SNH 2012). It must be clear that the CRM was not developed to provide a threshold of collisions, but an order of magnitude which would help the authorities – when it was designed – as a way to decide on project permitting purposes. A full and detailed development of the model can be read in "Band, Madders, and Whitfield (2001) Developing field and analytical methods to assess avian collision risk at wind farms" and "De Lucas, Janss, and Ferrer (Eds). Birds and wind farms: Risk assessment and mitigations".

It is also important to mention that the model was developed in Scotland, where the major migratory routes like the RVRSF does not exist, and also scientific literature afterward, provided evidences of the lack of consistency between the pre and post construction monitoring at wind facilities; predicted risks rarely matched with the observed ones, once the wind farms became operational. See in this regard "*Ferrer et al. (2012) Weak relationship between risk assessment studies and recorded mortality in wind farms. Journal of Applied Ecology 2012, 49*". This study was also developed along another major bottleneck in the Western Palearctic where lower numbers – around 500,000 MSBs- but similar species occur.

Also, within the Red Sea-GoS region some CRMs for other projects were reviewed (as included in ESIA studies) along with the outcomes of associated Post-Construction Fatality Monitoring-PCFM results (for the same wind farms). Despite PCFM results being inconclusive, the CRM predictions do not seem to match well with their outcomes. There are wind farms which predicted higher fatality numbers for some species which were not later confirmed through the field data.

Collision Risk Model Input Data

The Collision Risk Model requires data relating to the species of birds occurring at the proposed Project and data on the type and specification of the proposed WTGs. The detailed assumptions about the model have been included in Annex…. The summary of input data are listed below:

- Collision Risk Modelling (CRM) (and subsequent Collision Risk Assessment (CRA) has been completed based on the worst-case turbine layout
- In addition, data inputs for the CRM analysis were derived from the results of the VP surveys, as well as the above-mentioned turbine specifications.
- *Bird Size and Flight Speed:* The biometric data, including body size, wing length, as well as flight speed used in the collision risk model has been taken from various sources[18] [19] [20] [21] and was populated with correct data prior to running the CRM.
- 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.
- *Bird Flight Activity and Flight Height:* Data on bird flight activity through the proposed Project area and on the proportion of those birds flying at rotor height are taken from the field surveys completed by in-country ornithologists. Data relating to birds flying above or below the blade swept area was not included in the collision risk analysis. Details about the number of birds recorded, the number of birds at risk height (≤200 m) and the percentage of these numbers accounted for related to the total of birds recorded has been included in **Annex I: Collision Risk Model** It must be stated that the planned turbines for this and other projects in the GoS have increased the turbine tip height from 120 to 180 m up to 200 m now, at the same time the wind manufacturing market has evolved. Because the data was collected with height intervals of 120, 120-150, 150-200, and above 200 m, the results for 200 m tip height was presented, as a precautionary approach.

The purpose of this modelled hypothetical scenario was to generate an upper bound collision risk estimate or "worst case". Published and validated avoidance rates (AR) are not available for several of the species, yet the AR parameter is well-known to be a very important parameter in Band CRM analysis, with outcomes very sensitive to slight variations (Cook et. al, 2012). For each species included within the CRM analysis, a "most realistic" AR parameter value was developed, bounded by a "conservative" low parameter estimate (95%), and a high estimate (99.9%), reflecting an upper bound, based on a comprehensive review of available literature. Considering these two boundaries, all extent of avoidance rates considered in the literature was covered.

This project has only completed one migratory season. It is well known that collision risk flights may greatly change within seasons for different years (e.g., two consecutive springs or

[18] Bird body size data from: The complete birds of the Western Palearctic Cramp (1998)
[19] Flight speed data from: A dictionary of birds. Campbell and Lack (1985)
[20] Bird Guide: Collins (2001)
[21] Birds of the western palearctic / BTO fact sheets

autumns) as seen and demonstrated in other ESIA studies in the region (e.g. Lekela or Amunet projects).

The table below shows the estimated results of the CRM for the spring season and the two extremes of avoidance rates considered. As stated above, CRM was not performed for avoidance rates between these extreme ranges, e.g. 98% and 99%, as the obtained values would be just intermediate numbers.

Table 7-1: Estimated number of fatalities according to the CRM for spring 2022 for wind turbines

Species	200 m	
	Avoidance 99.5%	Avoidance 95%
Black Kite	61	611
Black Stork	19	193
Booted Eagle	1	13
Common Kestrel	0	1
Eastern Imperial Eagle	0	3
Egyptian Vulture	0	4
Eurasian Sparrowhawk	1	5
European Honey Buzzard	143	1,425
Great White Pelican	334	3,334
Crested Honey Buzzard	0	0
Griffon Vulture	0	0
Greater Spotted Eagle	0	2
Lanner Falcon		
Lesser Kestrel		
Lesser Spotted Eagle	1	13
Levant Sparrowhawk	221	2,203
Long-legged Buzzard	1	14
Osprey	0	1
Pallid Harrier	0	2
Short-toed Snake Eagle	2	15
Sooty Falcon		
Steppe Buzzard	158	1,575
Steppe Eagle	65	651
Western Marsh Harrier	0	4
White Stork	1,722	17,015

The key outcomes for the key species noted earlier are provided in the figures below.

A general trend is that the overall risk is higher between 7:00 and 11:00, when > 50% of birds is at risk (all species pooled). The risk decreases afterwards but increases again throughout the end of the day.

The patterns of the risk are rather similar across the daylight hours and species, except for the Black Stork as noted in the figure below.

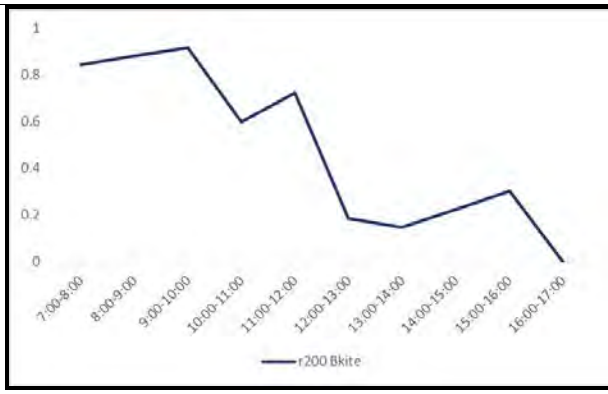


Figure 7-1: Percentage of risk flights 200 m (individuals) during the day for the Black Kite

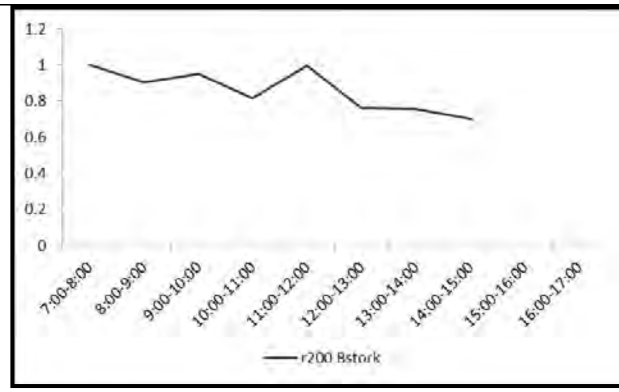


Figure 7-2: Percentage of risk flights 200 m (individuals) during the day for the Black Stork

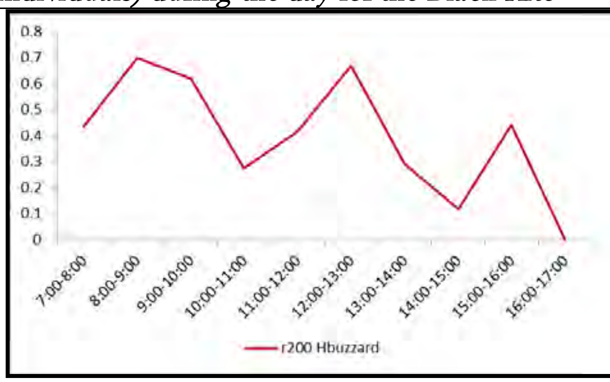


Figure 7-3: Percentage of risk flights 200 m (individuals) during the day for the Honey Buzzard

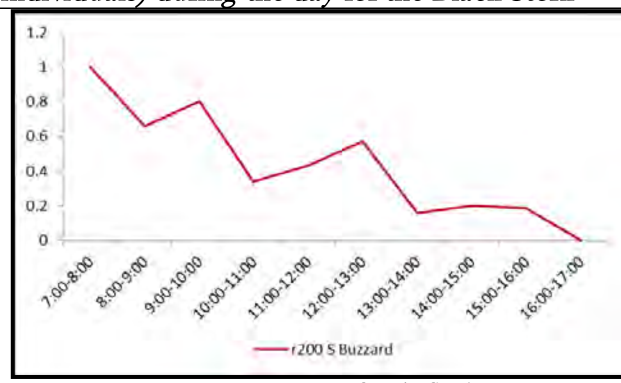


Figure 7-4: Percentage of risk flights 200 m (individuals) during the day for the Steppe Buzzard

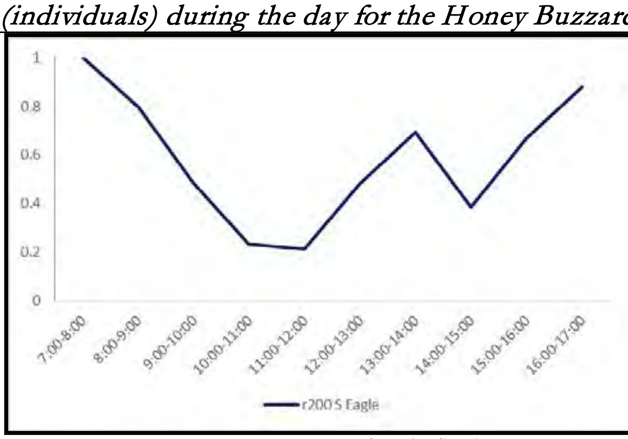


Figure 7-5: Percentage of risk flights 200 m (individuals) during the day for the Steppe Eagle

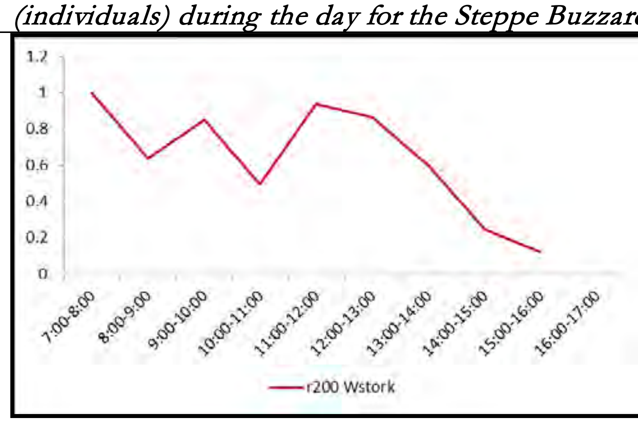


Figure 7-6: Percentage of risk flights 200 m (individuals) during the day for the White Stork

B. *Collision Risk Modelling and Flying at Risk for Autumn 2022*

Similar to the spring season, the CRM was performed with the autumn data and using the same two turbine models with two tip heights to be considered (200 m) and data inputs identified earlier.

The number of birds recorded, the number of birds at risk height (≤200 m) and the respective percentage of these numbers accounted for related to the total of birds recorded used in the model has been included in **Annex I: Collision Risk Model**.

As described earlier, the planned turbines for this and other projects in the GoS have increased the turbine tip height from 120 to 180 m up to 200 m now, at the same time the wind manufacturing market has evolved. Because the data were collected with height intervals of 120, 120-150, 150-200, and above 200 m, the results for 200 m tip height are presented, as a precautionary approach.

This project has only completed one migratory season which is considered a limitation. It is well known that collision risk flights may greatly change within seasons for different years (e.g., two consecutive springs or autumns) as seen for Lekela or Amunet projects as discussed earlier.

The table below shows the estimated results of the CRM for the autumn season and the two extremes of avoidance rates considered. As stated above, CRM was not performed for avoidance rates between these extreme ranges, e.g. 98% and 99%, as the obtained values would be just intermediate numbers.

Table 7-2: Estimated number of fatalities according to the CRM for autumn 2022 for wind turbines

Species	200 m	
	Avoidance 99.5%	Avoidance 95%
Black Kite	0	1
Black Stork	0	1
Booted Eagle	0	0
Common Kestrel	0	1
Eastern Imperial Eagle		
Egyptian Vulture	0	2
Eurasian Sparrowhawk	0	0
European Honey Buzzard	4	36
Great White Pelican	2	23
Crested Honey Buzzard		
Griffon Vulture		
Greater Spotted Eagle		
Lanner Falcon	0	0
Lesser Kestrel		
Lesser Spotted Eagle		
Levant Sparrowhawk		
Long-legged Buzzard	0	1
Montagu's harrier	0	1
Osprey		
Pallid Harrier	0	0
Short-toed Snake Eagle		
Sooty Falcon		

Steppe Buzzard	0	1
Steppe Eagle	0	2
Western Marsh Harrier	0	0
White Stork	2,173	21,470

Sensitivity of the Project Site

The baseline assessments have recorded high numbers of migratory soaring birds over the Project site and its vicinity. Some of those recorded species have an important status on the international or national levels. The baseline assessment concludes that the site is considered within a highly sensitive area in terms of avi-fauna. Additionally, the Project site is considered to be located along an intensive migration route. Taking all of the above into account, the receiving environment is considered of high sensitivity.

Magnitude of the Impact

The collision risk model (CRM) assessment data in the tables above are helpful for assessing impacts. The results suggest:

- In general, collision risk to all species is significantly lower in the autumn compared with the spring migration period.
- For the majority of MSBs passing through the project site airspace during spring and autumn migration, the risk of collision is low or zero.
- Most species had low or zero predicted collision rates when assessed per season, equivalent to annual fatality estimations during the migratory periods. Seven species had higher CRM estimates (Steppe Buzzard, European Honey-buzzard, Black Kite, Greater White Pelican, Levant Sparrow Hawk, Steppe Eagle, and White Stork).
- Based on the predicted collision rate estimates per season, equivalent to annual fatality estimations during the migratory periods, two species have the highest number of potential collisions: White Stork and Great White Pelican. The impacts for both species are likely to be greatest during spring migration without mitigation. In the autumn season, impacts are of lower risk. The CEA identified species which could be significantly impacted by the project and are presented in Table X below: Species of high concern are not presented as are noted in the CEA at requiring a zero threshold regardless of PBR. It is important to note that no species are predicted to be impacted at higher than the PBR value.

Species	98% Effectiveness of ATMP	Flyway Population	PBR Value	Fatality Threshold
Black Kite	1.22	132,700	2,626	3

Black Stork	0.38	19,500	1,804	3
Booted Eagle	0.02	3,169	63	0
Eastern Imperial Eagle	0	-	-	0
Great White Pelican	6.72	70,000	3,334	3
Greater Spotted Eagle	0	-	-	0
Levant Sparrowhawk	4.42	75,000	9,597	3
Pallid Harrier	0	-	-	0
Steppe Buzzard	3.16	1,250,000	43,739	5
Steppe Eagle	1.3	-	-	0
European Honey Buzzard	2.94	1,000,000	40,066	5
White Stork	77.9	450,000	21,430	5
Lesser Kestrel	0	22,500	1,629	3
Long-Legged Buzzard	0.02	21,750	761	0
Short-Toed Snake Eagle	0.04	8,783	174	0
Sooty Falcon	0	-	-	0

- This table has been produced with the figures following mitigation (e.g. shut down on demand / diverters).
- Four globally threatened MSBs pass through the project airspace. These are Steppe Eagle and Egyptian Vulture (IUCN - Endangered), Eastern Imperial Eagle, Greater Spotted Eagle. Additionally, Pallid Harrier (IUCN-Near Threatened) was also recorded during baseline flight activity monitoring. All these species had a predicted collision rate exceeding zero. The predicted collision rate for Steppe Eagle are considered the highest.

The CRM estimates indicate that for most MSB species including those globally threatened or near-threatened the impacts are likely to be low, however uncertainty relating to migration activity between years may mean that impacts could be higher and, in some cases, reach or exceed acceptable thresholds. Overall, there is potential for a noticeable change to occur and acceptable limits are likely to be breached for non-threatened species but not for the majority of MSBs, therefore the assessment concludes medium magnitude of impact

Based on the above, the impact significance for the wind power project is assessed as Moderate, based on a high receptor sensitivity and a medium magnitude of effect.

Residual Impacts

The table below presents the residual impact anticipated from the Project. This takes into account the CRM data as presented earlier and assumes the implementation of the comprehensive turbine shutdown on demand program as discussed in further details below. It is assumed that the turbine shutdown program has a 98% effectiveness in terms of collisions for birds.

Species	Avoidance 99.5 % (200 m)			98% Effectiveness of ATMP
	Spring	Autumn	Total	
Black Kite	61	0	61	1.22
Black Stork	19	0	19	0.38
Booted Eagle	1	0	1	0.02
Common Kestrel	0	0	0	0
Eastern Imperial Eagle	0		0	0
Egyptian Vulture	0	0	0	0
Eurasian Sparrowhawk	1	0	1	0.02
European Honey Buzzard	143	4	147	2.94
Great White Pelican	334	2	336	6.72
Crested Honey Buzzard	0		0	0
Griffon Vulture	0		0	0
Greater Spotted Eagle	0		0	0
Lanner Falcon		0	0	0
Lesser Kestrel			0	0
Lesser Spotted Eagle	1		1	0.02
Levant Sparrowhawk	221		221	4.42
Long-legged Buzzard	1	0	1	0.02
Montagu's harrier		0	0	0
Osprey	0		0	0
Pallid Harrier	0	0	0	0
Short-toed Snake Eagle	2		2	0.04
Sooty Falcon			0	0
Steppe Buzzard	158	0	158	3.16
Steppe Eagle	65	0	65	1.3
Western Marsh Harrier	0	0	0	0
White Stork	1,722	2,173	3,895	77.9

Mitigation and Monitoring Measures

Constraints

A potential environmental constraint was identified as the Wadi Dara community and as noted earlier as a precautionary measure a 2km setback is required (which has already been considered in the WTG layout).

Project Specific SESA-CIA Study

A standalone project specific SESA-CIA study has been undertaken. The study is provided as a standalone document. The main objectives of the assessment was to determine from a project perspective the following:

a. Sensitivity of site compared to other areas within the Gebel el Zeit IBA and whether other areas within the IBA are more sensitive and important for migrating birds.

b. Determine whether site is considered suitable for a wind farm development taking into account the sensitivity of the IBA and its conservation objectives.

c. Determine to the extent possible and feasible, the cumulative impacts of the site on the IBA with other future planned wind farm development within the identified ”red-zone” of the previous strategic 2007 Decon study.

d. Identify key mitigations and recommendations required and that should be implemented to mitigate impacts on avifauna in the IBA should project be developed.

Building on the study above, a more detailed SESA-CIA study will be undertaken in 2025 that will investigate all existing and planned developments within the IBA and GoS in general, The study will be undertaken by IFC and EBRD.

Avi-Fauna Monitoring and On-Demand Turbine Shutdown

Good International Industry Practice standard shutdown on demand and bird monitoring study protocol will be designed and implemented by the Project informed by baseline bird data and the results of similar monitoring at GoS wind projects.

Monitoring during the operation of the wind farm must be completed in order to inform the actual impact caused by the wind farm on resident and migratory birds. The monitoring must be undertaken with the primary objective of collision avoidance but also secondary for migration monitoring behavior.

Monitoring will be undertaken during the migration seasons. The start and end of the monitoring period will be agreed with the ATMP Technical Committee[22] prior to commencement of each migration season. Based on current information, monitoring must take place during the spring migration season (from 20 February until 15 May) and autumn migration season (from 10 August till 15 November). Throughout these periods, monitoring must take place continuously on a daily basis.

The program involves the shutdown of all or some WTG and/or Predictive Fixed Shutdown of all or some WTGs located at sensitive areas to birds in response to a potential bird collision risk. WTG shutdown is subject to certain criteria being met and ensures a high level of energy generation while

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

protecting biodiversity. Shutdowns are generally short term in nature. The program will be implemented by a Visual Observations (VOs) Approach and may be assisted by the combination of VOs with use of a Radar Systems (RSs) Approach Prior to the operational phase, specification for the implementation of BMP & SOD-Program under VOs and the combination of VOs with use of RSs, will be prepared building on the findings of the ESIA, CHA and CEA of the project. Detailed information will include identification of key species, key periods for monitoring, observation points, team composition, observation schedule, data collection observations, shutdown criteria, shutdown on-demand procedures and communication protocol, curtailment losses, risk management, standard data form, maps and data storage, data analysis, communication, required resources and equipment, breakdown of cost. The ATMP will include:

- Defining/delimiting key flight activity periods at the Project;
- Use of Radar and other high-tech monitoring technology if available;
- Drawing on bird monitoring data both historic and real time from RSs, VOs, bird behavioral variables, site-specific characteristics and weather data and other relevant data;
- Identifying high-risk areas and times; defining the groups of WTGs by zones for the SOD-Program and achieve effective coverage throughout the Project
- Adopting a reactive/responsive approach to mitigation but which will be informed and refined through a predictive approach;
- Determining strategically located vantage points for monitoring flight activity and to facilitate effective turbine shutdown; and
- Improving effective communication networks between bird observers as well as between bird observers and wind turbine operators

Cumulative Effects Assessment (CEA)

- A Cumulative Effects Assessment (CEA) has been undertaken which identifies the potential cumulative effects on birds of wind farms in development by this Project within 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 are presented as well. The CEA is presented as a standalone document.
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Critical Habitat Assessment (CHA)

Critical Habitat is likely to be triggered given the number of birds moving through the site in association with the IBA and PBFs will also be noted that will need to be safeguarded during the construction and operational phase to ensure no net loss of these features. Monitoring will need to be completed to ensure no net loss of PBFs during the operational phase. The CHA is presented as a standalone document. Offset should also be considered for such species and those are identified within the Biodiversity Action Plan (BAP) that is presented as a standalone document.

Avi-Fauna Carcass Search during Operation

A Good International Industry Practice standard post-construction fatality monitoring (PCFM) program (including bias correction trials) will be designed and implemented in line with the IFC/EBRD/KfW Guidance and Toolkit[23].

The PCFM program will assess the effectiveness of shutdown mitigation measures and allow the annual number of bird turbine collision fatalities to be estimated.

PCFM reporting, including fatality rate estimate analysis will be 6-monthy, Additionally, a comparative assessment between the fatality monitoring results and the outcomes of the pre-construction ESIA CRM will be provided annually.

Indirect Impacts on Sensitive Receptors (breeding / resident birds) – Disturbance

During the operation of the wind farm disturbance impacts are likely to be very minor as the site will not be subject to regular activity other than occasional vehicle movements and maintenance operations around the site, including turbine locations. Any such impact will have be very short-term (for the duration of the disturbance impact) and reversible and is likely to only result in impacts of low magnitude. The significance of operational disturbance is therefore considered to be minor.

Mitigation Measures

- Speed limits to be enforced.
- Sensitive species are to be included in the site induction for all operational staff where additional control measures will be discussed including allowing animals to move around the site, not chasing after them in vehicles or approaching them on foot and what to do if they observe breeding birds within their works areas.

Direct Impacts on Birds – Vehicle Collisions

Vehicle related collision are possible for all resident bird species present within the Project's AoI and this will result in direct mortality on receptors of low to high sensitivity. Any such impact would be

[23] https://www.ifc.org/en/insights-reports/2023/bird-bat-fatality-monitoring-onshore-wind-energy-facilities

negative, long-term and irreversible and would be of medium to high magnitude and therefore of minor to major significance (depending on the receptor killed).

It is possible that carcasses on the road could attract scavenging animals, including birds of prey which in turn would increase their risk of collision with vehicles and machinery.

Mitigation Measures

- Appropriate speed limits will be enforced by the O&M Contractor
- Regular signage will be installed along the site access roads and internal roads informing all drivers of the speed limit.
- A gated entrance will be staffed and any visitors or locals using the site roads will be informed of the speed limits and that there are regular checks of vehicle speeds.
- A ban on driving at night will be enforced and if absolutely necessary the speed limit will be reduced to 15km/h
- Ban against off-road driving at all times of the day, and if necessary, the works area will be subject to a walkover by the Project Ecologist.
- Regular checks of the road for carcasses and if found these will be moved away from the road to reduce the likelihood of hitting scavengers, including birds of prey to an authorized dump area.
- An incidental / chance find procedure will be included in the BMP so that all workers report any road collisions so that any such incident can be investigated in full.

Overall Conclusions and Recommendations

1. Project area falls within the Gebel El Zeit Important Bird Area (IBA) (BirdLife International 2022). According to International agreements this is considered a Key Biodiversity Area. Whatever the results would be in the coming migratory seasons, the site triggers for Critical Habitat designation and thus, the client should achieve No Net Loss (NNL) or even Net Gain (NG) According to the Performance Standards (PS6-IFC/WBG) and Requirements (PR6-EBRD).
2. In the spring 2022 a total of 2,856 records belonging to 242,768 birds and 25 species have been detected in the Project site. In addition, 2,965 birds remained unidentified. Eight (8) species accounted for 99.07% of the birds recorded which include the Black Kite, Common Crane, and White stork, European Honey Buzzard, Great White Pelican, Steppe Buzzard and Steppe Eagle. Two (2) species were classified as Vulnerable (VU) according to the IUCN Red List (Eastern Imperial Eagle and Greater Spotted Eagle), two (2) are Endangered (EN), the Egyptian Vulture

and the Steppe Eagle. A fourth one could be considered of special interest being Near Threatened (NT), the Pallid Harrier

3. In autumn 2022 a total of 470 records belonging to 202,279 birds and seventeen (17) species have been detected in the Project site. In addition, 2,965 birds remained unidentified. Three (3) species accounted for 99% of the birds recorded which include the White stork, European Honey Buzzard, and Great White Pelican. Two (2) species are Endangered (EN), the Egyptian Vulture and the Steppe Eagle. A fourth one could be considered of special interest being Near Threatened (NT), the Pallid Harrier

4. Birds pass randomly with no preference in any way for any specific areas or sites within the Project. This was confirmed through the comparison of passage rates between the five (5) or seven (7) VPs. The passage seems random as it depends on multiple factors that go beyond this assessment as it depends on factors and influences affecting the migration timing throughout the entire migration pathway. Only two species showed significant differences (Steppe and Long-legged Buzzards but these differences should be confirmed and further analysed in coming seasons but are unlikely to show a similar trend in the next spring season).

5. Migration patterns in terms of passage time in weeks/months was analysed and compared with historical migration patterns in the region as established by Shirihai et al. (2000) (with over 30 years of data). It is concluded that migration patterns in general are similar to those established by Shirihai et al. (2000) with minor differences.

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

7. The migration pattern in terms of passage during time of day was analysed. Species-specific patterns have been recorded but a single season is not enough to get strong conclusions as to make robust predictions.

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

9. The key and most important mitigation is the implementation of the ATMP in accordance with the established protocol under the "Executive Framework for Strategic Cumulative, Environmental & Social Assessment & Program of Ornithological monitoring and Active Turbine Management for Wind Energy Developments in Gulf of Suez"

10. A potential environmental constraint was identified for the Wadi Dara community. At this point, and as a precautionary requirement, a 2-km buffer from Wadi Dara is proposed.

11. Apart from the above and based on the outcomes there is no requirement to consider AT THIS STAGE any site-specific constraints or area of concern for placement of turbines within the Project site.

12. Critical Habitat is likely to be triggered given the number of birds moving through the site in association with the IBA and PBFs will also be noted that will need to be safeguarded during the construction and operational phase to ensure no net loss of these features. Monitoring will need to be completed to ensure no net loss of PBFs during the operational phase. Offset should also be considered for such species and those are identified within the Biodiversity Action Plan (BAP).

7.7 Bats

This section identifies the anticipated impacts on bats from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels. Bats were not recorded on site, and nearby windfarms have also not recorded more than occasional bat activity.

7.7.1 Potential Impacts during the Construction Phase

Habitat Loss, Fragmentation and Degradation

Site clearance and subsequent construction activities will result in the direct loss of areas of natural habitats over the full construction footprint of the Project including internal site roads, turbine bases, crane pads, substations, and permanent site structures (e.g. offices). Natural habitats are valued as being of Medium Sensitivity but are not listed as Priority Habitats. There is also likely to be temporary habitat loss and degradation of habitats as a result of temporary lay-down areas and other temporary facilities (e.g. worker accommodation) as well as cabling and communication routes.

Habitat loss can lead to a negative impact on overall population viability, due to loss of foraging areas. In the situation here the impact is reduced due to the nature of the development meaning that habitat loss is spread in small areas over a wider project site. This means that connectivity is maintained through the area and no barriers to movement put in place or wide areas of specific interest will be lost. Given habitats are found through the area the small loss of habitat (1.5% of the project area) it is considered that there will be no impact on conservation status of any bat species.

Despite this there will be mitigation for all these species in the form of provision of alternate habitat due to the enhancement of around 1.15 km^2 using appropriate, native planting in suitable parts of the Project Area, which will in turn attract invertebrates for foraging bats. This will ensure no loss the area available to use for these widespread species. Planting within these areas is being monitored and accordingly the success of habitat provision will be ensured. It is assumed that habitat loss associated with access from the main road will be minimized by following existing vehicle access routes. Assumed areas for infrastructure are provided at this stage in order to best asses the project impact.

However, such impacts on bats created during the construction phase would of a <u>long-term duration</u> as they would result in a permanent change in the natural biodiversity of the site. However, such impacts are expected to be of <u>negative nature, low magnitude</u>, and <u>low sensitivity</u> and therefore <u>not significant</u>.

<u>Mitigation Measures</u>

The following mitigation measures will be employed to reduce the significance of habitat loss, fragmentation, and degradation during the construction period. Mitigation measures are largely based on avoidance of impact through selection of the working areas to favor areas of degraded natural habitat or those areas where habitats have been modified. Where impacts cannot be avoided the following will be completed

- All site workers will undertake a Project induction before working on site. The induction will include a comprehensive biodiversity element where the baseline ecological value and sensitivity of the site will be discussed.
- Prior to construction works, working areas will be clearly demarked (using temporary fencing (e.g. orange netting attached to wooden posts)) so that site workers fully understand the working area. Encroachment into areas outside of agreed working areas will be prohibited and working areas will be subject to regular check by the EPC Ecologist to check enforcement of working areas.
- On completion of phased construction works the EPC Contractor will be responsible for habitat rehabilitation works in all areas that have been subject to temporary disturbance.
- Following construction an area of around 1.15 km^2 will be enhanced using appropriate, native planting in suitable parts of the Project Area, this will ensure that no net loss of habitat as a result of the works. Any areas of additional planting will be monitored as part of the biodiversity monitoring program and any species which do not establish will be replaced.

Direct and Indirect Impacts - Disturbance

The presence of site workers and machinery can result in disturbance related impacts to bats present within the AoI. These impacts are not certain, however the works are unlikely to be undertaken at night. Such impacts on bats created during the construction phase would of a <u>short-term</u> duration and are expected to be <u>of negative nature, low magnitude, and low sensitivity</u> and therefore <u>not significant</u>. It is likely that any disturbance impacts, irrespective of duration will be <u>reversible</u> once the disturbance event has passed.

<u>Mitigation Measures</u>

- Site wide induction to include information regarding disturbance of ecological receptors.
- Chance find procedure to report sightings of bats and investigation of any such sightings by the EPC Contractor in order that additional buffer areas can be agreed, where necessary.

Direct Impacts - Noise

Noise as a result of construction can result in direct impacts on bats due to acoustic masking, disturbance and displacement thereby reducing survivorship and reproductive success.

Any impacts are likely to be short- to medium term (for the duration of construction) and reversible. The magnitude of impact range is low and is likely to be of low to minor significance.

Mitigation Measures

EPC Contractors will adhere to the noise management measures indicated in Section 7.9.1.

Direct Impacts– Lighting

Lighting could impact foraging and commuting routes for bats.

Any impacts are likely to be short- to medium term (for the duration of construction) and reversible. The magnitude of impact is low and is likely to be of no/minor significance given the lack of bats present. Mitigation measures will help all nocturnal site use by other animals.

Mitigation Measures

Limit the amount of lighting, especially within the wider AoI (e.g at turbine construction sites). This will be achieved by ensuring that night-time working is limited.

Where lighting is required within worker compounds, site offices etc. ensure that any lighting is shielded and protected to reduce light-spill and glare. Low intensity lighting should also be used, where possible, to further reduce light spill.

- For external security lights PIR trigger units should be used and these should be timed to automatically switch off after five minutes.

7.7.2 Potential Impacts during the Operation Phase Direct Impacts on Bats – Collisions with Turbines

The potential impacts from the Project during operation are mainly related to risk of bat strikes and collisions with rotors of the operating wind turbines.

Many reports have corroborated the findings of bat collisions with wind turbines; this includes reports in Germany (Dürr 2001; Trapp *et al.* 2002; Dürr & Bach 2004), Sweden (Ahlén, 2002) and Spain (Alcalde, 2003). Evidences that turbines do not only kill bats from local populations but also from populations at far distance were established (Voigt *et al.*, 2012).

In addition, in reference to EUROBATS Guidelines for Considerations on Bats in Wind Farm Projects (Rodrigues et al, 2014), some of the species that are listed to have their distribution range in the Project area and its vicinity are documented to be vulnerable to collisions with wind turbines. For instance, *Pipistrellus spp.* are known to be at high risk of collision from wind turbines. The literature shows that two species of the genus have their distribution range in the area; *Pipstrellus kuhlii* and *P. rueppellii*. Also, *Eptesicus spp.* of which *Eptesicus bottae* is documented to be recorded in the area, are known to be of medium risk to collision with wind turbines. None of the species listed in the literature review are known to have low risk of collision with wind turbines. In fact, all remaining seven species' vulnerability to collision with wind turbines is unknown.

Although the static detectors were not left in place overnight, evidence to support the likely lack of impact comes from a nearby windfarm which has performed operational monitoring of bats. Only two bat carcasses were found from Autumn 2019 to Autumn 2023 showing very low numbers of bats affected by the turbines (of which there are a similar amount at 125 turbines on one plot and 96 at another). The methodology for monitoring included daily surveys six days a week from 20 February until 20 May in Spring and 10 November onwards in Autumn. The search plot for each turbine was a 200 x 200m area around the turbine itself. Surveys for bats have not been carried out at a time when the Wadis are wet, and it is possible that there is an increase in acidity at this time.

Appropriate monitoring is to be undertaken to ensure there is no significant impact on any bat species. This will be adaptively monitored by post construction fatality monitoring to international best practice. The use of methods in accordance with the Post-construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries – Good Practice Handbook and Decision Support Tool (2023) will ensure adaptive management is possible from the results of the monitoring.

Such impacts are anticipated to be of a <u>long-term duration</u> as <u>negative nature, medium magnitude</u>, and <u>low sensitivity</u> and therefore <u>of minor significance</u> due to the reasons provided below.

- Risk of collision of bats could potentially entail impacts on population on the species during specific periods of the year, mainly in spring season. However, based on literature review all bat species that are expected within the Project area are considered of Least Concern according to IUCN Red List of Threatened Species.
- The Project site being a feeding ground for bats (which in turn relates to bat activity) is expected to be minimal and insignificant given that the very low nocturnal insect activity due to the arid nature of the Project site and very low vegetation coverage. In addition, based on bat monitoring assessment undertaken onsite, no bat activity was recorded which further confirms the low sensitivity of the site in terms of bat activity.

<u>Mitigation and Monitoring Measures</u>

To verify the outcomes above, as part of the Carcass Search Surveys and program to be undertaken, this should cover bats as well. Based on the outcomes of the program above, if the results present any key outcomes, then additional management measures should be determined as appropriate and based on the outcomes of the carcass search survey program.

Direct Impacts on Bats – Lighting

Lighting could potentially result in negative impacts on foraging and commuting routes for bats.

Any impacts are likely to be short- to medium term and reversible. The magnitude of impact ranges from low to medium and is likely to be of low to moderate significance.

Mitigation Measures

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

7.8 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.

7.8.1 Potential Impacts during the Construction Phase

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

Although such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal, if such activities are improperly managed, they could damage or disturb archaeological remains present on the surface of the Project site. However, the archaeological baseline assessment discussed earlier concludes that there are no archaeological sites or remains within the Project site. Therefore, there are no anticipated impacts from the Project on surface archaeological remains within the Project site.

In addition, there is a chance that throughout such construction activities, archaeological remains buried in the ground are discovered. Improper management (if such sites are discovered) could potentially disturb or damage such sites which could potentially be of importance. Such potential impacts are of a short-term duration as they are limited to the construction phase, and are irreversible as should sites be discovered then inappropriate management could result in disturbance and/or damage, in which such an impact would be of medium magnitude. The impacts will be of a negative nature and low sensitivity given that the likelihood of such impacts is considered low. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

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

- During excavation activities, SCA must be notified to check if they will provide any observers to oversee the process and ensure that no underground archaeological remains of importance are unearthed and/or disturbed.
- Throughout the construction phase, and as the case with any Project development that entails such construction activities, there is a chance that potential archaeological remains in the ground might be discovered. It is expected that 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 EPC Contractor during the construction phase and which include:

- Submission of formal letter of communication with SCA; and
- For chance find procedure, inspection of actions taken in case of new discoveries, including fencing, limiting access to site, and contacting the Ministry of Tourism and Antiquities/ Red Sea and Suez Antiquities Inspection Office. Report should be prepared and submitted to the Ministry.

7.9 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.

7.9.1 Potential Impacts during the Construction Phase

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

Although such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal. Nevertheless, such activities will likely result in an increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact ambient air quality. If improperly managed, there is a risk of nuisance and health effects to construction workers onsite and to a lesser extent to the nearby surrounding receptors from windblown dust (such as nearby petroleum activities). In addition, construction activities will likely entail the use of vehicles, machinery and equipment (such as generators, compressors, etc.) which are expected to be a source of other pollutant emissions (such as SO2, NO2, etc.) which would also have minimal direct impacts on ambient air quality.

In addition, all the above activities will likely include the use of machinery and equipment such as generators, hammers, compressors, etc. and which are expected to be a source of noise and vibration generation within the Project site and its surroundings. If improperly managed, there is risk of nuisance and health affects to construction workers onsite and to a lesser extent to the nearby surrounding receptors (such as nearby petroleum activities).

However, it is important to note that there are no key receptors that are anticipated to be impacted from dust, noise and emission given that the closest receptor / community settlement to the Project site is Wadi Dara Village.

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 negative nature, and will be noticeable and therefore of medium magnitude. However, the impacts will be dispersed and are reversible as air quality would revert back to baseline conditions after construction works is completed and thus the receiving environment is considered of low sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

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

- 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.
- -Hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas, will be limited.
- -Project traffic will be reduced by routing through community areas wherever possible.
- -Grievance mechanism will be developed to record and respond to complaints regarding to noise.
- -In case of any noise related grievance, noise measurements will be carried out immediately at the area where noise related grievance is received. If monitoring results indicate that noise levels are above the defined limits, the Client will reduce/limit the number of equipment at the construction site, until the construction noise levels are reduced below the limit values.
- -Equipment with lower sound power levels should be selected.
- -Silencers should be installed for fans.
- -Suitable mufflers should be installed on engine exhausts and compressor components.
- -Acoustic enclosures should be installed for equipment casing radiating noise.
- -Noise sources should be re-located to less sensitive areas to take advantage of distance and shielding.
- -In addition to the above given measures, noise barriers could be installed without any gaps and with a continuous minimum surface density of 10 kg/m2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective.

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

<u>Monitoring and Reporting Requirements</u>

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

- Dust and noise monitoring should be undertaken on a quarterly basis during the construction phase at key points where active construction activities are undertaken. The monitoring should include TSP, PM10 and PM2.5 and noise levels.
- Periodic inspections should be conducted at nearby sites (e.g. such as nearby petroleum activities) to determine whether harmful levels of dust and noise from construction activities exist; and
- Reporting of any excessive levels of pollutants/dust or noise and the measures taken to minimize the impact and prevent it from occurring again.

7.9.2 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 7.12" along with other relevant impacts such as shadow flicker.

7.10 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.

7.10.1 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.

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 <u>short-term duration</u> during the Project construction phase. Such impacts are of a <u>negative nature</u>, and if such impacts are improperly managed, then they are expected to be of <u>high magnitude and medium sensitivity</u>. Given the above impact is considered of <u>moderate significance</u>.

Mitigation Measures

The EPC Contractor must develop a Traffic and Transport Plan before commencement of any transportation activities to ensure that the transportation process is properly and adequately managed and does not pose a risk of damage to the existing roads, highways, overpasses whilst ensuring public safety. The Plan must analyse and study the entire route for transportation of the Project components from the port till the Project site. The assessment must take into account worst case scenarios for transportation of Project components for blade lengths, tower sections, etc. The study must investigate any constraints which need to be considered along the highways leading to the Project site such as bridges, overhead utility cables, slants in roads, etc. and identify accommodations which need to be taken into account (bypasses, adjustments to roads, etc.)

The Plan must take into account the following:

- The Plan must be developed in accordance with relevant local traffic and transportation legislations related to traffic loads and weights, dimensions, speed limits, etc.
- The plan must consider, to the extent possible, the proper planning of generated trips of trucks to ensure they are spread over the course of a work day and hours of day, and which also take into account peak and non-peak commute hours on the highway;
- As part of the Plan, the EPC Contractor must establish coordination with relevant entity to take into account any specific requirements that should be considered and ensure they are aware of the transportation requirements and details related to the Project.

The plan must consider, (i) mapping of sensitive social receptors (schools, hospitals, playground, etc.) along the route, (ii) timely disclosure of transportation miles stones, (iii) community awareness raising on traffic safety by the Project's community liaison officers, and (iv) temporary signage along route.Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

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

- Submission of Traffic and Transport Plan with proof of coordination with the authorities discussed above for works required as part of the Study.
- Submission of proof of coordination with relevant entities.

7.10.2 Potential Impacts on Civil and Military Aviation during the Planning and Construction Phase

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.

Inappropriate management of planning activities and site locations (e.g. siting of turbines) and construction activities (e.g. excavations) could disturb such aviation practices.

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 <u>long-term duration</u>, of <u>negative nature</u>, and of <u>low magnitude</u> given impact is related to inappropriate management of activities, however given its importance it is considered if <u>high sensitivity</u>. Given all of the above, the impact is considered of <u>minor significance</u>.

<u>Mitigation Measures</u>

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

- Establish coordination with NREA to ensure that the clearance that has been provided by the Ministry of Defence for the area includes in particular approvals from civil and military aviation entities. In addition, based on the that adhere to any specific navigational safety requirements (e.g., navigational lights, blade paintings, etc.)

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to <u>not significant.</u>

<u>Monitoring and Reporting Requirements</u>

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

- Submission of formal non-objection letters from relevant entities

7.10.3 Potential Impacts on the Petroleum Facilities during Construction

The nearest petroleum activities are situated just outside Ras Sukhaeir, approximately 10 km from the Project site. Although this distance is relatively significant and a Coordination Agreement exists between NREA and the General Petroleum Company, specific requirements must still be considered during the detailed design phase of the Project.

The anticipated impacts are considered of short-term duration during the Project construction phase. Such impacts are of a negative nature, and if such impacts are improperly managed, then they are expected to be of medium magnitude and medium sensitivity due its distance from the Project site. Given the above impact is considered of minor significance.

Mitigation Measures

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

- Establish coordination via NREA with the GPC's head office in Cairo to discuss and determine any specific requirements to be taken into account for the detailed design of the Project as well as coordination agreement requirement during the construction and operation phase (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 insignificant.

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 proof of coordination with relevant entities

7.10.4 Potential Impacts on Water Resources during Construction and Operation

It is expected that the Project throughout the construction and operation phase will require water for potable usage (drinking, showering, etc.) and non-potable usage (e.g. cleaning of machinery and vehicles).

The Project is expected to require around 50,000 m^3 throughout the construction phase (for a total duration of 24 months) – equivalent to around 70 m^3/day. This will include around 38,000 m^3 for non potable uses such as construction works and personal hygiene (concrete works, minimize dust, cleaning of requirements, , vehicles and machinery washing, camp/toilets/showers,). as well as 12,000 m^3 as potable water requirements (for drinking).).

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 Gharib 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 Gharib 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 Gharib Water Company to secure water requirements for the Project most likely through tankers.

Taking all of the above into account, the anticipated impacts on the local water resources and utilities are considered of short-term duration during the Project construction phase and of long-term duration during the operation phase. Such impacts are of a negative nature, and are expected to be of low magnitude and of low sensitivity given the temporary nature of such impacts during construction and minimal water requirements of the Project during operation. To this extent, the impact is considered not significant.

Additional Requirements

The following identifies additional requirements to be applied by the EPC Contractor during the construction phase and Project Operator during the operation phase respectively and which include:

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

Management and Monitoring Requirements

- Water Management Plan

  A water management plan will be developed for both the construction and operational phase as described in the ESHS manual to Identification of procedures for onsite management of water supplies and minimization of water consumption. The plan will include the following :

  - Identification of sources of water supply that will be utilized for the Project, to include both potable and non-potable water requirements (sourcing of water is expected to be delivered via tanks but this is to be confirmed in the ESIA).
  - Estimation of anticipated quantities of potable and non-potable water requirements.
  - Ensure proper labeling of tanks as potable water, storage in shaded or insulated areas to protect against high temperatures, and regular cleaning and maintenance to prevent contamination.
  - Identify in detail procedures for onsite management of water supplies and minimization of water consumption. This could include but not limited to: (i) identify location of all water storage tanks onsite with clear markings as potable/non-potable; (ii) ensure water tanks are completely closed at all times with appropriate protection against sunlight; (iii) inspections for

potable and non-potable tanks and connections to ensure there are no leaks; (iv) install water saving fittings (taps, urinals, etc.) in toilets of site offices, and other as applicable.
  - Reflect the procedural actions for water management in: (i) induction training material for workers; and (ii) repeated/refresher Toolbox Talks (TBT).
- Wastewater Management Plan will be developed
  - Conduct a wastewater inventory to identify sources and estimate quantities of wastewater generated during construction and operation phases.
  - Identify final disposal location of generated wastewater. In addition, confirm that disposal locations identified are well managed and have sufficient capacity to receive amounts generated from project without affecting other projects and users.
  - Use of licensed wastewater companies for the collection and disposal of wastewater

Monitoring

- Require the EPC Contractor/operator to maintain daily and monthly water consumption logs for potable and non-potable uses.
- Conduct visual inspection to observe possible leaks in tanks or other areas.
- Ensure efficient water use through awareness programs and optimized consumption practices.
- Conduct periodic water quality testing for potable water to ensure compliance with parameters included in Decree 458/2007
- Monthly wastewater generation report to EGH
- Documentation of wastewater disposal through licensed companies

7.10.5 Potential Impacts on Waste Utilities during Construction and Operation

With regards to the project is the following waste streams during the construction and operation phases are expected to be generated:

- Wastewater during construction and operation is 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 Project can be assumed by taking into account an 80% wastewater generation factor for potable water requirements which will amount to around 10,000m3 throughout the construction phase. Wastewater generated 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. The septic tanks will be fully enclosed, leak-proof, and regularly maintained.
- Solid waste during construction and operation from the Project will include
  - General municipal waste (such as food, paper, glass, bottles, plastic, etc.).
  - Construction waste from excavated material for the foundations. Assuming a footing diameter of 20 meters and depth of excavation of 1m, a total of 13,000 tonnes is

expected to be generated. [24] Other construction waste such as concrete and cement waste (spillage, overordering, demolition) and packaging waste (plastics, insulation, packaging, general debris) are considered insignificant.

- Hazardous waste during construction and operation will include routine waste generated from such activities to include spent oil, lubricants, paint cans, solvents.

Throughout both the construction and operation phases, hazardous waste will be collected by contractor for safe disposal while non-hazardous waste will be recycled whenever possible or otherwise disposed of in approved landfills.

The EPC Contractor during the construction phase and the Project Operator during the operation phase respectively will be responsible for the following:

- Coordination with the Red Sea Water and Wastewater Company and obtain list of authorized contractors for collection of wastewaters from the site to the Ras Ghareb WWTP.
- Coordination 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.
- Coordination 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.

During the operation phase, the following quantities of waste are expected:

- Hazardous Waste: Oils, lubricants, and hydraulic fluids: 2-5 tons/year.
- Nonhazardous Waste: Metal scraps, insulator parts, general maintenance debris: 5-10 tons/year.

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 insignificant.

Management Measures

The following identifies the additional requirements to be applied by the EPC Contractor during the construction phase and Project Operator during the operation phase respectively and which include:

[24] Volume of excavation for 20m diameter footings for 25 wind turbines at a 1 meter depth of excavations has been calculated using $V=\pi r^2 h= 3.1416x10^2x1x25= 7,854\ m^3$
Assuming soil density of around 1.7 t/m^3, the quantity of excavated material is estimated to be around 13,000 tonnes.

- Coordinate with the Red Sea Water and Wastewater 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.
- Implement solid waste management measures indicated in Section 7.4.2(i), specifically, the following:
    - A Waste Management Plan will be prepared by the EPC Contractor/operator according in line with the ESHS manual. It will include but not limited the following:
        - Types of waste and for each type of waste expected to be generated during both construction and operation, provide the list of waste delivery/management facilities, plants and landfills.
        - Provide also the exact location and the confirmation of the availability of each waste management facility, plant and landfill.
        - Add procedures to check the waste management facilities, plants and landfills conformity, authorization and compliance with the project standards.
        - Adhere to waste hierarchy principles with associated mitigation measures to include prevent, minimize, reuse, recycle, recover and dispose.
        - Waste Management will be included in the Site Induction so that ensure that site workers understand the possibility of recycling.
        - Daily inspections of working areas and worker compound should be completed, and corrective actions applied, where necessary.
        - The waste shall always be properly accumulated, labelled, segregated per categories, protected from weathering and often delivered to the waste management facilities.
        - Ensure that recycling measures are implemented including i) separation and disposal of recyclables in a separate container (cardboard, paper, glass, metal, etc.); and (ii) separation and disposal of non-recyclable materials in a separate container (e.g. food waste). Each container must be clearly marked. In addition, EPC Contractor/operator must seek ways to reduce construction waste by reusing materials (for example through recycling of concrete for road base coarse);
        - Maintain records and manifests that indicate volume of waste generated onsite, collected by EPC contractor/operator, and recycled /disposed of at the landfill.
        - selecting the waste facilities for recycling, recovery and disposal.

- Identifying local off takers with recycling capacity

7.10.6 Potential Impacts on Telecommunication and Television & Radio Links during the Planning and Construction Phase

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 with NTRC 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, 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 letter from NTRC

7.10.7 Potential Impacts on Nearby Wind Farms

As noted earlier, there are several operating and planned wind farm development Projects within the GoS area. Within the Project area, there is another existing and operational wind farm known as the JICA, KfW, Spain and ACWA Wind farms ("Section 5.11.8") bordering the Project site.

Inappropriate management of planning activities (e.g., siting of turbines and proper buffer distance) could affect such nearby wind farms.

Taking all of the above into account, the anticipated impacts are considered of long-term duration during the operation phase. Such impacts are of a negative nature, and if such impacts are improperly managed, then they are expected to be of medium magnitude and medium sensitivity due to their distance from the Project site. Given the above impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the Developer / EPC Contractor during the planning phase:

- Further follow/communication with NREA to ensure if buffer distance of the Project from other nearby wind farm projects is considered sufficient and appropriate from a technical perspective

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 Developer / EPC Contractor during the planning phase and which include:

- Submission of proof of coordination with relevant entities.

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

As noted earlier, there is a high Voltage Overhead Transmission Line (OHTL) that belongs to EETC within the Project area and runs in the north-east section of the Project area. Inappropriate planning and design of the Project and the turbines could impact and affect such existing infrastructure elements within the Project area.

The anticipated impacts on the OHTL are considered of long-term duration during the operation phase. Such impacts are of a negative nature, and if such impacts are improperly managed, then they are expected to be of medium magnitude and medium sensitivity due to their distance from the Project site. Given the above impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the Developer / EPC Contractor during the planning phase:

- Account for a setback distance from the OHTL and undertake follow/communication with EETC to verify that such setback distance is considered sufficient. As required by the "Electricity Law 87/2015" as presented in the table below, it is expected that the Project will require a 25m horizontal distance from each side of the OHTL.

OHTL Type	Voltages	RoW
Ultra-High Voltage OHTL	132 kV and above	25m
High Voltages OHTL	33kV - 66kV	13m
Medium Voltages OHTL	1 kV - 33kV	5m
Ultra-High Voltage Cables	132 kV and above	5m
High Voltage Cables	33kV - 66kV	5m
Medium Voltages Cables	1 kV - 33kV	2m
Low Voltages Cables	below 1kV	2m

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to <u>not significant.</u>

<u>Monitoring and Reporting Requirements</u>

The following identifies the monitoring and reporting requirements that must be adhered to by the Developer / EPC Contractor during the planning phase and which include:

- Submission of proof of coordination with relevant entities.

7.11 Labor and Working Conditions

7.11.1 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 petroleum activities
- Working in very windy conditions and low temperatures during the winter, and
- Access to potable drinking water in all work locations on site.

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 moderate 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

Occupational Health and Safety

It is expected that the EPC Contractor will prepare an Occupational Health and Safety Plan (OHSP) regarding the Project's construction, installation and commissioning works as well as the general construction site operations. In addition, the Project 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 of the EPC Contractor and all involved sub-contractors, as well as the Project Operator.

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). In addition, it must also be compliant with the IFC PS2, EBRD PR 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 Industry Practice (GIIP).

In general, the OHSP should address the following components:

- Identify roles and responsibilities of the personnel involved within the Project to include the EHS manager, construction manager, supervisor, and other sub-contractor's responsibilities;
- Identify in details information in relation to formulation of safety committees, communication protocols, first aid personnel and facilities, first aid training programs, occupational health and safety culture, emergency preparedness and response, quality system, reporting requirements, competence and job safety training, safety inspections, recruitment procedures, safety audits, risk assessment, etc.;
- Risk assessment, method statement, and job safety analysis procedure;
- Permit to work procedure;
- Identify in details the hazards which may be associated with various activities to take place and the various measures to be implemented to reduce such risks including the requirements for Personal Protective Equipment (PPE). This includes for example hand tools, access equipment, lifting equipment, mobile working equipment, etc.
- The developer should oversight of 'OHS' at the level of the EPC contractor and subcontractors
- Appointing a sufficient number of occupational health and safety supervisors;
- Establish training requirements for workers to comply with health and safety procedures and protective equipment, with emphasising on 'OHS' in worker induction training and toolbox talks emphasis on 'OHS' in worker induction training and toolbox talks
- Include specific procedures and protocols related to venomous species onsite to include but not limited to undertaking awareness sessions on potential presence of key species, measures to be undertaken in case they are found, ensuring medical resources are available to handle incident;
- Insurance for all workers on site including contractor and subcontractor workers.

EPC Contractor and Project Operator are expected to adopt and implement the provisions of the OHSP throughout the Project construction and operation phase.

Emergency Preparedness and Response

The EPC Contract and Project Operator are also expected to prepare and implement an Emergency Preparedness and Response Plan for the Project construction and operation phase.

The objective is to establish a series of organizational, operational and preventive measures in the event of an emergency that are adapted to the circumstance of such situations, which in turn will ensure the safety of workers and property within the specific Project site. The plan should take into account the following:

- Inclusion of requirements for an emergency responder team that includes at a minimum first aiders and firefighters that receive appropriate and certified training
- Inclusion of requirements to undertake emergency drills in coordination with external emergency response services if required (e.g., civil defense, nearest hospital, etc.)
- Identify in detail of emergency procedures to be implemented to include first actions, alerting emergency contacts, site evacuation, communicating with external emergency services
- Identification in details of emergency control measures to include but not limited to: (i) fire, (ii) personnel accidents, (iii) spillage, (iv) sandstorms, (iv) heats strokes, (v) war conflicts/security deterioration and other.
- Identification of location of assembly points onsite
- Identification of emergency signs to be implemented onsite
- Need for adequate means of communication for security guards (and other workers) when in remote locations on site, i.e. mobile phones and recharge points.
- Identify roles and responsibilities for implementation of plan to include establishment of an emergency committee and assigning roles to an emergency manager

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor and Project Operator during the construction and 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
  Submission of an Emergency Preparedness and Response plan

7.11.2 Worker Rights and General Working Conditions

Inappropriate management of the workforce during both the construction and operation phase could entail several worker rights and general working conditions risks and violations by employing entities such as the EPC Contractor and Project Operator. This could include but not limited to engaging child workers, confiscation of passports of foreign workers, unsuitable working hours, and other.

The developer should oversight of these issues at the level of the EPC contractor and subcontractors, as well as vulnerability of certain categories of workers (migrant workers and day laborers) during construction. Think of issues such as labor contract, (timely) payment of wages and overtime, social insurance, worker accommodation, worker grievance mechanism, etc.

The above impacts are anticipated to be of short-term nature during the construction period and long-term nature during the operation phase. Such impacts are of a negative nature, and inappropriate management of workforce could result in impacts that are of medium sensitivity and medium magnitude. Given the above such an impact is considered of minor significance.

Mitigation Measures

The EPC Contractor and Project Operator are required to develop and implement a Human Resources (HR) procedure for workers that should be guided by the Local Labour Law as well as the IFC PR 2 and EBRD PR 2 as well as the ILO Fundamental Labour Conventions covering the following in particular:

- Providing reasonable working conditions and terms of employment to include but not limited to contract management, working hours, salaries/wages, annual and medical leaves, bereavement leaves, accommodation, etc.
- Recognizing workers' rights to form and to join workers' organizations and to bargain collectively
- Prohibition of child labor within the workforce
- Overall management of young workers within the labor force
- Prohibition of forced labor
- Non-discrimination throughout the entire work cycle in all its forms
- Providing equal opportunities for all throughout procurement and employment opportunities including women groups
- Include training requirements for workers on 'Worker Rights & General Working Conditions' in worker induction training and toolbox talks
- Overall management of daily workers, migrant workers and third-party workers
- Preparing the following management plans for the construction phase:
  - Labor Management Plan, including sections on 'Monitoring of EPC contractor/ subcontractors,' 'Worker Grievance Mechanism,' 'Worker Accommodation,' and 'Worker Welfare Facilities.' The latter includes potable water, shaded/ sheltered areas for lunch and praying, mobile latrines, etc. accessible across entire Project site,
  - Demobilization Strategy for the construction workforce; this includes clarification on notice periods, severance packages, provision of a 'Letter of Recommendation' for future employment, support in finding employment on neighboring wind farms or other projects with EPC contractor or its subcontractors, etc.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Worker Grievance Mechanism

The EPC Contract and Project Operator are also expected to prepare and implement a worker grievance mechanism for the Project construction and operation phase. The objective is to ensure a robust and comprehensive procedure to capture, document, resolve and close out any worker complaint, whether classified as grievances or not. The plan should take into account the following:

- Identification of a step-by-step process and guideline to ensure that every complaint/grievance made by workers are registered, documented and fully addressed
- The overall outline/structure of the grievance mechanism will be as follows:

- Workers will be allowed to lodge grievances through various platforms and channels to include grievance boxes distributed onsite, telephone, face to face meetings with responsible personnel, workers representatives and unions. Contact details for all such channels will be identified and provided in detail.

- Anonymous lodging of grievances will be allowed.

- All grievances will be recorded and a case handler will be assigned and who will be determined at a later stage.

- All grievances will be handled in the shortest possible period. The first approach will be to inform the worker within the first 24 hours after receiving the grievance. The worker will be informed within 7 working days on whether or not the grievance proceeds and what the next steps will be.

- Once a resolution has been agreed or a decision made, the case handler will monitor the implementation of the response.

- After the implementation of an agreed resolution has been verified the grievance close-out will take place. It will entail reaching a unanimous agreement, clearly communicated to avoid misunderstandings.

- A close-out report will be prepared with evidence to support closure (e.g., photos).

Worker Accommodation

It is not clear at this point whether there will be any onsite accommodation for workers. Nevertheless, should the EPC Contractor opt for onsite accommodation unit for workers, it must conform to the national requirements. In addition, it should also confirm to international best practice requirements – this includes 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. If the contractor will be relying on off-site rental accommodation, any off-site accommodation rented to accommodate non-local workers must be inspected in line with national requirements and lender standards.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor and Project Operator:

- Undertake monthly inspections during construction and quarterly during operation against the developed HR procedure
- Submission of HR inspection report that identifies any corrective measures undertaken
- Submission of a Worker Grievance Mechanism.

If applicable, inspection on workers accommodation to ensure its compliance with the requirements of "Instructions for Prevention of Health Nuisances from Workers Accommodation No. (1) For the year 2013" and "Workers' accommodation: process and standards" (EBRD/IFC Guidance Note, 2009).Other potential human rights impacts include the potential for risks, particularly labour risks, in project supply chains. The project's supply chain risks should be assessed and disclosed in the management documents and plans that should be prepared for the project.

7.12 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.

7.12.1 Potential Impacts from Noise from Wind Turbines during Operation

This section is an extract from the standalone detailed noise assessment report (Annex III). Wind turbines produce noise during operation from mechanical and aerodynamic sources. Mechanical noises are mainly limited from the machinery in the nacelle of the turbine (gearbox, generator, auxiliary equipment, etc.) while aerodynamic noise is generated from the movement of air around the turbine blades and tower.

Propagation of the sound from a turbine is primarily a function of distance, but it can also be affected by the placement of the turbine, surrounding terrain, and atmospheric conditions. In addition, noise levels depend greatly on the level of operation of the turbines (percentage of rated power). Nevertheless, in some cases, background/ambient sound already exceeds the sound produced by any wind turbine (e.g., high wind speeds, surrounding activities, etc.). In this case, the sound from the wind turbine blends into the background sound, simply becoming part of the present soundscape without the notice of residences.

As required by the IFC EHS Guideline for Wind Energy, the following is noted in relation to noise assessment for wind farms:

- Receptors should be chosen according to their environmental sensitivity (human, livestock, or wildlife).
- Preliminary modelling should be carried out to determine whether more detailed investigation is warranted. The preliminary modelling can be as simple as assuming hemispherical propagation (i.e., the radiation of sound, in all directions, from a source point). Preliminary modelling should focus on sensitive receptors within 2,000 meters (m) of any of the turbines in a wind energy facility.
- If the preliminary model suggests that turbine noise at all sensitive receptors is likely to be below an LA90 of 35 decibels (dB) (A) at a wind speed of 10 meters/second (m/s) at 10 m height during day and night times, then this preliminary modelling is likely to be sufficient to assess noise impact; otherwise, it is recommended that more detailed modelling be carried out, which may include background ambient noise measurements.

The IFC EHS Guideline for Wind Energy is based on the on "the Assessment and Rating of Noise from Wind Farms" (ETSU-R-97). ETSU can be regarded as relevant guidance on good practice, it contains a methodology for generating noise limits for a wind turbine and wind farms. ETSU-R-97 is referenced by the United Kingdom (UK) Government as a best practice guide for UK Legislation. The 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
- Noise Sensitive Receiver locations (NSR) as identified in "Section 5.2 earlier. As identified within this section, the only potential NSR would be the village of Wadi Dara. Various NSR's have been selected within Wadi Dara in various locations (north (considered closest to the WTGs), middle and southern (considered farthest to the WTGs) parts of the village) for the purpose of this preliminary noise assessment.

Noise prediction modelling for the Project has been completed using leading noise modelling software program SoundPLAN 9.1. The program allows for the calculation of sound pressure levels due to various sources using empirical calculation algorithms of the applicable International Standards and Regulations.

The propagation methodology adopted for this noise study, and the equations used within the SoundPLAN model are based on the International Organisation for Standardisation (ISO) 9613:2024 'Acoustics – Attenuation of Sound during Propagation Outdoors' – Part 2: Engineering Method for the Prediction of Sound Pressure Levels Outdoors (ISO 9613-2) as per the modelling requires of IOA GPG. ISO 9613-2 is a general-purpose standard for outdoor noise propagation, the standard specifies a 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.

The method predicts the equivalent continuous A-weighted sound pressure level (L_{Aeq}) under meteorological conditions favourable to propagation from sources of known sound emission. The standard takes into account the following physical effects on sound:

- Geometrical divergence;
- Atmospheric absorption;
- Ground effect;
- Reflection from surfaces; and
- Screening by obstacles.

Noise from WTGs is reduced by distance, atmospheric losses, screening effects and other 'miscellaneous' losses. ISO 9613-2 empirical formula calculates the predicted sound pressure level at a specified distance by taking into account the sound power level in octave frequency bands and subtracting a number of attenuating factors as described generally above.

The predicted noise level for each octave band is calculated by the following equation (1) and the modelling equation as applied by the calculation software is shown as per equation (2).

$$\mathbf{L_{90} = L_{w(eq)} + D - A_{geo} - A_{atm} - A_{gr} - A_{bar} - A_{misc} - 2\ dB \qquad (1)}$$

Where:

L_{90}: sound Level exceeded 90% of the time.

$L_{w(eq)}$: equivalent continuous sound power level (dB)

D: directivity (dB)

A_{geo}: attenuation over distance (dB)

A_{atm}: atmospheric attenuation (dB)

A_{gr}: attenuation due to ground cover (dB)

A_{bar}: barrier attenuation (dB)

A_{misc}: miscellaneous attenuation factors (dB)

The 2 dB represents a correction used to convert the L_{Aeq} levels, as used to describe the turbine sound power to the L_{A90} parameter, used in the ETSU-R-97 assessment. The applied equation for the Standard computed is as follows:

$$\boldsymbol{L_s = [L_W + D_1 + K_0] - [D_S + \sum D]} \qquad \textbf{(2)}$$

Where:

L_s: sound pressure level for a single frequency

L_W: sound power

D_1: directivity of the source

K_0: spherical model ($K_0 = 10\log\left[\frac{4\pi}{\sigma}\right]$ where σ is the spatial angle)

D_S: geometrical spreading ($D_S = 10\log(dist.source, receiver) + 11\ dB(A)$)

$\sum D$: contributing factors – air absorption, ground absorption, meteorological effects, volume type absorption and screening

A summary of the calculation settings and standards are detailed in the table below.

Table 7-3: Model Calculation and Parameter Settings for ISO 9613-2

Model Parameter	Parameter Setting / Standard							
Calculation Standard	(ISO) 9613-2 'Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors (ISO, 2024)' *Application as per IOA GPG*							
Wind Speed	10.0 m/s							
Ground Absorption Coefficient	0.5							
Receiver Height	4 m							
Meteorological Data[25]	Humidity 70% Air Pressure 1013.3 mbar T = 25ºC							
Atmospheric Attenuation Coefficients (dB / km)	63 Hz 0.1	125 Hz 0.3	250 Hz 1.1	500 Hz 2.8	1 kHz 5.0	2 kHz 9.0	4 kHz 22.9	8 kHz 76.6

The following assumptions have been made for the modelling assessment, and wherever possible, a conservative approach has been taken:

[25] International Organisation for Standardisation (ISO), ISO9613-2 'Acoustics – Attenuation of Sound During Propagation Outdoors', 2024 https://www.iso.org/standard/74047.html.

- ISO 9613-2 calculates predicted noise levels with the assumption that SRs are located downwind of the turbine noise as this is considered to be the most conservative. Therefore, directivity and attenuation due to metrological factors such as wind speed and wind direction upwind from a source have not been taken into account.
- Due to the surrounding area being a mix of hard and soft ground surfaces, an absorption coefficient of 0.5 has been assumed.
- Noise modelling calculations were carried out for the worst-case downwind scenario, including a gridded calculation and a separate discrete receiver calculation, in order to generate overall grid noise maps, and to undertake a tabulated assessment at NSRs respectively. A noise contour map has been calculated and is presented in the figure below for both turbine options which include the following:

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 7-4: Noise contour map setup specification – ISO 9613-2

Parameter Description	Noise Map Parameter
WTG Operation	Worst Case – All WTGs operating
Mapping Grid Resolution	25 x 25 m
Mapping Result Range	35 – 70 dB(A)

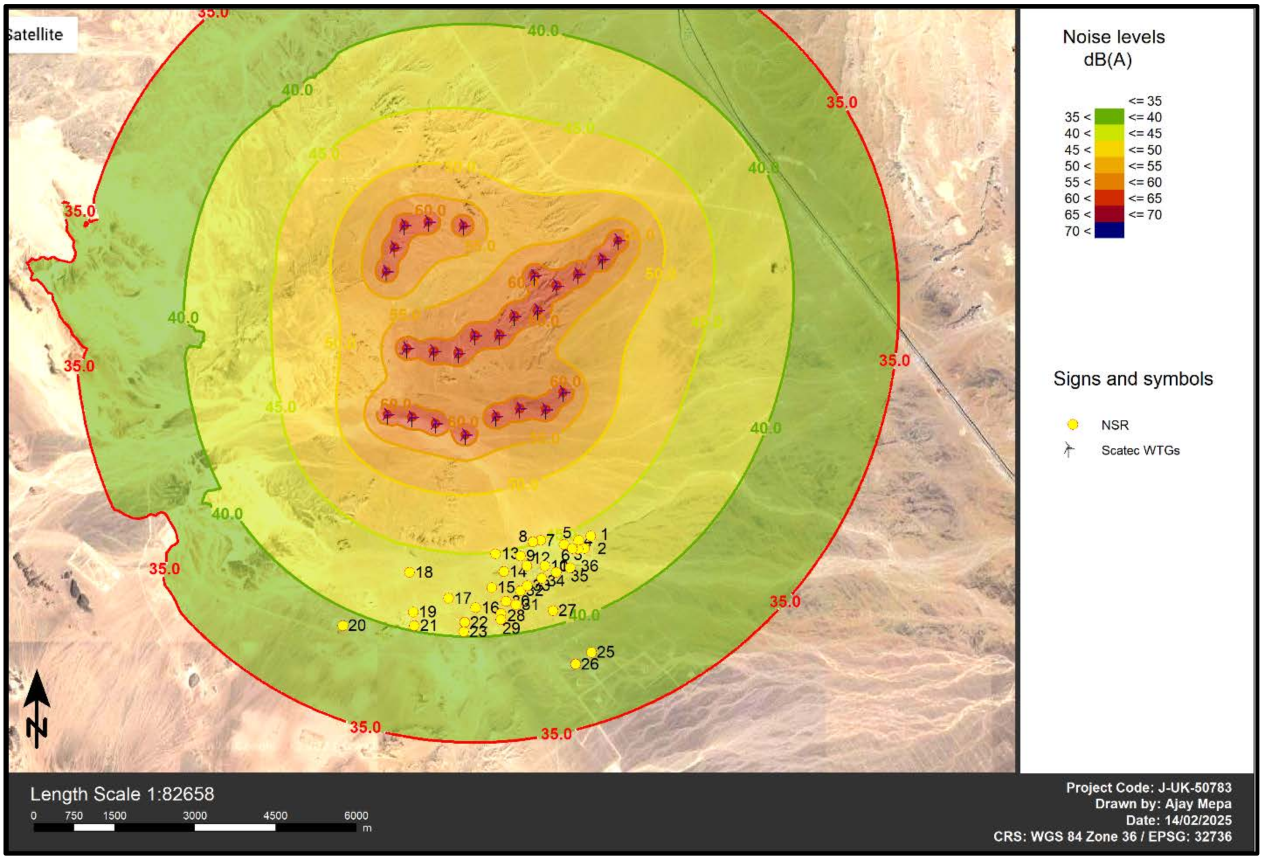


Figure 7-7: Noise Contour Map for Scatec Layout 2 - W_{10}: 10 m/s (Isolated Assessment)

Based on the results of the noise contour map and the identification of the NSRs, the table below displays the contribution noise levels at the NSR for the designated worst-case scenario for a W10 of 10 m/s for the isolated WTG assessments respectively.

Table 7-5: Predicted noise levels at NSRs from Scatec Wind Farm (Isolated) (W_{10}) – Layout 2

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10 m/s Wind Speed (W_{10}) – dB(A) - Scatec (Isolated)
NSR1	44.0
NSR2	43.5
NSR3	43.7
NSR4	44.2
NSR5	44.3
NSR6	43.9
NSR7	45.1

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10 m/s Wind Speed (W_{10}) – dB(A) - Scatec (Isolated)
NSR8	45.2
NSR9	44.4
NSR10	43.4
NSR11	43.4
NSR12	43.7
NSR13	44.9
NSR14	43.6
NSR15	42.7
NSR16	41.6
NSR17	42.1
NSR18	43.3
NSR19	41.0
NSR20	39.1
NSR21	40.3
NSR22	40.8
NSR23	40.3
NSR25	38.1
NSR26	37.8
NSR27	40.8
NSR28	41.2
NSR29	40.8
NSR30	41.8
NSR31	41.5
NSR32	42.3
NSR33	42.5
NSR34	42.8
NSR35	42.8
NSR36	42.8

The daytime and night-time background noise level has been calculated and presented in the figure below.

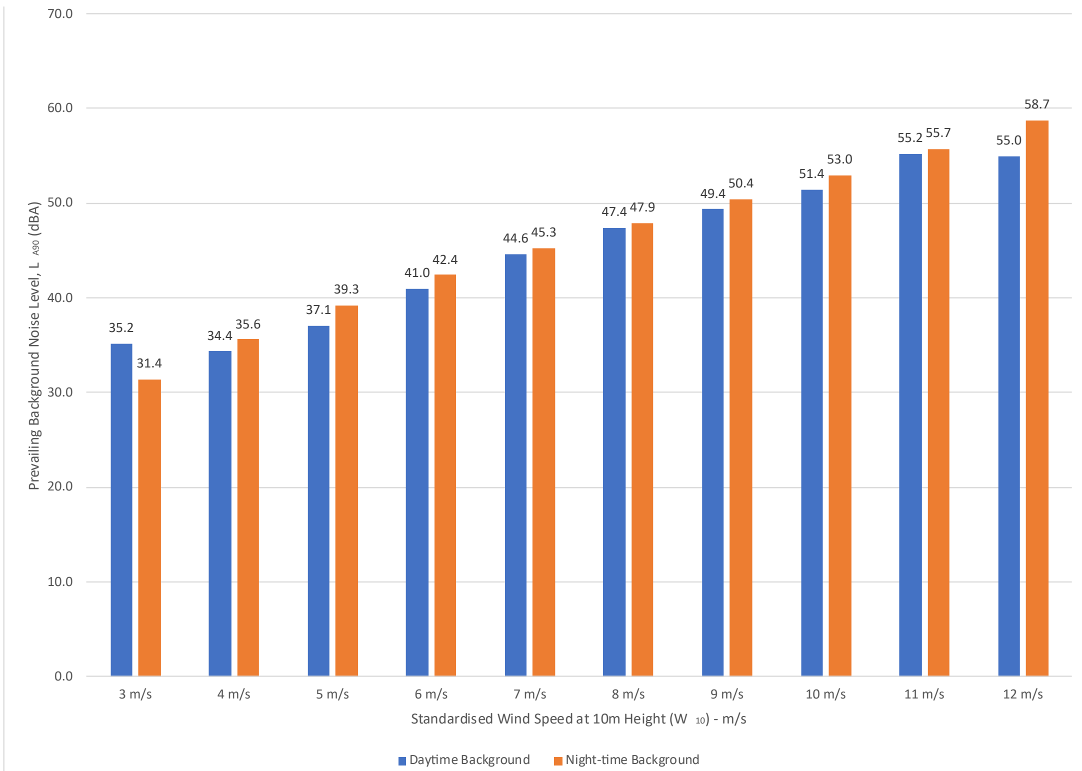


Figure 7-8: Prevailing Background Noise level according to standardized wind speed W_{10}

Based on the results of this noise study no specific mitigation or curtailment for noise is required for the Project, however, the following recommendations are made:

- Grievance mechanism will be established to follow up any noise related grievance.
- In case of grievance, 48 hours continuous noise measurements will be conducted immediately on the area where grievance is received. Based on the outcomes and results, appropriate management and mitigations measures should be determined and agreed with the griever (e.g. installation of noise insulation measures at the structure such as double glazed windows, vegetative buffers, etc.).
- Noise monitoring campaigns will be conducted annually on the first 2 years of operation phase. In the case results indicate that levels are within allowable limits and no grievances are received, no further requirements are needed. Should grievances be received, then requirements in first point apply.

Upon completion of the construction of the wind farm, during the commissioning period a detailed long-term verification noise monitoring programme should be implemented. The monitoring programme should be carefully designed with specific planning of equipment, measurement locations and periods.

7.12.2 Potential Impacts from Shadow Flicker from Wind Turbines during Operation

This section is an extract from the standalone shadow flicker assessment report (Annex IV). 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.).

There are three conditions which must be met in order for shadow flicker to occur:

- The sun must be shining without cloud cover;
- The wind turbine must be between the sun and the observer; and
- The observer must be within the shadow of the wind turbine.

The shadow length of an object is dependent on the angle of the sun, which in turn varies depending on the time of the year and time of the day. An illustration of the shadow flicker on a receptor is presented in the figure below.

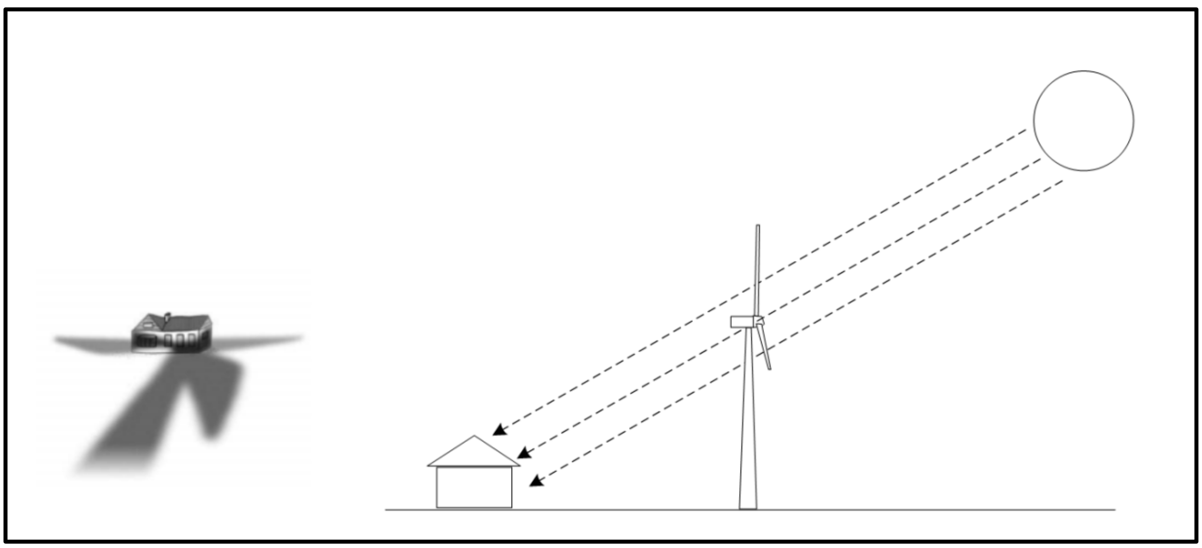


Figure 7-9: Visual Description of Shadow Flicker

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. 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.

Taking the above into account, as identified in "Section 5.2" earlier, <u>the only potential NSR would be the village of Wadi Dara </u>has been identified within the vicinity of Scatec wind farm.

Therefore, as part of the ESIA a shadow flicker assessment has been undertaken. The following main objectives have been identified as outcomes for the assessment:

- Calculation of shadow flicker occurrences for the worst-case scenario assessment with all wind turbines operating; and
- The assessment of the receptors considered in the 'impact zone' of the potential shadow effects.

The assessment was based on the following information:

- General arrangement and layout drawings of the wind farm, including topography;
- Wind Turbine supplier data – geometric sizing, rotor diameter and hub height.
- Metrological data – sun movement, sunlight phases, wind direction and % occurrence at the receptor location.

<u>Shadow Flicker Model and Calculations</u>

Shadow flicker for the Project was modelled in WindPRO Version 3.6. WindPRO is considered to be an industry standard software program for turbine calculations. The software incorporates the turbine sites and surrounds and simulates the path of the sun over the course of the year and assesses at intervals the potential shadow flicker at a given receptor (domestic dwelling).

The software gives a conservative estimate of the number of hours per year that shadows could be cast by the rotation of the turbine blades.

The sun is modelled by a single-point source of light, whereas in reality the sun is not defined by a point source and is instead a sphere. Due to the spherical shape of the sun, there are shading areas in which the sunbeams or part of the sunbeams are covered by objects.

The model further assumes clear sky during 100% of the year (which is not the case in reality). Therefore, the model produces the worst-case scenario in line with a conservative assessment methodology.

The calculation model used within WindPRO uses the following parameters define the shadow propagation angle behind the rotor disk:

- The diameter of the Sun, D: 1,390,000 km;

- The distance to the Sun, d: 150,000,000 km;
- Angle of attack: 0.531 degrees.

The following calculations and assumptions were used for WindPRO calculations:

- Calculations only when more than 20% of the sun is covered by the blade;
- Minimum sun height over the horizon of influence: 3 o ;
- Day step for calculation: 1 day;
- Time step for calculation: 1 minute;
- A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non-visible WTG do not contribute to calculated flicker values;
- A WTG will be visible if it is visible from any part of the receiver window;
- The ZVI calculation is based on the following assumptions:
  - Height contours are used
  - Eye height: 1.5m;
  - Grid Resolution: 10.0 m;
- The calculated times are "worst-case" given by the following assumptions:
  - The sun is shining continuously during the day, from sunrise to sunset;
  - The rotor plane is always perpendicular to the line from the WTG to the sun; and
  - The WTG is always operating.

The assessment was carried out for the following (shown in the figures below):

- The worst-case scenario results of the shadow flicker assessment at the identified receptors as total hours per year.
- The worst-case scenario results of the shadow flicker assessment at the identified receptors as maximum minutes per day.

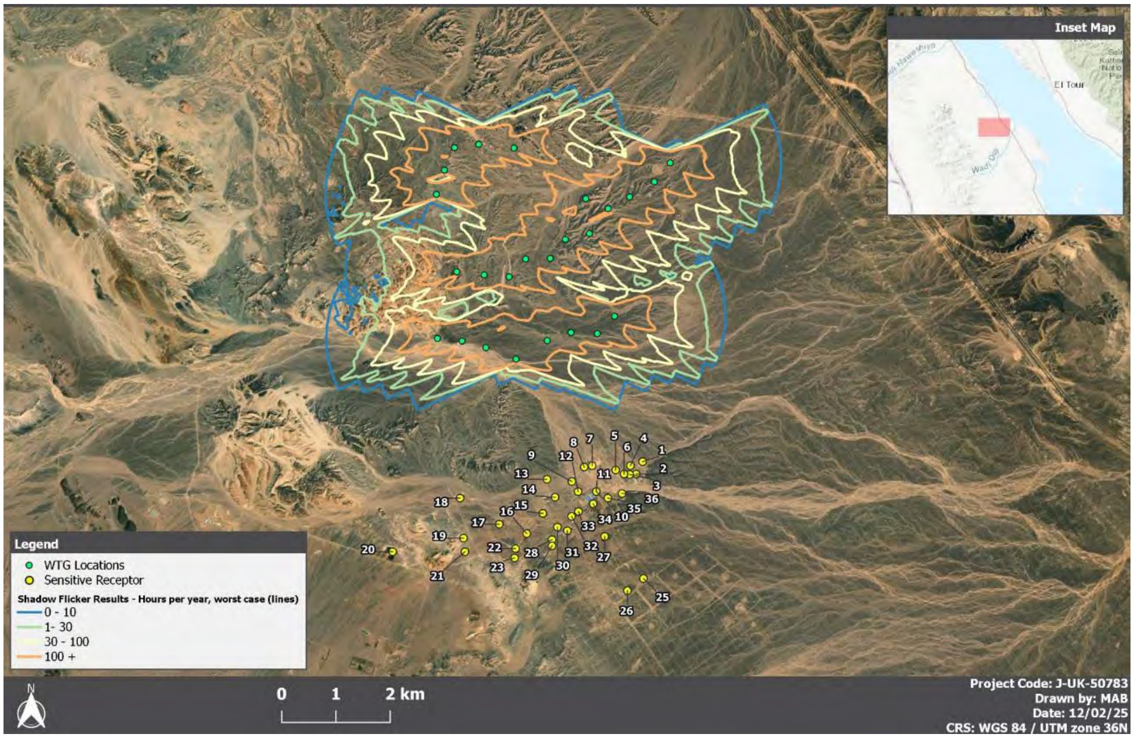


Figure 7-10: Shadow Flicker Map for Worst Case Scenario (hours per year)

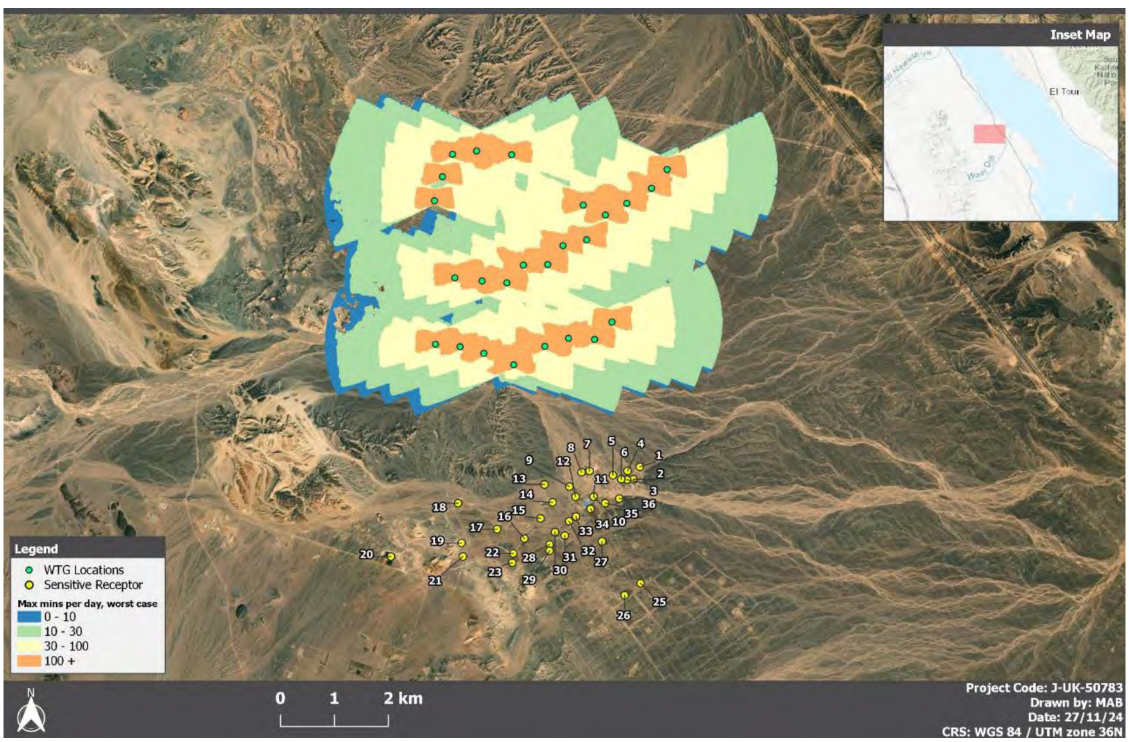


Figure 7-11: Shadow Flicker Map for Worst Case Scenario (mins per day)

Modelling Results

The calculations results presented are for the worst-case shadow flicker only as the calculation standards only predict for worst-case scenario, which represents the optimum conditions for shadow flicker to occur. The shadow flicker is quantified by whether or not the turbine is in operation and rotor position is between the sun and the receptor. In the case of these calculations all turbines are in operation.

The maximum possible duration of shadow flicker was calculated at the nearest dwellings with full time residents (sensitive receivers) and compared to the limits set by the Project standards for shadow flicker according to the following parameters:

- Accumulated exposure on residential properties should not exceed a total of 30 hours per year;
- Exposure on residential properties should not be longer than 30 minutes per day.

The comparison for the above limits is presented in the following assessment tables:

- Table 7-67-4: Shadow flicker impacts in terms of hours per year.
- Table 7-757-5: Shadow flicker impacts in terms of minutes per day.

As noted within the table below, none of receptors are impacted by shadow flicker. In fact, the entire Wadi Dara village is outside of the shadow flicker limits from the turbines.

Table 7-6: Assessment of shadow flicker for 'hours per year' limitation

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

Table 7-7: Assessment of shadow flicker for 'minutes per day' limitation

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM minutes per day]	Limit – Minutes per day	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

The results of the prediction calculations showed that under worst-case conditions for Scatec Wind Farm Layout 2, shadow flicker does not occur over the recommended maximum of 30 days per year and/or 30 minutes per day, at any of the identified sensitive receptors.

The impacts are therefore considered of <u>long-term duration</u> throughout the Project operation phase, of a <u>negative nature</u>, and are expected to be of <u>low magnitude</u> given that shadow flicker limits were not exceeded and <u>medium sensitivity</u> given that it entails potential for nuisance and disturbing indoor environment. Given the above such an impact is considered of <u>minor significance</u>.

Taking the above into account, no mitigation, monitoring or curtailment measures are deemed necessary for either proposed layout. The following mitigation measures are recommended for both proposed layouts:

- Grievance mechanism to be established to follow up any shadow flicker related grievance.

In case limit values provided in Project Standards are exceeded due to the contribution of the Project operation, mitigation measures (e.g. improving the curtailment conditions at the receptor, limiting the operational hours of the certain WTGs for the certain hours at certain dates/seasons) to be decided with grievance holder.

7.12.3 Potential Impacts from Trespassing of Unauthorized 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 <u>long-term duration</u> throughout the Project operation phase, of a <u>negative nature</u>, and are expected to be of <u>medium magnitude</u> and <u>high sensitivity</u> 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 <u>moderate significance</u>.

<u>Mitigation Measures</u>

The following presents the mitigation measures that are to be implemented by the Project Operator during the operation phase of the Project and which include:

- A Security Risk Assessment should be developed for the Wind Farm Project and which takes into account the following:
  - Each turbine to be fitted with locked doors to prevent unauthorized access to the turbines;
  - Substation area to be completely fenced with concrete walls to prevent unauthorized access;
  - Onsite guards within the entire Project site at all times to ensure the safety and security of the Project as well as preventing unauthorized access to any of the Project components. However, it must be ensured that all onsite guards are adequately trained to deal with unauthorized trespassing incidents.
  - Post informative signs on the turbines and substation about public safety hazards and emergency contact information. Signs, especially warnings need to be pictorial as well as written to ensure they are understood by those unable to read

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to <u>*not significant.*</u>

<u>Monitoring and Reporting Requirements</u>

The following presents the mitigation measures that are to be implemented by the Project Operator during the operation phase of the Project and which include:

- Submission of Security Risk Assessment

7.12.4 Potential Impacts from Worker Influx during Construction

During construction the Project a relatively significant number of workers will be expected onsite (around 600 workers) for duration of approximately 24 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.

Inappropriate Code of Conduct

Other risks from worker influx include inappropriate code of conduct by workers towards local communities which might result in hostilities and resentment. Such inappropriate conduct could include also disrespecting the traditional culture and social norms of the area and local communities.

Increase in Social Vices

Population influx could result in an increase of social vices including alcoholism, drug abuse, and other.

Such impacts are considered of short-term duration during the construction phase, of a negative nature, and are expected to be of medium magnitude and medium sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

The EPC Contractor is expected to prepare a worker influx plan to be implemented for the construction phase of the Project. The plan must take into account the following:

- Medical examination program. All workers must be subject to a preliminary medical examination before commencement of any job tasks in accordance with local applicable requirements. In addition, routine medical examination for workers (bi-annually) must be undertaken. Such medical examinations must be undertaken at certified centers. Copies of medical examination results of all workers must be retained onsite. So that the medical examination programs does not conflict with the non-discrimination principle; Testing for 'fit-to-work' is allowed, but medical test results must remain private between medical doctor and job applicant, as applicants cannot be rejected based on existing illnesses, or pregnancy in case of women applicants.
- 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 behavior 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 EPC Contractor:

- Submission of the Worker Influx Plan

7.12.5 Potential Impacts from Security Personnel

Inappropriate management of security issues and incidents by security personnel towards local communities could result in resentment, distrust and escalation of events. Such impacts are considered of short-term duration during the construction phase and long-term duration during the Project operation phase, of a negative nature, and are expected to be of medium magnitude and medium sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

The EPC Contractor and Project Operator are expected to prepare a Security Management Plan to be implemented for the construction and operation phase of the Project.

The plan must identify appropriate measures for hiring, rules of conduct, training, equipping, and monitoring of security personnel to control and manage such issues. The plan must adhere to: (i) IFC PS 4 (Community Health, Safety and Security); and (ii) EBRD PR 2 (Labor and Working Conditions), all of which identify requirements for security personnel. This includes in specific requirements to ensure security personnel are guided by the Voluntary Principles on Security and Human Rights in terms of hiring, rules of conduct, training, equipping and monitoring of such personnel. They also require reasonable inquiries that those providing security measures are not implicated in past abuses, will ensure they are trained adequately in the use of force (and firearms if applicable) and appropriate conduct towards the workers and the local community. Force should only be used when strictly necessary, and to an extent proportional to the threat.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor and Project Operator:

- Submission of the Security Management Plan

7.12.6 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, 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 such impacts are only of 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 EPC Contractor during the construction 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 EPC Contractor during the construction phase of the Project and which include:

- Inspections and visual monitoring to ensure that non-reflective finishes have been used.

7.12.7 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.

However, as discussed under "Section 5.1" earlier, the only potential receptor in this case would be Wadi Dara. Taking into account the tip height of each turbine option (100m for Envision), and taking into account the setback distance required by the IFC EHS Guideline (1.5 x turbine height) that is equivalent to 150m for the Envision.

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 buffer distance required 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.

Taking the above into account, there are no mitigation or monitoring measures to be considered.

7.13 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 Project (construction and operation) those have been identified collectively throughout this section.

During the construction and operation phases, the Project is expected to create the following job opportunities:

- Around 400 job opportunities at peak during the construction phase for a duration of approximately 24 months. This will mainly include skilled job opportunities (to include engineers, technicians, consultants, surveyors, etc.) and unskilled job opportunities (mainly laborers but will also include a number of security personnel).
- Around 25 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. However, it is understood that the socio-economic development of the area is not hinged on a single project but rather on implementing collective and coordinated actions, including other development projects and investment within the area.

Nevertheless, proper planning and local community engagement from the start is crucial to understand issues and opportunities which in turn would enable the Project build true sustainable links which will bring maximum benefits to the local communities. Given the above, such impacts are anticipated to be *positive*.

Recommendations and Required Action

As the impacts discussed are mainly positive, no mitigation measures have been identified. This section provides recommendations which aim to enhance such positive impacts anticipated from the Project throughout the construction and operation phases to the greatest extent possible.

- Local Recruitment Procedure: the EPC Contractor under supervision from the Developer should develop a Local Recruitment Procedure that must identify the number of job opportunities targeted for local communities to include skilled and unskilled workers. Such job opportunities shall also take into account employment of local communities in the area around the project to include fresh graduate engineers, technicians, labourers, etc. In addition, the procedure must include details on how job opportunities will be announced as well as a selection process that is fair and transparent and provides equal opportunities for all including females. The Procedure should investigate the potential for implementation through a joint collaboration between the Developer/EPC Contractor and the other wind farm developers in the area. Prioritising employment from the community is considered a key issue and this should be reflected in the EPC Contract and subsequent subcontracts.
- Local Procurement Procedure: the EPC Contractor under supervision from the Developer should develop a Local Procurement Procedure that must identify the procurement opportunities targeted for local communities to include for example local subcontractors, local supplies and services, cleaning services, etc. In addition, the procedure must include details on how procurement opportunities will be announced as well as a selection process that is fair and transparent and provides equal opportunities for all. The Procedure should investigate the potential for implementation through a joint collaboration between the Developer/EPC Contractor and the other wind farm developers in the area. Prioritising procurement opportunities from the community is considered a key issue and this should be reflected in the EPC Contract and subsequent subcontracts.
- Social Responsibility Program: it is recommended that the Developer implement a social responsibility program which aims to benefit the local communities to the greatest extent possible. In this case, a structured approach must be developed which must identify priority development projects which could benefit local communities (e.g., based on a needs assessment if available). Based on that the social responsibility program can prioritize projects for local communities based on available budget, vision, timeline for implementation and other factors.

7.14Assessment of Cumulative Impacts

This section provides an assessment of cumulative impacts. The table below provides the key outcomes of the cumulative impacts for each attribute and key additional requirements to be considered. The cumulative impacts discussed throughout this section below refer to the entire existing and planned wind farm developments within the Gulf of Suez (GoS) region which include:

- AMUNET 500MW Wind Farm (operation)
- RSWE 500MW Wind Farm (construction)
- RGWE 262 MW Wind Farm (operational)
- NIAT 500MW Wind Farm (planned)
- Lekela 250MW Wind Farm (operational)
- NREA Governmental Wind Farms 830 MW (operational)
- Infinity Masdar IBH 200 MW (Planned)
- Acwa-1.1 GW (Planned)

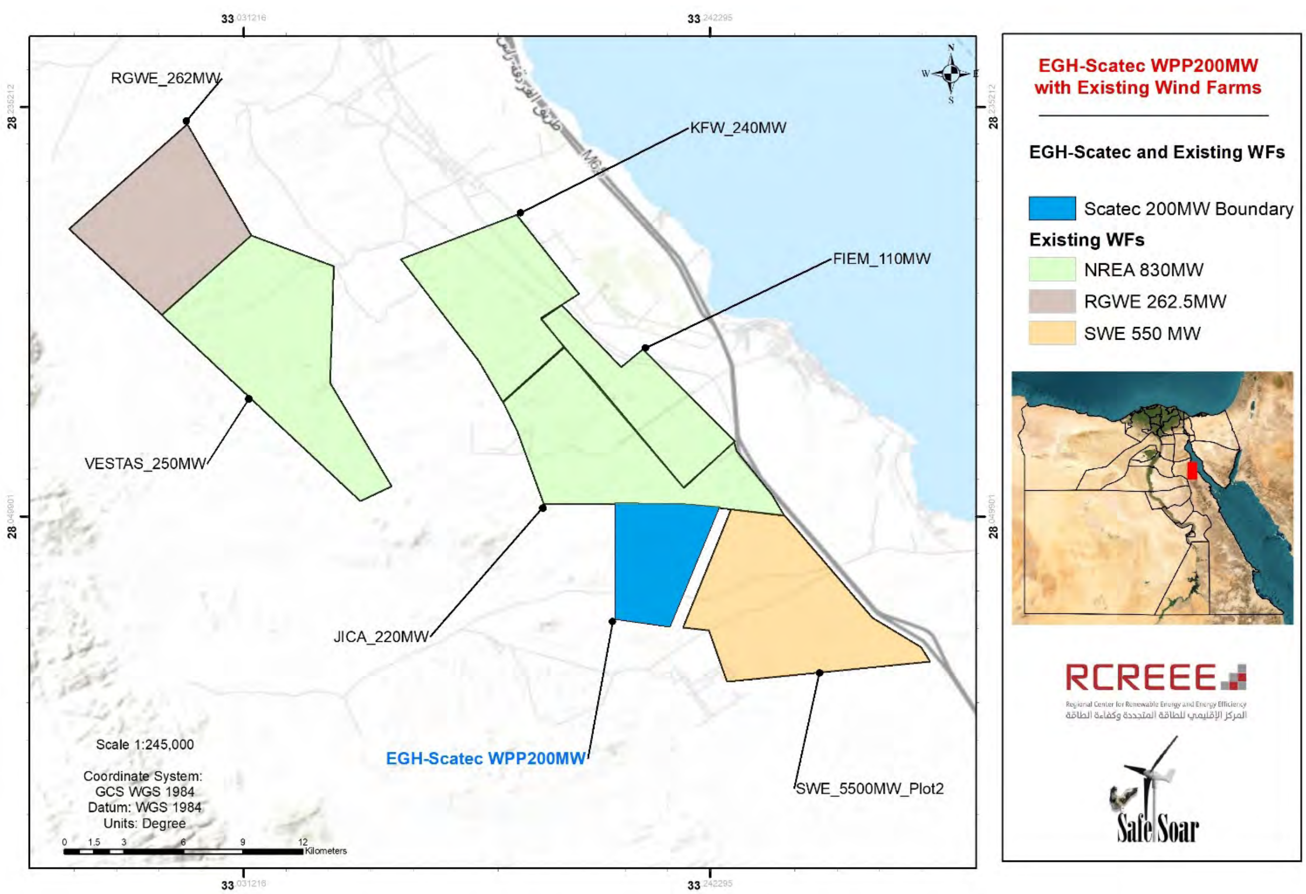


Figure 7-12: Existing and Planned Wind Farm Developments within the Gulf of Suez (GoS) Region

Table 7-8: Assessment of Cumulative Impacts

E&S Attributes	Outcome	Additional Requirements
Landscape and Visual	As discussed earlier, in general visual impacts created from the development of the Project are not considered an issue of concern mainly due area being located within an industrial area which includes petroleum facilities, military units, substations, desalination plants, wastewater treatment plants, and other for which its aesthetical value loses some importance. In addition, there are several planned, existing and under construction wind farm developments in the area so the addition of this Project will not be a significant impact to the visual and landscape characteristics of the area.	No additional requirements to be considered
Land Use	This is a site and project specific issue. For each project, a standalone land use survey is expected to be undertaken based on which proper mitigation and monitoring measures should be identified.	No further requirements.
Geology, Hydrology, Hydrogeology	This is a site and project specific issue. For each project, a standalone hydrology and hydrogeology baseline is expected to be undertaken based on which proper mitigation and monitoring measures should be identified. In addition, proper waste management measures are expected to be undertaken for each project. However, Negligible impacts on groundwater and surface water.	A minimum distance of 150 m from wind turbines to existing groundwater wells y is required..
Biodiversity	A **<u>Cumulative Effects Assessment (CEA)</u>** has been prepared for the entire Gulf of Suez (GoS) region for all the wind farms in the area. This is provided a standalone document.	
Birds (avi-fauna)		
Bats		
Archaeology and Cultural Heritage	This is a site and project specific issue. For each project, a standalone archaeology and cultural heritage survey is expected to be undertaken.	No further requirements.
Air Quality and Noise	Additional dust generation may occur during construction activities if project schedules overlap; however, it is not expected to be significant due to the absence of nearby populations or wildlife that could be affected. Cumulative noise impacts may arise during construction due to the simultaneous construction phase of the project and the operational phases of other projects in the area, followed by its own operation alongside other facilities. Cumulative impacts were assessed and results are shown below.	▪ It is necessary that all site specific mitigation measures are strictly adhered to ▪ Coordinate with nearby projects to avoid overlapping high-noise activities when possible, especially during construction phase overlaps. ▪ Notify Wadi Dara Population in advance of potential high-noise activities overlaps and expected duration. ▪ Use of Low-Noise Equipment: Prioritize the use of newer, well-maintained equipment with noise-reducing features. ▪ Limit noisy construction activities to daytime hours to reduce disturbance. ▪ Regularly maintain and service machinery to minimize excessive noise emissions. ▪ Provide ear protection for workers exposed to high noise levels.

E&S Attributes	Outcome	Additional Requirements
Infrastructure and Utilities	This is a site and project specific issue. For each project, a standalone infrastructure and utilities survey is expected to be undertaken based on which proper mitigation and monitoring measures should be identified.	Co-operation with the Rhas Gharib waste collection system is recommended, as well as mapping of local off-takers of waste for recycling purposes. Regarding construction related transport of materials from port to site, identify public safety hotspots along the route and design mitigation measures (from Ain Sokhna traffic will pass by Zaafarana, Ras Gharib, and Ras Shukeir; from Safaga traffic will pass by Hurghada and El Gouna)..
Worker Rights and General Working Conditions	General risks associated with employing local labour or subcontractors. Potential risks are limited to labour on the project site. The employment of local labour is in itself positive but potential risks may be associated with it worker rights and general working conditions.	The lender's requirements regarding labor go beyond just occupational health and safety. The developer must oversee labor issues at the contractor and subcontractor level, given the potential presence of certain vulnerable categories of workers (migrant workers and day laborers) during construction. Employment contracts, timely payment of wages and overtime, social insurance, temporary worker accommodation, worker grievance mechanism, etc. must be monitored.
Occupational Health and Safety	General risks associated to persons involved in construction, operation and decommissioning of wind farms.	Adhering to international standards of health and safety guidelines.
Public Health and Safety	All impacts are project and site-specific with the exception of noise which is discussed in further details below.	No further requirements
Socio-economics	Impacts anticipated are positive in nature related to employment and procurement. Wind farm construction will create employment.	Project specific recommendations to enhance positive impacts have been provided. Refer to "Section 7.1". These are expected to be implemented for all wind farms in the GoS region. Besides local employment, Project will also aim to maximize local supplier opportunities during the construction and operations phase.

7.14.1 Cumulative Noise Effect from All Wind Farms in the Area

This section is an extract from the standalone detailed noise assessment report (Annex III). The wind farms present in the surrounding area of the proposed Project location have the potential to increase the cumulative noise level at the identified NSRs.

Noise contour maps for the worst-case noise scenario have been calculated for cumulative assessments. The purpose of the noise contour map is to provide an overview of noise levels over a geographic area and therefore allowing a quick basic analysis of the noise propagation for identification of specific NSRs.

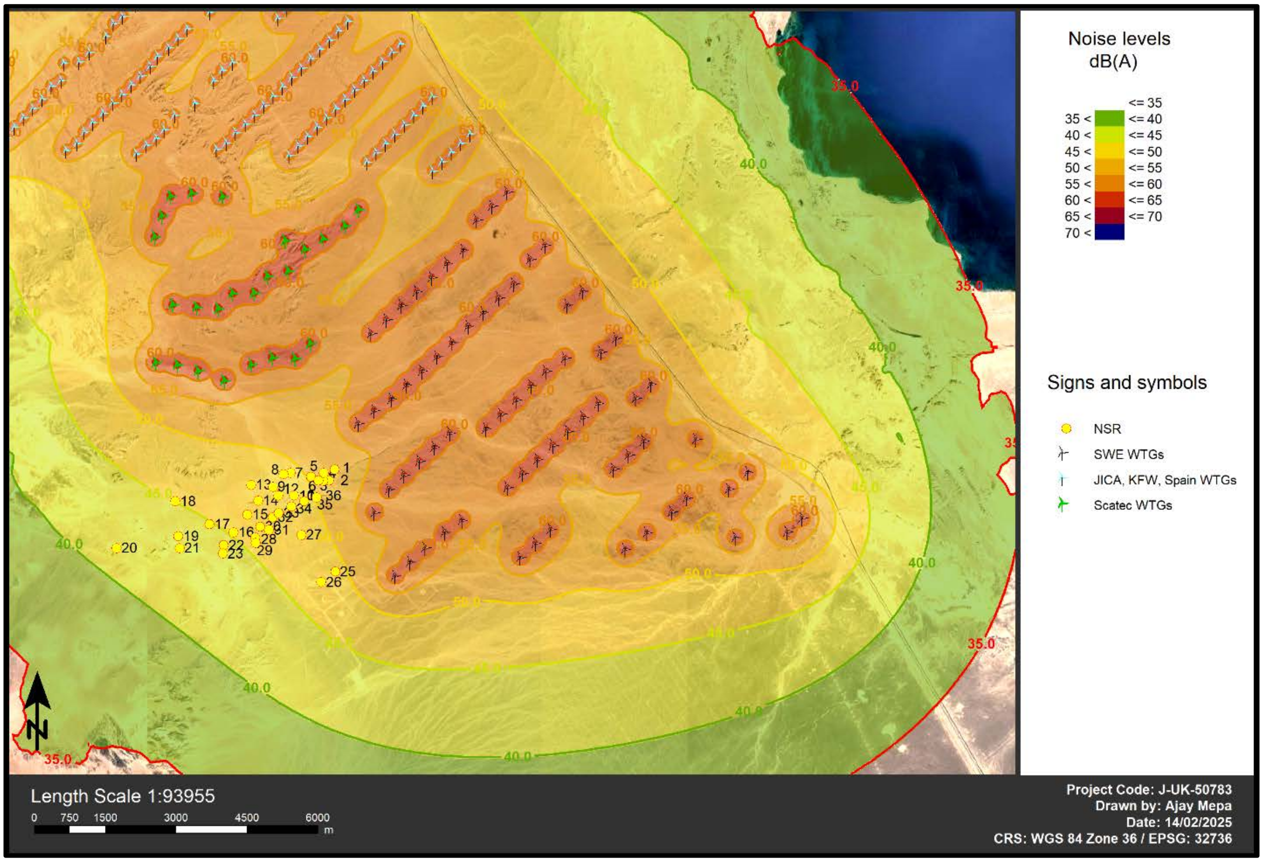


Figure 7-13: Noise Contour Map for Scatec Layout 2 - W_{10}: 10 m/s (Cumulative Assessment

Based on the results of the noise contour map and the identification of the NSRs, the table below displays the contribution noise levels at the NSR for the designated worst-case scenario for a W10 of 10 m/s for the isolated and cumulative WTG assessments respectively.

Table 7-9: Predicted noise levels at NSRs from Scatec Wind Farm (Cumulative) (W_{10}) – Layout 2

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10 m/s Wind Speed (W_{10}) – dB(A) - Scatec (Cumulative)
NSR1	52.0
NSR2	51.3
NSR3	50.9
NSR4	51.2
NSR5	50.3
NSR6	50.6
NSR7	49.4
NSR8	49.1

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10 m/s Wind Speed (W_{10}) – dB(A) - Scatec (Cumulative)
NSR9	48.3
NSR10	48.8
NSR11	48.8
NSR12	48.1
NSR13	47.7
NSR14	47.2
NSR15	46.3
NSR16	45.2
NSR17	44.8
NSR18	45.0
NSR19	43.5
NSR20	41.3
NSR21	43.0
NSR22	44.4
NSR23	44.1
NSR25	48.9
NSR26	47.4
NSR27	47.9
NSR28	45.7
NSR29	45.5
NSR30	46.3
NSR31	46.5
NSR32	47.1
NSR33	47.5
NSR34	48.3
NSR35	49.2
NSR36	50.1

For the worst-case scenario W_{10} of 10 m/s scenario for the final layout, the resulting cumulative noise levels were predicted to be below the ETSU-R-97 daytime noise limit for all NSRs. For the worst-case scenario W_{10} of 10 m/s scenario for the final layout, the resulting cumulative noise levels were predicted to be below the ETSU-R-97 night-time noise limit for all NSRs.

Based on the results of this noise study no specific mitigation or curtailment for noise is required for the Project, however, the following recommendations are made:

- Grievance mechanism will be established to follow up any noise related grievance.
- In case of grievance, 48 hours continuous noise measurements will be conducted immediately on the area where grievance is received. Based on the outcomes and results, appropriate management and mitigations measures should be determined and agreed with the griever (e.g. installation of noise insulation measures at the structure such as double glazed windows, vegetative buffers, etc.).
- Noise monitoring campaigns will be conducted annually on the first 2 years of operation phase. In the case results indicate that levels are within allowable limits and no grievances are received, no further requirements are needed. Should grievances be received, then requirements in first point apply.

Upon completion of the construction of the wind farm, during the commissioning period a detailed long-term verification noise monitoring programme should be implemented. The monitoring programme should be carefully designed with specific planning of equipment, measurement locations and periods.

7.14.2 Cumulative shadow flicker impacts from Wind Farms in the Area

This section is an extract from the standalone shadow flicker assessment report (Annex IV). Cumulative shadow flicker impacts from Scatec Wind Farm proposed layouts and the nearby SWE Wind Farm were considered. Cumulative shadow flicker impact refers to the combined shadow flicker impact from multiple wind farms on specific SRs. The shadow flicker impact from one or multiple WTGs at one wind farm could be combined with additional shadow flicker impact from one or multiple WTGs at another wind farm, and therefore increase the total shadow flicker exposure at a particular SR.

Figure 7-14**7-15** shows the limit of shadow flicker extent from the Scatec Wind Farm Layout and SWE Wind Farms. It is demonstrated that shadow flicker impacts between the two wind farms do not overlap at any of the identified receptors.

It can be concluded that no further action is necessary regarding cumulative shadow flicker impact.

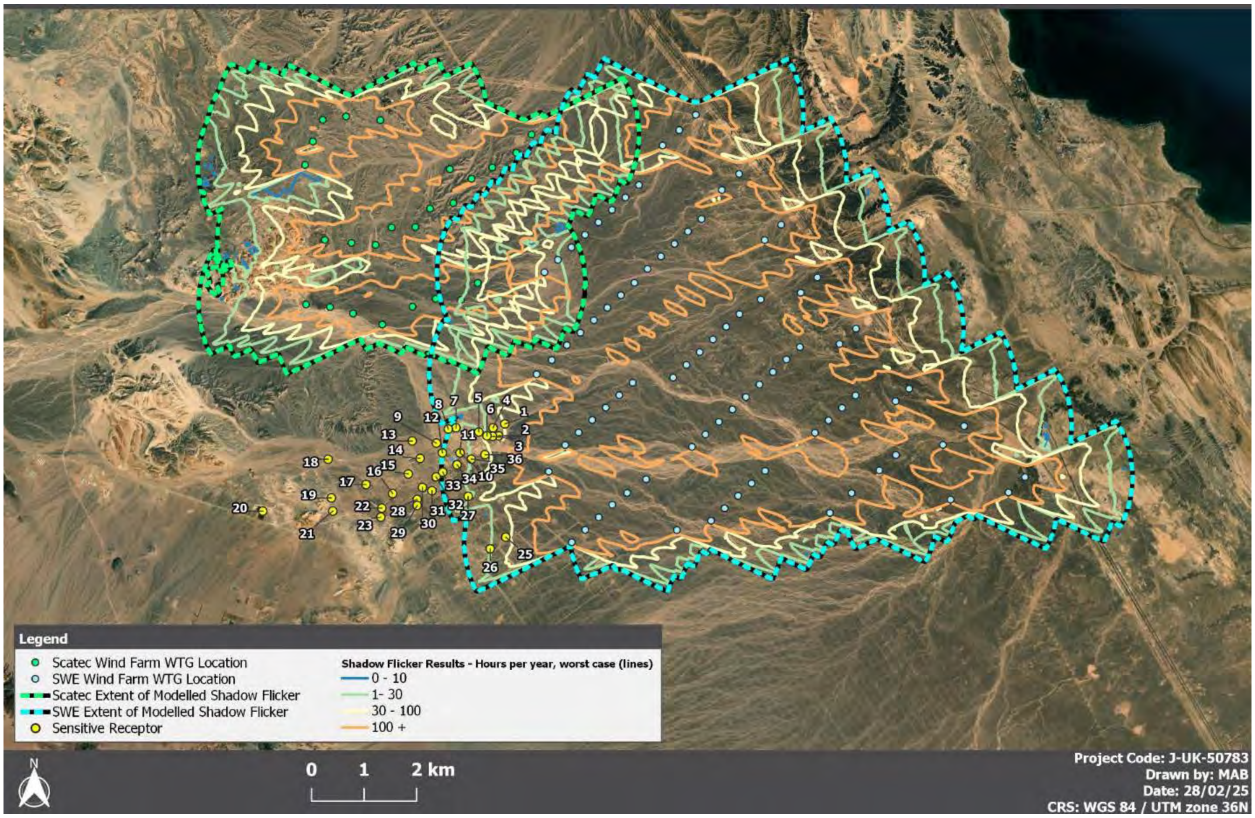


Figure 7-14: Cumulative Impact Assessment (hours per year)

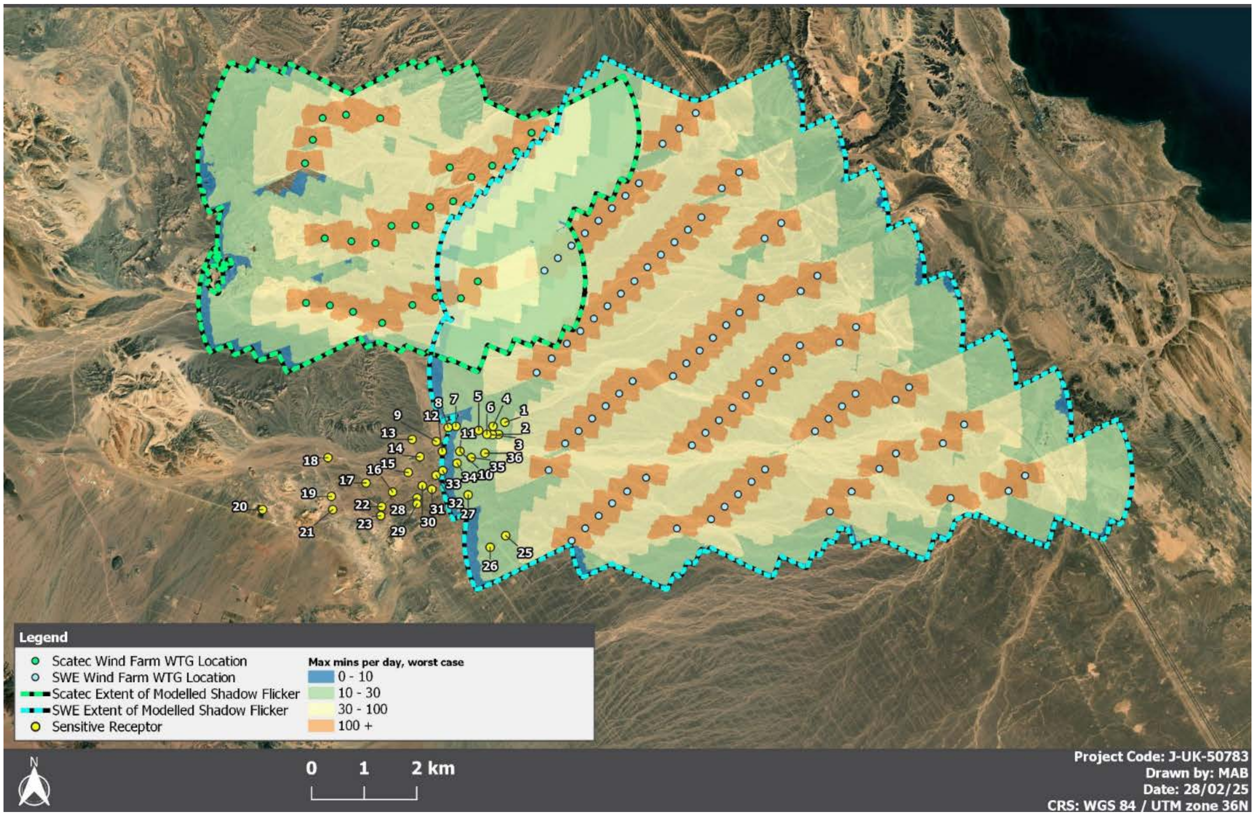


Figure 7-15: Cumulative Impact Assessment (mins per year)

The results of the prediction calculations showed that under worst-case conditions shadow flicker does not occur over the recommended maximum of 30 days per year and/or 30 minutes per day, at any of the identified sensitive receptors. Taking the above into account, no curtailment measures are deemed necessary for either proposed layout.

The following mitigation measures are recommended for both proposed layouts:

- Grievance mechanism to be established to follow up any shadow flicker related grievance.

In case limit values provided in Project Standards are exceeded due to the contribution of the Project operation, mitigation measures (e.g. improving the curtailment conditions at the receptor, limiting the operational hours of the certain WTGs for the certain hours at certain dates/seasons) to be decided with grievance holder.

8 Environmental & Social Management System (ESMS)

The two main pillars for a successful environmental and social performance of a project of this nature (i.e. compliance with national and international environmental and social standards) are:

1. ESMS (Environmental and Social Management System) – Throughout the Project's construction and operation phase an ESMS must be implemented by all relevant parties (i.e., Developer, EPC Contractor and Project Operator). The ESMS must be project and site specific. The development and implementation of an ESMS is considered a key requirement under lenders requirements. The ESMS provides an umbrella set of documents and procedures governing E&S management of the entire project, specifying: relevant E&S policies; code of conduct; interface with contractors (roles & responsibilities; procedures, meeting protocol); organizational structure; capacity and staffing requirements (numbers and necessary skill sets/ experience); Stakeholder engagement; training requirements; reference to both grievance mechanisms, monitoring & evaluation, reporting, available budget, etc. Its function is to outline the basic principles for effective and efficient control of the process.
2. ESMP (Environmental and Social Management Plan) – which is an element of the ESMS and specifically includes a compilation of stand-alone, site specific/project specific management plans which translates the generic management system into practical, day-today management plans.

8.1 Environmental, Social Management System (ESMS)

8.1.1 Environment, Health, and safety (EHS) Manual

To guide the development of the ESMS, an Environment, Health, and safety (EHS) Manual was developed as a ESMS Framework. The manual describes the structure and content of the ESMS and of all its elements, including the ESMP for both the construction and operational phase of the project. The EHS manual includes information about :

- ESMS Policies including ESHS, HR, project lifecycle management, labor policies and environmental and sustainability policies.
- Legal and policy framework for implementation of ESMS
- the key procedures and ESMP plans and plan frameworks to be developed at a later stage that will handle the key impacts and risks during construction and operation. Additional details on the requirements of such plans and the overall framework in the ESHS manual.
- ESHS Meetings, Training, Inspection and Monitoring Requirements
- Contractor and Subcontractor ESHS Management
- Institutional framework to ensure that such procedures and measures are implemented effectively and efficiently. This includes identification of roles and responsibilities, training requirements, monitoring and reporting requirements, and other as applicable;

- Identification of a high-level framework for labour management that should be adhered to during the construction and operation phase.
- Management of Change

approach for periodic audits during the construction and operation phase to ensure all ~~EHSS~~ ESHS requirements are implemented effectively;

A summary of these is described in the sections below. More details can be found in the ESHS manual.

8.1.2 ESHS Management Structure

To ensure proper implementation of the ESMS, lenders' requirements specify certain requirements relating to the organization's capacity to ensure dedication to complying with environmental, social, health, safety, and labor standards. Specific personnel, including management representatives, will be appointed with defined responsibilities to oversee and enforce the ESMS. Environmental and social duties will be clearly assigned and communicated to relevant team members. To maintain effective and ongoing environmental and social performance, the client will allocate the necessary human and financial resources.

Different entities are involved in the construction and operation phase of the project. Responsibilities of each entity are listed in the text below along with a general description of their roles.

Scatec Egypt Green Hydrogen (EGH): The owner and developer of the Project (hereafter referred to as 'the Developer') and are responsible for management of the Wind Farm and overall responsibility of the Project's EHS performance during the construction phase. And supervision over EPC.; The developer will assign a E&S and H&S supervision engineer who will oversee the construction activities including all HSE

- Engineering, Procurement, and Construction (EPC) Contractor: will be responsible for preparing the detailed design and layout of the Project; supply of the material and equipment (e.g., wind turbines); construction of the Project and its various components (turbines, internal roads, building infrastructure, and, etc.). The EPC Contractor for this Project has not been assigned yet but will have at least one HSE manager and an HSE officer ;
- Project Operator: responsible for Operation and Maintenance (O&M) of the Project and will be responsible for ensuring EHS performance aspects are adhered to. The Project Operator has not been assigned at this stage
- Egyptian Electricity Transmission Company (EETC): will be the off taker of electricity and is the entity that signed the Power Purchase Agreement (PPA) with the Developer. In addition, they will also be responsible for designing, building and operating the associated interconnection facilities. This will include the Overhead Transmission Line (OHTL) that will connect from the Project site to the existing national grid.
- National Renewable Energy Authority (NREA): is entity responsible for allocation of the land for the development of the Project;

- International Financing Institutions (IFIs): entities that will provide financing to the Developer for the development of the Project. Such IFIs will ensure that the Project is developed in accordance with GIIP E&S requirements. At this stage, the IFI will include EBRD as well as British International Investment (BII), European Investment Bank (EIB), U.S. International Development Finance Corporation (DFC) and the Deutsche Investitions und Entwicklungsgesellschaft (DEG);
- Independent Environmental and Social Consultant (IESC): is engaged by and on behalf of the IFIs to ensure that the Project is being developed in accordance with their E&S requirements.
- Egyptian Environmental Affairs Agency (EEAA): the official governmental entity responsible for protection of the environment in Egypt. The EEAA is responsible for approval of the Environmental and Social Impact Assessment (ESIA) and making sure it complies with the "Environmental Protection Law No. 4 of 1994" and granting the environmental clearance for the Project;

8.1.3 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 ESMS components.

The table below identifies the **roles and responsibilities of the main entities involved in the ESMS implementation**.

Table 8-1: Roles and Responsibilities of Entities Involved in ESMS implementation

Project Role	Entity	Responsibilities	Staffing Requirements
Project Owner and Developer	Egypt Green Hydrogen SAE (EGH)	▪ Selection of EPC Contractor and Project Operator; ▪ Implement mitigation and monitoring requirements as applicable for such entity as detailed in the ESMP; and ▪ Ensure overall compliance of EPC Contractor and Project Operator with the requirements of the ESMP and ESMS.	▪ Construction Manager ▪ HSSE Manager or as part of Third-Party Employer representative (e.g. Owner's Engineer) ▪ Community Liaison Officer (CLO) ▪ HR Manager
EPC Contractor	TBD	▪ Appoint a competent ESHS team. ▪ Implement mitigation and monitoring requirements as detailed in the ESMP and ESMS requirements;	For Project nature and duration, this is expected to include at a minimum full-time and onsite HSE Manager and one HSE officer is to be deployed for 50 workers.
Project Operator	TBD	▪ Appoint a competent HSE team. ▪ Implement mitigation and monitoring requirements as detailed in the ESMP and ESMS requirements;	For Project nature and duration, this is expected to include HSE Manager (which is required to be full-time onsite at all times).

The specific staffing during the respective construction and operation phase for each of the entities is described in Sections 8.1.4.1 and 8.1.4.2 below. More information is available in the Environment, Health, and safety (EHS) Manual that is part of the ESMS (as discussed in further details below). This includes an organisational structure that identifies the lines of authority and roles and responsibilities of all involved entities.

8.1.3.1 Staffing During Construction Phase

1. Construction Manager – EGH

- Overall monitoring of ESHS performance of the Project and defines feasible and sustainable actions to enhance it
- Ensures the availability of required resources to properly implement the EHSS plans and requirements
- Promotes leadership in ESHS and implement ESHS improvement initiatives
- Provides the means to control the ESHS risks on all activities of the Projects
- Enhances the ESHS compliance culture through exemplarity and commitment
- Chairs monthly ESHS Committee meetings
- Guarantees that all employees under his/her authority and responsibility are medically fit, trained, accredited, equipped and competent to perform their work
- Ensures the consistent enforcement and implementation of all programs, policies and procedures
- Ensures that EPC Contractor and subcontractors meet ESHS requirements of the Project
- Ensures effective coordination among all roles (ESHS Manager, CLO, HR Manager, and EPC Contractor)
- Oversees the overall procurement supervision to ensure alignment with ESHS requirements and project policies
- Ensures that supply chain risks are identified, assessed, and mitigated in collaboration with the ESHS Manager and HR Manager

2. ESHS Manager – EGH

- Supports Construction Manager in steering and implementing the ESHS management of Project
- Focal Point for all Environmental, Social, Health and Safety (ESHS) and social issues
- Maintains and updates ESHS rules, regulations and guidelines, local/international requirements as applicable to the project
- Advises on legislative changes concerning ESHS which may affect the Project
- Develop, maintains & monitors the ESHS plans
- Reviews and approves all EPC Contractor and subcontractors' ESHS plans as required
- Ensures the implementation and verification of corrective and preventive actions

- Supports the management in the promotion and improvement of ESHS awareness
- Assists in the investigation of any accident / near miss and compiles the necessary reports
- Communicates with EPC Contractor and subcontractors and advises on their ESHS matters
- Coordinates between the CLO, HR Manager, and EPC Contractor's ESHS Manager to align on ESHS objectives
- Guides the EPC Contractor's ESHS Manager to ensure compliance with project-wide ESHS requirements.
- Participates to all ESHS meetings
- Supports the EPC Contractor and subcontractors' managers in identifying and assessing the ESHS risks of their activities, as well as in defining mitigation measures to control these risks
- Plans, organizes, participates and conducts ESHS audits
- Keeps all records as required
- Collaborates with the Construction Manager to evaluate suppliers and contractors for compliance with ESHS standards and policies
- Monitors supply chain practices to ensure adherence to applicable ESHS requirements, particularly regarding hazardous materials, waste management, and worker safety
- To oversee and manage Project compliance with relevant national E&S legislation and international Lender E&S standards
- To oversee and lead the entire team related to these tasks

3. Community Liaison Officer (CLO) – EGH

- Monitors and maintains a positive profile of the project with the community and required stakeholders
- Manages day to day interaction with all stakeholders during the construction and operation phase as indicated within the project Stakeholder Engagement Plan (SEP) including (but not limited to) local community members and others
- Implements and manages stakeholder grievance mechanism
- Implements, monitors and reports on the implementation of community support initiatives
- Coordinates with the ESHS Manager on community safety concerns
- Collaborates with the HR Manager to manage workforce-related grievances linked to community issues
- Collaborate with the HR manager and ESHS staff on compliance with national and lender's labour laws and working conditions standards.
- Responsible for overseeing the Project's worker grievance mechanism and for liaising with the entire construction workforce (of the developer, EPC and sub-contractors).

4. HR Manager – EGH

- Overall responsibility for implementation of HR, employment and labor management principles and requirements for EGH staff
- Undertakes and follows up on HR and labor management audit during construction and operation to ensure EPC Contractor compliance with the relevant requirements
- Aligns with the ESHS Manager on worker safety and welfare initiatives
- Coordinates with the CLO on workforce grievances involving local communities
- Collaborates with the Construction Manager and EPC Contractor to ensure labor practices in the supply chain comply with local laws, international labor standards, and project policies
- Collaborate with the CLO and ESHS staff on compliance with national and lender's labour laws and working conditions standards.

5. Owner's Engineer (OE)

EGH will appoint an Owner's Engineer (OE) for the project with the objective of ensuring that the EPC Contractor is adhering to the technical project specifications.

OE team will include an ESHS officer whom will be mainly responsible for supporting the EGH ESHS Manager in undertaking and fulfilling his roles and responsibilities as identified earlier.

6. EPC Contractor Requirements

The EPC Contractor will each be required to assign a full-time and suitably qualified onsite ESHS Manager that will be responsible for undertaking the following responsibilities:

- Should have basic knowledge of and experience in compliance with relevant national E&S legislation and international Lender E&S requirements during construction of large-scale infrastructure projects
- Overall responsibility for development and implementation of EPC Contractor ESHS Management System requirements
- Ensures the availability of required resources to properly implement the ESHS plans and requirements
- Provides ESHS reporting requirements as relevant
- Provides ESHS training requirements as relevant
- Undertakes ESHS inspection and monitoring requirements as relevant
- Organizes and participates in ESHS meetings
- Reports on ESHS incidents
- Ensures that all subcontractors nominate sufficient ESHS officers for the overall implementation of ESHS plans and requirements as applicable
- Reports to and works under the guidance of the ESHS Manager to ensure ESHS compliance
- Engages with the CLO and HR Manager on community and workforce-related safety concerns

- Ensures all suppliers and subcontractors comply with the project's ESHS requirements, including procurement policies and supply chain risk management
- Implements a system to monitor and report on supply chain compliance
- Collaborates with EGH's ESHS Manager and HR Manager to address supply chain issues and align on corrective actions (if needed)

The ESHS Manager should be supported by 2-3 (depending on construction schedule) full-time and suitably qualified onsite ESHS Officers.

7. Other Project Personnel

- Cooperate with, and constructively participates in the ESHS plans
- Comply with Project ESHS requirements that apply to an individual's work
- Work within competencies held
- Adhere to procedures to protect safety, the safety of your fellow employees, and the safety of the general public
- Encouraged to communicate and cooperate with the ESHS Manager, CLO, and HR Manager to ensure adherence to ESHS standards
- Proactively involved in the ESHS program; this involvement may include some aspects of planning, problem solving, priority setting, training, and improving site specific work practices
- Do not misuse or damage any equipment
- Adhere to procurement and supply chain policies as relevant to individual roles

8.1.3.2 Staffing During Operation Phase

1. Operation Manager – EGH

- Similar to *Construction Manager* but for operation phase

2. ESHS Manager – EGH

- Similar to *ESHS Manager in 8.1.3.1* but for operation phase

Community Liaison Officer (CLO) – EGH

- Similar to Section *8.1.3.1* but for operation phase

3. HR Manager – EGH

- Similar to Section *8.1.3.1* but for operation phase

4. O&M Contractor – TBD

- The O&M Contractor will be required to assign an onsite, full-time and suitably qualified ESHS Manager. Roles and responsibilities will be similar to those identified in Section *8.1.3.1* but for operation phase.
- The O&M Contractor will be required to assign a dedicated ornithologist to ensure the effective implementation of biodiversity mitigation measures with particular focus on migration seasons.

5. Other Project Personnel

- Similar to Section *8.1.3.1* but for operation phase

8.1.4 Training and Awareness

A training plan on ESHS and General Working Conditions and worker induction training on ESHS and General Working Conditions must be developed and maintained onsite which identifies the type of training that is required for each worker onsite. The plan will ensure that each worker is competent in relation to the tasks to be performed. In addition, signed attendance sheets and training material must be maintained onsite at all times. This should be completed by the EPC Contractor and Project Operator as applicable.

Training should include the following as applicable and as highlighted in the table that follows.

- Basic visitor ESHS induction training
- Worker ESHS induction training for all workers onsite to include for example EPC Contractor and subcontractor crew
- Emergency response training for all workers onsite to include for example EPC Contractor and subcontractor crew
- Specialized training: there are other specific training requirements that must be adhered to and which are related to specific topics as applicable. This includes for example specific training for Occupational Health and Safety (OHS) issues such as working at height, electrical works, etc.
- Tool Box Talks (TBT): regular TBT meetings must be undertaken with for example EPC Contractors respective crews and subcontractor crew. Topics and frequency are developed and distributed regularly.

Table 8-2: Training Elements

Training	EPC Contractor	Project Operator
Basic visitor HSE induction training	✓	✓
worker induction training on EHS and General Working Conditions.	✓	✓
Emergency response training	✓	✓
Specialized training	✓	✓

Tool Box Talks (TBT)	✓	✓

8.1.5 Inspection and Monitoring

ESHS inspection and monitoring must be undertaken to ensure compliance of involved entities with the mitigation and monitoring requirements as detailed in the ESMP and ESMS requirements. This should be completed by the Developer, EPC Contractor, and Project Operator as applicable.

Inspection and monitoring should include the following as applicable and as highlighted in the table that follows.

- Daily ESHS 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 ESMS. Monthly inspection and monitoring of General Working Conditions
- HSE Audits to be undertaken by Developer on EPC Contractor to ensure compliance with ESMP requirement and ESMS. HSE audits should be undertaken monthly during the construction phase and quarterly during the operation phase.

Table 8-3: Elements for Inspection and Monitoring

Inspection and Monitoring	Developer	EPC Contractor	Project Operator
Daily HSE Inspection and Monitoring		✓	
Weekly Site Inspections		✓	✓
Monthly inspection and monitoring of General Working Conditions		✓	✓
HSE Audits	✓		

8.1.6 Meetings

Regular ESHS meeting must be undertaken to discuss ESHS performance onsite, outstanding issues, key issues of concern and other as applicable. Signed attendance sheets and Minutes of Meeting (MoM) must be maintained onsite at all times. This should be completed by the Developer, EPC Contractor, and Project Operator as applicable.

Meetings should include the following as applicable and as highlighted in the table that follows.

- Weekly ESHS meetings
- Monthly meeting on ESHS / General Working Conditions.
- Quarterly management ESHS reviews

Table 8-4: Required Meetings

Meetings	Developer	EPC Contractor	Project Operator
Weekly ESHS Meetings		✓	✓
Monthly ESHS Meeting	✓	✓	✓
Quarterly Management ESHS reviews	✓	✓	✓

8.1.7 Reporting

ESHS reporting will be required to summarize the following:

- Progress in implementing the ESMP and ESMS, including 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).
- General Working Conditions - including on the 'Worker Grievance Mechanism
- Security incidents

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

Table 8-5: Reporting Requirements

Reporting	EPC Contractor	Project Operator
Reporting	Monthly	Monthly

8.2 Environmental, Social, Health and Safety Management Plan (ESMP)

The ESIA is considered a key document in assessing environmental and social risks and impacts related to the Project, as well as recommending initial mitigations measures.. One of the key outputs of the ESIA is a preliminary ESMP that lists all necessary E&S management plans (a compilation of stand-alone documents) to be prepared by the Developer and to be approved by the IFIs financing the Project..

8.2.1 EHS Management during Planning Phase

During the planning phase, the developer developed/is responsible for developing a number of documents, namely:

- ESHS manual
- Labor Management Plan' for the Construction phase.;
- ESHS Training, Monitoring and Reporting Plan
- ESHS plans and documents that have been prepared and are to be implemented by ~~Scatec~~EGH, including:
  - Stakeholder Engagement Plan (SEP);
  - Community Grievance Mechanism
  - Active Turbine Management Plan (ATMP)
  - Environmental and Social Impact Assessment (ESIA
  - Cumulative Effects Assessment (CEA):
  - Critical Habitat Assessment (CHA
  - Biodiversity Management Plan (BMP) / Biodiversity Action Plan (BAP)
  - Gender and Human Rights Risk Assessment Report
  - Detailed Noise Assessment Report
  - Detailed Shadow Flicker Assessment Report
  - Detailed Flood Risk Assessment Report
  - Climate Change Risk Assessment Report
  - Mini-Strategic Environmental and Cumulative Effects Assessment
- Project-wide Grievance Mechanism in place; one for communities and one for the construction workforce – the latter one overarching the worker grievance mechanisms of the EPC Contractor and subcontractors.

8.2.2 ESHS Management during Construction

The EPC Contractor

The EPC Contractor will be the responsible party for ESHS management during the construction phase of the project. This will be done through developing and implementing a number of sub plans and procedures, prepared as standalone documents to manage key environmental and social project aspects and will include but are not limited to the following:

- Manual (in line with Developer) that should include: (i) ESHS Policy; (ii) Human Resources Policy and Procedures; (iii) ESHS Organizational Structure and Responsibilities; (iv) ESHS Training, Monitoring and Reporting Plan
- Procedure for subcontractors in place that allows for workers to issue grievances, and if unresolved, be able to escalate to the EPC Contractor and even Developer.
- Final and complete list of management plans:
  - Water Management Plan
  - Waste Management Plan
  - Air Quality and Noise Management Plan

- o Traffic and Transport Management Plan
- o Worker Influx and Accommodation Plan
- o Occupational Health and Safety Plan
- o Emergency Preparedness and Response Plan
- o Security Management Plan
- o Chance Find Procedure
- o Worker Grievance Mechanism
- o Soil Management Plan
- o Wastewater Management Plan
- o Procurement and Supply Chain Management Plan
- o Labour Management Plan

The EPC contractor will develop the above in line with the Management plan framework detailed within the ESHS manual was provided for each of the above plans

The above documents must be submitted to EGH for approval before commencement of construction activities onsite.

Subcontractors

the EPC Contractor is responsible for ensuring that all subcontractors involved in the project comply with the E&S requirements set by the Developer and EPC Contractors. Specifically, subcontractors must:

- Implement and adhere to ESHS requirements and conditions outlined in the ESHS plans and procedures provided by the EPC Contractors.
- Develop and submit relevant ESHS plans and procedures as required for their scope of work, ensuring approval from the EPC Contractors.
- Comply with all applicable local laws, regulations, and international standards, including IFC and EBRD requirements.

8.2.3 ESHS Management during Operation

The project operator will be responsible for ESHS management during the operational phase. This will include:

- ESHS Manual (in line with Developer) that should include: (i) ESHS Policy; (ii) Human Resources Policy and Procedures; (iii) ESHS Organizational Structure and Responsibilities; (iv) ESHS Training, Monitoring and Reporting Plan
- Worker Grievance Mechanism that allows for workers to issue grievances, and if unresolved, be able to escalate to the Developer.
- Final and complete list of management plans, namely:
  - Water Management Plan
  - Waste Management Plan
  - Occupational Health and Safety Plan
  - Emergency Preparedness and Response Plan
  - Worker Grievance Mechanism

The operator will develop the above in line with the Management plan framework detailed within the ESHS manual was provided for each of the above plans

The above documents must be submitted to ~~Scatec~~ EGH for approval before commencement of operation activities onsite.

9 Stakeholder Engagement and Public Consultations

This Chapter discusses in detail the stakeholder consultation and engagement activities 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.

9.1 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 EBRD and IFC 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 March/April 2022.

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: (i) locally affected communities or individuals and their formal and informal representatives, (ii) national or local government authorities, politicians, religious leaders, civil society organisations and groups with special interests, (iii) 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.

9.2 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:

- Summarize national and international legal & policy requirements for stakeholder engagement;

- Describe and identify the stakeholders affected and/or with an interest in the Project;
- Summarize 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.

9.3 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 0" below for additional details). In addition, the public consultation is required to include the following entities (refer to "Section 9.6" below for additional details):

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

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

Stakeholder engagement activities undertaken as part of the ESIA meet GIIP E&S requirements to include the relevant environmental and social requirements of IFIs to include EBRD and IFC as identified below.

  - EBRD Performance Requirements (PR) to include mainly: (i) PR 1: Assessment and Management of Environmental and Social Impacts and Issues; (ii) PR 2: Labor and Working Conditions; (iii) PR 4: Health and Safety; and (iv) PR 10: Information Disclosure and Stakeholder Engagement

- IFC requirements to include mainly: (i) Performance Standards (PS) (2012) to include PS 1: Assessment and Management of Environmental and Social Risks and Impacts; PS 2: Labor and Working Conditions; and PS 4: Community Health, Safety and Security; and (iii) EHS Guidelines to include: General EHS Guidelines (2007); EHS Guidelines for Wind Energy (2015); and EHS Guidelines for Electric Power Transmission and Distribution (2007)

9.4 Stakeholder Identification and Analysis

In order to design and engagement process with stakeholders, several stakeholder groups that may be interested and/or affected by the Project development and implementation have been identified. There are various social groups that have an interest in the Project on different levels. These may be described as:

1. People and groups who will be directly or indirectly affected by the project (such as local communities);
2. People and groups who may participate in the implementation of the project (such as investors and lenders);
3. People and groups who are not affected by the project development per se may but have a possibility to influence and make decisions on implementation of the Project (such as Ministries or regulatory agencies).

The main categories of stakeholders identified so far are listed in the table below. This document is a living document and will need to be updated and modified during Project development and as a result of its implementation with the various identified stakeholders throughout as identified below.

Vulnerable Groups

The stakeholder list also includes vulnerable groups and is defined as groups that are expected to be disproportionally affected by project impacts due to their race, color, sex, language, religion, political opinion, national or social origin, gender, ethnicity, culture, physical or mental disability, and other. Vulnerable groups are project-specific and depend on a range of issues which must be understood such as project location, socio-economic and demographic context, as well as the nature of the development and type of impacts anticipated.

The vulnerable groups within this context were identified to include:

- Women groups of the local community. Cultural norms in Egypt and within the local communities, in specific, could limit their participation in decision-making in general as well as their employment opportunities as opposed to their male counterparts.
- Disabled Groups: are considered vulnerable groups mainly due to physical disability which could limit their access to information on the Project.
- Elderly Groups: are considered vulnerable groups mainly due to age limitations which could limit their access to information on the Project.

- Casual workers and day labourers: are considered vulnerable groups mainly due to a lack of labour contracts - typically not offered to these categories - any health & safety issues, violation of worker rights, or substandard working conditions will affect these categories disproportionately.

Given the nature and location of the Project there are no additional groups considered as vulnerable that would require special consideration throughout the consultation process.

Table 9-1: 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
Residents of the nearby villages of the Project to include Wadi Dara Settlement and Ras Gharib Town which are administratively under Red Sea Governorate and Ras Ghareb City (or District). For the above, this includes the following groups within the local communities in specific: ▪ Community Members: local community members have a vested interest in the project due to mainly potential for job opportunities. In addition, local community members could be impacted by other potential negative impacts (e.g. worker influx, noise & shadow flicker, etc.). Such impacts are discussed and identified within the ESIA. ▪ Community Leaders: They are socially active members and known figureheads for local 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 subcontractors): such groups have a vested interest in the project due to mainly potential for procurement opportunities such as subcontracting works (e.g. civil works, provision of food and amenities, etc.)
Women groups within local communities, such groups have a vested interest in the project due to mainly potential for job opportunities. In addition, such groups could be impacted by other potential negative impacts (e.g. worker influx, Gender Based Violence and Harassment (GBVH), etc.) Such impacts are discussed and identified within the ESIA. Taken into consideration additional vulnerability of Bedouin women within the women's groups.
Bedouin Groups: the key Bedouin group known in the area are the Ma'aza tribe and specifically the Hammadin family of the Ma'aza tribe. Although they do not reside within the Project site, they hold customary ownership/control of the Project site and surrounding lands which is known as 'Urfi Contracts' and 'Ghafra System'. Such tribes would be helpful in providing security and protection and could also have a vested interest in employment and procurement opportunities (such as security guards, provision of raw materials, provision of food supplies and water to the workers, etc.). Taken into consideration additional vulnerability of Bedouin women within the women's groups.
Residents of Ras Shukeir that is located around 8km to the northeast of the Project site. This settlement is used by petroleum companies in the area as housing/accommodation units, offices, and also includes some petroleum facilities. No key impacts are anticipated on Ras Shukeir and they could have a vested interest in obtaining updated information on the Project in general.
The Project construction workforce - including those of (sub-) contractors, and those workers that are hired locally from local communities and construction workforce as 'casual workers' or 'day labourers'. Especially as local workers are a direct interface between the Project and the communities of Ras Ghareb, Wadi Dara, and the Bedouin.

2. Stakeholders who may Participate in Implementation of the Project
Investor/Lender: entities that will provide financing for the Project development. In particular, they have interest in ensuring that the Project is developed and implemented in accordance with their E&S requirements and standards, and will monitor the compliance of the Project against such requirements.
Workers: This includes all Project workforce to include but not limited to workers from Developer team, workers from EPC Contractor, Project Operator and any involved subcontractor(s).
3. Stakeholders who may have a possibility to influence and make decisions on implementation of the project and/or may have an interest in the Project
Central Government
The Egyptian Environmental Affairs Agency (EEAA): state body regulating environmental management. For this Project, this will include review and approval of ESIA, issuance of environmental permit, monitoring implementation of Environmental and Social Management Plan (ESMP) and compliance with other conditions, as applicable.
Egyptian Electricity Transmission Company (EETC): off-taker and entity that signed the Power Purchase Agreement (PPA) with Developer. They will also be responsible for designing, building, and operating the associated interconnection facilities (i.e. Overhead Transmission Line).
New & Renewable Energy Authority (NREA): national focal point for expanding efforts to develop renewable energy technologies to Egypt in coordination with other concerned national institutions. In addition, NREA also the entity responsible for allocation of the land for the development of the Project.
Ministry of Labor: official governmental entity responsible for setting labor policies and legislations as well as ensuring protection of labor rights and working conditions. Has a vested interest in ensuring that labor rights and proper working condition are maintained for the Project in accordance with Egyptian laws and regulations.
Ministry of Civil Aviation: Official governmental entity responsible for civil aviation management in Egypt and responsible for issuing permits for projects with specific height requirements.
Armed Forces Operations Authority: Official governmental entity responsible for military aviation management in Egypt and responsible for issuing permits for projects with specific height requirements.
Ministry of Tourism and Archeology The ministry 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.
Ministry of Interior: The Ministry is responsible for national and local security, as well as approving emergency response and firefighting plans for establishments/projects.
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 and represents the main investment activity in the Project area.
National Telecom Regulatory Authority: Responsible for overall regulation and administration of the telecommunication sector in Egypt including interface with telecommunication companies and their infrastructure elements such as broadcasting towers. Given that project could impact such infrastructure elements, approvals are required.

Telecommunication Operators: Could own and operate telecommunication infrastructure within the area. This includes mainly Orange, Etisalat and Vodafone. Given that project could impact such infrastructure elements, approvals are required.
Radio and Television Union: Responsible for overall regulation and administration of the radio and television sector in Egypt including infrastructure elements. Given that project could impact such infrastructure elements, approvals are required.
Local Governmental Agencies
Red Sea Governorate: Governorate's main role is supporting the Project in all aspects as required to include providing required permissions. They key departments of the Governorate that are related to the Project include the following: - Environmental Administration that is responsible for monitoring compliance to environmental requirements along with EEAA; - Labor Office that is responsible for overall management of the labor force in Red Sea Governorate, monitoring recruitment by development projects within the Governorate, monitor labor grievances and other; - Roads Directorate: responsible for services and development of external roads in the governorate and issuing permits for any construction work on the external roads - Public Health Directorate: provide the health services and facilities to the local districts and ensure overall local community health and safety
Ras Gharib Local City Council: main role is supporting the Project in all aspects as required to include providing required permissions. In addition, the Council is also responsible for supervision and follow-up for monitoring compliance to environmental requirements along with EEAA and Red Sea Governorate, and also has overall responsibility for solid waste management and disposal within their area of influence.
Directorate of Social Solidarity Ras Gharib: official governmental entity that acts as the overall management, organization and registration of local community associations, foundations and NGOs. They could have a vested interest in obtaining updates on employment and procurement opportunities provided by the Developer as well as any social responsibility programs.
Red Sea Water and Wastewater Company: official entity that is responsible for water and wastewater management within the Governorate. In addition, it will be the entity that will be responsible for providing the Project's requirements of water as well as disposal of wastewater.
Red Sea Governorate Antiquities Inspector Offices: Official governmental entity representing the Ministry of Antiquities within the Red Sea Governorate. They will be responsible for protection and management of archaeology and cultural heritage resources in the area as well as implementation of chance find procedures by development projects.
Non-Governmental Organizations (NGOs) and Other Organizations
NGOS are 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 international and in general NGOs are responsible for sharing information with the community. The key NGOs active within the area are summarized below.

NGOs/ CBOs	**Scope**

Orban El-Saharaa	Social Development
Association for the Conservation of the Environment in Red Sea (HEPCA)	Environmental protection
Red Sea Ecotourism	Social and cultural services
Environmental protection in the Red Sea	Environmental 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

Nature Conservation Egypt (NCE): this is considered one of the most important and key NGOs in Egypt that is involved in biodiversity protection and conservation. NCE is also the Egyptian partner of the Bird Life International. They have a vested interest in the impacts of the Project on biodiversity in general and avifauna in particular and they key mitigation and monitoring programs that will be implemented.
Education providers (in particular technical / vocational training institutes): Provides knowledge and skills required for various occupations, including renewables and solar 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.
Media (Newspaper, Television, Internet): They could disclose potential information and updates about the Project.
Regional Center for Renewable Energy and Energy Efficiency (RCREEE): 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. In addition, during the operation phase, RCREEE will be responsible in particular for the implementation of the Active Turbine Management Plan (ATMP).

9.5 Stakeholder Consultation and Engagement To-Date

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

The table below provides a summary of all stakeholders previously consulted and engaged throughout the project – primarily as part of the ESIA being conducted for the project site in April-May 2022 and currently under preparation. The consultant conducted round of consultation with various stakeholders in 2022, the results of these activities were reviewed, and a second round of consultation was conducted in October-November 2024 to provide updates on the developer's approach to the project site.

The table provides a summary of the stakeholder groups engaged and the main objective and outcome.

The objective of such consultations was to:

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

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

The table below presents summary for the outcomes of the stakeholder consultations undertaken, the table also presents the social issues and impacts discussed during the 2024 consultation updates with Ras Ghareb City Council, Wadi Dara Local Unit and Bedouin groups, which are critical to consider in the project's construction plans and HSE management.

Table 9-2: Summary of Consultations Undertaken during ESIA Process

No.	Entity	Objective	Outcomes
1	EEAA	Introduction of project and location, discuss overall methodology for ESIA, key anticipated impacts, and determine any key issues of concern and/or additional requirements to be considered as part of the study or the ESIA.	A meeting was held with **Mr. Maher Mahmoud/ Head of the Regional Branch Office of EEAA in the Red Sea Governorate**. Key points noted include the following: ▪ He explained the importance of the Project area being located within key bird migration routes and therefore this impact in particular should be thoroughly studied and analyzed. In addition, other impacts of the project on the surrounding environment in general should be studied including in particular impacts resulting from natural factors such as floods. ▪ The ESIA team discussed some of the key environmental problems in the project area, mainly problems related to the existence of poultry farms in Wadi Dara, which dispose of farm waste and carcasses in an improper manner, causing pollution. It was explained that if such practices continue, they could also have an impact on the project as they do attract birds and animals. ▪ Eng. Maher stated that the Environment Office in the Red Sea Governorate is carrying out many environmental campaigns, whether to raise awareness or monitor environmental violations, such as dumping waste by such entities above and others or hunting activities within the area. This is done in cooperation with the Department of Natural Reserves and the Environmental Department of Ras Ghareb City Council. The consultant held a meeting with **Dr. Tamer/ Head of the Natural Reserves Department in the Red Sea Governorate (October 2024)**, stressed that the Gulf of Suez area is an important area for bird migration routes in the Red Sea, which requires taking this aspect into consideration in potential impacts studies of wind farm projects in the area, so that the project does not pose any risks to bird migration routes in the area.
2	EETC		A meeting was held with the following officials**: (i) Ms. Hasnaa Mahmoud / General Manager of Environmental and Social Assessments Units; and (ii) Ms. Rasha / Environmental and Social Specialist for Electricity Projects.** They both expressed their support to the Project and highlighted the following: ▪ Clarified that EETC is a main stakeholder in energy production projects, which is in line with the Ministry of Electricity's plan to support clean energy production, and which is in line with Egypt's 2030 plan to support the preservation of the environment and energy sources. ▪ Stressed the importance of studying the cumulative impacts of energy production projects from wind farms in the Gulf of Suez area, as NREA's plan includes many projects in the area and such study should also take into account the construction of the various OHTLs for the electricity transmission.

No.	Entity	Objective	Outcomes
			▪ Pointed out the importance of continuous consultation with EETC during the various stages of the project until the completion of the ESIA study and the operational phase.
3	NREA		**Mr. Akmal Mahmoud / Environmental Studies Office.** Key points raised include: ▪ ESIA study must include the project site and the OHTL, because the electricity transmission lines are a major component of the project and have an impact on the migratory birds in the area.
4	Ministry of Tourism and Archeology	Same as 1 above but with focus on archeology and cultural heritage methodology and impacts for the ESIA and any issues of concern related to that.	A meeting was held with **Mr. Ayman Ashmawy / Head of the Egyptian Antiquities Sector at the General Authority for Antiquities.** ▪ Explained that there are no archaeological discoveries sites recorded close to the project site. ▪ Stated that a field survey for the Project site should be conducted to ensure that there are no elements within the site.
5	Nature Conservation Sector of EEAA	Same as 1 above but with focus on biodiversity, birds and bats methodology and impacts for the ESIA and any issues of concern related to that.	Two meetings were conducted with the officials from the Nature Conservation Sector of the EEAA to include: **(i) Mr. Osama Al-Gabali / Migratory Soaring Birds project; and (ii) Mr. Ayman Hamada / EEAA - Head of the Central Administration for Biodiversity.** *It is important to note that MSB Egypt is based in the Egyptian Environmental Affairs Agency (EEAA), which is incorporated within the Nature Conservation Sector (NCS) of the Egyptian Ministry of State for Environmental Affairs (MSEA). MSB Egypt is technically supported by Nature Conservation in Egypt (NCE), BirdLife in Egypt.* Key points raised include the following: ▪ Wind farms of tip height more than 100m in the Gebel El Zeit region and 120m in the Gulf of Suez region are currently not accepted by EEAA. If army permits/approvals are issued related to higher tip heights than 100m/120m those are security permits and are not permits or approvals from EEAA. ▪ Before any approval is provided by EEAA on increasing tip heights, a cumulative study should be undertaken for the entire Gebel El Zeit and GOS region that assesses the following: - Collision risk cumulatively given that with the new turbines the clearance between the ground and the rotor tip will be around 7m which is considered risky compared to other rotor diameters - Barrier effect. The aim is to study the risk on birds from flying the additional vertical distance due to the increase in tip height of turbines from 100m (or 120m) to the new tip heights.

No.	Entity	Objective	Outcomes
			- Design mitigation measures should be addressed at the cumulative level such as requiring a distance between the rows to be not less than 1km and a minimum distance between wind turbines of 2.5 – 3.5 the rotor diameter - A meeting should be undertaken with EEAA to discuss the heights with all the investors together with RCREEE and the consultants.
6	Ras Ghareb Local Council	Same as 1 above but with focus on land use, infrastructure and utilities and socio-economic methodology and impacts and any issues of concern related to that.	The consultant held number of meetings with officials of Ras Ghareb City Council to include: **(i) Mr. Hamid Ahmed / Head of the Ras Ghareb City Council; and (ii) Mr. Ahmed Abdel-Al / Director of Local Unit of Wadi Dara.** Key issues raised include the following: ▪ Officials welcomed the project and explained that wind energy projects are an important investment in Ras Ghareb ▪ Stressed that the results of all the consultation activities that were conducted for the Project should be taken into consideration, including in particular any community needs which should be considered as part of community responsibility activities by the Developer. A meeting was held with **General Mamdouh Mahmoud/ Head of the Ras Ghareb City Council, in November 2024**. During the meeting, the Head of the City Council expressed great interest in wind farm projects but highlighted some key points that may sometimes raise concerns: ▪ Coordination with the City Council: Developers must coordinate with the City Council regarding any community service projects targeting the Ras Gharib area. ▪ Commitment to Local Employment: Priority must be given to hiring local workers, with minimal reliance on non-local labor. The influx of Chinese workers in Ras Gharib has previously impacted the community, leading to increased housing and rental costs. ▪ Compliance with Environmental Standards: Contractors must adhere to environmental regulations, particularly regarding waste disposal. Some contractors currently working on a wind energy project in the area have been dumping construction waste near the road, resulting in fines that, unfortunately, have had little effect. ▪ Labor Recruitment through Official Channels: Local labor should be recruited through the City Council or the Labor Office in Ras Gharib to ensure proper registration and protection of workers' rights. ▪ Transparent Agreements with Local Workers: Agreements with local workers should be transparent, especially concerning monthly wages and contract details.

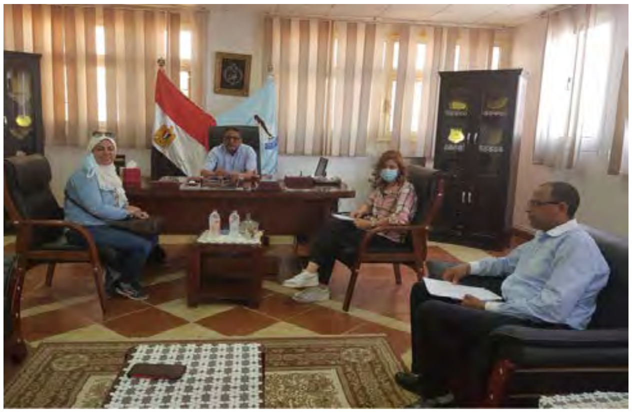
No.	Entity	Objective	Outcomes
			In addition to the meeting with the City Council Chairman, the consultant held a meeting with **Mr. Mohamed Badran, Head of the Local Unit for Wadi Dara Village (November 2024)**. During the meeting, Mr. Badran highlighted the following points: ▪ The village suffers from limited water and electricity resources. Therefore, the project should rely on its own resources to meet its needs, as the village's resources are scarce. ▪ Could the project contribute to supplying electricity to the village? This request could be considered as a solution to many of the village's challenges. ▪ Mr. Badran did not express any concerns regarding the influx of labor into the area or its impact on existing farms. However, he emphasized the importance of proper disposal of construction site waste, as the accumulation of waste on-site or near roads could pose environmental risks, particularly municipal waste generated by site workers.
7	Other key local E&S Directorates	Introduction of project and location, discuss overall methodology for ESIA, key anticipated impacts, and determine any key issues of concern and/or additional requirements to be considered as part of the study or the ESIA.	The Consultant held a meeting with Mrs. Hoda Muslim and Mr. Omar Shaker from the Directorate of Social Solidarity in Ras Ghareb. *The Directorate of Social Solidarity is the official governmental entity that acts as the overall management, organization and registration of local community associations, foundations and NGOs.* Key issues raised include the following: ▪ Stressed on the importance of giving job opportunities priority to the local communities of Ras Ghareb including in particular the youth, especially during the operation phase, as they are permanent and stable jobs. ▪ Ras Ghareb city has educational qualifications specialized in various sectors, which will help meet the project's labor needs. ▪ Indicated that the city of Ras Ghareb has experienced contracting companies due to their previous work with petroleum companies. Those should be given priority instead of contractors from outside the city. ▪ NGOs are in constant contact with community members and can participate in setting priorities in the areas of community needs to propose projects that achieve the highest benefit to the community.
8	Red Sea Water and Wastewater Company	Same as above but with focus on water supply and wastewater management for the Project area. and any	An interview was held with **Ms. Iman Mohamed / Director of the Water and Wastewater Company in Ras Ghareb.** ▪ Explained that the current project site does not conflict with any existing facilities utilized for water and sanitation.

No.	Entity	Objective	Outcomes
		issues of concern related to that.	▪ The company is able to provide the project's needs for water and sanitation services, but through licensed and approved contractors because the company does not have trucks to transport water or sanitary waste, taking into account that the project site is more than 40 km away from the city of Ras Ghareb, in addition to the fact that the project's needs for water and sanitation services are not available in the village of Wadi Dara, the village closest to the project site.
9	Ras Ghareb citizens	Same as above but with focus on land use and socio-economic methodology and impacts. Key local community representatives will be identified through the Ras Ghareb City Administration and key local NGOs in Ras Ghareb.	The Consultant conducted a **FGD with women from the local community in Ras Ghareb City in coordination with Mrs. Enas Abdel Muti, director of the Ebad Al Rahman Association NGO.** *Ebad Al Rahman Association is considered the biggest and most active local community NGO in the local community that is mainly managed by female workers. The Association was asked to nominate a number of women representatives considered most active within the local community.* The participants explained that wind energy projects have become very familiar to the community in Ras Ghareb and are supported by the community and government agencies in the city, in the hope that they will provide job opportunities and development projects in the area. The women participating in the session mainly focused on: (i) requiring that priority to such job opportunities are provided to local communities; and (ii) requiring that the Developer undertake a social responsibility program based on local community needs in Ras Ghareb and discussed the following needs: ▪ The importance of consulting with government agencies and department (such as the labor office and the educational administration) because they have data and information on community needs. ▪ Health services for the disabled as the city's health services lack specialized centers to provide health care and rehabilitation for the disabled. ▪ Establishing a technical education school to graduate qualified people to work within wind energy projects, which maximizes the future benefit of the community in training and technical qualification. ▪ The participants confirmed the importance of knowing the aims and plans which the Developer intends to implement for the residents of Ras Ghareb though their Corporate Social Responsibility (CSR) Program. ▪ Developing and establishing schools to help increase the number of operating schools that accommodate larger numbers of students. ▪ Stated that unemployment and lack of health services are among the difficulties facing individuals in Ras Ghareb. They also indicated that job opportunities are limited for women and are concentrated in the

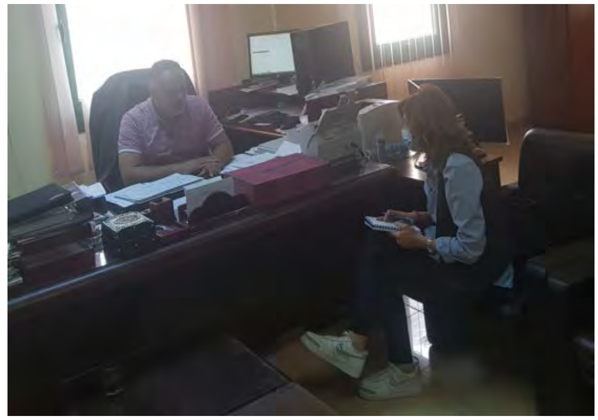
No.	Entity	Objective	Outcomes
			government sector (education / health / administrative jobs in the city council), in addition to some very limited private economic activities (clothing shops/ beauty salons/ nurseries, etc.).
			Another **FGD was planned with key local community representatives and businesses in Ras Ghareb**. The representatives were to be identified mainly by the Ras Ghareb City Administration. They hoped that investment projects as this one would help provide job opportunities for all including in particular youth which would have a direct impact on the local community. No specific concerns were raised. On the contrary, they made it clear that the Project site is a great distance from the city center, and they do not foresee any direct negative impact on the local community, whether in the construction or operation stage. Other issues raised include ▪ They do not feel a direct economic benefit from investment projects in the field of wind energy to date as they believe Developers in general do not depend on the city of Ras Ghareb for supplies and contracting work despite the availability of construction contractors and supplies. ▪ They stated that the City Council has lists of officially registered companies, local contractors, and supply companies ▪ They suggested that job opportunities can be announced through the city council as well and indicated that the city's labor office also has the available workforce according to different specializations. The consultant held a meeting and a FGDs with **Business Community (local subcontractors) in Ras Gharib (October 2024)** to introduce the project. Community members from the contracting sector raised some concerns related to the establishment of wind farms in the area: ▪ Lack of Direct Benefits: So far, we have not experienced any direct benefits from the wind farms currently under construction or those that have completed construction and entered operation. External contractors are being hired instead of local ones. ▪ Transparency in Announcing Opportunities: The process of announcing contracting opportunities during the construction phase must be transparent, as we are not informed about them in a timely manner.
			The consultant conducted FGD with youth from the local community in Ras Ghareb. The youth explained that Ras Ghareb is a small city that lacks many services, in addition to limited job opportunities. We hope that investment projects will contribute to providing job opportunities for young and reviving the local market. It will have a direct impact on the local community.

No.	Entity	Objective	Outcomes
			None of the community members objected to the project or expressed any concerns about it. On the contrary, they made it clear that the project site is a great distance from the city, in addition to the absence of any direct negative impact on the local community from the project, whether in the construction or operation phase. Some young raised the following issues: ▪ The community in Ras Gharib city does not feel a direct economic benefit from investment projects in the field of wind energy, as the project owners do not rely on Ras Gharib city for supplies and contracting works despite the availability of building and supply contractors. ▪ Young from Ghareb should be announced about job opportunities available during construction and operation. Job opportunities for individuals and companies can be announced through the city council.
10	Local Businesses in Wadi Dara	Same as above but with focus on socio-economic methodology and impacts. Key Local businesses will be identified from the Ras Ghareb city council database.	Several meetings were undertaken to include: (i) owners of poultry farms; (ii) owners of livestock farms; and (iii) head of the Agricultural Association in the village of Wadi Dara. Key points raised include the following: ▪ Wadi Dara is located on the southern east border of the project site. There are permanent and non-permanent residents in the area. The village has around 100/150 permanent residents that house mostly men attending to these businesses and lands as well as five families living in Wadi Dara (which are the only families living in Wadi Dara), with an average size of 4 members. The village is highly dependent on the city of Ras Ghareb for public services, especially in regards to its medical services. ▪ People in Wadi Dara suffer from a lack of basic services and utilities, especially electricity and water. They rely on generators with diesel for electricity as well as water trucks from Ras Ghareb. These are some of the important factors in the poor economic development of the village. ▪ Interviewees do not have any negative attitudes towards wind energy projects and no key issues of concern were raised ▪ Interviewees hoped that the presence of investments in wind farms in the area will help provide electricity to the village of Wadi Dara. However, it was explained to them by the Consultant that the project has an obligation under the signed PPA to sell electricity to the government. Therefore, the residents of Wadi Dara could benefit indirectly from this, if later electricity transmission is expanded to Wadi Dara. However, they could be other benefits such as employment.

No.	Entity	Objective	Outcomes
11	Bedouins residing near the project area	Same as above but with focus on land use and socio-economic methodology and impacts. Consultations will be undertaken with head of tribal leader.	A FGDs was undertaken with the Bedouins in Ras Ghareb and other nomadic Bedouin families who live in the areas surrounding the Project site near the mountain. They explained the complex systems and rules between the Bedouin tribes that can be summarized as follows: There are several Bedouin tribes in Ras Ghareb. These tribes settle in separate areas of the Red Sea Governorate and the Governorates of Upper Egypt. Families from the three tribes that are the Ma'aza, Bashareya, and Ababdeh tribes are settled in Ras Ghareb, Zafarana and Wadi Dara. However, the Ma'azah tribe is the most numerous of the tribes in the Project area. The Ma'azah is divided into three families, which are: The Hammadin, Tababna and Khoshman families. Some of the three families are sedentary, and live deep in the desert, far from the city and villages like the Khoshman family. Relationships between Bedouin families are very organized according to the customary law known as "Urfi" or "Ghafra system" that governs them, where the Ghafra system is an informal security system and the "Urfi" is the unofficial law that governs the relations of Bedouin families and the borders of their control over land. Bedouins cannot cross the border between each other, because this could create endless conflicts between them, and this is undesirable and unacceptable for the heads of families. The Bedouins respect the customary arrangements between them because they preserve the right of each family to the land. The project site falls under the Ghafra system of the Ma'aza tribe and specifically under the Hammadin family of the Ma'aza tribe. Nevertheless, the Khoshman family works with the Hammadin family through the Ghafra system as the two families are related. **Consultations were undertaken with Sheikh Eid Mesalam - head of the Hammadin family along with a number of male and female representatives from this family and the Khoshman family.** The Bedouin families had no issues or concerns regarding the Project development. Conversely, they welcomed the Project. In general, the Bedouin families benefit from project developments in their areas as they provide safety and security for the project area under the Ghafra system in which they follow.



Meeting with the head of Ras Ghareb City Council



Meeting with EEAA in the Red Sea Governorate

Photos from the meetings with local business owners in Wadi Dara

Consultation activities with Bedouin families

FGD with women from the local community in Ras Ghareb City

Figure 9-1: Sample Photos of Consultation

9.6 Future Stakeholder Engagement and Consultation

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

9.7 Disclosure of the Documents

It is of utmost necessity to ensure that stakeholders are kept well informed about the Project throughout its life cycle, thus information will be accessible to the public, key stakeholders, and local communities through dissemination of related documents.

The disclosure package will include the following key documents that are available publicly in Arabic and English language.

- Environmental and Social Impact Assessment (ESIA) for the Scatec Wind Farm that will also include the associated Overhead Transmission Line (OHTL)
- Non-Technical Summary (NTS)
- Stakeholder Engagement Plan (SEP)

The above documents are available at the following avenues:

- Developer Website. The documentation above will remain on the website for the life of the project.
- Hard copies available at Red Sea Governorate and Ras Ghareb Local Governmental Unit

Red Sea Governorate
October 6, Hurghada,

Red Sea Governorate, Egypt
Tel: 065354627/06535546337

Ras Ghareb Local Governmental Unit
Location: Al-Mina Street City: 11432
Ras Ghareb – Red Sea
Tel: 01001318480 – 0120195877

9.8 Public Disclosure Sessions

9.8.1 Introduction

A public consultation session was held in Ras Gharib City, Red Sea Governorate (Four Seasons Hall, Ras Gharib City) on February 16, 2025, to disclose the results of the Environmental and Social Impact Assessment (ESIA) for the Egypt Green Hydrogen Wind Power Project with a capacity of 200 MW in the Gebel El-Zeit area, Red Sea Governorate. The ESIA consultant provided a project description. Below is a summary of the session details.

9.8.2 Objective of the Session

The session aimed to:

- Present the project to stakeholders;
- Disclose the project and the results of the Environmental and Social Impact Assessment, including the methodology, impacts, mitigation measures, and the Environmental and Social Management Plan (ESMP);
- Allow interested stakeholders to comment on the ESIA results, the key issues identified, and any other concerns they may have;
- Listen to concerns and recommendations raised by stakeholders.

9.8.3 Announcement of the Session

The list of invitees was jointly determined by the consultant and the Regional Center for Renewable Energy and Energy Efficiency (RCREEE), in coordination with the Environmental and Social Impact Assessment consultant. The list included the headquarters of the Egyptian Environmental Affairs Agency (EEAA) and its regional branch, the New and Renewable Energy Authority (NREA), the Egyptian Electricity Transmission Company (EETC), the Red Sea Governorate, other governmental entities, Ras Gharib City Council, the National Council for Women, local community representatives, non-governmental organizations, the Nature Conservation Egypt (NCE), and wind energy project developers in the Gulf of Suez and Gebel El-Zeit.

In coordination with the ESIA consultant, invitees were informed of the date and location of the public consultation. Participants were invited through:

- Invitations and the executive summary sent by the ESIA consultant to stakeholders in the governorate, NGOs, and local community representatives via hand-delivered mail, fax, and email;
- Telephone communication by the ESIA consultant;
- An announcement in an official daily newspaper, as shown in the figure below (the announcement was published in Al-Gomhuria newspaper on February 2, 2025).

Figure 9-2: Announcement of the Consultation Session in an Official Newspaper

9.8.4 Participant Description

A total of 85 participants attended the session, in addition to the consultant's representative. The session was conducted in the presence of:

- Representatives from the Egyptian Environmental Affairs Agency (EEAA), the Egyptian Electricity Transmission Company (EETC), the New and Renewable Energy Authority (NREA), Ras Gharib City Council, and the project developer;
- A representative from the consultant EcoConServ (Environmental and Social Expert);
- Representatives from the Regional Center for Renewable Energy and Energy Efficiency (RCREEE).

The attendees included representatives from the Red Sea Governorate, non-governmental organizations (NGOs), Ras Gharib City Council, academia, wind energy projects, and local community representatives.

The table below provides a summary of the entities that attended the session. A Non-Technical Executive Summary of the Environmental and Social Impact Assessment (ESIA) was prepared and distributed to the attendees.

Table 9-3: Numerical Distribution of Participants by Entity

Entity	Number of Attendees
Egyptian Environmental Affairs Agency (EEAA)	1
EEAA – Red Sea Regional Branch	1
Egyptian Electricity Transmission Company (EETC)	2
Regional Center for Renewable Energy and Energy Efficiency (RCREEE)	3
New and Renewable Energy Authority (NREA)	1
Red Sea Electricity Company	2
Egypt Green Hydrogen Company	2
Red Sea Governorate	3
Ras Gharib City Council	5
Local Community Members in Ras Gharib	35
Bedouin Community Leaders in Ras Gharib Area	3
Religious Figures	2
Wadi Dara Village Representatives	4
Non-Governmental Organizations (NGOs)	8
Academics	2
Wind Energy Projects in the Project Area	4
General Petroleum Company & Other Oil & Gas Companies	4
Directorate of Social Solidarity – Red Sea	1
National Council for Women – Red Sea Branch	2
Active Political Parties in the Governorate	2
Total	**85**

Figure 9-3: ***Images from the Public Consultation Session***

9.8.5 Outcomes and Key Discussions of the Session

The session was facilitated by representatives from the following key entities:

1. Representatives of the Egyptian Environmental Affairs Agency (EEAA) and the Egyptian Electricity Transmission Company (EETC)
2. The Head of Ras Gharib City Council
3. Consultants from the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) and the Environmental and Social Impact Assessment (ESIA) consultant (EcoConServ)

The public consultation session began with **welcoming remarks** from representatives of all the aforementioned entities. They emphasized that the **objective** of the session was to present the **findings of the ESIA study** for the proposed wind farm project and to provide an opportunity for community members and stakeholders to express their concerns and recommendations. The importance of **consultation sessions** was highlighted as they serve as a platform for discussions on project impacts, particularly in the field of **energy development and its effects on the natural environment**.

The **ESIA consultants and RCREEE representatives** provided a **detailed presentation** on the **methodology** adopted for the ESIA study, along with an overview of the **project site, key**

components, and development phases. The consultants outlined the **potential environmental and social impacts** of the project, along with the **associated mitigation measures**, with a particular focus on **biodiversity impacts in the Jabal El-Zeit area**.

Following the presentations, an **open discussion** was held, allowing attendees to **comment, raise concerns, and seek clarifications**. The discussions covered **various topics**, some of which were **directly related to the project**, such as **impacts on biodiversity and electromagnetic field effects**, while others were **indirectly related**, such as **employment opportunities generated by renewable energy projects in the region**.

The table below summarizes the **key comments and responses** from the public disclosure session.

Table 9-4: Key Outcomes and Responses of the Public Disclosure Session

Topic	Comment/Question	Response
Employment Opportunities During Construction – Training and Skill Development	Salwa Mahmoud, Assistant Secretary of the Homeland Protectors Party, emphasized the importance of organizing training courses for young people, assessing their skills, and facilitating employment opportunities for 30 trained individuals from the city. Eng. Khaled Abdel Wahab, a resident of Ras Gharib, highlighted the need to establish training and qualification centers for young professionals and engineers to keep pace with industry developments and required professions. He stressed the importance of equipping them with expertise through dedicated training and skill development centers.	The ESIA consultant from EcoConServ explained that recruitment for the project will follow a structured plan developed by the appointed general contractor responsible for construction, in coordination with project needs. The consultant also noted that additional subcontractors will be hired based on project requirements. She emphasized that Ras Gharib has many registered subcontractors listed with the city council and a significant local workforce that should be considered for employment during the construction phase. Eng. Ali, a representative from the Regional Center, proposed that the city council prepare an official letter or memorandum listing all available workers, applicants, and their specializations at various levels. This document would facilitate access to qualified candidates for the investor, ensuring a streamlined hiring process based on project needs. The ESIA consultant supported the proposal put forth by Eng. Ali, emphasizing the necessity of creating a database of all available labor, including workers and specialists, categorized by relevant skills required for the project. She confirmed that the city council is the most appropriate official body for coordinating this effort and facilitating access to the required workforce. The consultant also reaffirmed the importance of these requests and assured attendees that they will be taken into consideration. Furthermore, efforts will be made to establish a direct connection between the developer and the city council to enhance coordination on employment opportunities.
Construction Start Date	Mr. Mohamed Abu El-Hassan, Chairman of Ras Gharib Club, expressed his support for the implementation of such projects, highlighting their benefits at	The consultant explained that field surveys for the project area are scheduled to commence in the third quarter of 2025. Construction is expected to be completed by the fourth quarter

Topic	Comment/Question	Response
	various levels. He also inquired about the timeline for the project's construction and operation.	of 2027. Following this phase, the operational period will begin and will continue for 25 years.
Electricity Facilities for Wadi Dara Area	Mr. Mohamed Badran, Head of Wadi Dara Village, highlighted the challenges faced by farmers and poultry farm owners in the village due to insufficient electricity resources, despite being surrounded by wind farms and energy production projects. He inquired about possible solutions to this issue.	The consultant stated that farm owners and investors, in coordination with the local administration, should submit a formal memorandum to the Ministry of Electricity outlining the issue of unreliable electricity supply, which negatively impacts farm production. Additionally, the consultant advised requesting assistance from the attending officials from the Ministry of Electricity to facilitate the submission of the memorandum and clarify the necessary procedures to address the issue.
Potential Negative Environmental Impacts	Engineer Mohamed Ahmed emphasized the importance of focusing on environmental protection and nature conservation. He highlighted concerns regarding land use, the loss of valuable natural resources, and the fragmentation of available resources. He also stressed the need to present both the positive and negative aspects of the project's impact on natural life after the operational phase.	Environmental consultant Eng. Mary Mohareb from EcoConServ clarified that the project land was allocated for wind energy projects by a presidential decree. She further stated that the developer is responsible for the proper management of available resources and ensuring no adverse effects on the surrounding environment. The Environmental and Social Impact Assessment (ESIA) includes an Environmental and Social Management Plan (ESMP), which outlines all mitigation measures that the contractor and developer must adhere to during the construction and operational phases. Additionally, after the completion of the 25-year operational phase, the developer will be responsible for handing over the project land.
Potential Impacts on Biodiversity in the Area	Dr. Mohamed Hussein, representative of the Egyptian Nature Conservation Association, emphasized the importance of preserving natural life and biodiversity in the area. He requested clarification on the specific monitoring points used to assess wildlife and habitats in the project area.	Eng. Ali Khazma explained that several monitoring points were identified both within and outside the project site to observe the burrows of the Egyptian Dabb lizard and assess potential impacts from project construction. The study findings confirmed that the potential impacts on the Egyptian Dabb lizard are considered moderate. A habitat protection plan has been proposed, which the developer will be required to implement throughout the project's lifecycle to mitigate any potential impacts.

Topic	Comment/Question	Response
Potential Impacts from Waste Generated During the Decommissioning Phase	One of the attendees inquired about the potential negative impacts of the project and whether the decommissioning phase might result in environmental effects due to the waste generated.	Eng. Mari explained that the negative impacts of the project during the decommissioning phase would be similar to those occurring during the construction phase. The project components will either be reused depending on their condition or disposed of safely. Additionally, adherence to health and safety regulations is required during both the construction and decommissioning phases. Throughout all project stages, the primary objective remains compliance with health and safety standards and adherence to the legal requirements. Companies must also collaborate with the Environmental Affairs Agency to ensure the safe and proper disposal of waste.

9.9 Stakeholder Engagement Plan

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

- The SEP for the Project describes the planned stakeholder consultation activities and engagement process and includes the following:
- Define the Project's approach to future stakeholder engagement;
- Identify stakeholders within the area influenced by the Project;
- Profile identified stakeholders to understand their priorities;
- Propose an action plan for future engagement with identified stakeholders; and
- Set out the grievance/project complaints mechanism.

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

10 Assessment for Associated Facilities

This section presents an overall description of the associated facilities for the Project along with an Environmental and Social assessment of the OHTL. As discussed previously under "Section 3.3.3", the main associated facility includes the Overhead Transmission Line (OHTL).

10.1 Project Description

The OHTL is considered a key component for the Project as it will supply the electricity produced by the Wind Farm to the National Grid. Without the OHTL, the Wind Farm Project cannot be realised.

<u>The following describes the typical main OHTL (Project) component. Note the Developer has not provided details of the OHTL with the exception of the route. The following is a description based on typical OHTL design and industry standards in the project area.</u>

10.1.1 Transmission Towers

The main component of the OHTL is the transmission towers. It is expected that the transmission tower will be a three (3) phase steel beam Double-Circuit Transmission Towers (DCT). Transmission towers transport the electricity from the substation located within the Wind Farm to the High Voltage National Grid. The typical structure of the DCT tower is presented in the figure below.

The OHTL is likely to consist of around 35 towers that will be distributed throughout the route. The height of each tower is likely to be around 50 m.

Each transmission tower will consist of the following:

- **Foundations:** each tower will be fixed and bolted to the ground through reinforced concrete foundations. The exact area for each foundation was not provided by EETC but it will be determined at a later stage as part of the detailed design; and
- **Cross-Arms:** each tower will have six (6) steel beam cross arms (3 on each side) which connects the conductors (discussed below) with the towers (refer to Figure 10-110-1 below).

10.1.2 Conductors

The conductor is the line used to carry electrical energy from one tower to the next until its connection with the High Voltage National Grid. There will be six (6) conductors, three (3) on each side of the tower that will through the cross-arms (refer to Figure 10-110-1 below). The conductor will be a 220kV line.

10.1.3 Infrastructure Elements

The only infrastructure requirements for the Project will be access roads, which might be required in areas where the towers are inaccessible based on existing site conditions. Such access roads are required for access of construction vehicles and machinery during construction and for maintenance activities during operation. The layout of the access roads within the Project site will be determined at a later stage as part of the detailed design to be prepared by the OHTL Contractor.

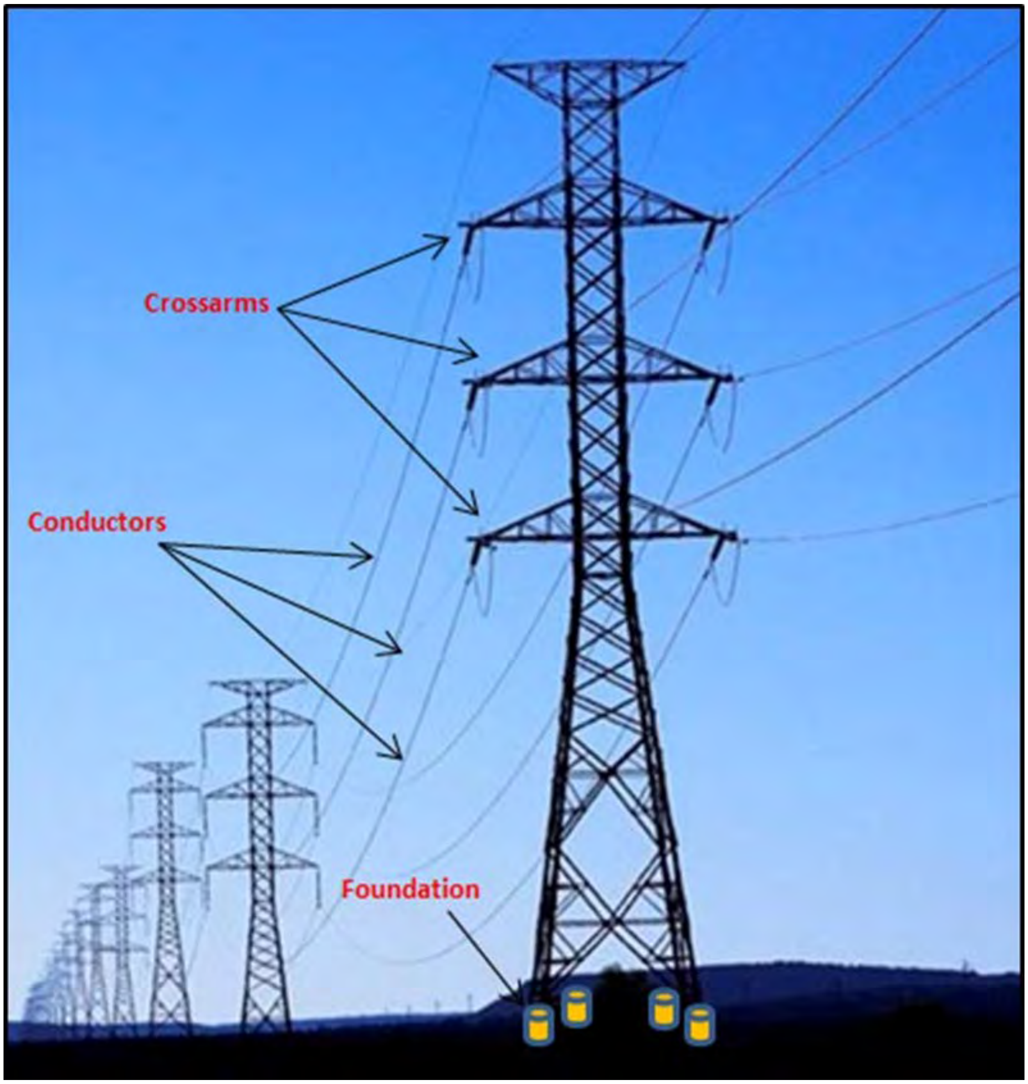


Figure 10-1: Typical Structural Components of Transmission Towers

10.1.4 Right of Way for the OHTL

Electricity transmission and distribution projects require Rights-of-Way (RoW) to protect the system from windfall, contact with trees, branches, utilities, buildings, and other potential hazards that may result in damage to the system, or power failures, as well as public health and safety concerns. RoW are also utilized to access, service, and inspect transmission and distribution systems.

The IFC EHS Guidelines for Electric Power Transmission and Distribution (2007), states that the RoW width for transmission lines ranges from 15 to 100m depending on voltage and proximity to other RoW, but typical range is between 15 and 30m.

Within the local requirements, EETC will take into account the requirements of the Electricity Law 87/2015, which provides requirements for safe distance between the conductors and the neighbouring lands and buildings and other receptors. Based on the law, the requirements of the RoW distances applicable for the 220kV OHTL is 25m horizontal distance from each side. Any successive buildings, structures or other receptors to be built shall take into account this safety distance/ RoW.

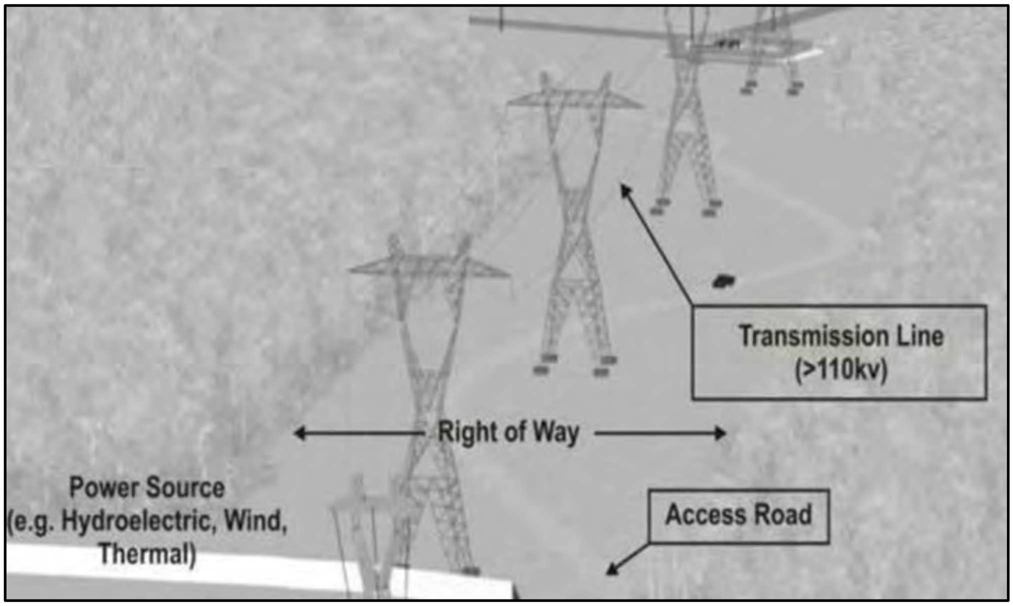


Figure 10-2: Right of Way and Access Road for OHTL (IFC, 2007)

10.1.5 OHTL Route

The figure below shows the OHTL route as well as the project site, the existing OHTL and the project substation. The OHTL has a length of approximately 1.5 km and connects to the existing HV network via a connection pylon.

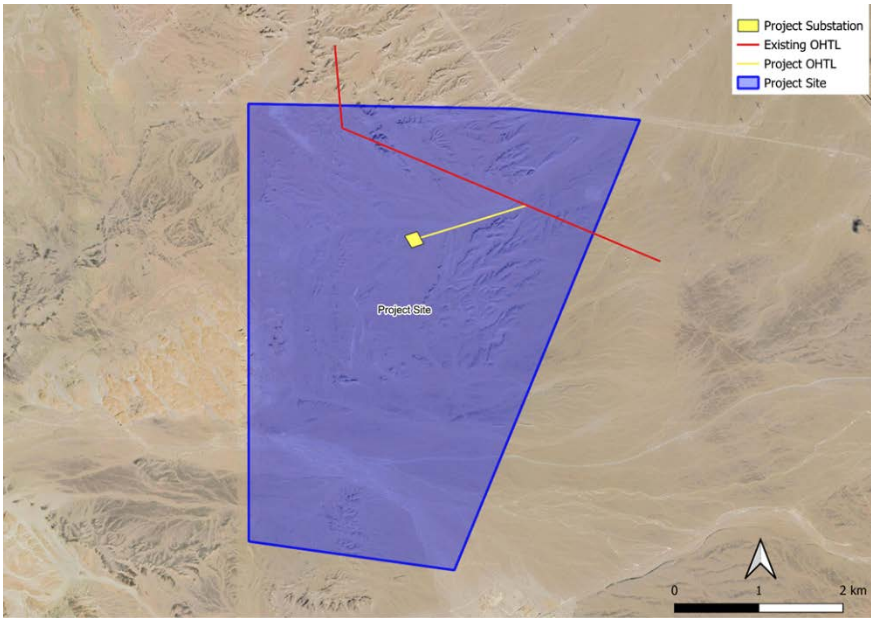


Figure 10-3: OHTL Route in relation to the Project Site and Substation

10.1.6 Overview of Project Phases

This section presents the likely activities to take place during the Project development and which will include three (3) distinct phases: (i) construction, (ii) operation and (iii) decommissioning each of which is summarized below.

Planning & Construction Phase

Typical activities during the construction phase for the OHTL include the following:

- Transportation of various Project components to the Project site. The components are expected to be transported by road to the Project area;
- Site preparation activities for the tower foundations. Such activities are limited to the individual footprint of the towers and therefore the actual area of disturbance is small. Nevertheless, such activities could include land clearing activities, excavations, and levelling;
- Installation of components such as the DCT towers, cross-arms, and conductors; and
- In addition to the erection of each DCT, there is additional construction work (which could include excavations, land clearing activities, etc.) for the road network that will be developed for access of equipment and machinery onsite.

Throughout the construction phase, the Project will require skilled labour (such as engineers, technicians, surveyors, etc.) and unskilled labour. It is likely that the OHTL Contractor will have his own team to cover such employment opportunities.

Operation Phase

The OHTL is expected to remain operational throughout the operation period of the Wind Farm – which is set for 20 years. The operational phase will be mainly limited to maintenance and repair activities for the OHTL when needed. These could also include some routine maintenance activities (based on a set schedule) as well as maintenance in case of failure of any of the Project components. Maintenance activities are generally undertaken by a dedicated team of technicians from EETC and do not normally require any permanent staff to be onsite. The EETC Team would undertake required technical activities during any given day and leave the site.

Decommissioning Phase

Decommissioning activities will depend on the Wind Farm. As discussed earlier, the Wind Farm Project is expected to remain operational for 20 years after which the Project could be decommissioned. Decommissioning activities will include disassembly of the towers for final disposal. However, most of these materials are salvageable (i.e. recyclable).

10.2Environmental and Social Assessment of the OHTL

10.2.1 Landscape and Visual

Based on the site visit undertaken for the Project area and the 100m buffer on both sides, no critical visual receptors were identified. In fact, the route and the buffer area are devoid of any receptors. Within the wider area, the key receptors are those similar to the Wind Farm and which were identified previously under "Section 5.1".

Key impacts are mainly limited to the operational phase. Visual impacts associated typically concern the OHTL towers themselves (e.g. colour, height, and number) and impacts relating to their interaction with the character of the surrounding landscape and the visual receptor which might be present. Nevertheless, in general, such structures are not considered mega or huge structures that would impose a key change on the landscape and visual character of the area. More importantly, such impacts are considered insignificant due to the following:

- Within the Project area and surrounding there are no key sensitive visual receptors.
- Project area is considered a barren and desert area and in general is located within an industrial area with petroleum activities and wind farm developments for which its aesthetical value loses some importance.
- There are several electricity transmission lines within the area (refer to section below), and therefore the addition of this Project will not be a significant impact to the visual and landscape characteristic of the area.

Mitigation Measures

There is no mitigation or monitoring measures to be considered.

10.2.2 Land Use

No physical structures were noted within the OHTL route and 100m buffer area on both sides. In addition, no economic activities were noted (such as grazing, agricultural, petroleum activities or Bedouin groups) nor any evidence of any such activities. The entire route runs inside the boundary areas where the land is vacant and consists of unoccupied desert and barren lands.

Inappropriate siting of Project components could result in land use impacts related to physical displacement and/or economical displacement or similar. Nevertheless, no such impacts are anticipated from the Project due to the following as discussed earlier in the baseline section:

- The Project site itself (which include the OHTL route and 100m buffer on both sides) in general is uninhabited and vacant and does not include any physical or economical land use activities. Therefore, physical and economical displacement impacts are considered irrelevant.
- The Project site is under governmental ownership and has been allocated to NREA. Therefore, no land acquisition or compensation process is required.

Taking the above into account, there are no anticipated impacts on land use and there are no mitigations or monitoring measures to be considered.

10.2.3 Biodiversity

As mentioned, the OHTL lies within the Project boundary and therefore in general has similar biodiversity characteristics to that of the Project site. Please refer to biodiversity baseline sections within the ESIA. However, a site-specific survey was undertaken in October 2024 for the OHTL and it is noted the study area is largely unvegetated with no floral species recorded, apart from Wadi systems. Arabian Red Fox (*Vulpes vulpes*) was the only mammal species was observed during the OHTL surveys and in particular no Egyptian Spiny-Tailed Lizard burrows were recorded.

Avifauna

For avifauna in particular, a holistic approach has been undertaken, using data from other existing OHTLs to understand areas of high bird movement and risk as well as look at actual impacts at current OHTLs to determine predicted numbers of MSB collisions per year / over the lifetime of the Project.

This available data on actual bird deaths along existing OHTLs is more valuable than surveys within the area that MSBs pass through as it provides real data from similar and close by projects and will provide a more accurate result. Three assessments have been undertaken:

- Number of deaths per year: using bird collision data from wind farms in the immediate vicinity of the proposed project to extrapolate how many individual birds are predicted to collide with the OHTL each year. This has been done by taking the average of number of fatalities for each species per km over several seasons (with data from 2018-2024) at eight wind farms: FIEM, Gabal EL Zayt, JICA, KFW, LEKELA, NREA, RGWE and Zaafarana. Data from these projects has been extrapolated to predict how many birds will collide with the proposed OHTL per km of line, per year. As part of the extrapolation, it has been assumed that no bird diverters are currently in place (it is known to be the case that at least 5 of the lines have no diverters and the exact use of diverters along the full length of the other lines is unknown). The number of recorded fatalities at each OHTL was multiplied up using the results of OHTL studies using GenEst at Lakela and RGWE. Whilst this data was not available for all projects a standardized approach for scaling up the number of recorded carcasses was used to ensure that searcher efficiency, effort and prey removal were considered.

- Number of deaths with and without diverters: data has been used from background data studies showing the typical impact of addition of diverters to decrease bird collision an understand what the impact would be reduced to in this project with bird diverters used.

- Compounded and cumulative risk assessment: using bird collision data from local wind farms with OHTLs along similar lines to assess which areas of the OHTL are at the highest risk of MSB collisions, a cumulative risk assessment was undertaken by RCREEE and Safe Soar.

This assessment takes into account five indicators (parameters):

1. Topography

Points	Criteria
1	Flat surface
2	Area with small elevations
3	Area with higher elevations and hills
4	Area with hills and different successive elevations

2. The cumulative effect resulting from the convergence of other OHTLs

Points	Criteria
1	Distance between different OHTLs > 1000 m
2	Distance between different OHTLs 500-1000 m
3	Distance between different OHTLs 250-500 m
4	Distance between different OHTLs 50-250 m

When calculating the risk level for the cumulative effect of converging OHTLs, the differences in the pylon elevations are taken into account. If two converging lines have different elevations, this increases the risk level by one point.

3. The cumulative effect resulting from the convergence of OHTLs with Wind Turbines

Points	Criteria
1	Distance between OHTL and Wind Turbines > 2000 m
2	Distance between OHTL and Wind Turbines 1000-2000 m
3	Distance between OHTL and Wind Turbines 500-1000 m
4	Distance between OHTL and Wind Turbines 100-500 m

4. Distance from any attraction (Sea –Sabkha - Hills or Mountainous areas)

Points	Criteria
1	Distance from attraction site >10 km
2	Distance from attraction site 6-10 km
3	Distance from attraction site 3-6 km
4	Distance from attraction site 0-3 km

5. Bird Density (This indicator is assessed in segments of 2.5 km)

Points	Criteria
1	0-1000 Bird / 2.5 km
2	1001-5000 Bird / 2.5 km
3	5001-10000 Bird / 2.5 km
4	≥10000 Bird / 2.5 km

Each indicator was assessed in segments of around 2.5 km

Impacts during Construction Phase

Habitat Loss, Fragmentation and Degradation

Site clearance and subsequent construction activities associated with the proposed OHTLs will result in the direct loss of areas of natural habitats. Natural habitats are valued as being of Medium Sensitivity as they are not listed as Annex 1 or Priority Habitats, and permanent loss will be limited to the small areas of the transmission tower bases and associated clearance around them and the two switching stations. There is also likely to be temporary habitat loss and degradation of habitats as a result of temporary access roads (although unlikely to be required) and work areas, temporary lay-down areas and other possible temporary facilities (e.g. batching plants, worker accommodation). The final design of the OHTL will be completed by the OHTL Contractor and therefore the full details of required habitat loss is not currently known.

The EPC contractor will ensure that detailed consideration has been given to locating temporary works areas (laydown areas, workers camps, batching plants, access roads, etc.) are sited within areas that are already modified habitat or degraded, poor condition, natural habitat. The actual loss of natural habitat will therefore be very minor.

The proposed route of the OHTL shows a typical Red Sea coast Biodiversity with all but one species recorded being of IUCN Least Concern and no endemic species noted. No Egyptian Spiny-Tailed Lizard burrows were recorded on the proposed OHTL route; however, it is assumed they are in the area as they were found within the main project area.

Habitat loss of terrestrial species can lead to a negative impact on overall population viability. In the situation here the impact is reduced due to the nature of the development meaning that habitat loss is spread in small areas over a wider project site. This means that connectivity is maintained through the area and no barriers to movement put in place or wide areas of specific interest will be lost. Given habitats are found through the area the small loss of habitat, it is considered that there will be no impact on conservation status of these species.

The potential impacts on habitat loss, fragmentation and degradation would be negative in nature yet short-term in duration. Impacts at pylons would be medium in magnitude yet deemed irreversible and along the working route medium in magnitude however short term and reversible. Considering the ecology of the site, the receiving environment is determined to be of medium sensitivity. Given the above, the impact is considered overall of moderate significance.

Direct Impacts on Sensitive Receptors (Habitats and Flora) – Non-native Species and Introduced Flora

It is possible that non-native or introduced flora could be imported into the area on vehicles or within any imported soil material. The impacts of non-native and introduced flora could have a moderate significant impact in absence of any mitigation as these species could become established and out-compete native flora. Construction works could improve conditions for these species and it is possible earth moving could increase the distribution and spread them along the route of the OHTL.

Impacts associated with non-native, invasive or introduced flora could result in long-term negative impacts, medium in magnitude and deemed irreversible (if allowed to become established). Considering the ecology of the site, the receiving environment is determined to be of medium sensitivity. Given the above, the impact is considered overall of moderate significance.

Direct Impacts on Sensitive Receptors (Vertebrates) – Site Clearance and Earthworks

Regarding impacts to habitats, it is near-certain that site preparation works and construction activities will negative impact sensitive ecological receptors (e.g. reptiles, mammals, breeding birds) as a result of direct mortality.

Egyptian Spiny Tailed Lizard (IUCN VU) are likely to be particularly exposed to impacts during construction works for the Project and OHTL as they are a diurnal species meaning they will be mobile while site works are active.

Impacts associated site clearance and earthworks could result in medium-term negative impacts, medium in magnitude and deemed irreversible (e.g. loss of breeding habitat and mortality). Given the above, the impact is considered overall of moderate significance. It is worth noting that the species was not recorded on the OHTL during surveys but has a possible presence.

Direct Impacts on Sensitive Receptors (Vertebrates) – Vehicle Collisions

Vehicle related collision is possible for all vertebrate species present within the Project's AoI and this will result in direct mortality on receptors of low to high sensitivity. Any such impact would be negative, long-term and irreversible and would be of medium to high magnitude and therefore of minor to major significance (depending on the receptor killed).

Both small and large vertebrate species are at risk of vehicle collisions throughout construction. Species such as Egyptian Spiny Tailed Lizard are at higher risk of collision with vehicles and machinery as they are active in the day. It is possible that carcasses on the road could attract scavenging animals, including birds of prey which in turn would increase their risk of collision with vehicles and machinery.

Impacts associated with vehicle collisions could result in medium-term negative impacts, medium in magnitude and deemed irreversible (e.g. mortality). Given the above, the impact is considered overall of moderate significance. It is worth noting that the species was not recorded on the OHTL during surveys but has a possible presence.

Direct Impacts on Sensitive Receptors (Habitats, Vertebrates) – Poaching, Collection etc.

It is possible that site worker may poach or take plants and animals from the site, either for firewood or in the case of the Spiny-Tailed Lizard to be sold. Species such as Red Fox could also face persecution.

Any of the identified receptors are potentially at risk from this long-term, irreversible negative impact. The likelihood of this occurring is possible and the magnitude of this impact ranges from Low to High magnitude depending on the receptor affected.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Disturbance

The presence of site workers and machinery can result in disturbance related impacts to all terrestrial ecological receptors present within the area. These impacts are not certain, and the magnitude of such impacts will vary depending on the sensitivity of each receptor to disturbance. The significance of any such disturbance impacts is likely to range from Minor to Moderate / Major, depending on the sensitivity of the affected receptor. The duration of impact will also likely vary from very short-term (e.g. running away from a vehicle using the access road) to short to medium term in areas adjacent to construction areas or worker accommodation. It is likely that any disturbance impacts, irrespective of duration will be reversible once the disturbance event has passed.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Reduced Air Quality / Dust

The habitat across the area is very sandy. It is likely that constructed related ground disturbance will likely increase the amount of dust in the air which in turn could result in negative impacts on plants and vertebrate receptors. In addition, air pollution from site vehicles from the concreate batching plant could also result in negative impacts on valued receptors. These impacts are possible, short-term and reversible and are considered to be of minor to moderate significance.

Direct Impacts on Sensitive Receptors (Vertebrates) – Noise

Noise as a result of construction can result in direct impacts on valued ecological receptors (vertebrates) due to acoustic masking, disturbance and displacement thereby reducing survivorship and reproductive success.

Any impacts are likely to be short- to medium term (for the duration of construction) and reversible. The magnitude of impact ranges from low to medium and is likely to be of low not significant to moderate significance.

Direct Impacts on Sensitive Receptors (Vertebrates) – Lighting

Lighting could impact foraging and commuting routes for bats.

Any impacts are likely to be short- to medium term (for the duration of construction) and reversible. The magnitude of impact is low and is likely to be not significant given the lack of bats present. Mitigation measures will help all nocturnal site use by other animals.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Littering, Waste Management

Unmitigated it is possible that poor waste management could result in the proliferation of litter across the Project area including plastic containers, plastic bags and glass. This waste could result is negative impacts to sensitive receptors through ingestion or entanglement. Any such impact could be long-term and irreversible, and the significance of this impact would be not significant to major depending on the receptor effected.

In addition, poor management of other solid wastes, including food waste could result in the presence of pest species such as rats and mice, which could outcompete wild rodents and feral cats and dogs which could increase the risk of predation of wild rodents and other prey species.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Pest Species

As discussed above it is possible that pest species become established within the Project as a result of increased littering or poor waste management as well as the propensity of certain species (e.g. rats, cats and dogs) to associate with human habitation.

An increase in pest species could result in long-term negative impacts on wild animals through direct and indirect competition for food resources, direct mortality through predation, and direct impacts as result of disturbance impacts. Such impacts could be reversible or irreversible, will be between low to high magnitude and as such significance will vary from minor to major depending on the receptor being affected.

Impacts During Operational Phase

Direct and Indirect Impacts on Sensitive Receptors (Birds) – Collision with OHTL

The proposed OHTL Route is approximately 1.5 km long and notably cross a main bird flyway. There is no refined migration corridor along any part of the route, so birds moving through will be on a broad front generally moving along the flyway adjacent to, or crossing, the Gulf of Suez. Although, it has been identified that the route runs through an IBA designated for migratory birds, Gebel El Zeit IBA, and crosses a known migratory corridor, the East Africa Flyway. As such, these areas are likely to have a higher volume of migratory birds and will potentially have a higher risk of collision with OHTLs. Additionally, due to the scale of the project and the other wind projects within the area of the project, there is likely to be an impact cumulatively.

The operation of OHTLs is likely to have an impact on birds as they are proven mortality factor for migratory and soaring birds. In most cases, impacts from over-head powerlines lead to severe injuries or immediate death. In case of collision accidents, birds crash at high flight speed into cables or wires. The resulting injuries vary widely and are comparable to traumata caused by collisions with cars. Electrocution harms mostly birds sitting on the live components or having ground contact, but this is less of an issue with high power OHTL such as the one proposed here.

Table 10-1: MSBs likely to utilize OHTL area, their conservation status and notes on likelihood of site utilization

Common Name	Conservation Status	Notes
	IUCN	
Egyptian Vulture	EN	Migratory species through the flyway. Migration through the AoI is likely.
Steppe Eagle	EN	High numbers of birds recorded migrating through the project area. Migration through the AoI is likely
Greater-spotted Eagle	VU	Recorded across the project area in low numbers on migration. Migration through the AoI is likely
Eastern Imperial Eagle	VU	Migratory populations considered to be low following surveys in project area. Migration through the AoI is likely
Red Footed Falcon	VU	A single bird registered on survey. Migration through AoI possible.
Sooty Falcon	VU	A single bird registered on survey. Migration through AoI possible.
Pallid Harrier	VU	Recorded in low numbers during surveys. Likely migration through the Project AoI.

White Stork	LC	Very high numbers of birds recorded migrating through the project area. Migration through the AoI is likely.
Black Kite	LC	Migratory species through the flyway. Migration through the AoI is likely.
Steppe Buzzard	LC	Migratory species through the flyway. Migration through the AoI is likely.
European Honey Buzzard	LC	Very high numbers of birds recorded migrating through the project area. Migration through the AoI is likely.
White Pelican	LC	Migratory species through the flyway. Migration through the AoI is likely.
Levant Sparrowhawk	LC	Migratory species through the flyway. Migration through the AoI is likely.

Generally, any large soaring or fast flying species is at risk of collision with OHTLs. The size and flight behavior (and sometimes other biological characteristics) of these species results in a low level of detection and being able to avoid collision with such structures.

It is anticipated that most migratory soaring birds will be at insignificant risk to collisions due to their flight behavior, i.e. smaller and more maneuverable birds (such as falcons and harriers) will actively avoid the OHTL and most large soaring raptors (like eagles and vultures) will be moving at a much greater height than the OHTL and avoid it. This is shown in the existing data from the OHTL bird surveys from nearby wind farms and the Wind Farm VP surveys. However, factors such as unsuitable weather for migration and the need to rest or roost is likely to bring them into greater risk of collision.

This assessment is a starting point for understanding risk for the proposed OHTL line, further studies using real data from local OHTL schemes have been used to demonstrate predicted impacts.

Using available data from the monitoring of confirmed bird casualties along 8 OHTLs in the vicinity of the project and proposed route of the OHTL, an assessment has been undertaken to show predicted collision of MSBs for 1.5 km of OHTL as presented in the table below.

Following fatality monitoring at other wind farms locally, it has been predicted that MSBs will have a low number of collisions per year across the OHTL line as presented in the table below. White Storks are predicted to have the highest numbers of collisions per year; however, this is still predicted to be under one bird collision per year. without mitigation. Although low collisions are predicted, mitigation is discussed in further details below.

Table 10-2: Predicted Fatalities for 1.5 km of proposed OHTL

Species	Predicted Collisions per year
Black Kite	0.0236
Honey Buzzard	0.1800
Long-Legged Buzzard	0.0193
Marsh Harrier	0.0171
Steppe Buzzard	0.0600

Species	Predicted Collisions per year
Eurasian Sparrowhawk	0.0193
Steppe Eagle	0.0086
White Pelican	0.0043
White Stork	0.6600

Collisions with OHTLs could result in long-term negative impacts on MSBs through direct mortality and injury. Such impacts could be irreversible, but are low magnitude and as such significance is minor.

Indirect Disturbance Impacts on Sensitive Receptors (terrestrial mammals and breeding / resident birds)

During the operation of the OHTL disturbance impacts are likely to be very minor as the site will not be subject to regular activity other than occasional vehicle movements and maintenance operations around the site. It is possible other receptors including breeding passerines and other mammals may experience disturbance impacts during the operation of the OHTL.

Any such impact will have to be very short-term (for the duration of the disturbance impact) and reversible and is likely to only result in impacts of low magnitude. The significance of operational disturbance is therefore considered to be minor, at worst.

Indirect Impacts on Sensitive Receptors (terrestrial mammals and breeding / resident birds) – Disturbance

During operation disturbance impacts are likely to be very minor as the site will not be subject to regular activity other than occasional vehicle movements and maintenance operations around the site. Egyptian Spiny-Tailed Lizard may suffer some minor impact to their daily foraging activities.

Any such impact will be very short-term (for the duration of the disturbance impact) and reversible and is likely to only result in impacts of low magnitude. The significance of operational disturbance is therefore considered to be minor, at worst.

Direct Impacts on Sensitive Receptors (Vertebrates) – Vehicle Collisions

Vehicle related collision are possible for all vertebrate species present within the Project's area and this will result in direct mortality on receptors of low to high sensitivity. Any such impact would be negative, long-term and irreversible and would be of medium to high magnitude and therefore of minor to major significance (depending on the receptor killed).

Species such as Egyptian Spiny-Tailed Lizard have a high risk of collision with vehicles due to their diurnal nature. It is possible that carcasses on the road could attract scavenging animals, including birds of prey which in turn would increase their risk of collision with vehicles and machinery.

Direct Impacts on Sensitive Receptors (Vertebrates) – Lighting

Lighting could potentially result in negative impacts of a range of ecological receptors including impacting foraging and commuting routes for bats.

Any impacts are likely to be short- to medium term and reversible. The magnitude of impact ranges from low to medium and is likely to be of minor to moderate significance.

Direct Impacts on Sensitive Receptors (Habitats and Flora) – Non-native Species and Introduced Flora

It is possible that non-native or introduced flora could be imported into the area on vehicles or within any imported soil material. The impacts of non-native and introduced flora could potentially be significant in absence of any mitigation as these species could become established and out-compete native flora.

Impacts associated with non-native, invasive or introduced flora could result in long-term negative impacts, irreversible (if allowed to become established) and potentially significant.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Pest Species

It is possible that pest species become established within the Project as a result of increased littering or poor waste management as well as the propensity of certain species (e.g. rats, cats and dogs) to associate with human habitation.

An increase in pest species could result in long-term negative impacts on wild animals through direct and indirect competition for food resources, direct mortality through predation, and direct impacts as result of disturbance impacts. Such impacts could be reversible or irreversible, will be between low to high magnitude and as such significance will vary from minor to major depending on the receptor being affected.

The following section describes mitigation measures to the impacts described in this section.

Mitigation Measures during Construction Phase

Habitat Loss, Fragmentation and Degradation

The following mitigation measures will be employed to reduce the significance of habitat loss, fragmentation, and degradation during the construction period. Mitigation measures are largely based on avoidance of impact through selection of the working areas to favor areas of degraded natural habitat or those areas where habitats have been modified. Where impacts cannot be avoided the following will be completed

- All site workers will undertake a Project induction before working on site. The induction will include a comprehensive biodiversity element where the baseline ecological value and sensitivity of the site will be discussed.

- Prior to construction works, working areas will be clearly demarked (using temporary fencing (e.g. orange netting attached to wooden posts)) so that site workers fully understand the working area. Encroachment into areas outside of agreed working areas will be prohibited and working areas will be subject to regular check by the EPC Project Ecologist to check enforcement of working areas.
- On completion of phased construction works the EPC Contractor will be responsible for habitat rehabilitation works in all areas that have been subject to temporary disturbance.

Direct Impacts on Sensitive Receptors (Habitats and Flora) – Non-native Species and Introduced Flora

- Prior to construction works, working areas will be subject to a botanical walkover survey to identify areas of non-native or invasive species. Any specimens will be clearly marked, and the area avoided and if this is not possible the specimen will be removed and disposed of.
- Areas of soil in proximity to these species will be stored separately and not used further on the site. It will be collected from the site and disposed of or used as deep sub-soil fill (to reduce the chance of seed germinating.
- Areas of non-native or invasive species will be mapped and a program of mechanical control will be completed over the construction period in order to remove these species from the area. Chemical control will be avoided however, if necessary, will be used but in accordance with national and international guidelines.
- Soil imports to be taken from local quarries or borrow pits to avoid importing non-native and invasive species.
- Adequate wheel-washing facilities to be constructed at the entrance to the site and any wastewater will be disposed of correctly to prevent spread of undesirable species.
- Regular site walkover surveys throughout the construction period by a suitably qualified botanist to check to the presence and abundance of non-native or invasive species.

Direct Impacts on Sensitive Receptors (Vertebrates) - Site Clearance and Earthworks

A summary of mitigation measure to avoid and mitigate for direct impacts on sensitive vertebrate receptors is included below. These measures will be included (and expanded upon) in a Construction Biodiversity Management Plan/Biodiversity Action Plan.

- All site workers will undertake a Project induction before working on site. The induction will include a comprehensive biodiversity element where the baseline ecological value and sensitivity of the receptors within the area will be discussed.

- Prior to construction works, working areas will be clearly demarked (using temporary fencing (e.g. orange netting attached to wooden posts)) so that site workers fully understand the working area. Encroachment into areas outside of agreed working areas will be prohibited and working areas will be subject to regular check by the EPC Project Ecologist to check enforcement of working areas.
- Working areas should avoid trees / shrubs as these are likely, due to their sporadic distribution across the area to be of importance to breeding birds (e.g. passerines, raptors).
- A pre-construction walk-over survey will be undertaken of all working areas to check for the presence of ground nesting birds. Surveys will be completed by an appropriately qualified ecologist and surveys will be undertaken in the hours after sunrise (up to 10:00). The surveyors will aim to identify behavior indicative of breeding activity (e.g. carrying food / nesting material / fecal sacs, presence of nests, eggs or chicks (both nidifugous and nidicolous).
- Where nests are found they will be recorded in full and their locations mapped, with the data transferred to Excel master sheets and Google Earth. Mapping will then be circulated to the project team along with details of a works exclusion zone. Exclusion zones will be dependent on the species of bird nesting along with its conservation status and be agreed with the qualified Project Ecologist.
- Mitigation during construction will include timing work to remove suitable nesting habitat outside of the most sensitive times of year for ground nesting species, and for all clearance work within this time period to be done under the supervision of an on-site ecologist.

Pre-construction surveys for sensitive species (i.e. those qualifying Priority Biodiversity Features) of herpetofauna have taken place within the Project site and the locations of known/active burrows used by Egyptian Spiny-tailed Lizard have been marked. This survey effort and marking will be repeated for the OHTLs.

Direct Impacts on Sensitive Receptors (Vertebrates) – Vehicle Collisions

- Appropriate speed limits are to be enforced by the EPC Contractor on the OHTL Contractor
- Regular signage will be installed along the site access roads and internal roads informing all drivers of the speed limit
- A gated entrance will be staffed and any visitors or locals using the site roads will be informed of the speed limits and that there are regular checks of vehicle speeds
- A ban of driving at night will be enforced and if absolutely necessary the speed limit will be reduced to 15km/h
- Ban against off-road driving at all times of the day

- Regular checks of the road for carcasses and proper disposal if found
- An incidental / chance find procedure will be included in the BMP so that all workers report any road collisions so that any such incident can be investigated in full.

Direct Impacts on Sensitive Receptors (Habitats, Vertebrates) – Poaching, Collection, etc.

- The Project will enforce strict controls on hunting, gathering, poaching and otherwise disturbing flora and fauna within the Project area. Any breaches of this ban will be strictly enforced, and any workers found in breach of this control measure will be subject to disciplinary procedures.
- The ban on hunting etc. will be included in the site induction along with discussions about the sanctions for breaches of this control measure.
- A chance find procedure will be implemented should any site worker find a wild animal, especially one that has become a nuisance (e.g. scavenger in the works camp, presence of small mammals in worker accommodation, presence of snake or scorpion on the works site) and the EPC Ecologist will arrange for an appropriately qualified person to capture and relocate. Where scavengers have been identified within the works site additional housekeeping measures may be required.

Direct Impacts on Sensitive Receptors (Vertebrates) – Disturbance

- Site wide induction to include information regarding disturbance of ecological receptors.
- Chance find procedure to report sightings of potentially sensitive receptor and investigation of any such sightings by the EPC Contractor in order that additional buffer areas can be agreed, where necessary.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Reduced Air Quality / Dust

- Where necessary tracks will be damped down to reduce the risk of dust. Damping down will also include areas adjacent to roads. These measures will be implemented where necessary.
- Vehicles will be properly maintained to reduce emissions.

Direct Impacts on Sensitive Receptors (Vertebrates) – Noise

- Vehicles will be properly maintained to noise emissions.
- Use of available technology and management practices with construction methodologies to reduce noise.
- Regular monitoring of noise levels within works compounds and works areas as far as possible and apply corrective measures as necessary.

Direct Impacts on Sensitive Receptors (Vertebrates) – Lighting

- Limit the amount of lighting, especially within the wider area (e.g. at transmission tower construction sites). This will be achieved by ensuring that night-time working is limited.
- Where lighting is required within worker compounds, site offices etc. ensure that any lighting is shielded and protected to reduce light-spill and glare. Low intensity lighting should also be used, where possible, to further reduce light spill.
- For external security lights PIR trigger units should be used and these should be timed to automatically switch off after five minutes.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Littering, Waste Management

- Waste Management will be included in the Site Induction so that all site workers understand their responsibilities to maintaining a clean and tidy site. Where possible all materials that can be recycled will be.
- Zero tolerance to littering on the works site and within the worker compound. This zero-tolerance approach should also be applied to smoking and workers must use appropriate smoking areas (supplied with 'butt bins') at all times, even when on construction sites. Litter must not be thrown out of vehicle windows when driving to and from or around the site.
- Daily inspections of working areas and worker compound should be completed, and corrective actions applied, where necessary.

Direct and Indirect Impacts on Sensitive Receptors (Vertebrates) – Pest Species

Where pest species are identified the EPC Contractor / Ecologist will be notified and an appropriate course of action taken. For small mammal pest's live traps will be used, in order to reduce the risk of bycatch. Poison baits should be avoided, unless it can be certain that non-target species will be affected, and any such use should be in accordance with national and international best practice. If poison baits are to be used it must be certain that any poisoned animal cannot move out on to the wider area to reduce the risk of natural predators eating poisoned animals. Any chemical control of pest must only be undertaken in accordance with national and international guidelines.

Mitigation Measures during Operation Phase

Direct and Indirect Impacts on Sensitive Receptors (Birds) – Collision with OHTL

The proposed design of the towers and lines are possibly the least impactful possible as the towers are free standing with no support wires.

An extensive literature review and meta-analysis was performed (Bernardion et al. 2019) to evaluate the overall effectiveness of wire-marking in reducing bird collisions with power lines, including the possible influencing factors of power line voltage, habitat and type of device. Data was gathered from

35 field studies across the world (which included 66 trials) assessing the effectiveness of wire-marking based on regular carcass searches beneath power lines. Overall, wire-marking reduced bird collisions with power lines by 50.4%. This is a blanket reduction factor and cannot be fully accurate for all species of bird, and may change depending on the geography and topography of the area.

The below table shows the difference in collision predictions with and without diverter mitigation. Number of collisions is based on local windfarm OHTL carcass monitoring data, some sites of which were checked over five years in spring and autumn. Individuals killed per km of OHTL was recorded, some with diverters and some without. Numbers killed were averaged and then multiplied across the distance of this OHTL line.

The results, based on local OHTL data show that there is a reduction is collisions through the use of diverters and therefore this has been recommended for this project, along the length of the OHTLs.

Species	Collisions per year without diverters	Collisions per year with diverters
Black Kite	0.011	0.005
Honey Buzzard	0.084	0.042
Long-Legged Buzzard	0.009	0.004
Marsh Harrier	0.008	0.004
Steppe Buzzard	0.028	0.014
Eurasian Sparrowhawk	0.009	0.004
Steppe Eagle	0.004	0.002
White Pelican	0.002	0.001
White Stork	0.308	0.154

Bird Flight Diverters (BFDs) are to be installed every 10 m along the entire length of the OHTL on the shield wire as detailed in the BMP. All BFDs installed will be dynamic (*e.g.* move in the wind) to increase visibility. The BFDs will include models that glow or light up at night (e.g. FireFly diverters) to increase visibility for birds staging in the area and arriving late or leaving early.

The Project Developer and EPC Contractor are committed to installing diverters that meet the required long-term guarantee and specifications. Installation of shield/earthing wire and attached BFDs will be completed at the same time (within 1 week). BFDs will be installed to the manufacturer's guidance and assessment of the OHTL, taking into consideration number and spacing, at a minimum of 1 every 10 m.

The installation of BFDs will need to be recorded by the Project Ecologist and need to be included in the annual reports. BFDs should be checked every 6 months before the spring and autumn migration seasons so that they are in place and operational for higher risk periods. Any damaged or defective BFDs will need to be replaced within 2 months of being reported as faulty.

However, the need for and extent of replacing damaged / defective BFDs will be undertaken following a review of the outcomes of the PCFM studies (discussed in further details below). This issue will be discussed in agreement with lenders and other relevant stakeholders.

Indirect Impacts on Sensitive Receptors

- Ban on off-road driving, especially during sensitive periods of the year (e.g. breeding bird season) and if off-road driving is required a check of the working area should be completed by the Project's Ecologist.
- Speed limits to be enforced.
- Sensitive species are to be included in the site induction for all operational staff where additional control measures will be discussed including allowing animals to move around the site, not chasing after them in vehicles or approaching them on foot.

In addition, if any significant maintenance work is required (e.g. replacement of any transmission towers or wires etc.) all impacts related to construction will be relevant and all mitigation outlined in previous sections will be followed.

The following section describes the long-term monitoring of the Project AoI which will be completed as set out above and will include:

- Habitat and Flora monitoring within the AoI to measure the success of habitat rehabilitation work to reasonably demonstrate a net gain in Natural Habitat as well as to record the presence of invasive / non-native flora.
- Post-construction fatality monitoring to be completed in the first three years of operation to record the actual impact of collisions with the OHTL. Additional surveys and or mitigation measures to be implemented as part of an Adaptive Management Strategy.
- All of the above monitoring requirements will be included within Construction and Operational Biodiversity Action Plans which will include KPIs and a BEMP against which the results of the monitoring will be assessed.

Avifauna

- Operational monitoring will be completed in line with best international practice presented in Post-Construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries (EBRD, IFC, KfW 2023) to monitor actual levels of mortality. Post construction fatality monitoring will be completed along the whole OHTL and the program of post construction monitoring will include carcass searching, searcher efficiency trials and carcass persistence trials. The results of the post-construction fatality monitoring will be used to inform a GenEst Analysis. Post-construction monitoring will follow the latest international best practice including the recently published PCFM Handbook (EBRD, IFC, KFW 2023). Full details of the PCFM Protocol will be included in an Operational BMP/BAP document. PCFM survey areas will also include OHTLs that are adjacent to the Project AoI, especially in areas that may be subject to greater movement of high-risk species.

- An adaptive management strategy will be developed (in line with the PCFM Handbook), and additional mitigation will be undertaken if the results of the post-construction fatality monitoring indicate higher than predicted mortality, especially in relation to species of elevated conservation concern. Adaptive management could include retrofitting of BFDs (or different type of BFD) on unmarked lines (including adjacent OHTL) where PCFM surveys indicate areas of elevated mortality or provision of additional BFDs on marked lines if the installed BFDs are not preventing (or reducing) mortality. This could include installation of additional BFDs or those that are shown to increase avoidance / reduce collision in species susceptible to OHTL impacts. Installation of BFDs can be undertaken using a drone and would not require powerlines to be disconnected. Installed mitigation could also be changed if additional research into the effectiveness of BFDs comes to light during the construction period which would be agreed with lenders.

- On completion of the post-construction fatality monitoring a decision will be taken to continue or cease this survey effort or reduce it to specific times of the year. This will be undertaken with the Lenders. If monitoring is ceased site workers will continue to record any carcasses they find and this information will be passed on to the Project team.

- A chance find procedure will be implemented and any carcasses seen by site workers will be reported to the Project Ecologist so that they can investigate.

The following section describes cumulative impacts with regards to the OHTL and the surrounding projects.

Avifauna

Cumulative Impacts with the SWE wind farm

The cumulative impacts between the turbines and the OHTL have been considered. Without mitigation it is likely there would be a significant impact on MSBs. The turbines themselves are to operate on a 'Shut down on demand' strategy. This should mean that the combined impact of the turbines and OHTL is of minor significance, when proposed with mitigation along the length of the OHTL. An adaptive management scheme is proposed which will monitor higher than predicted mortality and further mitigation undertaken.

Cumulative Impacts with other OHTLs

There are several windfarms in operation within the same area with associated OHTLs, and therefore the addition of new OHTL lines may have a cumulative impact on species within the area (figure below).

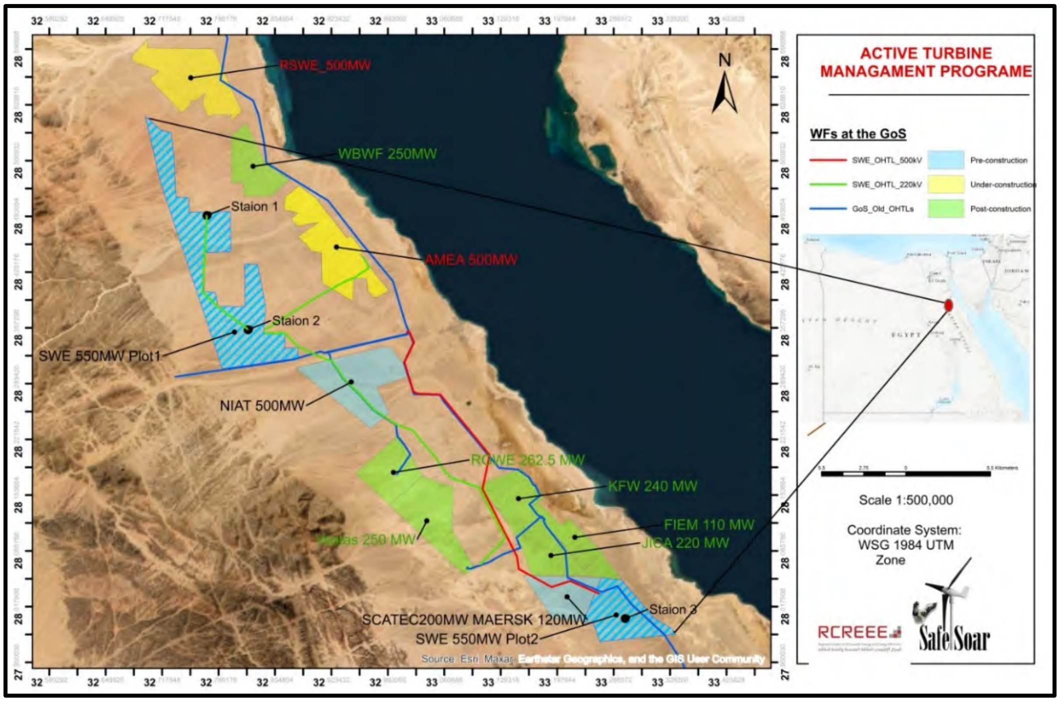


Figure 10-4: Wind and OHTL projects within the Gulf of Suez

- Because of this the aforementioned projects have been considered within this assessment as each project could potentially affect the same populations of migratory birds. For example, birds migrating through NIAT wind farm, JICA wind farm and AMEA wind farm are likely to move across the OHTL and could also possibly migrate through the project area.

- For those projects already constructed or for those with impact assessments no significant residual impact are predicted after the application of impact avoidance through project design or additional mitigation has been applied such that residual impacts were considered to be minor / not significant.

- Where residual negative impacts are possible and cannot be effectively off-setting will be applied to ensure no net loss to these VECs. Collision risk and electrocution residual impacts for other species (e.g. raptors, waterfowl) is not significant for any of these projects. The OHTL will be constructed with BFDs along its entire length. Collision risk of other species will therefore be minimal as BFDs are known to be effective at significantly reducing collision in other species and electrocution risk for raptors is minimal on HV lines due to their size (and visibility), insulation, distance between any live parts and size of pylons providing ample safe perching opportunities well away from any dangerous components.

Adaptive Management for Avifauna

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

Mammals (including bats)

Significant negative impacts on bats at each of the proposed and future wind farms and OHTL are not predicted or expected however on-going monitoring will be completed at all projects which will employ adaptive management which will trigger additional industry-wide mitigation should actual impacts exceed predicted impacts and if mortality is shown to breach PBR thresholds.

10.2.4 Archaeology and Cultural Heritage

Based on the site survey undertaken, no archaeology and cultural heritage sites were identified or recorded within the OHTL route as well as the 100m buffer area.

Site preparation activities which are to take place onsite by the OHTL Contractor for the OHTL transmission towers and the various Project components to include foundations, access roads, 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 components 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, as discussed earlier there are no surface archaeology or cultural heritages sites within the Project area and therefore no impacts are relevant.

Nevertheless, 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 archaeological importance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the OHTL Contractor 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 OHTL Contractor 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.

10.2.5 Air Quality and Noise

Site preparation activities which are to take place onsite by the OHTL Contractor for the OHTL transmission towers and the various Project components to include foundations, cables, access roads, 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 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. 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, CO, etc.) which would also have limited but 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.

Mitigation Measures

The following identifies the mitigation measures to be applied by the OHTL Contractor during the construction phase:

- Based on inspections and visual monitoring undertaken, if dust or pollutant emissions were found to be excessive due to construction activities, the source of such emissions should be identified and adequate control measures must be implemented;
- Comply with the Occupational Safety and Health Administration (OSHA) requirements and the Egyptian Codes to ensure that for activities associated with high dust and noise levels, workers are equipped with proper Personal Protective Equipment (e.g. masks, eye goggles, breathing masks, ear muffs, etc.);
- Apply basic dust control and suppression measures which could include:
  - Regular watering of construction active areas 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 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.

- Hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas, will be limited.
- Project traffic will be reduced by routing through community areas wherever possible.
- Grievance mechanism will be developed to record and respond to complaints regarding to noise.
- In case of any noise related grievance, noise measurements will be carried out immediately at the area where noise related grievance is received. If monitoring results indicate that noise levels are above the defined limits, the Client will reduce/limit the number of equipment at the construction site, until the construction noise levels are reduced below the limit values.
- Equipment with lower sound power levels should be selected.
- Silencers should be installed for fans.
- Suitable mufflers should be installed on engine exhausts and compressor components.
- Acoustic enclosures should be installed for equipment casing radiating noise.
- Noise sources should be re-located to less sensitive areas to take advantage of distance and shielding.
- In addition to the above given measures, noise barriers could be installed without any gaps and with a continuous minimum surface density of 10 kg/m2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective.

<u>Monitoring and Reporting Requirements</u>

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

- Inspection and visual monitoring of the works should be carried out at all times. In addition, periodic inspections should be conducted at nearby sites (e.g. roads) 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.

10.2.6 Occupational Health and Safety

This section identifies and assesses the anticipated impacts from the Project activities 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. Throughout this section, the impacts during the construction and operation phase have been discussed collectively due to the similarity in nature of the impacts.

Throughout the construction phase, there will be generic occupational health and safety risks to workers, as working on construction sites increases the risk of injury or death due to accidents. The following risks are generally associated to construction sites and apply for the construction of the Project and could include:

- Slips and falls;
- Working at heights;
- Struck-by objects;
- Moving machineries;
- Working in confined spaces and excavations;
- Exposure to chemicals, hazardous or flammable materials; and
- Exposure to electric shocks and burns when touching live components.

Similarly, throughout the operation phase, there are occupational health and safety risks to workers from the various operation and maintenance activities expected to take place for the Project. The following risks are generally associated to such a Project and which could include:

- Working at heights during maintenance activities; and
- Exposure to a variety of hazards such as electric shock, and thermal burn hazards.

Mitigation Measures

The OHTL Contractor will be required to submit an Occupational Health and Safety Plan (OHSP) regarding the Project's construction activities. The objective of the Plan 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 of the OHTL Contractor and all involved sub-contractors. It is expected that such a plan provides details on the following:

- Identifies in details information in relation to emergency measures and plans, communication protocols, first aid instructions and facilities, training programs, occupational health and safety culture, inspection programs, monitoring and reporting requirements, incident management, etc.
- Identifies in details the activities that are expected for the Project (e.g. civil works, electrical wiring, tower assembly, electrical installation, commissioning, etc.) and lists the specific jobs which are to be undertaken under each activity and the hazards which may be associated for each (electric hazards, working with machinery, vertical works, etc.);
- For each of the activities above, the OHSP is expected to identify the preventive equipment and systems that must be in place to eliminate or reduce such risks. This includes: (i) collective protective equipment (safety signs, traffic signs, hand signs, marking and signalling of work in

progress, etc.); (ii) personal protective equipment (this includes the compulsory equipment for any worker or visitor onsite and obligatory equipment based on the tasks being carried out) (iii) detailed safety measures on how the task should be implemented in a safe manner to reduce any occupational health and safety risks.

In addition, similar to the above, it is expected that EETC has its own OHSP, which is implemented for all their maintenance activities for high voltage electricity lines in Egypt. It is expected that such a plan will be implemented for this Project in specific.

The OHTL Contractor and EETC are expected to adopt and implement the recommendations/provisions of the OHSP throughout the Project construction and operation phase.

10.2.7 Worker Rights and General Working Conditions

Inappropriate management of the workforce during both the construction and operation phase could entail several worker rights and general working conditions risks and violations by employing entities such as the EPC Contractor and Project Operator. This could include but not limited to engaging child workers, confiscation of passports of foreign workers, unsuitable working hours, and other.

The above impacts are anticipated to be of short-term nature during the construction period and long-term nature during the operation phase. Such impacts are of a negative nature, and inappropriate management of workforce could result in impacts that are of medium sensitivity and medium magnitude. Given the above such an impact is considered of minor significance.

Mitigation Measures

The Contractor and Project Operator are required to implement worker rights and general working conditions procedure for workers that should be according to the Local Labour Law as well as the IFC PR 2 and EBRD PR 2 as well as the ILO Fundamental Labour Conventions including the following in particular:

- Providing reasonable working conditions and terms of employment to include but not limited to contract management, working hours, salaries/wages, annual and medical leaves, bereavement leaves, accommodation, etc.
- Recognizing workers' rights to form and to join workers' organizations and to bargain collectively
- Prohibition of child labor within the workforce
- Overall management of young workers within the labor force
- Prohibition of forced labor
- Non-discrimination throughout the entire work cycle in all its forms
- Providing equal opportunities for all throughout procurement and employment opportunities including women groups

- Include training requirements for workers on 'Worker Rights & General Working Conditions' in worker induction training and toolbox talks
- The Contract and Project Operator are also expected to prepare and implement a worker grievance mechanism for the Project construction and operation phase. All grievances will be handled in the shortest possible period. The first approach will be to inform the worker within the first 24 hours after receiving the grievance. The worker will be informed within 7 working days on whether or not the grievance proceeds and what the next steps will be.

Worker Accommodation: It is not clear at this point whether there will be any onsite accommodation for workers. Nevertheless, should the Contractor opt for onsite accommodation unit for workers or off-site rental accommodation, it must conform to the national requirements. In addition, it should also confirm to international best practice requirements – this includes mainly the "Workers' accommodation: process and standards" (EBRD/IFC Guidance Note, 2009).

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor and Project Operator:

- Undertake monthly inspections during construction against the developed HR procedure
- Submission of a Worker Grievance Mechanism.
- If applicable, inspection on workers accommodation to ensure its compliance with the requirements of "Instructions for Prevention of Health Nuisances from Workers Accommodation No. (1) For the year 2013" and "Workers' accommodation: process and standards" (EBRD/IFC Guidance Note, 2009).

10.2.8 Community Health, Safety and Security

This section identifies and assesses the anticipated impacts from the Project activities on community health, safety and security during the 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. There are no foreseen impacts on community health, safety and security during the construction and planning phase given that the OHTL is located far from the boundaries of Wadi Dara (over 5 km)

In particular, the potential impacts on community health and safety, which are discussed throughout this section, include the following:

- Potential impacts from public access to Projects components during operation; and

- Potential impacts from exposure of Electric and Magnetic Field (EMF); and
- Potential Impacts from Noise during Operation

Potential Impacts from Public Access to Project Components during Operation

Such an impact is 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 transmission tower, which could result in safety hazards (electric shock, thermal burn hazards and other).

Potential impacts from Exposure of Electric and Magnetic Field (EMF) during Operation

Electric and magnetic fields (EMF) are radiation associated with the use of electric power such as household wiring, electric appliances and also from OHTL. Electric fields are produced from the voltage in the transmission line 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 from transmission lines. 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.

Table 10-3: ICNIRP Exposure Limits for General Public Exposure to Electric and Magnetic Fields

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)). Finally, the IFC EHS guideline also state that transmission lines require RoW to protect the system and also protection from potential hazards and in which RoW for transmission lines are generally from 15m to 100m.

Potential Impacts from Noise during Operation

According to the "IFC EHS Guidelines for Electric Power Transmission and Distribution" (IFC, 2007) noise in the form of buzzing or humming can be often heard around high voltage power lines producing corona – however noise produced by power lines does not carry any known health risks. In addition, such noise quickly dissipates with distance and is easily drowned out by typical background noises.

However, as noted earlier, the OHTL and a significant buffer (several kilometres) on both sides is completely vacant and no activities or receptors were recorded (e.g. permanent settlements or similar) which could be impacted by the OHTL. Therefore, the impacts are expected to be insignificant.

11 Annexes

11.1 Annex I: Collision Risk Model

C. *Collision Risk Modelling and Flying at Risk for Spring 2022*

The Collision Risk Model (CRM) is a simplified model developed to predict the potential impact of wind turbines on birds. There are several CRM models developed / improved around the world. One of the most used is known as the Band model (SNH 2012). It must be clear that the CRM was not developed to provide a threshold of collisions, but an order of magnitude which would help the authorities – when it was designed – as a way to decide on project permitting purposes. A full and detailed development of the model can be read in "Band, Madders, and Whitfield (2001) Developing field and analytical methods to assess avian collision risk at wind farms" and "De Lucas, Janss, and Ferrer (Eds). Birds and wind farms: Risk assessment and mitigations".

It is also important to mention that the model was developed in Scotland, where the major migratory routes like the RVRSF does not exist, and also scientific literature afterward, provided evidences of the lack of consistency between the pre and post construction monitoring at wind facilities; predicted risks rarely matched with the observed ones, once the wind farms became operational. See in this regard "*Ferrer et al. (2012) Weak relationship between risk assessment studies and recorded mortality in wind farms. Journal of Applied Ecology 2012, 49*". This study was also developed along another major bottleneck in the Western Palearctic where lower numbers – around 500,000 MSBs- but similar species occur.

Also, within the Red Sea-GoS region some CRMs for other projects were reviewed (as included in ESIA studies) along with the outcomes of associated Post-Construction Fatality Monitoring-PCFM results (for the same wind farms). Despite PCFM results being inconclusive, the CRM predictions do not seem to match well with their outcomes. There are wind farms which predicted higher fatality numbers for some species which were not later confirmed through the field data.

Collision Risk Model Input Data

The Collision Risk Model requires data relating to the species of birds occurring at the proposed Project and data on the type and specification of the proposed WTGs.

Collision Risk Modelling (CRM) (and subsequent Collision Risk Assessment (CRA)) has been completed based on the worst-case turbine layout – this includes the 27 wind turbine layout with the specifications presented below.

Component	Description
	Scenario 1
Project Generation Capacity (MW)	202.5
Number of Wind Turbines	27
Rated Power per Turbine (MW)	7.5
Rotor Diameter (m)	169.5
Hub Height (m)	100

Tip height (m)	185.5

Data inputs for the CRM analysis were derived from the results of the VP surveys, as well as the above-mentioned turbine specifications and the following assumptions.

Rotation speed (rpm)	7.5	Average value calculated from manufacturer's specifications for similarly-sized turbine.
Percent of time operational	Monthly values ranging from 64% to 85%	Project specific data not available, representative values taken from SOSS example
Maximum blade width (m)	4.5	From manufacturer's specifications
Pitch (degrees)	47.5	Mean value from manufacturer's specifications

Bird Size and Flight Speed

The biometric data, including body size, wing length, as well as flight speed used in the collision risk model has been taken from various sources[26] [27] [28] [29]and was populated with correct data prior to running the CRM.

Input values used in the CRM analysis are presented in the table below. Data on physical dimensions of birds were derived from Cornell Lab of Ornithology's Birds of the World (https://birdsoftheworld.org), 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 11-1: Physical and observational characteristics of each bird species included within the CRM analysis

Scientific name	English Common Name	Length (m)	Wingspan(m)	Flighttype	Flightspeed (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

[26] Bird body size data from: The complete birds of the Western Palearctic Cramp (1998)
[27] Flight speed data from: A dictionary of birds. Campbell and Lack (1985)
[28] Bird Guide: Collins (2001)
[29] Birds of the western palearctic / BTO fact sheets

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 macrorus	Pallid 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

Bird Flight Activity and Flight Height

Data on bird flight activity through the proposed Project area and on the proportion of those birds flying at rotor height are taken from the field surveys completed by in-country ornithologists. Data relating to birds flying above or below the blade swept area was not included in the collision risk analysis.

The table below shows the number of birds recorded, the number of birds at risk height (≤200 m) and the percentage of these numbers accounted for related to the total of birds recorded. It must be stated that the planned turbines for this and other projects in the GoS have increased the turbine tip height from 120 to 180 m up to 200 m now, at the same time the wind manufacturing market has evolved. Because the data was collected with height intervals of 120, 120-150, 150-200, and above 200 m, the results for 200 m tip height was presented, as a precautionary approach.

Table 11-2: Number of birds recorded, numbers at risk, and % of birds at risk height (< 200 m)

Species	**Risk 200 m**		
	Yes	**Total**	**% Risk 200**
Black Kite	3546	5640	62.87%
Black Stork	1361	1578	86.25%
Booted Eagle	55	113	48.67%
Crane	3345	19599	17.07%
Crested Honey Buzzard	1	1	100.00%
Egyptian Vulture	24	38	63.16%
Griffon Vulture	1	1	100.00%

Honey Buzzard	6669	11640	57.29%
Hobby	0	2	0.00%
Imperial Eagle	14	25	56.00%
Kestrel	49	54	90.74%
Lesser Spotted Eagle	67	117	57.26%
Levant Sparrowhawk	18000	18001	99.99%
Long-legged Buzz	72	116	62.07%
Marsh Harrier	29	31	93.55%
Montague's Harrier	2	3	66.67%
Osprey	5	6	83.33%
Pallid Harrier	5	6	83.33%
Short-toed Eagle	57	123	46.34%
Sparrowhawk	26	46	56.52%
Spotted Eagle	4	5	80.00%
Steppe Buzzard	5170	12713	40.67%
Steppe Eagle	2324	5314	43.73%
White Pelican	23949	26960	88.83%
White Stork	84006	140636	59.73%
Total general	**148781**	**242768**	**61.29%**

The purpose of this modelled hypothetical scenario was to generate an upper bound collision risk estimate or "worst case". Published and validated avoidance rates (AR) are not available for several of the species, yet the AR parameter is well-known to be a very important parameter in Band CRM analysis, with outcomes very sensitive to slight variations (Cook et. al, 2012). For each species included within the CRM analysis, a "most realistic" AR parameter value was developed, bounded by a "conservative" low parameter estimate (95%), and a high estimate (99.9%), reflecting an upper bound, based on a comprehensive review of available literature. Considering these two boundaries, all extent of avoidance rates considered in the literature was covered.

This project has only completed one migratory season. It is well known that collision risk flights may greatly change within seasons for different years (e.g., two consecutive springs or autumns) as seen and demonstrated in other ESIA studies in the region (e.g. Lekela or Amunet projects).

The table below shows the estimated results of the CRM for the spring season and the two extremes of avoidance rates considered. As stated above, CRM was not performed for avoidance rates between these extreme ranges, e.g. 98% and 99%, as the obtained values would be just intermediate numbers.

Table 11-3: Estimated number of fatalities according to the CRM for spring 2022 for wind turbines

Species	200 m	
	Avoidance 99.5%	**Avoidance 95%**
Black Kite	61	611
Black Stork	19	193

Booted Eagle	1	13
Common Kestrel	0	1
Eastern Imperial Eagle	0	3
Egyptian Vulture	0	4
Eurasian Sparrowhawk	1	5
European Honey Buzzard	143	1,425
Great White Pelican	334	3,334
Crested Honey Buzzard	0	0
Griffon Vulture	0	0
Greater Spotted Eagle	0	2
Lanner Falcon		
Lesser Kestrel		
Lesser Spotted Eagle	1	13
Levant Sparrowhawk	221	2,203
Long-legged Buzzard	1	14
Osprey	0	1
Pallid Harrier	0	2
Short-toed Snake Eagle	2	15
Sooty Falcon		
Steppe Buzzard	158	1,575
Steppe Eagle	65	651
Western Marsh Harrier	0	4
White Stork	1,722	17,015

The key outcomes for the key species noted earlier are provided in the figures below.

A general trend is that the overall risk is higher between 7:00 and 11:00, when > 50% of birds is at risk (all species pooled). The risk decreases afterwards but increases again throughout the end of the day. The patterns of the risk are rather similar across the daylight hours and species, except for the Black Stork as noted in the figure below.

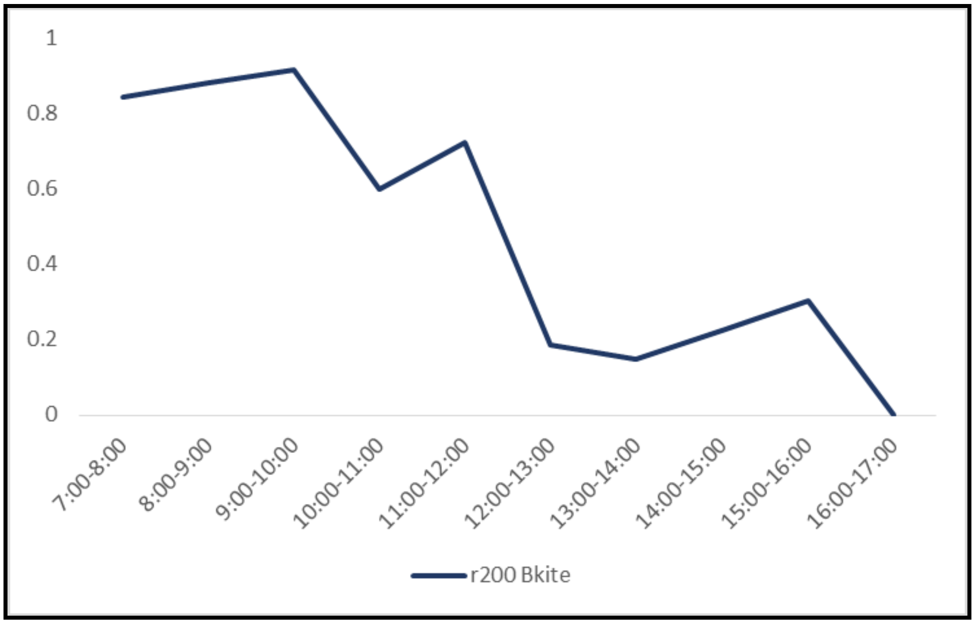


Figure 11-1: Percentage of risk flights 200 m (individuals) during the day for the Black Kite

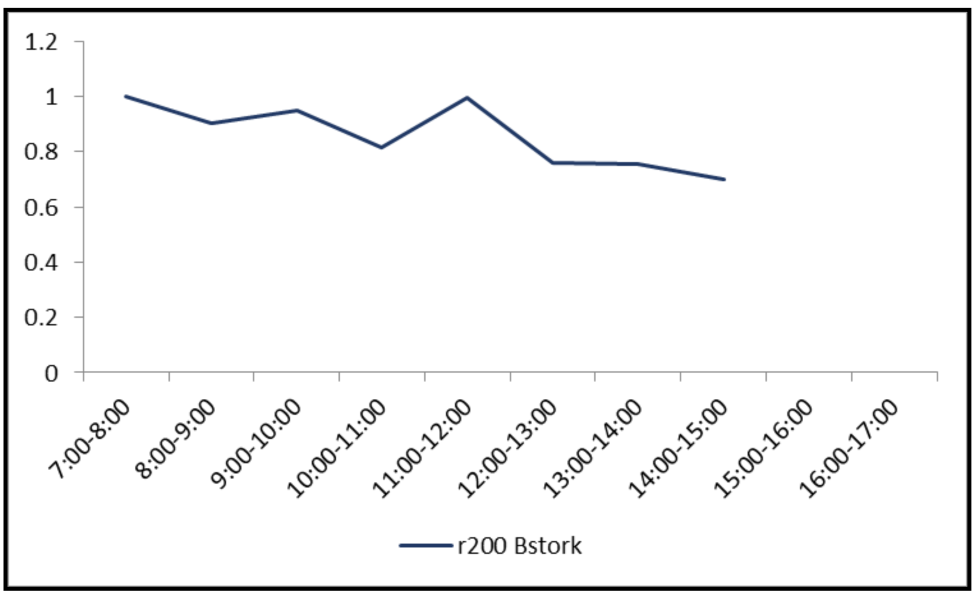


Figure 11-2: Percentage of risk flights 200 m (individuals) during the day for the Black Stork

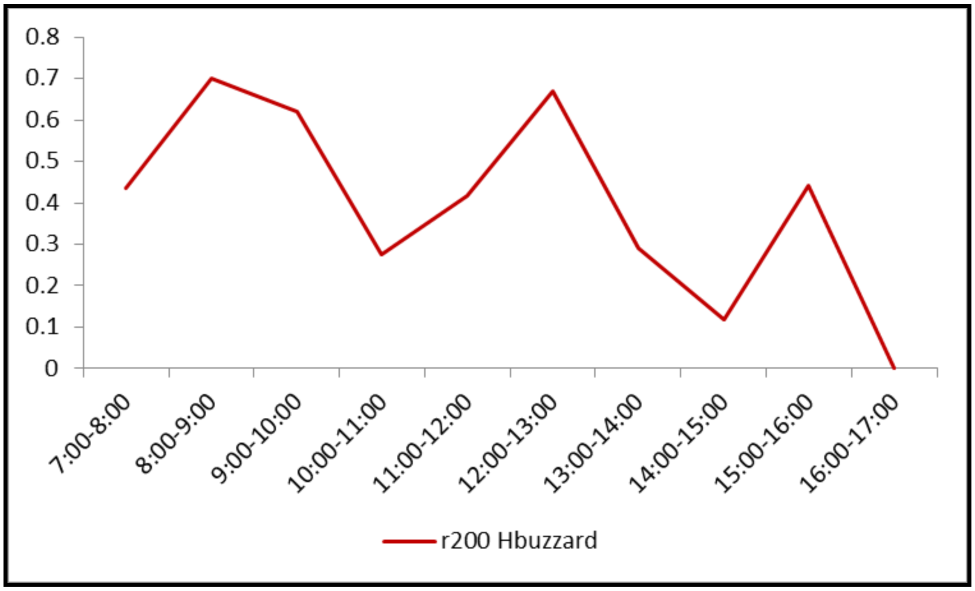


Figure 11-3: Percentage of risk flights 200 m (individuals) during the day for the Honey Buzzard

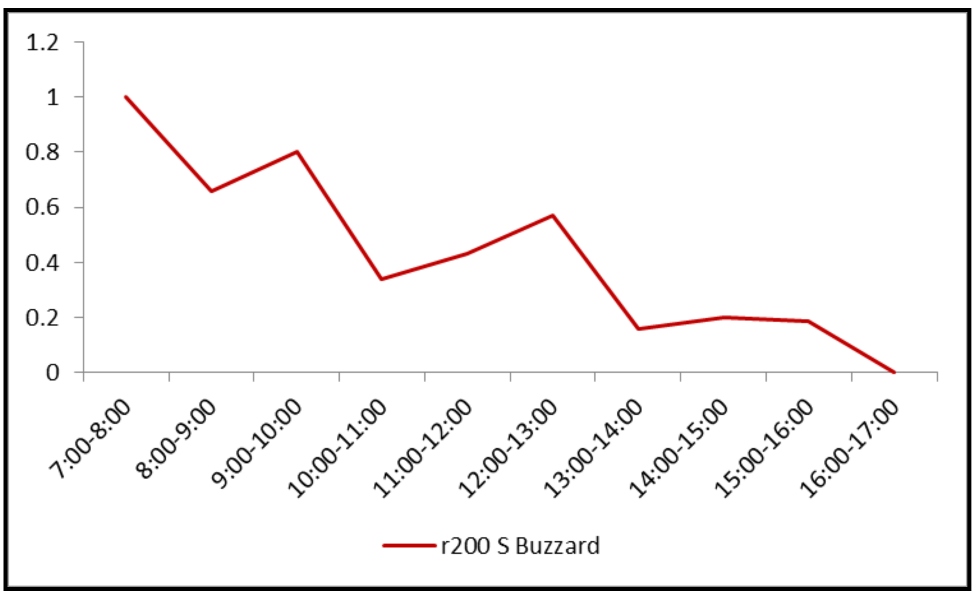


Figure 11-4: Percentage of risk flights 200 m (individuals) during the day for the Steppe Buzzard

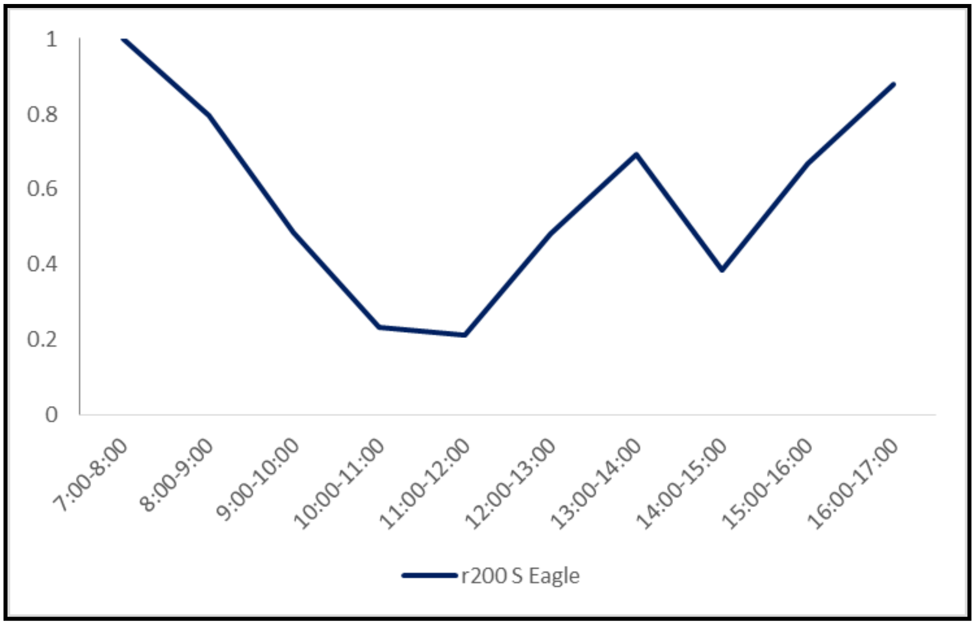


Figure 11-5: Percentage of risk flights 200 m (individuals) during the day for the Steppe Eagle

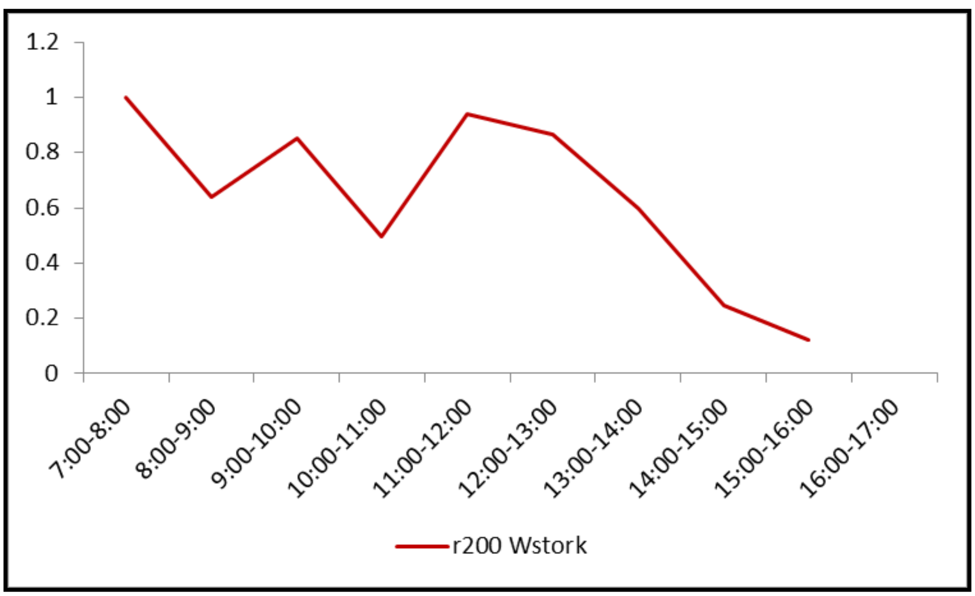


Figure 11-6: Percentage of risk flights 200 m (individuals) during the day for the White Stork

D. *Collision Risk Modelling and Flying at Risk for Autumn 2022*

Similar to the spring season, the CRM was performed with the autumn data and using the same two turbine models with two tip heights to be considered (200 m) and data inputs identified earlier.

The table below shows the number of birds recorded, the number of birds at risk height (≤200 m) and the respective percentage of these numbers accounted for related to the total of birds recorded. It must be stated that the planned turbines for this and other projects in the GoS have increased the turbine tip height from 120 to 180 m up to 200 m now, at the same time the wind manufacturing market has evolved. Because the data were collected with height intervals of 120, 120-150, 150-200, and above 200 m, the results for 200 m tip height are presented, as a precautionary approach.

Table 11-4: Number of birds recorded, numbers at risk, and % of birds at risk height (< 200 m)

Species	yes 200	%risk200	total
Black Kite	168	80.00%	210
Black Stork	11	100.00%	11
Booted Eagle	1	33.33%	3
Egyptian Vulture	13	100.00%	13
Honey Buzzard	1606	77.21%	2080
Kestrel	9	100.00%	9
Long-Legged Buzzard		0.00%	1
Marsh Harrier	39	95.12%	41
Monagu's Harrier	4	100.00%	11
Pallid Harrier	2	50.00%	4
Sparrowhawk		0.00%	1
Steppe Buzzard	17	73.91%	23
Steppe Eagle	9	60.00%	15
White Pelican	11598	83.76%	13847
White Stork	117520	63.18%	186010
Total	**131087**	**64.81%**	**202279**

This project has only completed one migratory season. It is well known that collision risk flights may greatly change within seasons for different years (e.g., two consecutive springs or autumns) as seen for Lekela or Amunet projects as discussed earlier.

The table below shows the estimated results of the CRM for the autumn season and the two extremes of avoidance rates considered. As stated above, CRM was not performed for avoidance rates between these extreme ranges, e.g. 98% and 99%, as the obtained values would be just intermediate numbers.

Table 11-5: Estimated number of fatalities according to the CRM for autumn 2022 for wind turbines

Species	200 m	
	Avoidance 99.5%	**Avoidance 95%**
Black Kite	0	1
Black Stork	0	1
Booted Eagle	0	0

Common Kestrel	0	1
Eastern Imperial Eagle		
Egyptian Vulture	0	2
Eurasian Sparrowhawk	0	0
European Honey Buzzard	4	36
Great White Pelican	2	23
Crested Honey Buzzard		
Griffon Vulture		
Greater Spotted Eagle		
Lanner Falcon	0	0
Lesser Kestrel		
Lesser Spotted Eagle		
Levant Sparrowhawk		
Long-legged Buzzard	0	1
Montagu's harrier	0	1
Osprey		
Pallid Harrier	0	0
Short-toed Snake Eagle		
Sooty Falcon		
Steppe Buzzard	0	1
Steppe Eagle	0	2
Western Marsh Harrier	0	0
White Stork	2,173	21,470

Sensitivity of the Project Site

The baseline assessments have recorded high numbers of migratory soaring birds over the Project site and its vicinity. Some of those recorded species have an important status on the international or national levels. The baseline assessment concludes that the site is considered within a highly sensitive area in terms of avi-fauna. Additionally, the Project site is considered to be located along an intensive migration route. Taking all of the above into account, the receiving environment is considered of high sensitivity.

Magnitude of the Impact

The collision risk model (CRM) assessment data in the tables above are helpful for assessing impacts. The results suggest:

- In general, collision risk to all species is significantly lower in the autumn compared with the spring migration period.
- For the majority of MSBs passing through the project site airspace during spring and autumn migration, the risk of collision is low or zero.

- Most species had low or zero predicted collision rates when assessed either seasonally or annually. Seven species had higher CRM estimates (Steppe Buzzard, European Honey-buzzard, Black Kite, Greater White Pelican, Levant Sparrow Hawk, Steppe Eagle, and White Stork).
- Based on the predicted seasonal and annual collision rate estimates, two species have the potential to be substantially impacted by the project: White Stork and Great White Pelican. The impacts for both species are likely to be greatest during spring migration without mitigation. In the autumn season, impacts are of lower risk.
- Four globally threatened MSBs pass through the project airspace. These are Steppe Eagle and Egyptian Vulture (IUCN - Endangered), Eastern Imperial Eagle, Greater Spotted Eagle. Additionally, Pallid Harrier (IUCN-Near Threatened) was also recorded during baseline flight activity monitoring. All these species had a predicted collision rate exceeding zero. The predicted collision rate for Steppe Eagle are considered the highest.

The CRM estimates indicate that for most MSB species including those globally threatened or near-threatened the impacts are likely to be low, however uncertainty relating to migration activity between years may mean that impacts could be higher and, in some cases, reach or exceed acceptable thresholds. Overall, there is potential for a noticeable change to occur and acceptable limits are likely to be breached for non-threatened species but not for the majority of MSBs, therefore the assessment concludes medium magnitude of impact

Based on the above, the impact significance for the wind power project is assessed as Moderate, based on a high receptor sensitivity and a medium magnitude of effect.

Residual Impacts

The table below presents the residual impact anticipated from the Project. This takes into account the CRM data as presented earlier and assumes the implementation of the comprehensive turbine shutdown on demand program as discussed in further details below. It is assumed that the turbine shutdown program has a 98% effectiveness in terms of collisions for birds.

Species	Avoidance 99.5 % (200 m)			98% Effectiveness of ATMP
	Spring	Autumn	Total	
Black Kite	61	0	61	1.22
Black Stork	19	0	19	0.38
Booted Eagle	1	0	1	0.02
Common Kestrel	0	0	0	0
Eastern Imperial Eagle	0		0	0
Egyptian Vulture	0	0	0	0
Eurasian Sparrowhawk	1	0	1	0.02
European Honey Buzzard	143	4	147	2.94
Great White Pelican	334	2	336	6.72
Crested Honey Buzzard	0		0	0

Griffon Vulture	0		0	0
Greater Spotted Eagle	0		0	0
Lanner Falcon		0	0	0
Lesser Kestrel			0	0
Lesser Spotted Eagle	1		1	0.02
Levant Sparrowhawk	221		221	4.42
Long-legged Buzzard	1	0	1	0.02
Montagu's harrier		0	0	0
Osprey	0		0	0
Pallid Harrier	0	0	0	0
Short-toed Snake Eagle	2		2	0.04
Sooty Falcon			0	0
Steppe Buzzard	158	0	158	3.16
Steppe Eagle	65	0	65	1.3
Western Marsh Harrier	0	0	0	0
White Stork	1,722	2,173	3,895	77.9

11.2 Annex II: Consultation session attendance sheets

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دراسة تقييم الأثر البيئي والاجتماعي لمشروع

مصر للهيدروجين الأخضر لإنتاج الكهرباء بطاقة الرياح بقدرة 205 ميجاوات

بمنطقة جبل الزيت في محافظة البحر الأحمر

قاعة الفورسيزونز بجوار نادي الفتح بمدينة راس غارب – محافظة البحر الأحمر

الاحد 16 فبراير 2025

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49	[illegible]	[illegible]		٠١٠٦٨٧٧٢٣١	[illegible]
50	سعيد كامل [illegible]	مدير ادارة السلامة شركة [illegible]	3kamel@petrobel.com	01152222384	[illegible]
51	[illegible]	مدير ادارة [illegible] راس غارب		٠١٠٠٠٠٧٣٥٠٨	[illegible]

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دراسة تقييم الأثر البيئي والاجتماعي لمشروع

مصر للهيدروجين الأخضر لإنتاج الكهرباء بطاقة الرياح بقدرة 205 ميجاوات

بمنطقة جبل الزيت في محافظة البحر الأحمر

قاعة الفورسيزونز بجوار نادي الفتح بمدينة رأس غارب - محافظة البحر الأحمر

الاحد 16 فبراير 2025

مسلسل	الاسم	الوظيفة/ الجهة التابع لها	الايميل	التليفون	التوقيع
52	[illegible]	[illegible]		٠[illegible]٧٦١٧٦١١٩	[illegible]
53	آمال عبد الوهاب مبارك	مفتش تموين		٠١٠٠٩٤٩٦٦٣٧	
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56	[illegible]	مفتش بيئي		٠١٠١٠٠ ٧٩ ٧٩٥	[illegible]
57	هبة أبو [illegible]	EPS manager IPH		01033032[illegible]8	[illegible]
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دراسة تقييم الأثر البيئي والاجتماعي لمشروع

مصر للهيدروجين الأخضر لإنتاج الكهرباء بطاقة الرياح بقدرة 205 ميجاوات

بمنطقة جبل الزيت في محافظة البحر الأحمر

قاعة الفورسيزونز بجوار نادي الفتح بمدينة رأس غارب - محافظة البحر الأحمر

الاحد 16 فبراير 2025

مسلسل	الاسم	الوظيفة/ الجهة التابع لها	الايميل	التليفون	التوقيع
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73	[illegible]	مدير إدارة البيئة بالمحافظة		٠١٠٠٥٢٥٢٧١٢	[illegible]
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83					
84					
85					

11.3 Annex III: Land Registration

11.4 Annex IV: Critical Habitat Assessment (CHA)

11.5 Annex V: Study of the Egyptian lizard

11.6 Assessment of IBA sensitivity and cumulative impact

11.7 Annex 8: Biodiversity Management Plan (BMP)

11.8 Annex 9: Biodiversity Action Plan (BAP)

11.9 Annex III: Detailed Noise Assessment

This document aims to outline the wind turbine generator (WTG) noise source effects on the surrounding community and sensitive receptors by completing noise prediction calculations. The results of the prediction calculation have been evaluated according to local and international regulations and standards, in particular the IFC Standards and Energy Technology Support Unit (ETSU) guidelines.

Objectives

As part of this specialist noise study, the following main objectives have been identified and therefore proposed as outcomes for this report:

- Review and analysis of baseline noise data measured at two locations.
- Noise prediction calculations and analysis for identified worst-case noise scenario (Ws = 10 m/s).
- Assessment of the above scenario according to IFC and local regulations.
- Noise impact assessment of the Scatec WTG development on the surrounding noise sensitive receptors (NSRs).

Input Data

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).
- Baseline noise and metrological data.
- NSR locations

Project Details

Project Background

The project is located off the Gulf of Suez in the eastern part of Egypt. The Scatec wind farm is located approximately 300 km southeast of the capital. The two Scatec layouts consist of 27 and 25 WTGs respectively and covers an area of approximately 25 km^2.

Figure 11-7 shows the Project location in a regional context, and Figure 11-8 and Figure 11-9 shows the Project location in a local context including the layout of the WTGs.

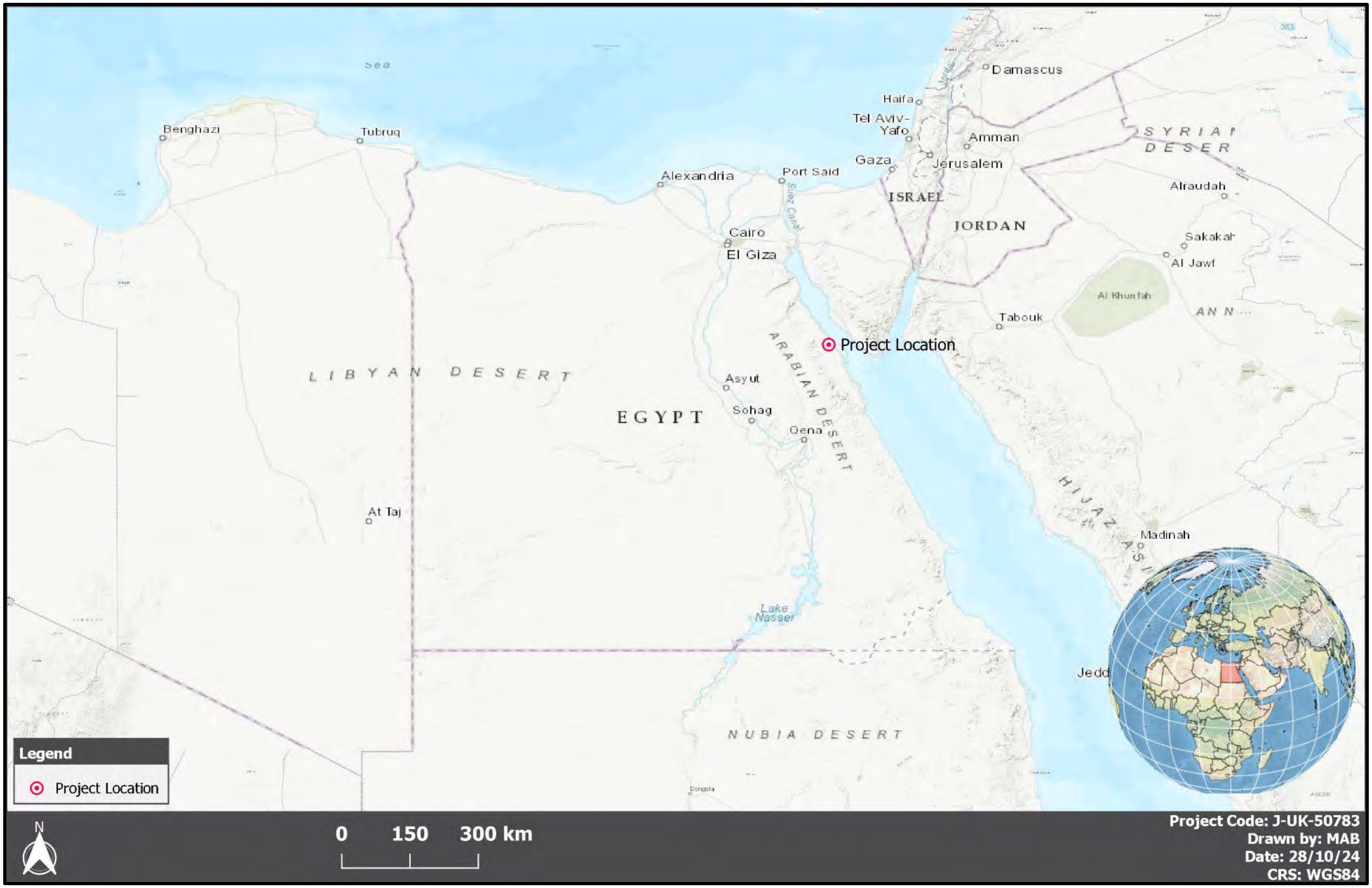

Figure 11-7: Project Location - Regional Context

Figure 11-8: Project Location - Local Context - Scatec Layout 1

Figure 11-9: Project Location - Local Context - Scatec Layout 2

WTG Technical Specifications

The two layouts for the Scatec wind farm site contain 27 and 25 WTGs respectively. The former each with a power rating of 7.5 MW and a 169.5 m rotor diameter, and the latter each with a power rating of 8.0 MW and 169.5 m rotor diameter.

The summary of the specifications for the Envision EN-169.5/7.5 MW and EN-169.5/8.0 MW to be used for the proposed Project are shown below in Table 61 and Table 72.

Table 11-6: Wind Turbine Generator Specification (Layout 1)[30]

Manufacturer	Envision
Model Type	EN-169.5/7.5 MW
Rated Power	7,500 kW
Rotor Diameter	169.5 m
Hub Height	100 m
Cut-in Wind Speed	3 m/s
Cut-out Wind Speed	25 m/s
Tower Type	Steel / hybrid – tubular tower
Blade Type	GFRP
Generator Type	DFIG

Table 11-7: Wind Turbine Generator Specification (Layout 2)[31]

Manufacturer	Envision
Model Type	EN-169.5/8.0 MW
Rated Power	8,000 kW
Rotor Diameter	169.5 m
Hub Height	100 m
Cut-in Wind Speed	3 m/s
Cut-out Wind Speed	25 m/s
Tower Type	Steel / hybrid – tubular tower
Blade Type	GFRP
Generator Type	DFIG

Noise Sensitive Receptors

Based on a review of Project data and a desktop review of the Project site and surrounding areas, a total of 35 NSRs have been identified near the Scatec wind farm. No other sensitive receptors have been identified within 2,000 m of any WTGs. Figure 11-10 and Figure 11-11 displays the locations of the NSRs and the table below provides their coordinates of the NSRs.

Table 11-8: Noise Sensitive Receptors

[30] "Envision, Technical Specification for the Sound Power Level of Envision EN-171/8.0 Wind Turbine Generator, DVP-0037456 B, 26 July 2023"
[31] "Envision, Technical Specification for the Sound Power Level of Envision EN-171/8.0 Wind Turbine Generator, DVP-0037456 B, 26 July 2023"

NSR	UTM Coordinates (Zone 36)	
	mE	mN
NSR1	523397	3096856
NSR2	523279	3096627
NSR3	523162	3096619
NSR4	523172	3096781
NSR5	522900	3096702
NSR6	522542	3096304
NSR7	522207	3096304
NSR8	521633	3096530
NSR9	521782	3096199
NSR10	521557	3095902
NSR11	521259	3095529
NSR12	520753	3095702
NSR13	520030	3096184
NSR14	520094	3095446
NSR15	518786	3095195
NSR16	520120	3095195
NSR17	521054	3095253
NSR18	521035	3095080
NSR19	523414	3094699
NSR20	523118	3094477
NSR21	522698	3095475
NSR22	521726	3095417
NSR23	521727	3095302
NSR25	521827	3095647
NSR26	522008	3095582
NSR27	522088	3095846
NSR28	522215	3095936
NSR29	522487	3096077
NSR30	522757	3096184
NSR31	523017	3096269
NSR32	523397	3096856
NSR33	523279	3096627
NSR34	523162	3096619
NSR35	523172	3096781
NSR36	522900	3096702

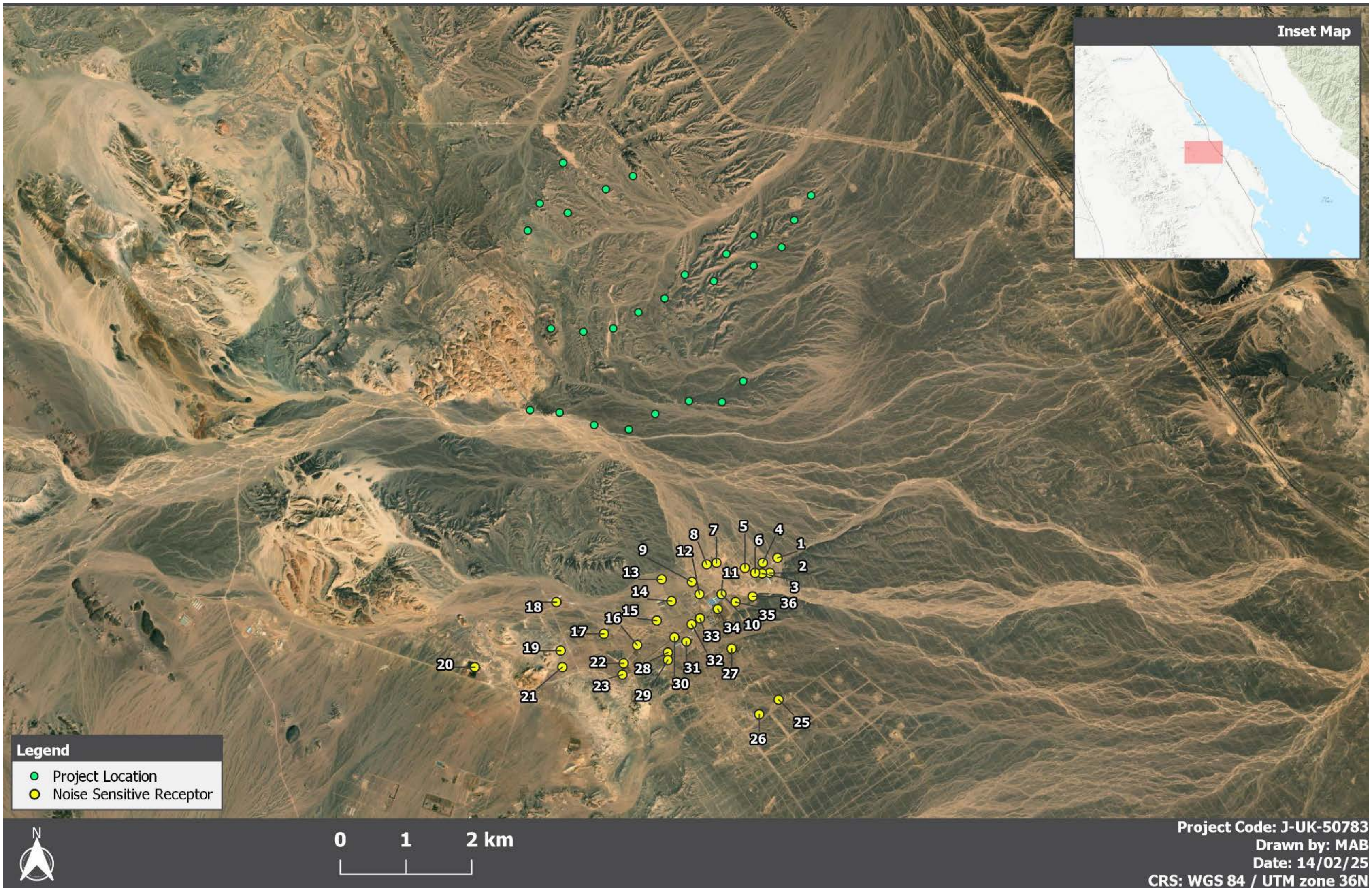

Figure 11-10: Noise Sensitive Receptors – Scatec Layout 1

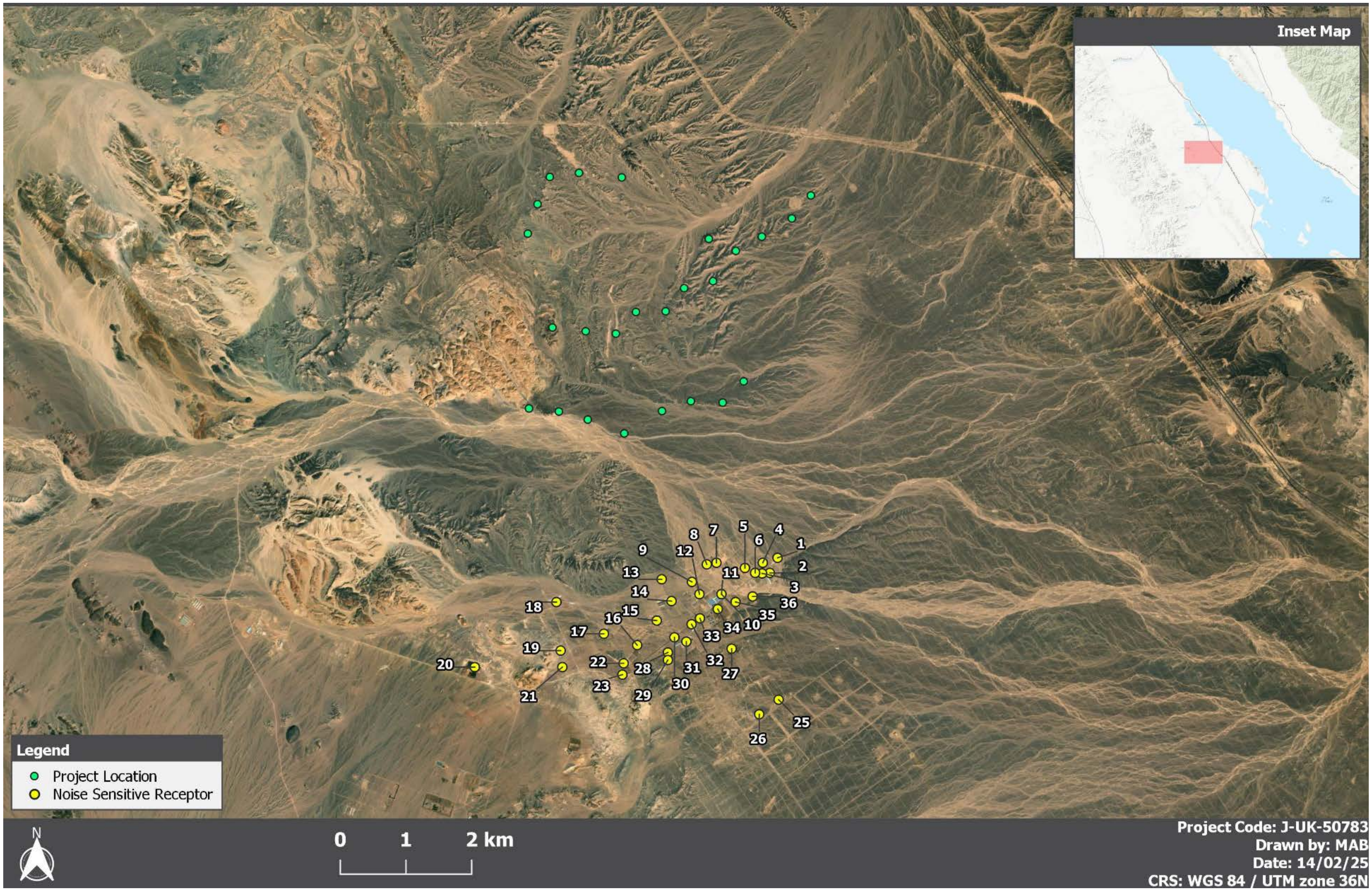

Figure 11-11: Noise Sensitive Receptors – Scatec Layout 2

Existing Wind Farms in Surrounding Area

There are existing and / or proposed wind farms present in the surrounding area of the proposed Project locations that have the potential to increase the cumulative noise levels at the identified NSRs. Therefore, the assessment should consider all wind turbine noise emissions that have the potential to increase noise levels at noise sensitive receptors. The figure below shows the locations of the existing wind farms with respect to the Scatec wind farm. These wind farms were included in the model.

SWE Wind Farms

The SWE wind farms contain a total 69 wind turbine generators, each of which houses an Envision EN-171/8.0 MW wind turbine. The table below details the basic specifications.

Table 11-9: Wind Turbine Generator Specification[32]

Manufacturer	Envision
Model Type	EN-171/8.0 MW
Rated Power	8,000 kW
Rotor Diameter	171 m
Hub Height	100 m
Tower Type	Steel / hybrid – tubular tower
Blade Type	GFRP
Generator Type	DFIG

JICA, KFW & Spain Wind Farms

The JICA, KFW & Spain wind farms contain a total 290 wind turbine generators, each of which houses a Siemens Gamesa SG G80 2.0 MW wind turbine. The table below details the basic specifications.

Table 11-10: Siemens Gamsea G80 2.0 MW Wind Turbine Generator Specification[33]

Manufacturer	Siemens Gamesa
Model Type	G80 2.0 MW
Rated Power	2,000 kW
Rotor Diameter	80 m
Hub Height	60 m
Tower Type	Conical Steel Barrel Tube
Blade Type	Siemens Gamesa – Fibreglass reinforced with epoxy or polyester resin
Generator Type	Doubly-fed induction machine

[32] "Envision, Technical Specification for the Sound Power Level of Envision EN-171/8.0 Wind Turbine Generator, DVP-0037456 B, 26 July 2023"
[33] Siemens Gamesa G80 2.0 MW power curve and noise emission levels, GD022912-en, 20/07/18

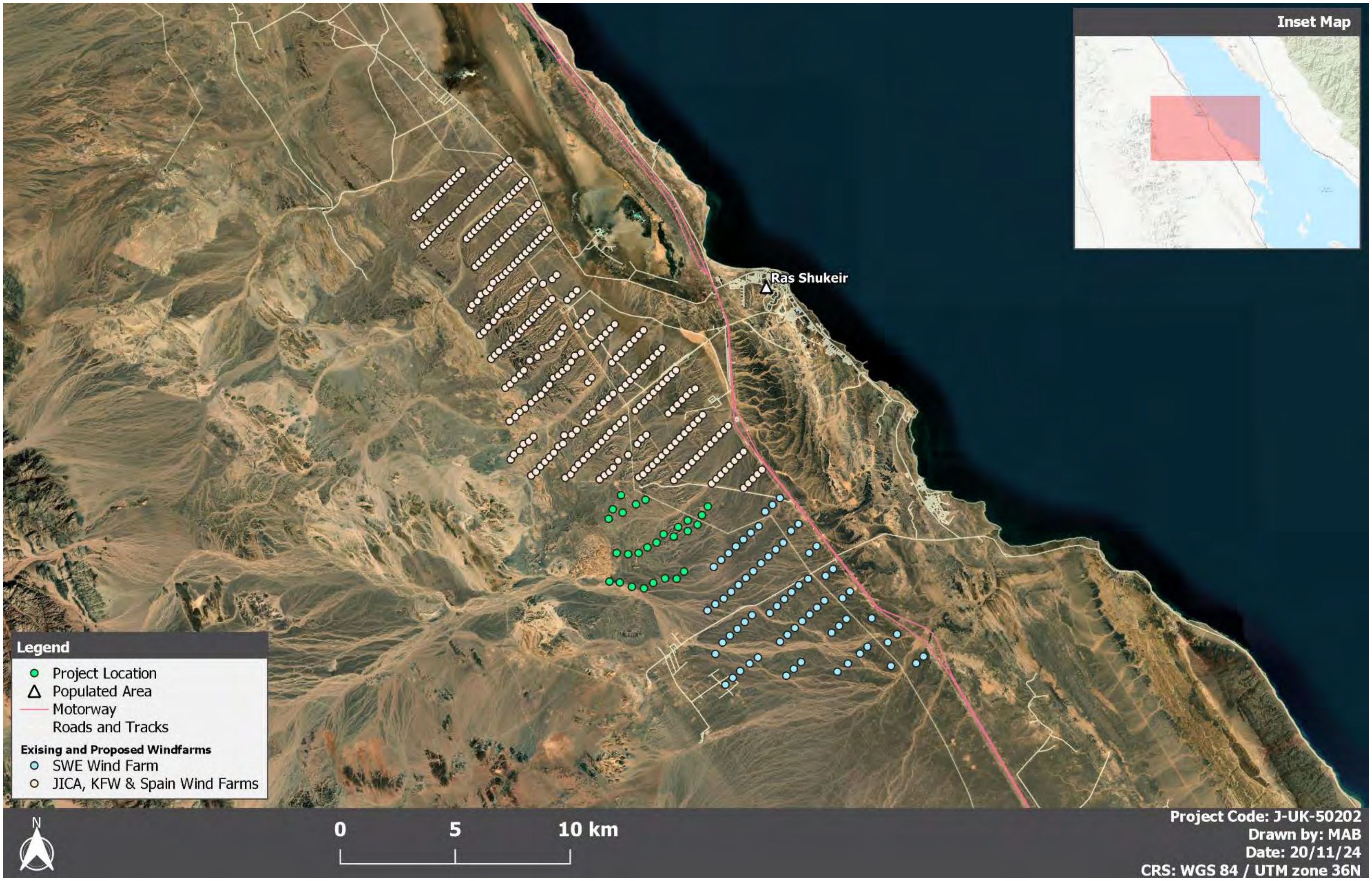

Figure 11-12: Existing and Proposed Wind Farms – Scatec Layout 1

Figure 11-13: Existing and Proposed Wind Farms – Scatec Layout 2

Identification and Analysis of Regulations and Standards

Regulatory Framework for Noise Assessments

International guidelines that have been reviewed included the World Health Organisations (WHO) Guideline for Community Noise (WHO 2002)[34] and the World Bank Group / International Finance Corporation (IFC) Environmental Health and Safety (EHS) General Guidance (2007)[35].

A review of international best practices for Wind Turbine Noise is applicable for the noise study, the following are the most applicable:

- ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms produced by the Energy Technology Support Unit (ETSU) for the UK Department of Trade and Industry[36].
- Institute of Acoustics (IOA) Good Practice Guide for Wind Turbine Noise[37].
- The World Bank Group / International Finance Corporation Environmental, Health, and Safety Guidelines for Wind Energy[38].

Summary of Applicable Standards and Best Practices pertaining to Wind Turbines

The following summarises the main standards and best practice guides to wind turbine noise:

IFC EHS Guidelines on Wind Energy

The IFC EHS Guidelines on Wind Energy refers as follows to noise considerations:

Operational Noise

A description of the main noise producing mechanism is listed along with a general methodology for conducting a noise impact assessment with the following principles:

- 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

[34] World Health Organisation, WHO Guideline for Community Noise, 2002 https://www.who.int/publications/i/item/a68672.
[35] International Finance Corporation, IFC Environmental Health and Safety General Guidance, 2007 https://www.ifc.org/content/dam/ifc/doc/2000/2007-general-ehs-guidelines-en.pdf.
[36] UK Department of Trade and Industry, ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms produced by the Energy Technology Support Unit (ETSU) for the UK Department of Trade and Industry, 1998 https://assets.publishing.service.gov.uk/media/5a798b42ed915d07d35b655a/ETSU_Full_copy__Searchable_.pdf.
[37] Institute of Acoustics, Good Practice Guide for Wind Turbine Noise, 2013 https://www.ioa.org.uk/sites/default/files/IOA%20Good%20Practice%20Guide%20on%20Wind%20Turbine%20Noise%20-%20May%202013.pdf.
[38] International Finance Corporation, Environmental, Health and Safety Guidelines for Wind Energy https://www.ifc.org/en/insights-reports/2015/publications-policy-ehs-wind-energy.

(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 L_{A90} of 35 decibels (dBA) at a wind speed of 10 meters/second (wind speed measured 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.
- All modelling should take account of the cumulative noise from all wind energy facilities in the vicinity having the potential to increase noise levels.
- If noise criteria based on ambient noise are to be used, it is necessary to measure the background noise in the absence of any wind turbines. This should be done at one or more noise-sensitive receptors. Often the critical receptors will be those closest to the wind energy facility, but if the nearest receptor is also close to other significant noise sources, an alternative receptor may need to be chosen.
- The background noise should be measured over a series of 10-minute intervals, using appropriate wind screens. At least five of these 10-minute measurements should be taken for each integer wind speed from cut-in speed to 12 m/s.

The above principles are referenced from the following key documents which are described in sections that follow:

- ETSU, Report ETSU-R-97, "The Assessment and Rating of Noise from Wind Farms" (1997).
- Institute of Acoustics (IOA), "A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise", 2013.

ETSU-R-97 "The Assessment and Rating of Noise from Wind Farms" (1997)

Published in September 1996, ETSU Report ETSU-R-97 was a research report produced by the Energy Technology Support Unit (ETSU). 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 UK Government as a best practice guide for UK Legislation.

The assessment procedure of ETSU-R-97 consists of the following steps:

- Predict noise levels from all turbines (existing and proposed) at the nearest receptors.
- Determine a study area.
- Identify potentially affected properties.
- (If required) undertake a measurement survey consisting of simultaneous measurements of background noise levels at representative properties with wind speed and direction at the proposed turbine site.

- Analyse the data to remove rain affected and atypical data and derive the noise limits for the scheme.
- Update noise predictions & assess compliance with the noise limits for a candidate turbine and provide design advice if compliance with the limits is considered unlikely.

In particular, ETSU-R-97 provides detailed methodology for the setting of external noise limits which are either:

- Relative to the background (L_{A90}); or,
- Fixed when background noise levels are otherwise very low.

IOA Good Practice Guide to ETSU-R-97

The Department of Energy and Climate Change (DECC) invited the Institute of Acoustics (IOA) to form a noise working group to produce a Good Practice Guide (GPG) to the application of ETSU-R-97 in terms of the technical elements only. The document was prepared by a specialist working group and reviewed by a peer group of professionals working in a variety of relevant disciplines. The document should be regarded as a refinement of the ETSU-R-97 guidance to ensure consistency, and this noise assessment follows the guidelines stated therein.

The main guidance in the IOA Good Practice Guide are:

- Background Data Collection.
- Data Analysis and Noise Limit Derivation.
- Noise Prediction Modelling.
- Cumulative Noise Assessment Principles.

Further the GPG clarifies the following main issues from ETSU-R-97:

- ISO 9613 is to be used for Wind Turbine noise predictions, with particular stipulations and limitations.
- The background noise measurements (and thereby defining limits) are to be corrected for wind shear by correlating the background noise measurements with the standardised wind speed at 10 m height which is derived from the hub height wind speed using a standard equation.

ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation

ISO 9613-2:1996 Part 2[39] describes a 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. The method predicts the equivalent continuous A-weighted sound pressure level (as described in ISO 1996) under meteorological conditions.

[39] International Organisation for Standardisation (ISO), ISO9613-2 'Acoustics – Attenuation of Sound During Propagation Outdoors', 2024 https://www.iso.org/standard/74047.html.

The application and further description of the ISO 9613-2 standard is described in Section 7 – Noise Model of this report.

Baseline Measurements

Noise Monitoring Survey

A noise monitoring survey commenced at two locations at the Project site on 27th January 2024 and finished on 10th February 2024. The purpose of the survey was to measure background noise levels across a range of wind speeds. The measurements were taken continuously in 10 minute intervals.

Sound Level Meter Details

Two B&K 2250's (S/N: 3010390 & 2709811) 'type 1' integrating sound level meters, together with a multi-function acoustic calibrator type 4231, were used for the measurement survey. The selected sound level meters automatically log environmental noise measurement parameters including L_{A90}. Noise measurements were made in accordance with best practice advocated in the International Standard "ISO 1996 Description and Measurement of Environmental Noise" [40] as well as ETSU-R-97 which gives key considerations for the selection of measurement locations.

The factory calibrated noise meter was also field calibrated prior to use and following field measurements in order to detect any potential 'drift' in the measurements. Calibration certificates are presented in Appendix B.

Microphone Orientation

During the noise measurements, the microphone was placed to ensure protection from air currents, vibrations, electric or magnetic fields, dust, and other influences that may affect the noise reading. There were no reflecting structures (other than the ground) so that the influence of reflections was minimised. The height of the microphone was set at 1.5 m above the ground level.

Meteorological Conditions

Weather conditions were generally found to be suitable during baseline noise monitoring. A period of rain was identified during the night hours of 2nd and 3rd February. Wind speed and direction were recorded at 10-minute averaging intervals, extracted from the Project met mast positioned at a hub height of 100 m.

Noise Survey Location

The IOA GPG states that the 'study area for background noise surveys (and noise assessment) should, as a minimum, be the area within which noise levels from the proposed, consented and existing wind turbine(s) may exceed 35 dB L_{A90} at up to 10 m/s wind speed'.

[40] "International Organization for Standardisation (ISO) 1996-1: 2003 'Description and Measurement of Environmental Noise'," 1996 https://cdn.standards.iteh.ai/samples/59765/b0c065255b7a45658425773086323f0e/ISO-1996-1-2016.pdf.

Considering the above, the selected noise monitoring sites were positioned to the west of the wind farm site, strategically placed within the region where the majority of NSRs are situated and can be considered representative of the other NSRs located within the same area. The location of the noise monitoring point / NSR is shown in Figure 11-14 and Figure 11-15 with the coordinates provided in the table below.

Table 11-11: Noise Sensitive Receptor / Noise Monitoring Location Coordinates

NSR	Coordinates UTM (Zone 36)	
	Easting mE	Northing mN
Noise Measurement Location 1	520901	3096119
Noise Measurement Location 2	521699	3094785

Noise Measurement Methodology

All measurements were taken as per the procedures and requirements set out in ETSU-R-97. The main measurement considerations as summarised by the IOA GPG are as follows:

- Measurements should be made in amenity areas between 3.5 and 20 metres from a dwelling.
- The measurement position should permit measurement of 'background noise levels judged to be typical/indicative of the area around the associated dwelling and any other dwellings for which the measurement location will serve as a proxy.
- The influence of noise from local sources should be taken into account when selecting measurement locations.
- The person selecting background noise monitoring positions and visiting these locations should record subjective impressions of sources contributing to local ambient noise levels.
- Residents should be consulted to establish the occurrence of unusual noise events during the monitoring period.

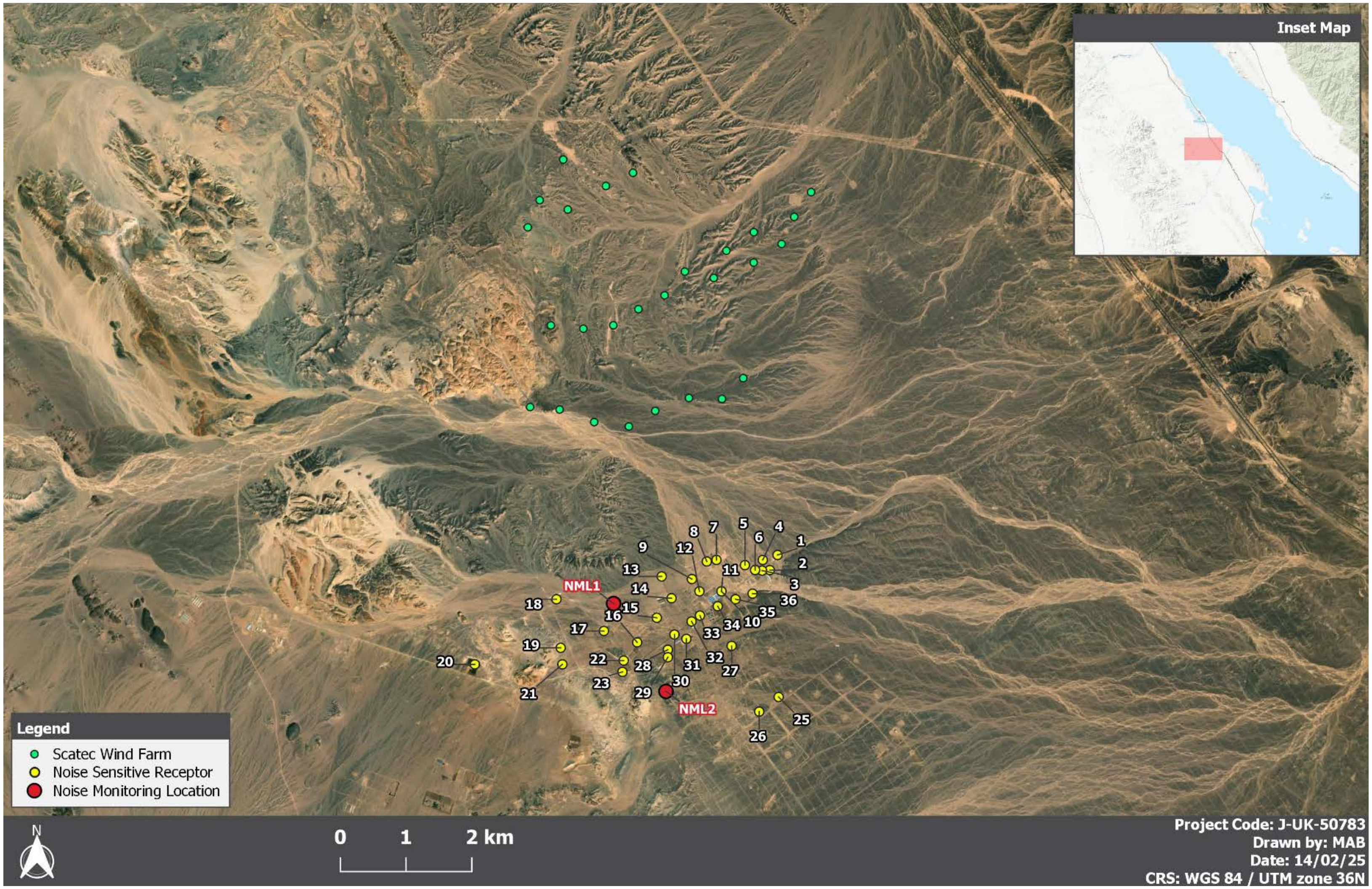

Figure 11-14: Location of Noise Measurement Site – Scatec Layout 1

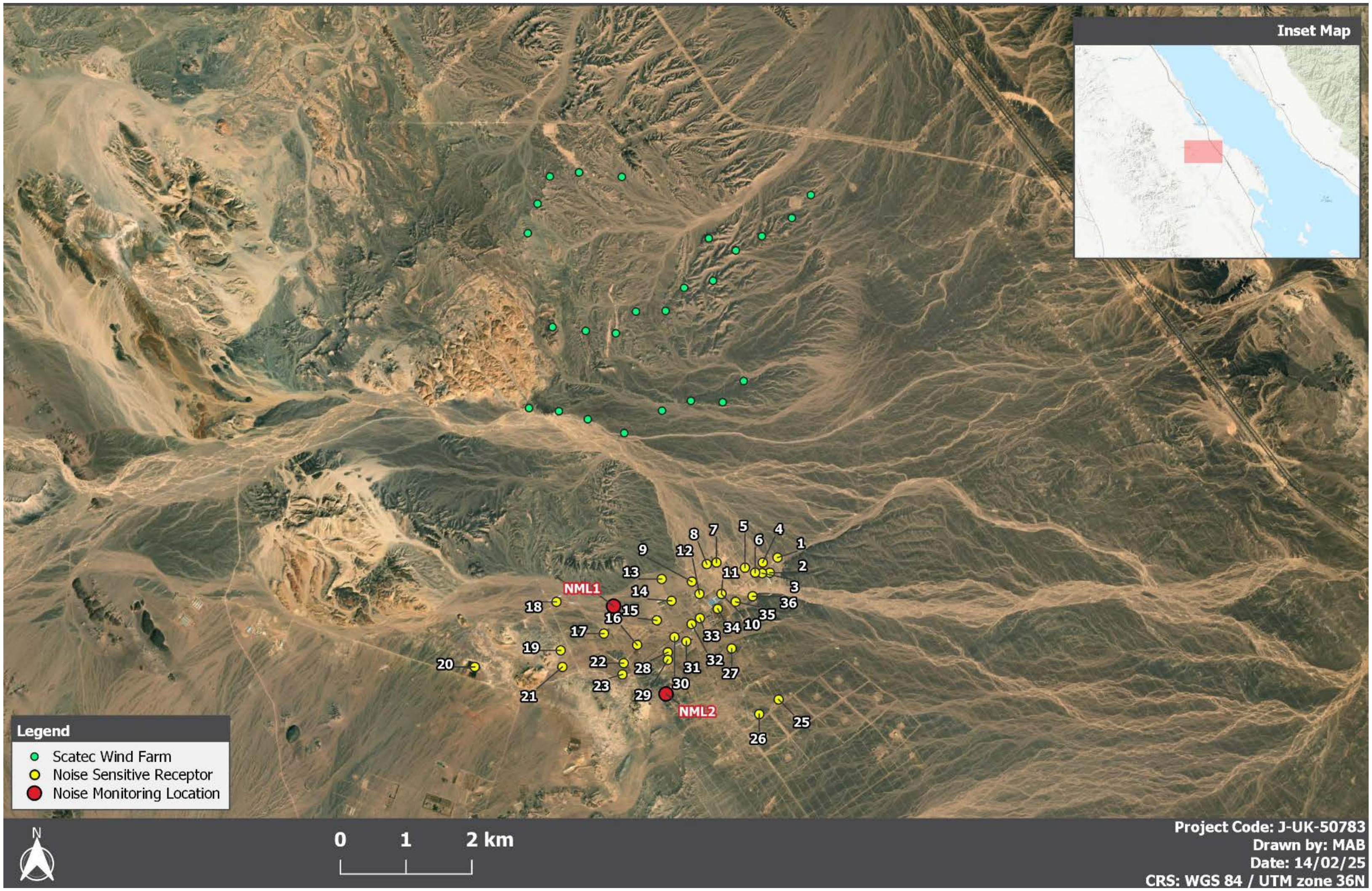

Figure 11-15: Location of Noise Measurement Site – Scatec Layout 2

Noise Survey Summary

The survey methodology followed is summarised in the table below.

Table 11-12: Summary of Noise Survey Methodology

Parameters	L_{Aeq} and L_{A90}
Equipment	Type 1 Sound Level Meter (SLM) Field Calibrator Wind shield Heavy Duty Tripod
Reference method	ISO 1996-1:2003 (International Organization for Standardisation (ISO) 1996-1: 2003 'Description and Measurement of Environmental Noise', 1996)
No. locations	2
Measurement interval	10 minutes
Duration (per location)	15 days
Data Points	NML 1: 2016 NML 2: 2016
Dates covered	27th January 2024 to 10th February 2024
Calibration drift over measurement period	0 dB

Measurement parameters were recorded within the sound level meters' in-built memory and retrieved using the associated software.

Windspeed

Wind speed data was recorded from a met mast located in the vicinity of the proposed wind farm site. The mast supports a variety of instruments at several heights as per the configuration shown in the table below.

Table 11-13: Key Component Configuration of Wind Mast

Equipment	Height (m)	Measurement Units	Manufacturer/SN
Anemometer 1	100	m/s	03223704
Anemometer 2	82	m/s	03223703
Anemometer 3	60	m/s	03223701
Wind Vane 1	96	deg	03222135
Wind Vane 2	80	deg	03222137
Wind Vane 3	22	deg	03222132
Thermometer	91	deg C	253753
Barometer	91	mb	B22 0162

The data from all instruments on the mast is captured on a 10-minute averaging period by a data logger. The banked data is then downloaded to cover the requisite monitoring period.

The wind speeds taken from the station were scaled to W_{10} (windspeed at 10 m) as per ETSU-R-97.

Numerical Analysis of Baseline Data Set

Data Analysis and Noise Limit Derivation

ESTU-97-R states that the purpose of data analysis is to provide a representative background noise level across a range of wind speeds for the daytime and night-time hours and therefore define appropriate noise limits for a proposed wind energy development.

The procedure for the analysis of background data is as follows:

- Limiting atypical noise sources during a designated period of noise measurement is essential to capture a representative depiction of the prevailing noise environment at a given measurement location.
- Data filtering of noise, the L_{A90},10-minute noise levels and average 10-minute wind speed data pairs are plotted on a scatter plot. To minimise the influence of atypical noise sources, filtering the data is generally required. Examples of atypical noise sources include low flying aircraft, 'dawn chorus' (morning birds), rainfall and traffic noise.
- Regression analysis using polynomials (unless heavy traffic noise is considered) is used and in most cases third order polynomials should be sufficient to allow reasonable representation of the prevailing background noise levels during the survey period.
- The derived prevailing background noise polynomial curve should not be extended beyond the range of covered by 'adequate' data points and for higher wind speeds it should be restricted to the highest point. Similar corrections should be undertaken for low wind speeds, i.e. the lowest derived background noise level is adopted for all wind speeds below where this derived minimum occurs. The above-described considerations are illustrated in the figure example below.

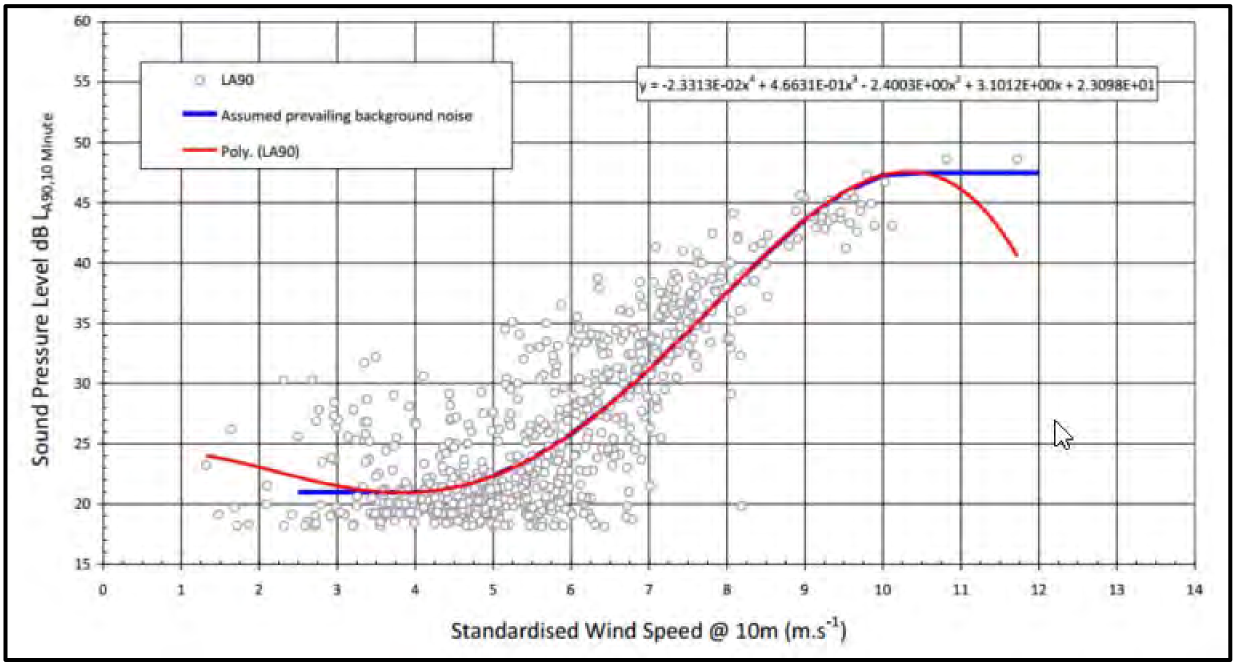

Figure 11-16: Example of limiting lower and upper prevailing background noise levels[41]

Correction for Wind Shear

The Institute of Acoustics GPG requires that wind shear on site is taken into account for the noise assessment. Wind Shear (or wind gradient) is a difference in wind speed and/or direction in the atmosphere. Generally pertaining to wind turbines, the horizontal wind shear is considered, which is the change in wind speed with change in altitude.

The use of the standard wind speed at 10 m height is preferred and is derived from the hub height wind speed according to the log law equation. This equation describes the variation in wind speed with height. The ground roughness is set at 0.05 m.

$$V_{10} = V_{hh} \cdot \frac{\ln\left[\frac{10}{Z_0}\right]}{\ln\left[\frac{hh}{Z_0}\right]} \qquad \textbf{(1)}$$

Where:

- V_{10} = Wind speed at 10 m height;
- V_{hh} = Wind speed at hub height; and
- Z_0 = Ground roughness length (0.05 m).

[41] Institute of Acoustics, Good Practice Guide for Wind Turbine Noise, 2013 https://www.ioa.org.uk/sites/default/files/IOA%20Good%20Practice%20Guide%20on%20Wind%20Turbine%20Noise%20-%20May%202013.pdf.

Noise Measurement Results

Noise measurement results from the measurement period is shown in the figures below, plotting sound level versus time for both the background noise level (L_{A90}).

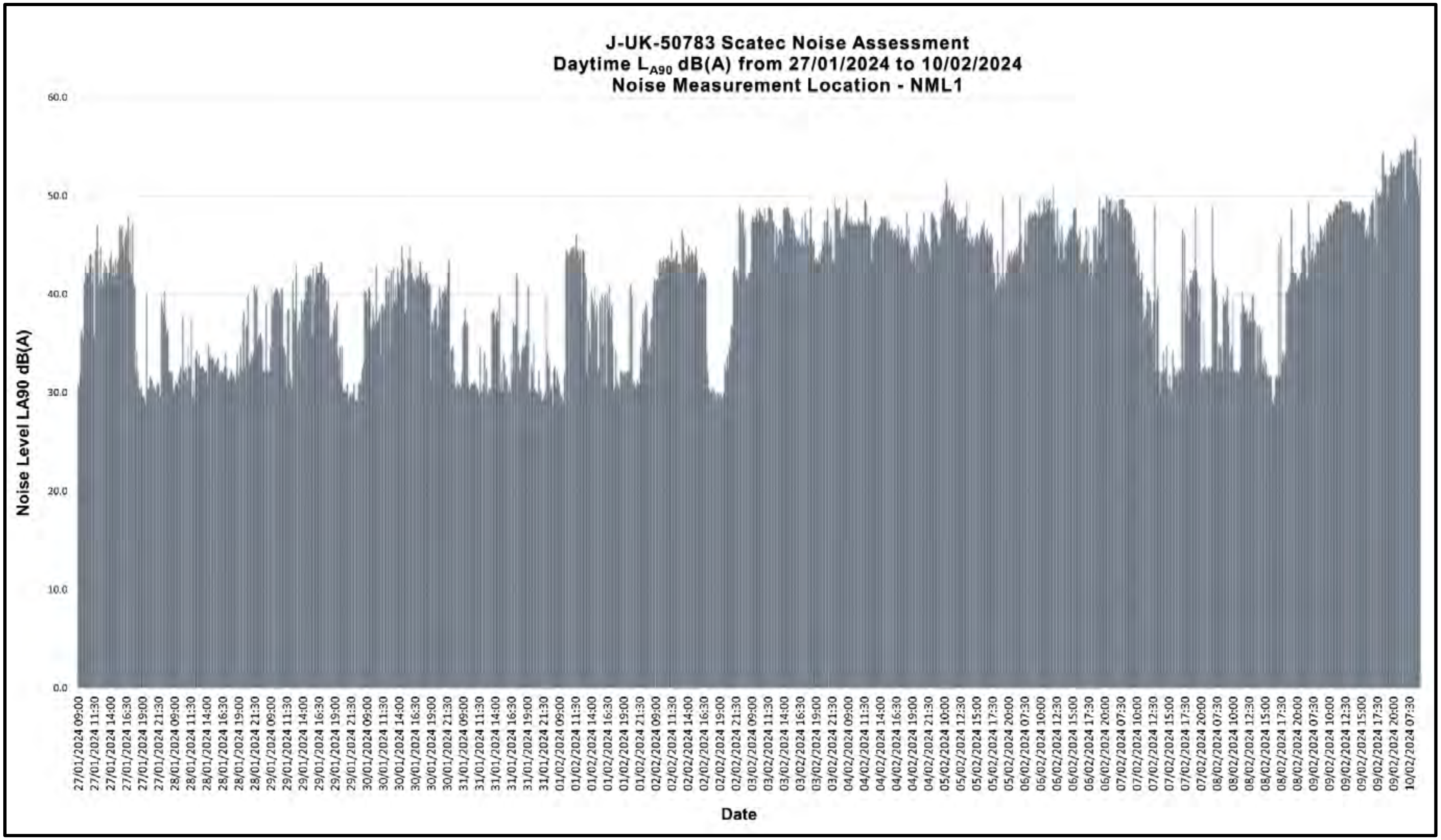

Figure 11-17: Daytime Noise Plot for Baseline Measurements – Measurement Location NML1

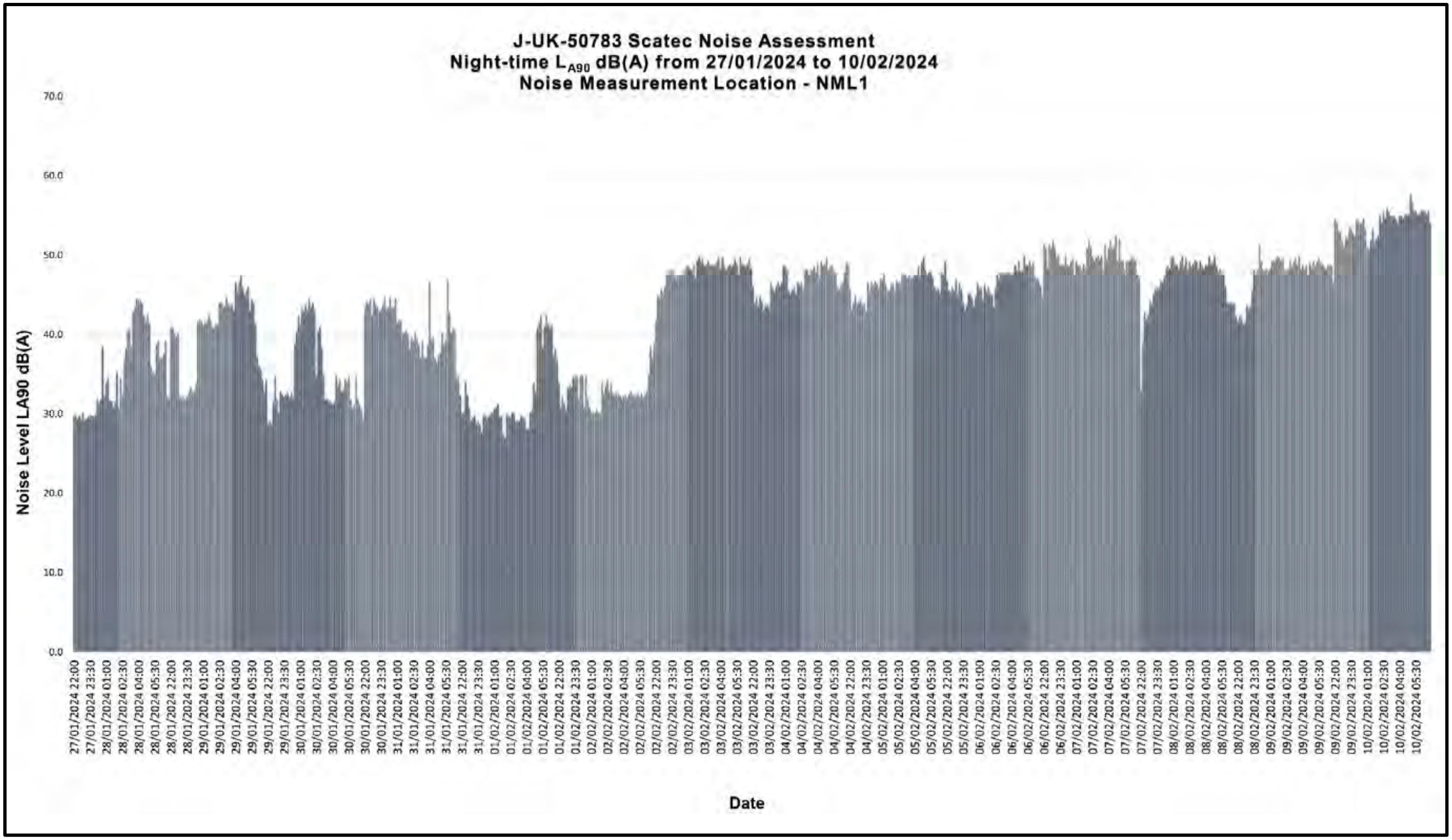

Figure 11-18: Night-time Noise Plot for Baseline Measurements – Measurement Location NML1

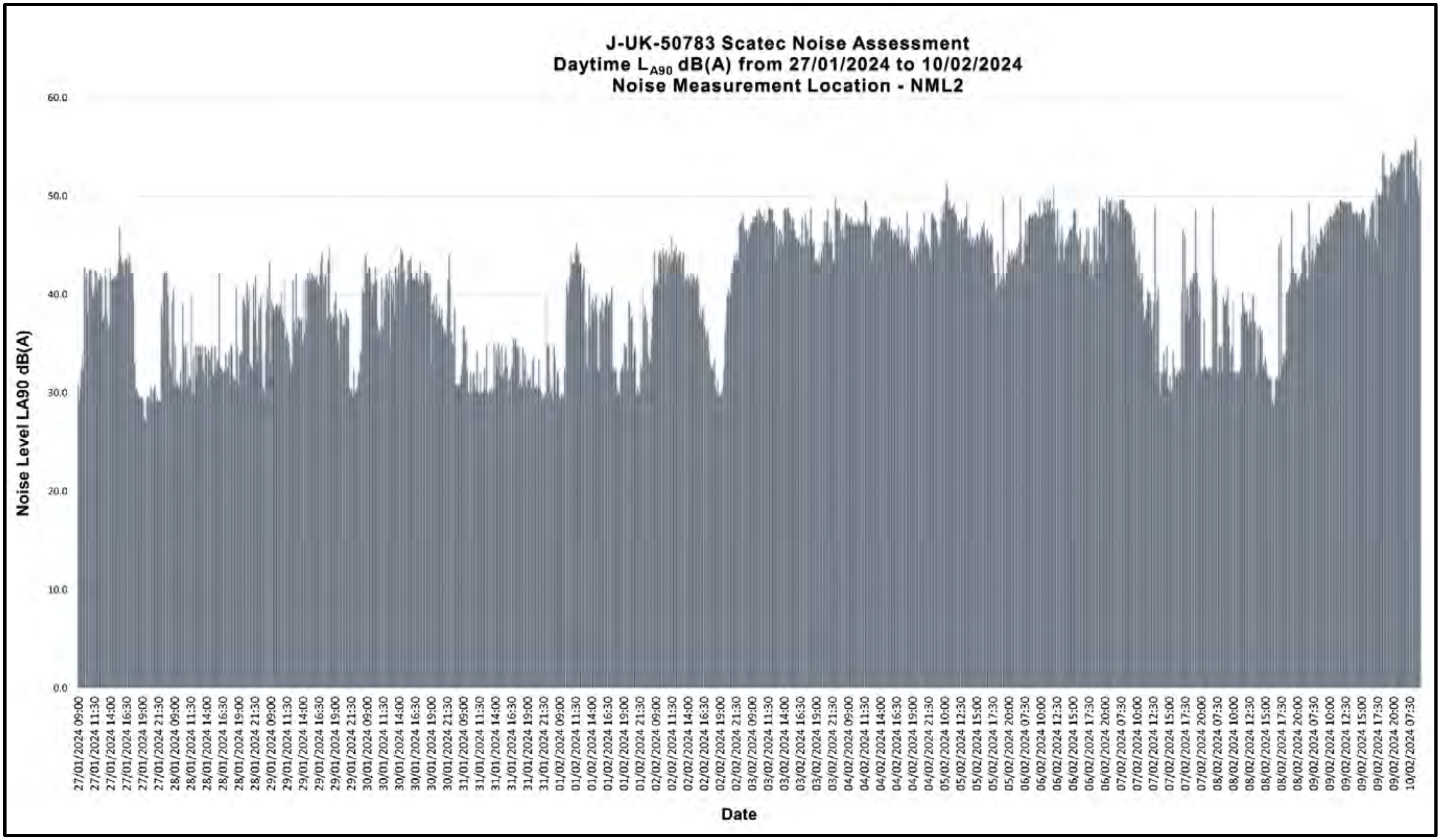

Figure 11-19: Daytime Noise Plot for Baseline Measurements – Measurement Location NML2

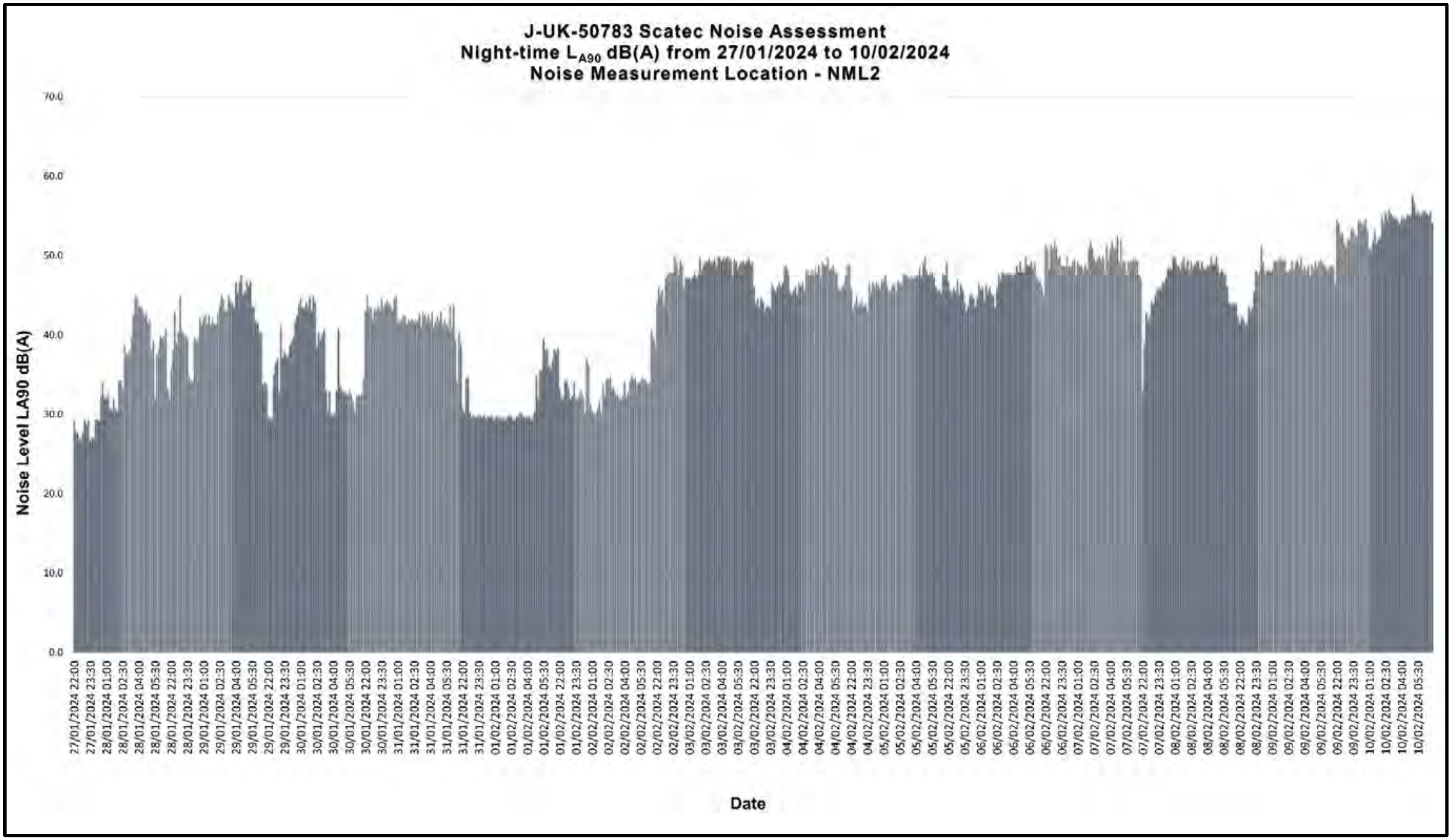

Figure 11-20: Night-time Noise Plot for Baseline Measurements – Measurement Location NML2

Determination of Background Noise vs. Wind Speed Relationship

Baseline data was filtered and divided into daytime and night-time hours as per defined time periods of ETSU-R-97 and IFC guidelines. The data points were then plotted in a scatter plot with L_{A90} (considered representative of background noise) displayed as a function of windspeed. A polynomial regression of the relationship between these parameters was then calculated. Where there were periods of rain, these data points were removed from the dataset.

The relationships derived for L_{A90} as a function of windspeed for the daytime and night-time periods over the course of this monitoring campaign are shown in Figure 11-21 and Figure 11-22.

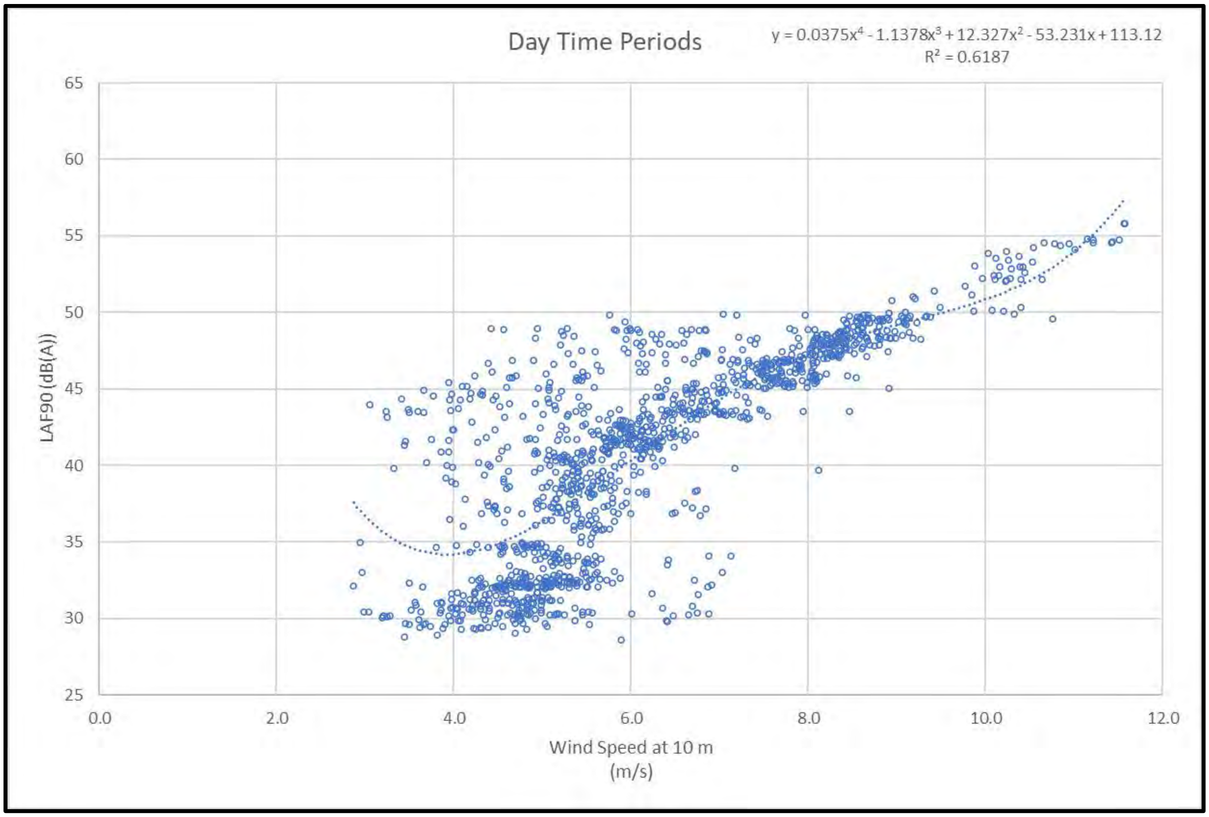

Figure 11-21: NM1 - Background Noise as a Function of Windspeed – Daytime

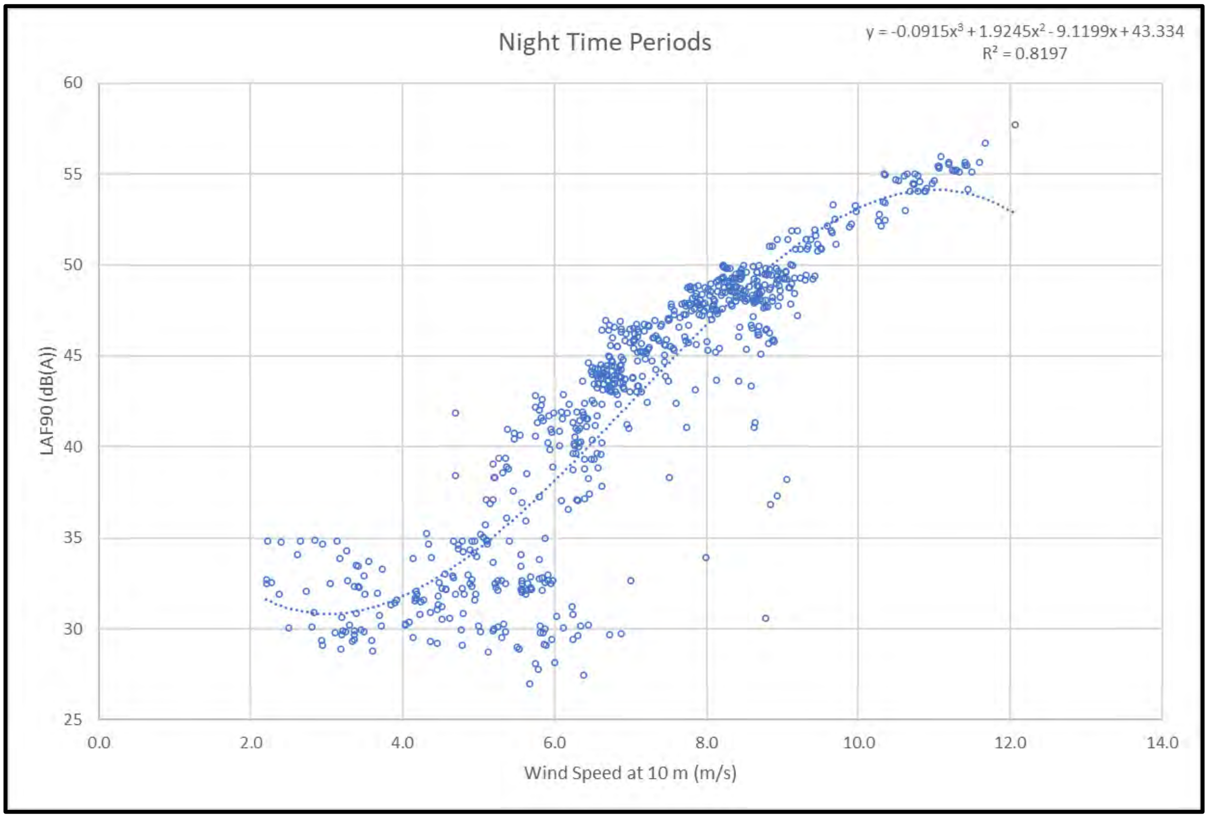

Figure 11-22: NM1 - Background Noise as a Function of Windspeed – Night-time

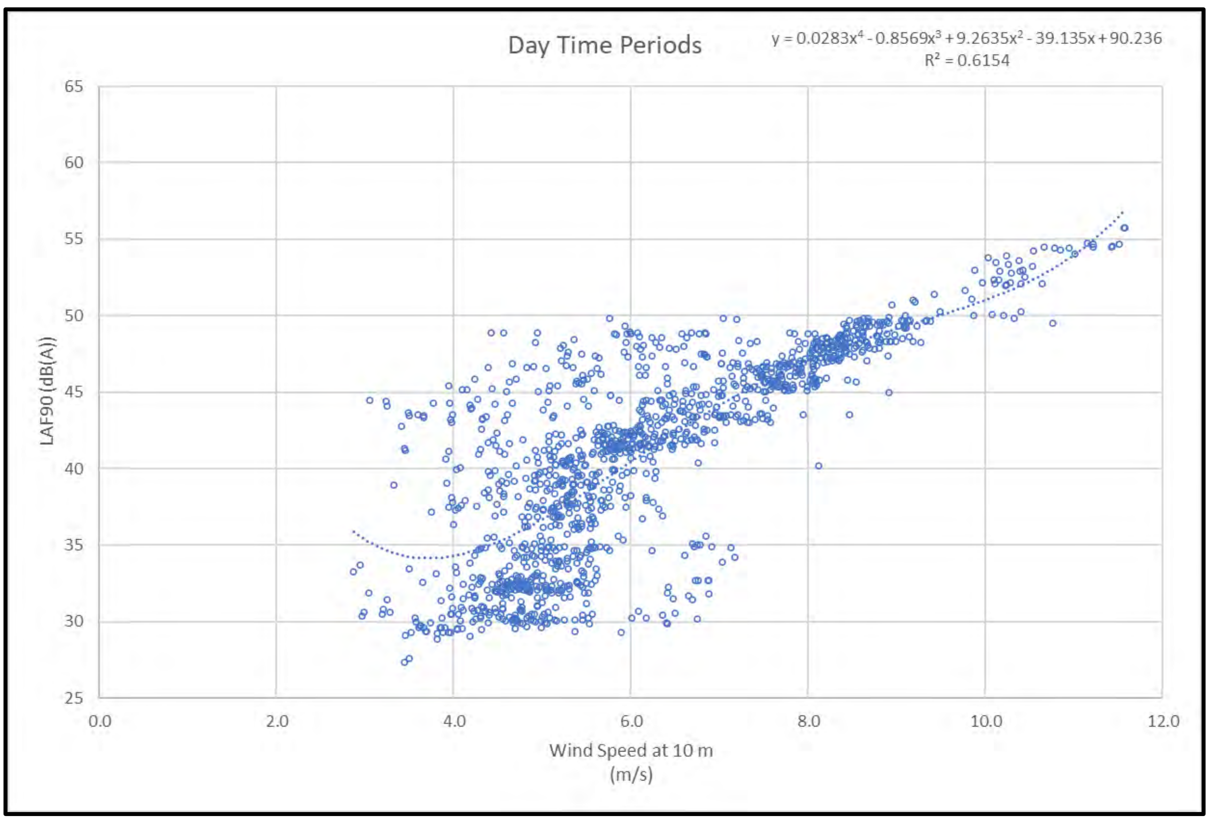

Figure 11-23: NM2 - Background Noise as a Function of Windspeed – Daytime

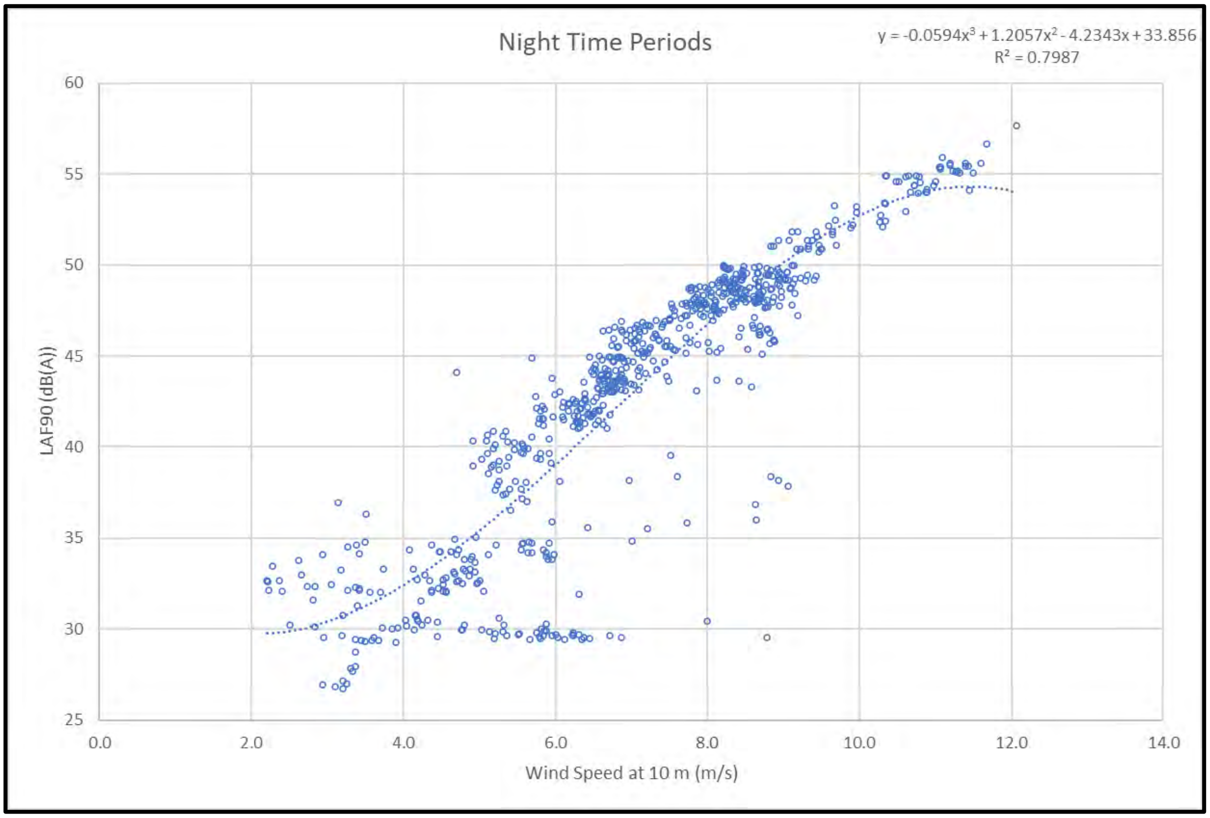

Figure 11-24: NM2 - Background Noise as a Function of Windspeed – Night-time

Wind Turbine Generator

Description of Wind Turbine Noise

There are two main generated noise sources from wind turbines:

- Aerodynamic Noise – produced from the flow of air around the blades.
- Mechanical Noise – produced from the mechanical and electrical components within the nacelle (the cover housing the generating components of a WTG).

Aerodynamic Noise

Aerodynamic noise is produced from the flow of air around the blades. These acoustic emissions can be either tonal or broadband. Broadband noise has a frequency spectrum where there are no discreet or dominant tones (non-periodic and relatively random phase and amplitude), whereas tonal noise is dominated by specific frequencies which are clearly identifiable. The figure below is a simplified representation of the airflow over a wind turbine blade.

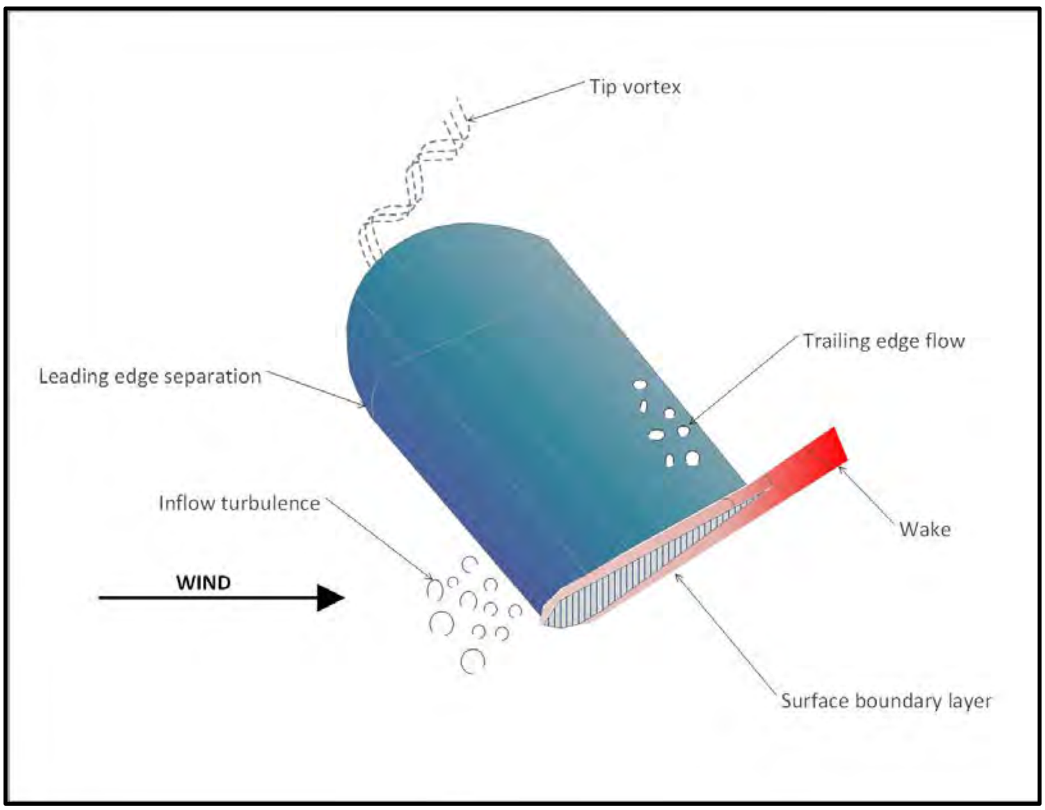

Figure 11-25: Simplified representation of airflow over a WTG blade

Aerodynamic broadband noise from wind turbines is emitted as the blades spin and interact with atmospheric turbulence as the displaced air flows along the blade surfaces. This produces a so-called "wooshing" sound through several mechanisms:

- Inflow turbulence noise occurs when the rotor blades encounter atmospheric turbulence as they pass through the air. Uneven pressure on a rotor blade causes variations in the local angle of attack, which affects the lift and drag forces to cause aerodynamic loading fluctuations. This generates noise that varies across a wide range of frequencies but is most significant at levels below 500 Hz.
- Trailing edge noise is produced as boundary-layer turbulence around the air foil passes into the wake, or trailing edge, of the blade. This noise is distributed across a wide frequency range but is most notable at high frequencies between 700 Hz and 2 kHz.
- Tip vortex noise occurs when tip turbulence interacts with the surface of the blade tip. While this is audible near the turbine, it tends to be a small component of the overall noise further away.
- Stall or separation noise occurs due to the interaction of turbulence with the blade surface.

Mechanical Noise

Mechanical noise is produced and is emitted by the mechanical and electro-mechanical machinery located within the nacelle. The figure below shows a basic view of the nacelle and components common to most wind turbines.

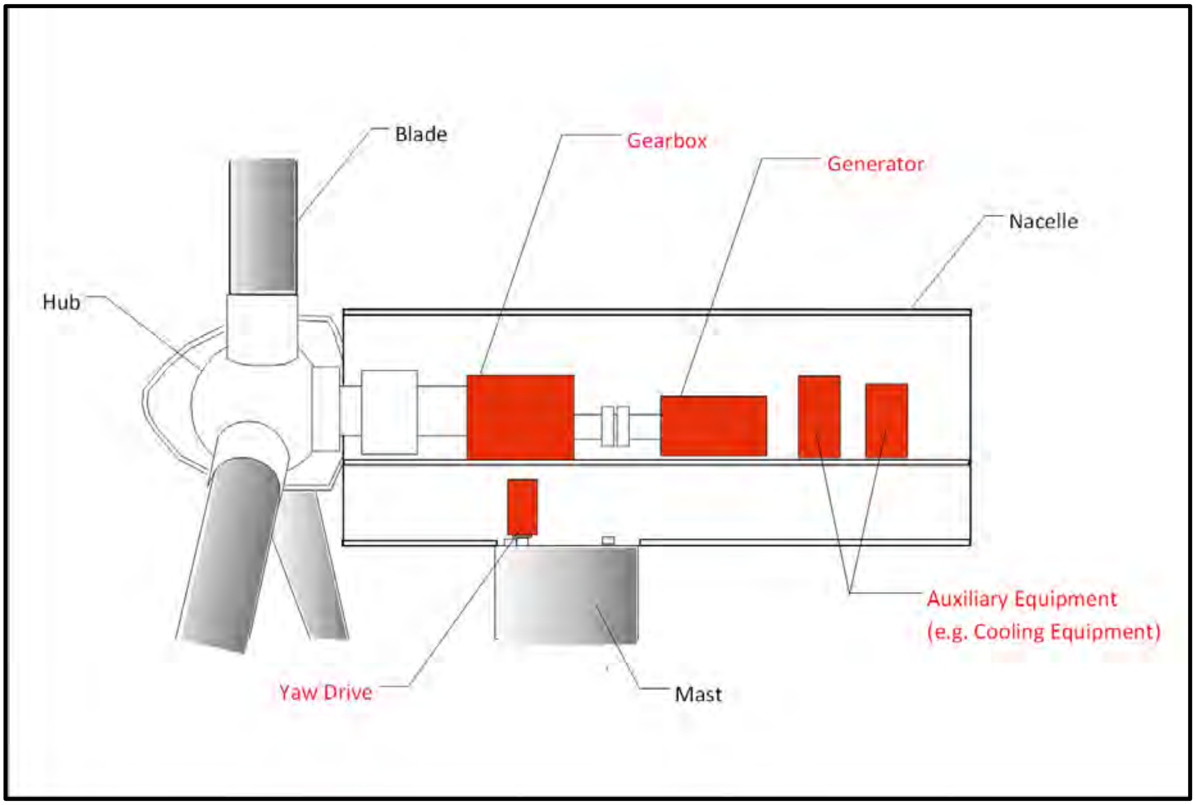

Figure 11-26: Schematic of WTG hub and nacelle of typical WTG

Envision EN-169.5/7.5 MW and EN-169.5/8.0 MW Wind Turbine Generator

The EN-169.5/7.5 MW wind turbine generator (WTG) features a power rating of 7.5 MW and 169.5 m rotor diameter, while the EN-169.5/8.0 MW wind turbine generator (WTG) features a power rating of 8.0 MW with the same rotor diameter. They both feature a three bladed fibreglass infusion-molded construction, mounted upwind of the tower. The gearbox has 3 stages of high speed, and the generator is a doubly-fed asynchronous three phase generator with a wound rotor motor, connected to a frequency Pulse-Width Modulation (PWM) converter.

The specifications for the EN-169.5/7.5 MW and the EN-169.5/8.0 MW wind turbines to be used for the proposed Project are shown in the table below.

Table 11-14: EN-169.5/7.5 MW Specification

General Details	
Rated Power	7,500 kW
Wind Class	N/A
Rotor Diameter	169.5 m
Swept Area	28,730.25 m^2
Power Density	261.05 W/m^2
Gearbox	3 Stage
Generator	DFIG
Frequency	50 Hz
Blades	
Length	83.9

Airfoil / Blade Type	Conventional design with structural shells
Physical Dimensions	
Hub Height	100 m
Tower Type	Steel/hybrid – tubular tower

Table 11-15: EN-169.5/8.0 MW Specification

General Details	
Rated Power	8,000 kW
Wind Class	N/A
Rotor Diameter	169.5 m
Swept Area	28,730.25 m^2
Power Density	278.45 W/m^2
Gearbox	3 Stage
Generator	DFIG
Frequency	50 Hz
Blades	
Length	83.9
Airfoil / Blade Type	Conventional design with structural shells
Physical Dimensions	
Hub Height	100 m
Tower Type	Steel/hybrid – tubular tower

Envision Noise Source Data

Noise source emission data, sound level performance specifications, noise emission analysis and sound warranties for the proposed Envision turbines are described below.

Sound power levels are derived from acoustics test measurements in accordance with IEC 61400-11 ed. 3 Wind Turbine Generator Systems – Part 11: Acoustic noise measurement techniques[42].

The sound power level at full rated power output for EN-169/7.5 MW and EN-169.5/8.0 MW (high rpm) is 110.1 dB(A) and 111.1 dB(A) respectively and is therefore considered a worst-case scenario.

A 2 dB correction has been applied to take into account uncertainty.

Table 11-16: Envision Modelling Scenario for Assessment (EN-169.5/7.5 MW)

Scenario Description	Wind Speed (at 10 m)	Sound Power Level dB(A)	Correction for Uncertainty
Worst-Case	10 m/s	110.1	+ 2 dB

Table 11-17: Envision Modelling Scenario for Assessment (EN-169.5/8.0 MW)

Scenario Description	Wind Speed (at 10 m)	Sound Power Level dB(A)	Correction for Uncertainty
Worst-Case	10 m/s	111.1	+ 2 dB

SWE and JICA, KFW, & Spain Wind Farm Noise Data

[42] IEC, Wind Turbine Generator Systems - Part 11: Acoustic noise measurement techniques, 2012 https://webstore.iec.ch/en/publication/5428.

Noise source emission data for SWE wind farm is provided in Table 1813 below.

Table 11-18: Envision Modelling Scenario for Assessment (EN-171/8.0 MW)

Scenario Description	Wind Speed (at 10 m)	Sound Power Level dB(A)	Correction for Uncertainty
Worst-Case	10 m/s	110.1	+ 2 dB

Noise source emission data for JICA, KFW, & Spain wind farm is provided in Table 1914 below.

Table 11-19: Envision Modelling Scenario for Assessment (Siemens Gamesa SG G80 2.0 MW)

Scenario Description	Wind Speed (at 10 m)	Sound Power Level dB(A)	Correction for Uncertainty
Worst-Case	10 m/s	103.1	+ 2 dB

Noise Model

The noise model used for this noise impact study was implemented using the industry recognised software SoundPLAN 9.1, incorporating ISO 9613-2 noise prediction standard as per the IOA GPG.

Propagation of Sound Outdoors

Sound is a sequence of pressure waves which propagate through fluid medium. In the case of all outdoor propagation of sound in air the following factors affect the propagation and resultant sound levels from the source.

- Type of source (point, line or area)
- Distance from the source
- Atmospheric absorption
- Wind
- Temperature and temperature gradient
- Obstacles such as barriers and buildings (Barrier effects)
- Ground Absorption
- Reflections
- Humidity and Precipitation

A brief description of the above is given as follows:

Types of Sources

Point sources are considered where the dimensions of a source are small compared to the distance of the receiver. An example of point sources are stacks and fans. Sound energy spreads spherically and the sound pressure level is the same for all points at the same distance from the source.

If the source is narrow and long in one direction perpendicular to the distance of the receiver, it is called a line source. The sound level propagates cylindrically such that the sound pressure level is equal at all points at the same distance from the line.

Barriers

Noise reduction caused by barriers is dependent on two main factors:

1. Path difference of the sound wave as it travels over the barrier compared with the direct transmission to the receiver.
2. The sound frequency of the noise in question.

Atmospheric Attenuation

Atmospheric attenuation is complex and therefore will be summarised in short. Atmospheric attenuation is dependent on the following main factors:

- Distance from source
- Frequency content of the noise
- Ambient temperature
- Relative Humidity
- Ambient Pressure

Distance from source and frequency content are the most influential to the atmospheric attenuation.

Wind and Temperature

Wind and temperature influence noise propagation in terms of directivity or focusing of propagation and increasing the distance of noise propagation. With wind effects, it is important to note that the upwind effect is far greater than the downwind dB difference.

Temperature effects noise through the mechanism of temperature gradients. The effects are similar to that of wind gradients, however, unlike wind gradients, the effects are omni-directional within the localised region where the temperature gradient exists. The nett effect is that sound travels further where a temperature inversion exists, as the sound waves travel assisted by favourable meteorological conditions for sound propagation.

Ground Effects

Reflections by the ground interact (interfere) with directly propagated sound and effect the receiver level depending on the ground covering and surface. The ground effect varies according to the ground type. Generally hard ground (e.g. water or concrete) is reflective and adds an additional 3 dB, whereas soft ground (e.g. grass and vegetation) decreases the sound at the receiver (varies with frequency).

Therefore, to effectively predict noise levels for the project, the above would need to be considered and effectively modelled with the chosen software package for noise propagation prediction modelling.

Modelling the Propagation of Sound

SoundPLAN 9.1 – ISO 9613-2 Calculations

Noise prediction modelling for the Project has been completed using leading noise modelling software program SoundPLAN 9.1. The program allows for the calculation of sound pressure levels due to various sources using empirical calculation algorithms of the applicable International Standards and Regulations.

The propagation methodology adopted for this noise study, and the equations used within the SoundPLAN model are based on the International Organisation for Standardisation (ISO) 9613:2024 'Acoustics – Attenuation of Sound during Propagation Outdoors' – Part 2: Engineering Method for the Prediction of Sound Pressure Levels Outdoors (ISO 9613-2) as per the modelling requires of IOA GPG. The complete standard can be reviewed by obtaining a licenced copy of the standard from the International Organisation for Standardisation (ISO). The following is a concise summary of the standard and applicable details.

ISO 9613-2 is a general-purpose standard for outdoor noise propagation, the standard specifies a 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.

The method predicts the equivalent continuous A-weighted sound pressure level (L_{Aeq}) under meteorological conditions favourable to propagation from sources of known sound emission. The standard takes into account the following physical effects on sound:

- Geometrical divergence;
- Atmospheric absorption;
- Ground effect;
- Reflection from surfaces; and
- Screening by obstacles.

Noise from WTGs is reduced by distance, atmospheric losses, screening effects and other 'miscellaneous' losses. ISO 9613-2 empirical formula calculates the predicted sound pressure level at a specified distance by taking into account the sound power level in octave frequency bands and subtracting a number of attenuating factors as described generally above.

The predicted noise level for each octave band is calculated by the following equation (1) and the modelling equation as applied by the calculation software is shown as per equation (2).

$$\mathbf{L_{90} = L_{w(eq)} + D - A_{geo} - A_{atm} - A_{gr} - A_{bar} - A_{misc} - 2\ dB} \qquad \mathbf{(1)}$$

Where:

L_{90}: sound Level exceeded 90% of the time.

$L_{w(eq)}$: equivalent continuous sound power level (dB)

D: directivity (dB)

A_{geo}: attenuation over distance (dB)

A_{atm}: atmospheric attenuation (dB)

A_{gr}: attenuation due to ground cover (dB)

A_{bar}: barrier attenuation (dB)

A_{misc}: miscellaneous attenuation factors (dB)

The 2 dB represents a correction used to convert the L_{Aeq} levels, as used to describe the turbine sound power to the L_{A90} parameter, used in the ETSU-R-97 assessment.

The applied equation for the Standard computed is as follows:

$$\boldsymbol{L_s = [L_W + D_1 + K_0] - [D_S + \sum D]} \qquad \textbf{(2)}$$

Where:

L_s: sound pressure level for a single frequency

L_W: sound power

D_1: directivity of the source

K_0: spherical model ($K_0 = 10 \log \left[\frac{4\pi}{\sigma}\right]$ where σ is the spatial angle)

D_S: geometrical spreading ($D_S = 10 \log(dist.source, receiver) + 11\ dB(A)$)

$\sum D$: contributing factors – air absorption, ground absorption, meteorological effects, volume type absorption and screening

Summary of the calculation settings and standards are detailed in the table below.

Table 11-20: Model Calculation and Parameter Settings for ISO 9613-2

Model Parameter	Parameter Setting / Standard							
Calculation Standard	(ISO) 9613-2 'Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: Engineering method for the prediction of sound pressure levels outdoors (ISO, 2024)' *Application as per IOA GPG*							
Wind Speed	10.0 m/s							
Ground Absorption Coefficient	0.5							
Receiver Height	4 m							
Meteorological Data[43]	Humidity 70% Air Pressure 1013.3 mbar T = 25ºC							
Atmospheric Attenuation Coefficients (dB / km)	63 Hz 0.1	125 Hz 0.3	250 Hz 1.1	500 Hz 2.8	1 kHz 5.0	2 kHz 9.0	4 kHz 22.9	8 kHz 76.6

Modelling Assumptions and Limitations

The following assumptions have been made for the modelling assessment, and wherever possible, a conservative approach has been taken:

[43] International Organisation for Standardisation (ISO), ISO9613-2 'Acoustics – Attenuation of Sound During Propagation Outdoors', 2024 https://www.iso.org/standard/74047.html.

- ISO 9613-2 calculates predicted noise levels with the assumption that SRs are located downwind of the turbine noise as this is considered to be the most conservative. Therefore, directivity and attenuation due to metrological factors such as wind speed and wind direction upwind from a source have not been taken into account.
- Due to the surrounding area being a mix of hard and soft ground surfaces, an absorption coefficient of 0.5 has been assumed.

Predicted Noise Levels

Noise modelling calculations were carried out for the worst-case downwind scenario, including a gridded calculation and a separate discrete receiver calculation, in order to generate overall grid noise maps, and to undertake a tabulated assessment at NSRs respectively. The model results are covered in sections that follow.

Noise Contour Maps

Noise contour maps for the worst-case noise scenario have been calculated for both the isolated and cumulative assessments and are presented in Figure 11-27 and Figure 11-28 (for Layout 1) and Figure 7-77-7 and Figure 7-137-14 (for Layout 2) on the following pages. The maps show contour lines and noise propagation level areas or 'zones' between the contour lines. The purpose of the noise contour map is to provide an overview of noise levels over a geographic area and therefore allowing a quick basic analysis of the noise propagation for identification of specific NSRs. The modelling specification for the noise contour map modelling is as per the table below.

Table 11-21: Noise contour map setup specification – ISO 9613-2

Parameter Description	Noise Map Parameter
WTG Operation	Worst Case – All WTGs operating
Mapping Grid Resolution	25 x 25 m
Mapping Result Range	35 – 70 dB(A)

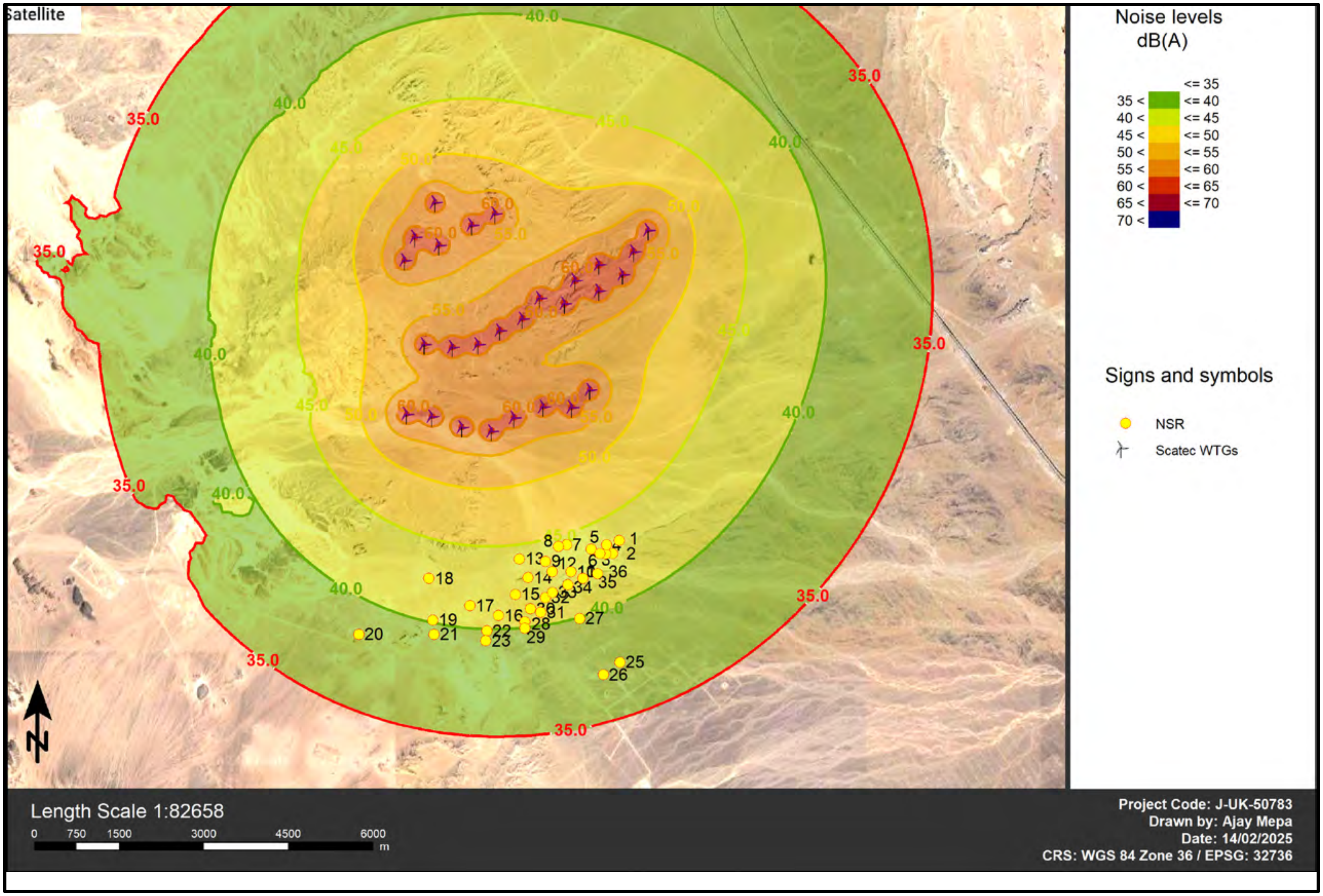

Figure 11-27: Noise Contour Map for Scatec Layout 1 - W_{10}: 10 m/s (Isolated Assessment)

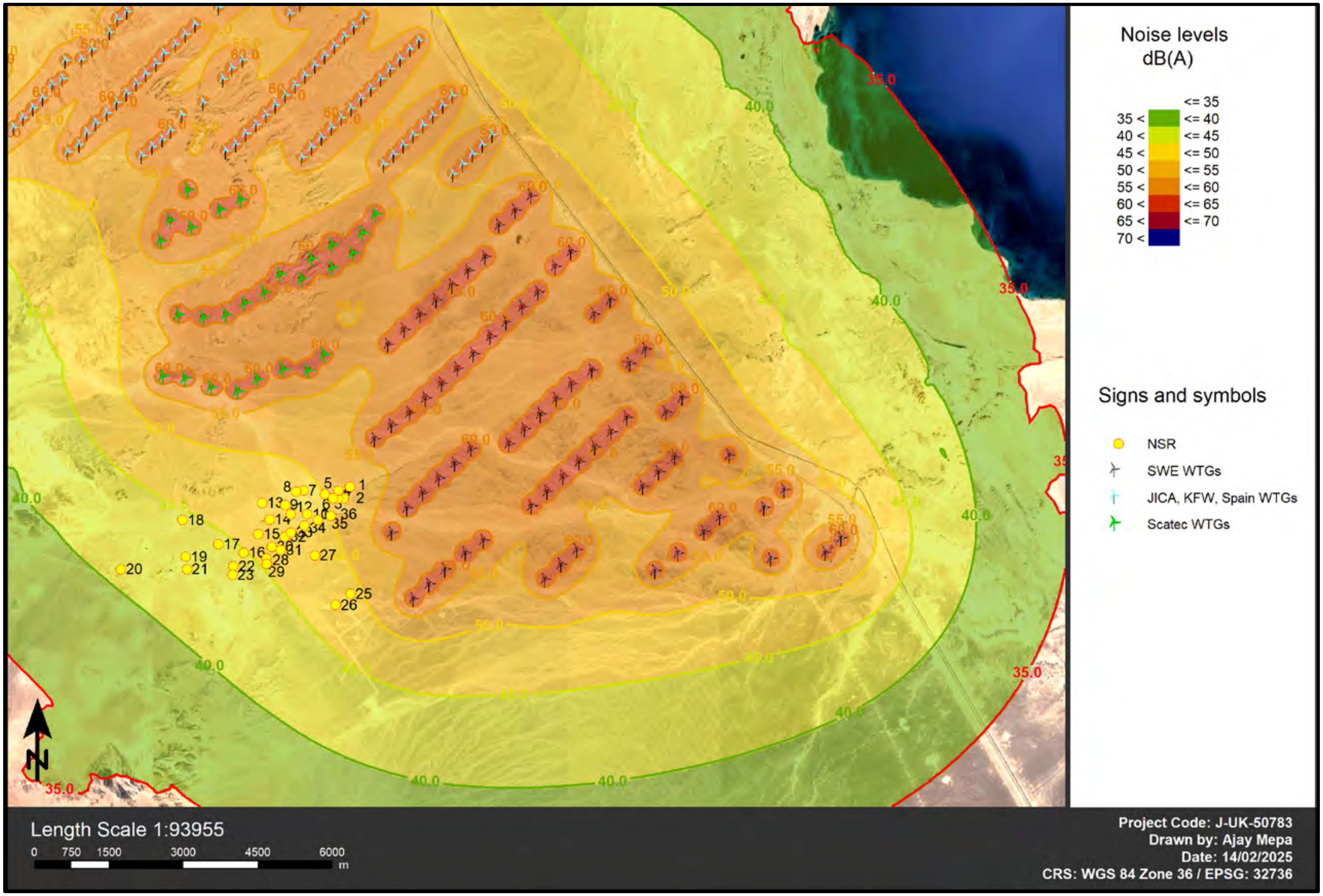

Figure 11-28: Noise Contour Map for Scatec Layout 1 - W_{10}: 10 m/s (Cumulative Assessment)

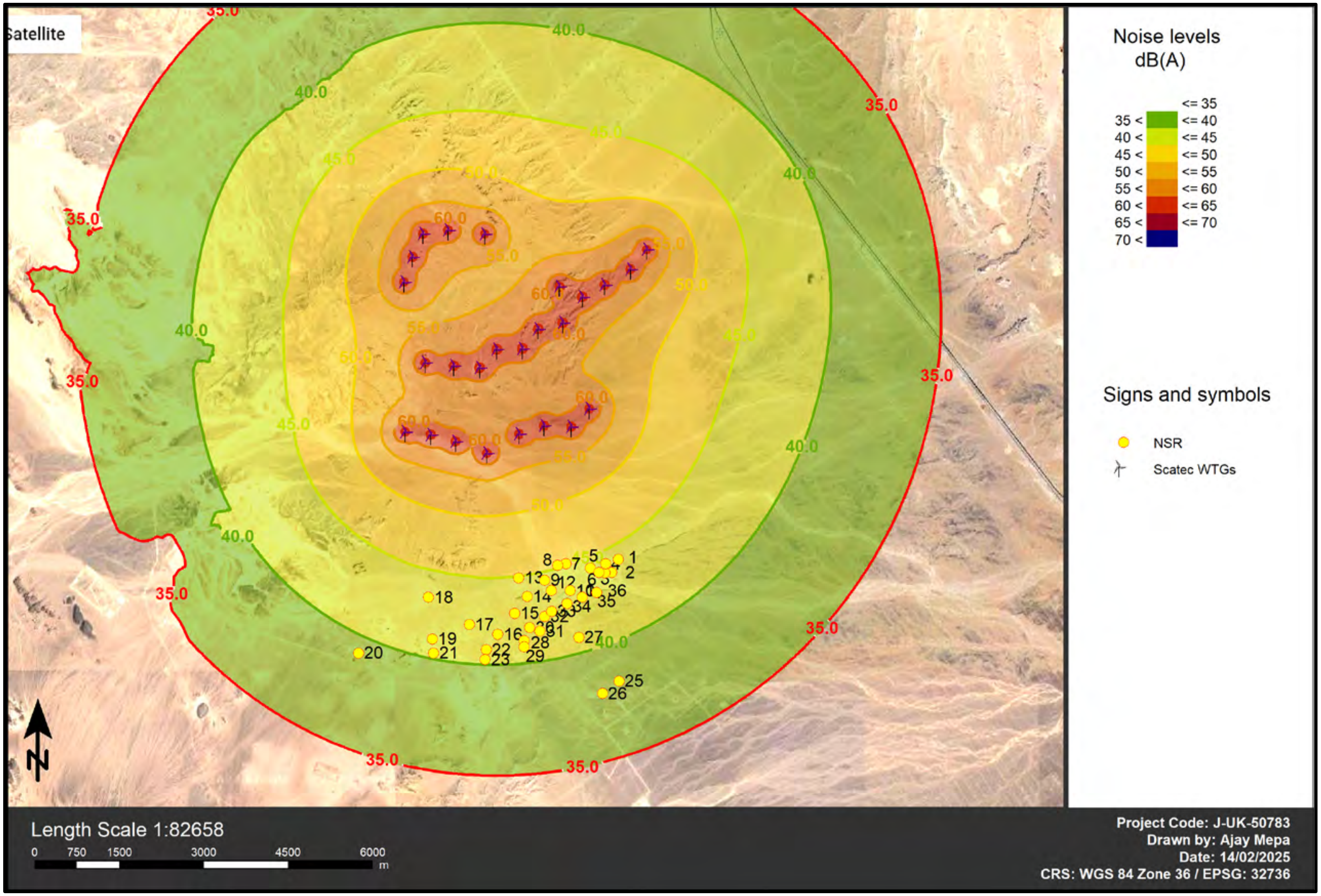

Figure 11-29: Noise Contour Map for Scatec Layout 2 - W_{10}: 10 m/s (Isolated Assessment)

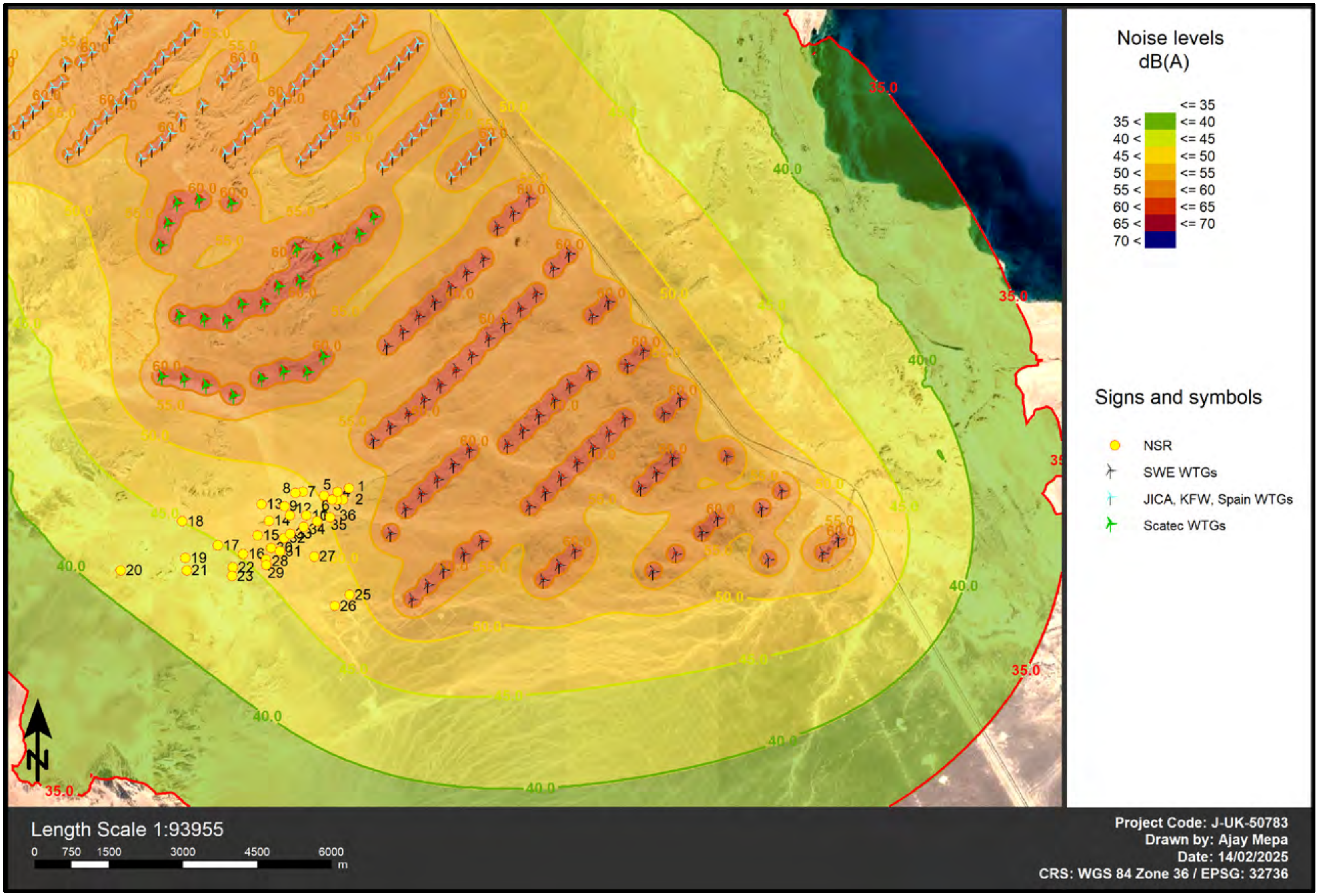

Figure 11-30: Noise Contour Map for Scatec Layout 2 - W_{10}: 10 m/s (Cumulative Assessment)

Predicted Noise Result at NSRs (Layout 1)

Based on the results of the noise contour map and the identification of the NSRs, the table below displays the predicted noise level results at each NSR from Layout 1 of the Scatec wind farm for both the isolated and cumulative WTG assessments.

Table 11-22: Predicted noise levels at NSRs from Scatec Wind Farm (Isolation & Cumulative) (W_{10}) – Layout 1

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10 m/s Wind Speed (W_{10}) – dB(A)	
	Scatec (Isolation)	Scatec (Cumulative)
NSR1	43.2	51.9
NSR2	42.7	51.2
NSR3	42.8	50.8
NSR4	43.3	51.0
NSR5	43.4	50.1
NSR6	43.0	50.4
NSR7	44.3	49.1
NSR8	44.3	48.8
NSR9	43.6	47.9
NSR10	42.6	48.6
NSR11	42.6	48.6
NSR12	42.9	47.8
NSR13	44.0	47.3
NSR14	42.8	46.9
NSR15	41.9	46.0
NSR16	40.7	44.9
NSR17	41.2	44.4
NSR18	42.4	44.4
NSR19	40.1	43.0
NSR20	38.2	40.8
NSR21	39.4	42.6
NSR22	39.9	44.0
NSR23	39.4	43.7
NSR25	37.3	48.8
NSR26	37.0	47.3
NSR27	39.9	47.8
NSR28	40.3	45.5

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10 m/s Wind Speed (W_{10}) – dB(A)	
	Scatec (Isolation)	Scatec (Cumulative)
NSR29	40.0	45.3
NSR30	41.0	46.0
NSR31	40.7	46.3
NSR32	41.5	46.9
NSR33	41.7	47.3
NSR34	41.9	48.1
NSR35	42.0	49.0
NSR36	41.9	49.9

Predicted Noise Result at NSRs (Layout 2)

Based on the results of the noise contour map and the identification of the NSRs, the table below displays the predicted noise level results at each NSR from Layout 2 of the Scatec wind farm for both the isolated and cumulative WTG assessments.

Table 11-23: Predicted noise levels at NSRs from Scatec Wind Farm (Isolation & Cumulative) (W_{10}) – Layout 2

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10 m/s Wind Speed (W_{10}) – dB(A)	
	Scatec (Isolation)	Scatec (Cumulative)
NSR1	44.0	52.0
NSR2	43.5	51.3
NSR3	43.7	50.9
NSR4	44.2	51.2
NSR5	44.3	50.3
NSR6	43.9	50.6
NSR7	45.1	49.4
NSR8	45.2	49.1
NSR9	44.4	48.3
NSR10	43.4	48.8
NSR11	43.4	48.8
NSR12	43.7	48.1
NSR13	44.9	47.7
NSR14	43.6	47.2
NSR15	42.7	46.3
NSR16	41.6	45.2
NSR17	42.1	44.8
NSR18	43.3	45.0

Noise Sensitive Receptor	Predicted Contribution Noise Level at 10 m/s Wind Speed (W_{10}) – dB(A)	
	Scatec (Isolation)	Scatec (Cumulative)
NSR19	41.0	43.5
NSR20	39.1	41.3
NSR21	40.3	43.0
NSR22	40.8	44.4
NSR23	40.3	44.1
NSR25	38.1	48.9
NSR26	37.8	47.4
NSR27	40.8	47.9
NSR28	41.2	45.7
NSR29	40.8	45.5
NSR30	41.8	46.3
NSR31	41.5	46.5
NSR32	42.3	47.1
NSR33	42.5	47.5
NSR34	42.8	48.3
NSR35	42.8	49.2
NSR36	42.8	50.1

Noise Impact Assessment

Noise Limit Determination

IOA Good Practice to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise interprets the ETSU-R-97 determination of the noise limits as per the following summary from Section 3.2 of IOA GPG.

Determination of the ETSU-R-97 Daytime Noise Limit

The daytime noise limit in ETSU-R-97 is set on the basis of protecting the amenity of people whilst outside their domestic dwellings. The daytime noise limit is based on the relationship between the prevailing background noise level and wind speed, with an allowance of + 5 dB.

Determination of the ETSU-R-97 Night-Time Noise Limit

ETSU-R-97 indicates that for the protection of sleep of occupants within buildings, an external free-field level of 43 dB L_{A90} is appropriate when background noise levels are considered low. When background noise levels are sufficiently high, then the noise limits are set to the prevailing background + 5 dB.

Summary of ETSU-R-97 Limits

The table below summarises the applicable available limits as described by ETSU-R-97.

Table 11-24: Summary of ETSU-R-97 Noise Limits

Assessment Period	Limits
Daytime	35 dB(A) or 5 dB above prevailing background, whichever is greater.
Night-time	43 dB(A) or 5 dB above prevailing background, whichever is greater.

Project Background Noise and Assessment Limits

Derived Background Noise L_{A90}

Using the methodology laid out in ETSU-R-97, the daytime and night-time background noise level at NM1 and NM2 was calculated and is presented graphically in the figures below.

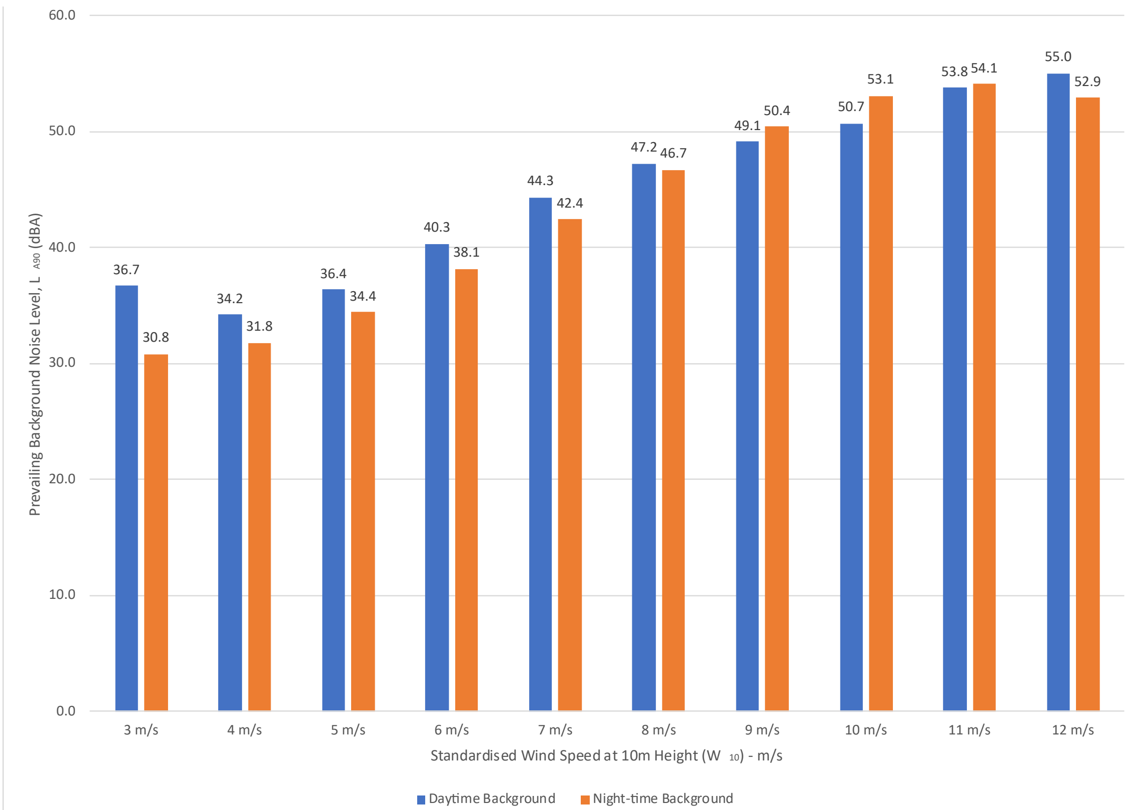

Figure 11-31: Prevailing Background Noise level according to standardized wind speed W_{10} at NM1

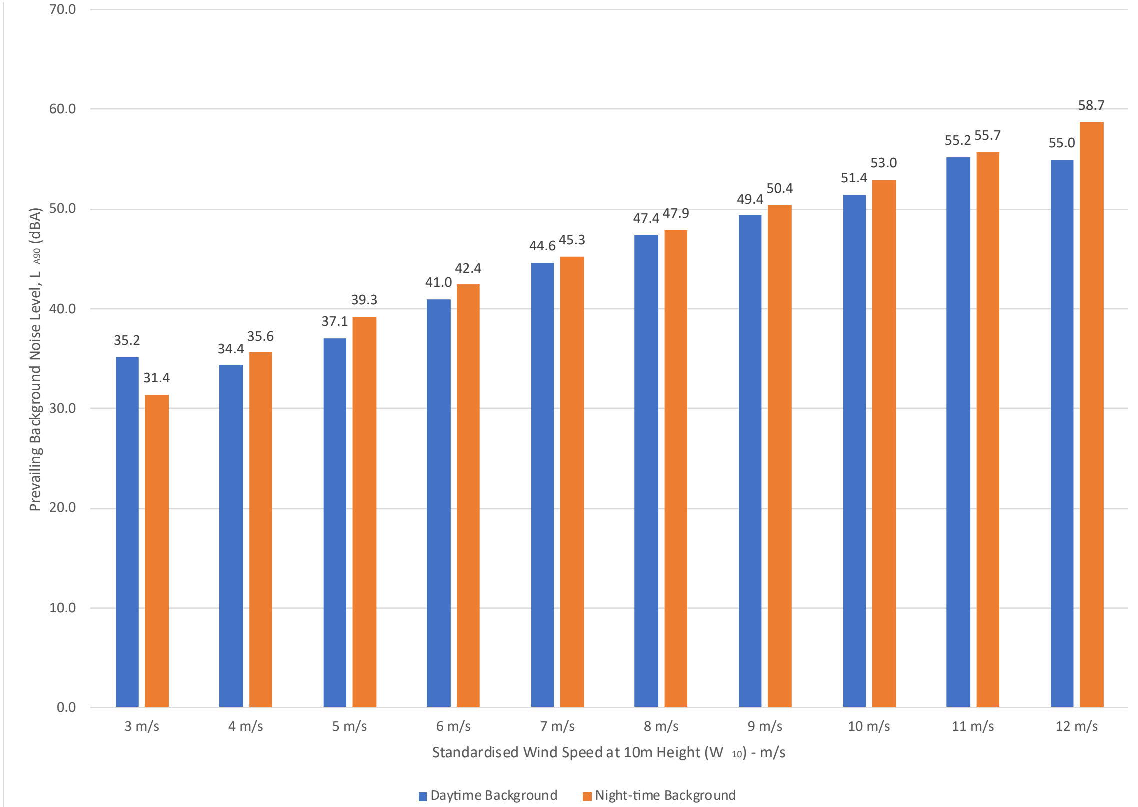

Figure 11-32: Prevailing Background Noise level according to standardized wind speed W_{10} at NM2

Determination of Assessment Noise Limits

For the daytime and night-time period, the limit is based on the background noise level +5 dB. The proposed assessment noise limits are set out in the table below.

Table 11-25: Proposed Noise Limits for WTG Noise Assessment

Location / Area	Standardised Wind Speed at 10 m Height, m/s			
	ETSU-R-97 Noise Limits, L_{A90} dB for the worst-case, 10 m/s			
	Daytime Background L_{A90} dB(A)	Daytime Limit L_{A90} dB(A) (i.e. background + 5 dB(A))	Night-time Background L_{A90} dB(A)	Night-time Limit L_{A90} dB(A)
NML1	**50.7**	**55.7**	53.1	58.1
NML2	51.4	56.4	**53.0**	**58.0**

Although the two wind speed data sets are similar, to remain conservative, the lowest derived daytime and night-time noise limit from the two monitoring locations is applied for all NSRS. This means that the daytime noise limit is 55.7 dB(A), and the night-time noise limit is 58 dB(A).

Noise Impact Assessment

The following sections and tables summarise the assessment of the noise at the defined NSRs in terms of the ETSU-R-97 limits for the worst-case noise modelling case.

Worst-case Scenario: Ws = 10 m/s – Layout 1

The tables below show the assessments for daytime and night-time periods, respectively, for a wind speed of W_{10} of 10 m/s, representing the worst-case scenario for Layout 1 of the Scatec windfarm. For a conservative approach, the predicted noise contribution from the WTGs includes the cumulative noise levels from all WTGs in the surrounding area.

Table 11-26: Noise impact assessment for day-time periods, W_{10} = 10 m/s – Layout 1

Noise Sensitive Receptor	Predicted Noise Contribution	Total Noise (Contribution + Background)	ETSU-R-97 Day-time Limit (background for 10 m/s + 5 dB)	Maximum Exceedance Value
	dB L_{A90}	dB L_{A90}	dB L_{A90}	dB
NSR1	51.9	54.4	55.7	0
NSR2	51.2	54.0	55.7	0
NSR3	50.8	53.8	55.7	0
NSR4	51.0	53.9	55.7	0
NSR5	50.1	53.4	55.7	0
NSR6	50.4	53.6	55.7	0
NSR7	49.1	53.0	55.7	0
NSR8	48.8	52.9	55.7	0
NSR9	47.9	52.5	55.7	0
NSR10	48.6	52.8	55.7	0
NSR11	48.6	52.8	55.7	0
NSR12	47.8	52.5	55.7	0
NSR13	47.3	52.3	55.7	0
NSR14	46.9	52.2	55.7	0
NSR15	46.0	52.0	55.7	0
NSR16	44.9	51.7	55.7	0
NSR17	44.4	51.6	55.7	0
NSR18	44.4	51.6	55.7	0
NSR19	43.0	51.4	55.7	0
NSR20	40.8	51.1	55.7	0
NSR21	42.6	51.3	55.7	0
NSR22	44.0	51.5	55.7	0
NSR23	43.7	51.5	55.7	0
NSR25	48.8	52.9	55.7	0
NSR26	47.3	52.3	55.7	0
NSR27	47.8	52.5	55.7	0
NSR28	45.5	51.8	55.7	0
NSR29	45.3	51.8	55.7	0
NSR30	46.0	52.0	55.7	0
NSR31	46.3	52.0	55.7	0
NSR32	46.9	52.2	55.7	0
NSR33	47.3	52.3	55.7	0
NSR34	48.1	52.6	55.7	0
NSR35	49.0	52.9	55.7	0
NSR36	49.9	53.3	55.7	0

Table 11-27: Noise impact assessment for night-time period, W_{10} = 10 m/s – Layout 1

Noise Sensitive Receptor	Predicted Noise Contribution	Total Noise (Contribution + Background)	ETSU-R-97 Night-time Limit (background for 10 m/s + 5 dB)	Maximum Exceedance Value
	dB L_{A90}	dB L_{A90}	dB L_{A90}	dB
NSR1	51.9	55.5	58	0
NSR2	51.2	55.2	58	0
NSR3	50.8	55.0	58	0
NSR4	51.0	55.1	58	0
NSR5	50.1	54.8	58	0
NSR6	50.4	54.9	58	0
NSR7	49.1	54.5	58	0
NSR8	48.8	54.4	58	0
NSR9	47.9	54.2	58	0
NSR10	48.6	54.3	58	0
NSR11	48.6	54.3	58	0
NSR12	47.8	54.1	58	0
NSR13	47.3	54.0	58	0
NSR14	46.9	54.0	58	0
NSR15	46.0	53.8	58	0
NSR16	44.9	53.6	58	0
NSR17	44.4	53.6	58	0
NSR18	44.4	53.6	58	0
NSR19	43.0	53.4	58	0
NSR20	40.8	53.3	58	0
NSR21	42.6	53.4	58	0
NSR22	44.0	53.5	58	0
NSR23	43.7	53.5	58	0
NSR25	48.8	54.4	58	0
NSR26	47.3	54.0	58	0
NSR27	47.8	54.1	58	0
NSR28	45.5	53.7	58	0
NSR29	45.3	53.7	58	0
NSR30	46.0	53.8	58	0
NSR31	46.3	53.8	58	0
NSR32	46.9	54.0	58	0
NSR33	47.3	54.0	58	0
NSR34	48.1	54.2	58	0
NSR35	49.0	54.5	58	0
NSR36	49.9	54.7	58	0

Worst-case Scenario: Ws = 10 m/s – Layout 2

The tables below show the assessments for daytime and night-time periods, respectively, for a wind speed of W_{10} of 10 m/s, representing the worst-case scenario for Layout 2 of the Scatec windfarm. For a conservative approach, the predicted noise contribution from the WTGs includes the cumulative noise levels from all WTGs in the surrounding area.

Table 11-28: Noise impact assessment for day-time periods, W_{10} = 10 m/s – Layout 2

Noise Sensitive Receptor	Predicted Noise Contribution	Total Noise (Contribution + Background)	ETSU-R-97 Day-time Limit (background for 10 m/s + 5 dB)	Maximum Exceedance Value
	dB L_{A90}	dB L_{A90}	dB L_{A90}	dB
NSR1	52.0	54.4	55.7	0
NSR2	51.3	54.0	55.7	0
NSR3	50.9	53.8	55.7	0
NSR4	51.2	54.0	55.7	0
NSR5	50.3	53.5	55.7	0
NSR6	50.6	53.7	55.7	0
NSR7	49.4	53.1	55.7	0
NSR8	49.1	53.0	55.7	0
NSR9	48.3	52.7	55.7	0
NSR10	48.8	52.9	55.7	0
NSR11	48.8	52.9	55.7	0
NSR12	48.1	52.6	55.7	0
NSR13	47.7	52.5	55.7	0
NSR14	47.2	52.3	55.7	0
NSR15	46.3	52.0	55.7	0
NSR16	45.2	51.8	55.7	0
NSR17	44.8	51.7	55.7	0
NSR18	45.0	51.7	55.7	0
NSR19	43.5	51.5	55.7	0
NSR20	41.3	51.2	55.7	0
NSR21	43.0	51.4	55.7	0
NSR22	44.4	51.6	55.7	0
NSR23	44.1	51.6	55.7	0
NSR25	48.9	52.9	55.7	0
NSR26	47.4	52.4	55.7	0
NSR27	47.9	52.5	55.7	0
NSR28	45.7	51.9	55.7	0
NSR29	45.5	51.8	55.7	0
NSR30	46.3	52.0	55.7	0
NSR31	46.5	52.1	55.7	0
NSR32	47.1	52.3	55.7	0
NSR33	47.5	52.4	55.7	0
NSR34	48.3	52.7	55.7	0
NSR35	49.2	53.0	55.7	0
NSR36	50.1	53.4	55.7	0

Table 11-29: Noise impact assessment for night-time period, W_{10} = 10 m/s – Layout 2

Noise Sensitive Receptor	Predicted Noise Contribution	Total Noise (Contribution + Background)	ETSU-R-97 Night-time Limit (background for 10 m/s + 5 dB)	Maximum Exceedance Value
	dB L_{A90}	dB L_{A90}	dB L_{A90}	dB
NSR1	52.0	55.5	58	0
NSR2	51.3	55.2	58	0

Noise Sensitive Receptor	Predicted Noise Contribution	Total Noise (Contribution + Background)	ETSU-R-97 Night-time Limit (background for 10 m/s + 5 dB)	Maximum Exceedance Value
	dB L_{A90}	dB L_{A90}	dB L_{A90}	dB
NSR3	50.9	55.1	58	0
NSR4	51.2	55.2	58	0
NSR5	50.3	54.9	58	0
NSR6	50.6	55.0	58	0
NSR7	49.4	54.6	58	0
NSR8	49.1	54.5	58	0
NSR9	48.3	54.3	58	0
NSR10	48.8	54.4	58	0
NSR11	48.8	54.4	58	0
NSR12	48.1	54.2	58	0
NSR13	47.7	54.1	58	0
NSR14	47.2	54.0	58	0
NSR15	46.3	53.8	58	0
NSR16	45.2	53.7	58	0
NSR17	44.8	53.6	58	0
NSR18	45.0	53.6	58	0
NSR19	43.5	53.5	58	0
NSR20	41.3	53.3	58	0
NSR21	43.0	53.4	58	0
NSR22	44.4	53.6	58	0
NSR23	44.1	53.5	58	0
NSR25	48.9	54.4	58	0
NSR26	47.4	54.1	58	0
NSR27	47.9	54.2	58	0
NSR28	45.7	53.7	58	0
NSR29	45.5	53.7	58	0
NSR30	46.3	53.8	58	0
NSR31	46.5	53.9	58	0
NSR32	47.1	54.0	58	0
NSR33	47.5	54.1	58	0
NSR34	48.3	54.3	58	0
NSR35	49.2	54.5	58	0
NSR36	50.1	54.8	58	0

Summary of Noise Impact Assessment

The main conclusions from the assessment results are summarised in the following sections.

Daytime Impact Assessment

For the worst-case scenario W_{10} of 10 m/s scenario for both Layout 1 and Layout 2, the resulting cumulative noise levels were predicted to be below the ETSU-R-97 daytime noise limit for all NSRs.

Night-time Impact Assessment

For the worst-case scenario W_{10} of 10 m/s scenario for both Layout 1 and Layout 2, the resulting cumulative noise levels were predicted to be below the ETSU-R-97 night-time noise limit for all NSRs.

Conclusions and Recommendations

An assessment was undertaken to assess the potential noise impact from the two proposed layouts of the Scatec Wind Farm Project, located in Egypt. The assessment focused on NSRs in the immediate surrounding areas where residential areas are located.

A baseline noise survey was conducted at two noise measurement sites located in the vicinity of the NSRs, adjacent to the wind farm development. Noise limits were derived from the baseline data and noise predictions were calculated with SoundPLAN 9.1 software according to ISO 9613-2 with input parameters and limitations stipulated as per IOA GPG.

The proposed wind turbine generators are the Envision EN-169.5/7.5 MW (Layout 1) and Envision EN-169.5/8.0 MW (Layout 2). Sound power data was provided in the form of vendor data sheets.

The assessment focused on the worst-case noise level scenario, involving all WTGs including existing WTGs, operating at maximum sound power output (10 m/s). No exceedances of the ETSU-R-97 derived limit were predicted during daytime or night-time at any of the NSRs.

Based on the results of this noise study no specific mitigation or curtailment for noise is required for the Project, however, the following recommendations are made:

- Grievance mechanism will be established to follow up any noise related grievance.
- In case of grievance, 48 hours continuous noise measurements will be conducted immediately on the area where grievance is received. Based on the outcomes and results, appropriate management and mitigations measures should be determined and agreed with the griever (e.g. installation of noise insulation measures at the structure such as double glazed windows, vegetative buffers, etc.).
- Noise monitoring campaigns will be conducted annually on the first 2 years of operation phase. In the case results indicate that levels are within allowable limits and no grievances are received, no further requirements are needed. Should grievances be received, then requirements in first point apply.

Upon completion of the construction of the wind farm, during the commissioning period a detailed long-term verification noise monitoring programme should be implemented. The monitoring programme should be carefully designed with specific planning of equipment, measurement locations and periods.

WTG Coordinates

Table 11-30: Scatec Wind Farm Layout 1 WTG Coordinates (Zone 36)

Wind Turbine Generator (WTG)	Longitude (UTM Easting) (mE)	Latitude (UTM Northing) (mN)
A01	519593.3	3101832.3
A02	519774.8	3102245.4
A03	520202.1	3102103
A04	520132.4	3102861
A05	520782.7	3102460.4
A06	521195.5	3102661.1
B07	519945.2	3100343.6
B08	520439.6	3100292.9
B09	520895.6	3100344.3
B10	521277.5	3100589.5
B11	521676.5	3100799.3
B12	521985.1	3101160.8
B13	522425.8	3101063.6
B14	522618	3101477
B15	523033	3101297.6
B16	523034.7	3101758.6
B17	523458.7	3101579.9
B18	523650.9	3101991.4
B19	523908.1	3102366.7
C20	519628.4	3099103.1
C21	520077.7	3099065.4
C22	520604.3	3098874.7
C23	521132	3098807.8
C24	521534.1	3099044.6
C25	522048.1	3099240.4
C26	522550.8	3099226.4
C27	522874.9	3099541.6

Table 11-31: Scatec Wind Farm Layout 2 WTG Coordinates (Zone 36)

Wind Turbine Generator (WTG)	Longitude (UTM Easting) (mE)	Latitude (UTM Northing) (mN)
A01	519593.1	3101785.8
A02	519741.4	3102233.7
A03	519927.8	3102647.5
A04	520373.7	3102709.6
A05	521025.1	3102640.9
B06	519968.8	3100358.5
B07	520475.1	3100301.3
B08	520934.2	3100265
B09	521240	3100595.1
B10	521692.4	3100605.4
B11	521974.3	3100956.4
B12	522414	3101063.1
B13	522350.2	3101706.8
B14	522761.1	3101523.5
B15	523157.8	3101739.8
B16	523614.4	3102017.2
B17	523905.2	3102366.4
C18	519611.5	3099127.8
C19	520066.9	3099081
C20	520506.9	3098958.4
C21	521062.5	3098748.4
C22	521637.9	3099088.8
C23	522077	3099238.1
C24	522561.1	3099216.9
C25	522881.4	3099538.9

11.10 Annex IV: Shadow Flicker Assessment

This document aims to outline the Wind Turbine Generator (WTG) shadow flicker effects on potential receptors by assessing shadow flicker predictions. The results of the prediction have been evaluated according to international best practices for shadow flicker.

Shadow flicker is defined as the optical flickering effect caused when rotating wind turbine blades periodically cast shadows through constrained openings (such as windows) on properties neighbouring the WTG sites.

There are three conditions which must be met in order for shadow flicker to occur:

- The sun must be shining without cloud cover;
- The wind turbine must be between the sun and the observer; and,
- The observer must be within the shadow of the wind turbine.

The shadow length of an object is dependent on the angle of the sun, which in turn varies depending on the time of the year and time of the day. An illustration of the shadow flicker on a receptor is presented in Figure 11-33.

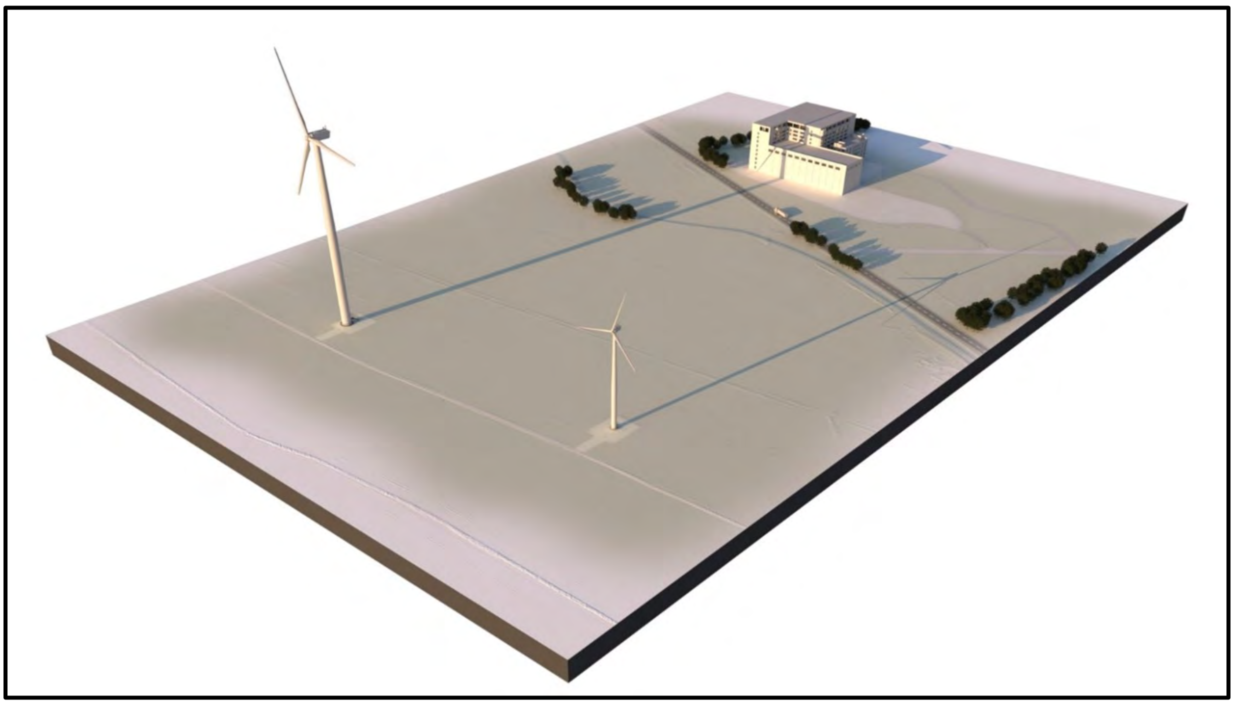

Figure 11-33: Visual Description of Shadow Flicker

Objectives

As part of this study the following main objectives have been identified as outcomes for this report:

- Calculation of shadow flicker occurrences for the worst-case scenario assessment with all WTGs operating; and,
- The assessment of the receptors considered in the 'impact zone' of the potential shadow effects.

Input Data

The study was based on the following information:

- General arrangement and layout drawings of the wind farm, including topography.
- Wind Turbine supplier data – geometric sizing, rotor diameter and hub height; and,
- Astronomical and metrological data – sun movement, sunlight phases, wind direction and frequency of occurrence at the receptor location.

Project Details

Project Background

The project is located just off the Gulf of Suez, in the eastern part of Egypt approximately 300 km southeast of the capital, Cairo. Two separate WTG layouts for Scatec Wind Farm are considered for the shadow flicker assessment. Layout 1 consists of 27 WTGs. Layout 2 consists of 25 WTGs. Each cover an area of approximately 25 km^2.

Figure 11-7 shows the Project location in a regional context, and Figure 11-8 shows the Project location in a local context for Layout 1, while Figure 11-36 shows the Project location in a local context for Layout 2.

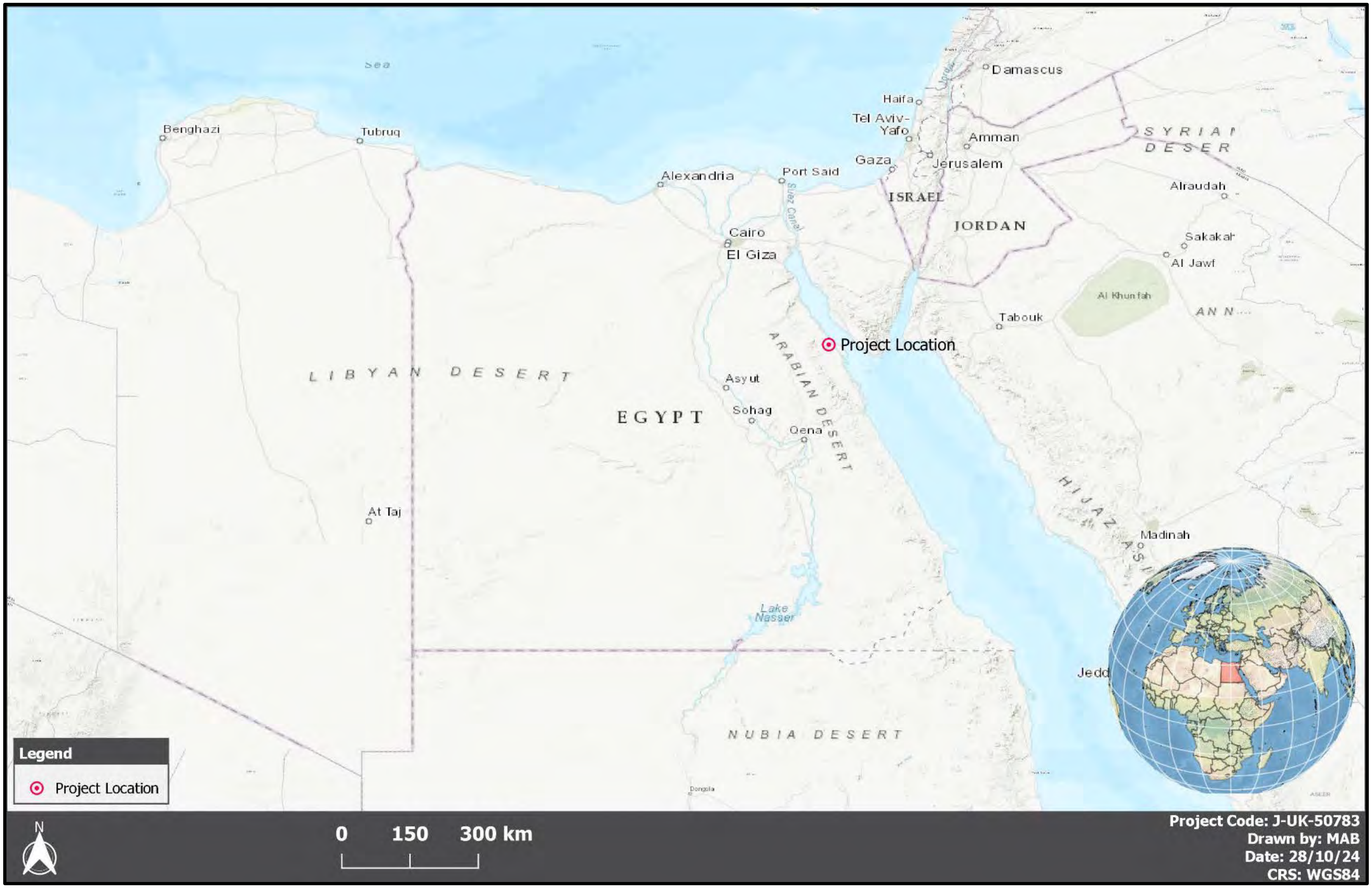

Figure 11-34: Scatec Wind Farm Project Area - Regional Context

Figure 11-35: Scatec Wind Farm Project Area - Local Context – Scatec Layout 1

Figure 11-36: Scatec Wind Farm Project Area - Local Context – Scatec Layout 2

Wind Turbine Site Layout

The project layout for Layout 1 is shown in Figure 11-10. Layout 1 consists of 27 WTGs with a rated power of 7.5 MW. Table 61 details the Envision EN169.5-7.5 MW turbine type basic specifications:

Table 11-32: Envision EN169.5-7.5 MW Wind Turbine Generator Specification

Manufacturer	Envision
Model Type	Envision EN169.5-7.5 MW
Rated Power	7,500 kW
Rotor Diameter	169.5 m
Hub Height	100 m

The coordinates of each of the WTG sites are listed in Appendix A.

The project Layout for Layout 2 is shown in Figure 11-38. Layout 2 consists of 25 WTGs each with a rated power of 8.0 MW. Table 332 details the Envision EN169.5-8.0 MW turbine type basic specifications:

Table 11-33: Envision EN169.5-8.0 MW Wind Turbine Generator Specification

Manufacturer	Envision
Model Type	Envision EN169.5-8.0 MW
Rated Power	8,000 kW
Rotor Diameter	169.5 m
Hub Height	100 m

The coordinates of each of the WTG sites for Layout 2 are listed in Appendix A.

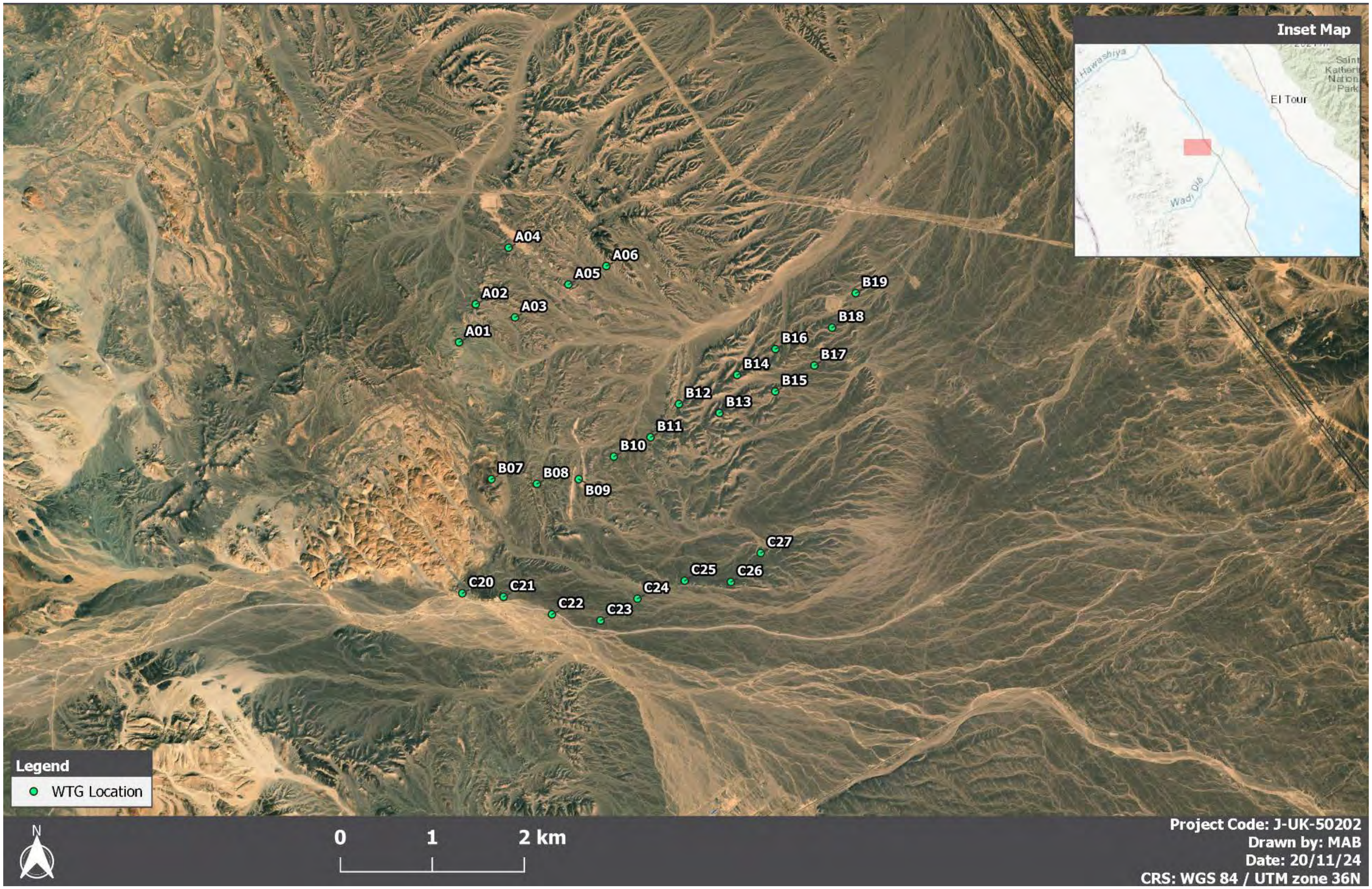

Figure 11-37: Location of Wind Turbine Sites – Layout 1

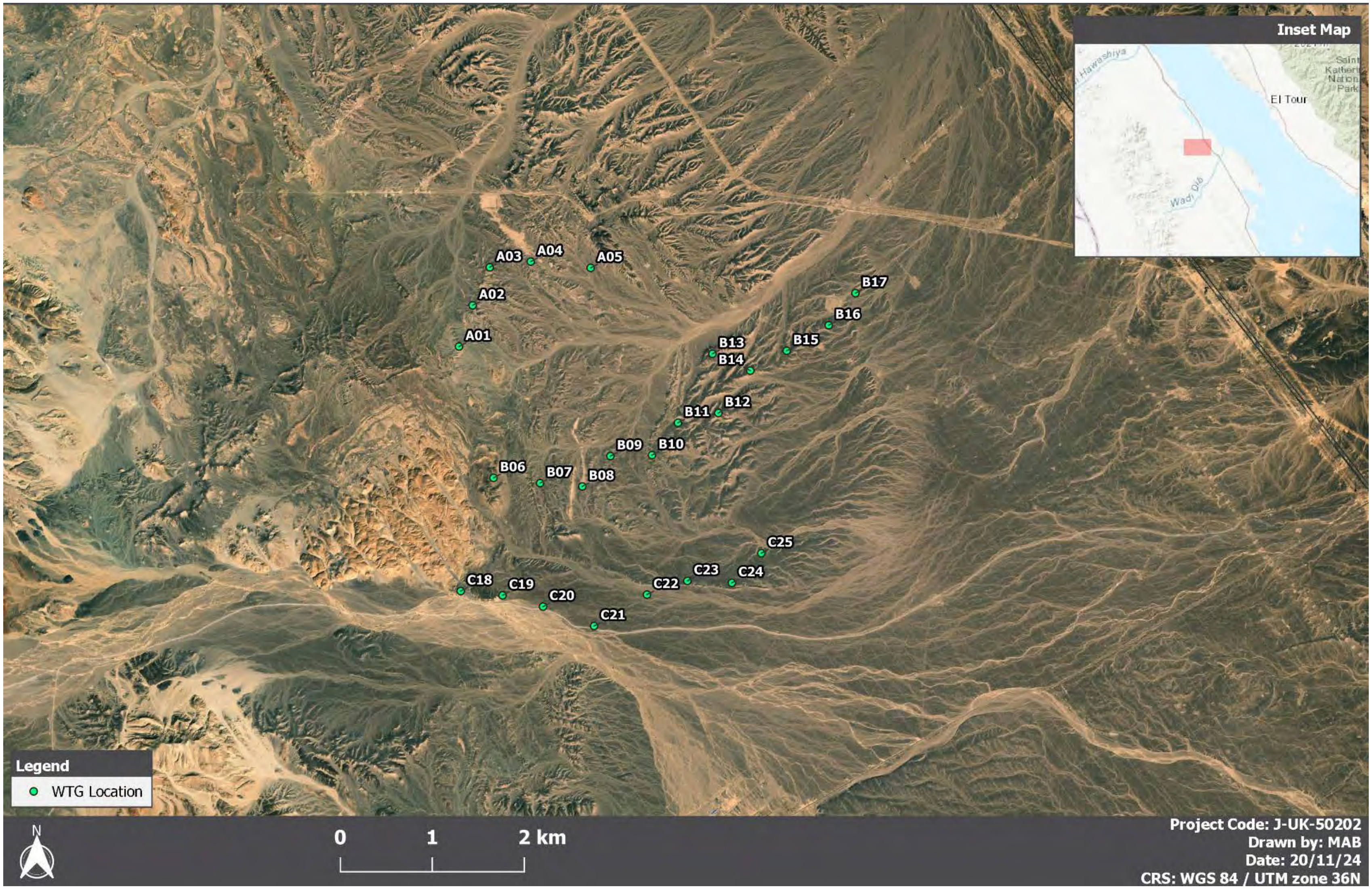

Figure 11-38: Location of Wind Turbine Sites – Layout 2

Identification and Analysis of Regulations and Standards

Regulatory Framework for Shadow Flicker

There are currently no laws or regulation regarding shadow flicker and blade glint from the operation of WTGs in Egypt. However, several countries (including the UK, Germany and Australia) have developed guidelines around the potential shadow flicker impacts and are aligned with the World Bank Group guidelines. The relevant guidelines include:

- The World Bank Group Environmental, Health, And Safety Guidelines for Wind Energy[44].
- Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergianlagen; Stand: 13.03.2002 (WEA-Shattenwurf-Hinweise)[45] – German Standard for the evaluation of optical emissions from WTGs.
- Planning Practice Guidance for Renewable and Low Carbon Energy 2013[46].
- Australian Department of State Development, Infrastructure, Local Government and Planning, State Code 23: Wind Farm Development[47].

The German guidelines refer the following limit of the shadow and is set by two factors:

- The angle of the Sun over the horizon must be at least 3 degrees; and,
- The blade of the WTG must cover at least 20% of the Sun.

The limits of shadow impact for a neighbour to a wind farm according to the guidelines are:

- A maximum of 30 hours per year of astronomical maximum shadow (considered worst case); and,
- A maximum of 30 minutes per day of astronomical maximum shadow (considered worst case).

If one of these thresholds is exceeded, mitigation measures should be devised in the form of curtailment strategies which would not allow for shadow flicker to occur – i.e., not operate certain WTGs at times and conditions when shadow flicker would occur.

Shadow flickering effects are only considered for domestic dwellings, workplaces, learning and/or health care spaces/facilities with one or more windows / openings that face in the direction of the WTGs / Wind Farm in question, or that are located nearby. Areas which are not used for human occupancy are not considered in this assessment (i.e., garages and storage areas).

[44] T. W. B. Group, “Environmental, Health, And Safety Guidelines for Wind Energy.,” 2015.
[45] WEA-Shattenwurf-Hinweise, Hinweise zur Ermittlung und Beurteilung der optschen Immissionen vo fWindernerianlagen, 2002.
[46] D. f. C. a. L. Government, “Planning Practice Guidance for Renewable and Low Carbon Energy,” London, 2013.
[47] I. L. G. a. P. Australian Department of State Development, “Planning guidance State Code 23: Wind Farm Development,” Brisbane, 2022.

Shadow Flicker Model and Calculation

Shadow Flicker Model

Shadow flicker for the Project was modelled in WindPRO Version 3.6. WindPRO is considered to be an industry standard software program for WTG calculations. The software simulates the suns movement throughout the year and evaluates the potential shadow flicker at a specific location (domestic dwelling) based on the wind turbine generator locations and their surroundings.

The software gives a conservative estimate of the number of hours per year that shadows could be cast by the rotation of the turbine blades.

Shadow Flicker Calculation Methodology

The German guidelines[45] which have been applied in this study, provide a shadow flicker calculation method which considers the following parameters:

- The position of the WTGs – x, y, z coordinates;
- The hub height and rotor diameter;
- The position of the shadow receptor object – x, y, z coordinates;
- The size of the window and its orientation, both directional (relative to South) and tilt (angle of plane to the horizontal);
- The geographic position (latitude and longitude);
- Time zone and daylight-saving time information; and,
- A simulation model, which holds information about the Earth's orbit and rotation relative to the Sun.

An illustration of the shadow flicker calculation prognosis is presented in Figure 11-39.

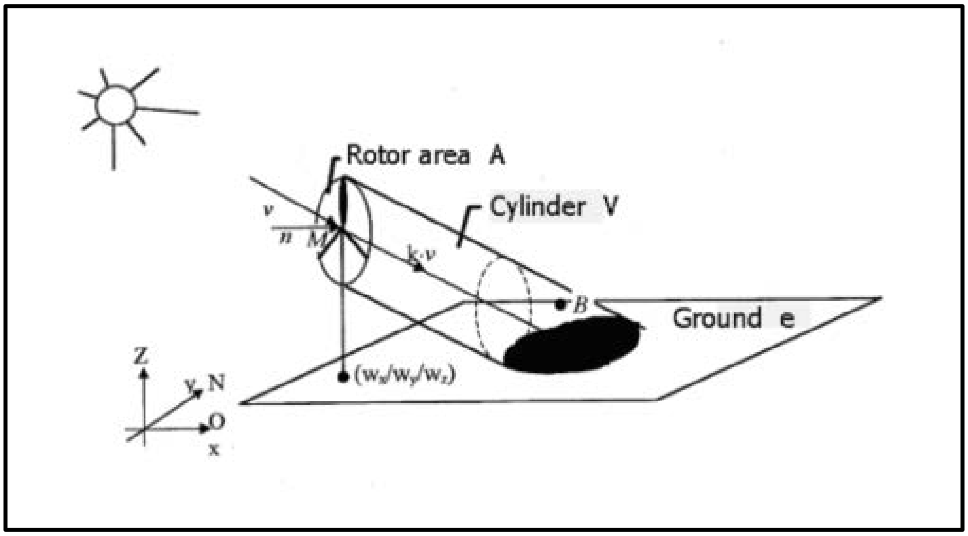

Figure 11-39: Shadow Flicker Calculation Prognosis[48]

The sun is modelled by a single-point source of light, whereas in reality the sun is not defined by a point source and is instead a sphere. Due to the spherical shape of the sun, there are shading areas in which the sunbeams or part of the sunbeams are covered by objects[48].

The model further assumes clear sky during 100% of the year (which is not the case in reality). Therefore, the model produces the worst-case scenario in line with a conservative assessment methodology.

The calculation model used within WindPRO uses the following parameters outlined in Table 343 below to define the shadow propagation angle behind the rotor disk:

Table 11-34: Shadow Propagation Angle Parameters

The diameter of the Sun (D)	1,390,000 km
The distance to the Sun (d)	150,000,000 km
Angle of attack	0.531 degrees

Assumptions and Settings for Shadow Calculations

The following calculations and assumptions were used for WindPRO calculations:

- Calculations only when more than 20% of the sun is covered by the blade;
- Minimum sun height over the horizon of influence: **3º**;
- Day step for calculation: **1 day**;
- Time step for calculation: **1 minute**;
- A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non-visible WTG do not contribute to calculated flicker values;

[48] E. I. A/S, WindPRO 3.1 User Guide, 2016.

- A WTG will be visible if it is visible from any part of the receiver window;
- Sensitive Receptors are modelled using the greenhouse mode, meaning that each Sensitive Receptor will face all directions (360 degree visibility);
- All Sensitive Receptors have been modelled taking into consideration the following;
  - They are single story buildings, and so shadow flicker has been calculated at a height of 1m above ground level (equivalent to the first floor windows).
  - Window height**: 1 meter**;
  - Window Width: **1 meter**;
  - Window tilt: **90º**;
  - The identified receptors are simulated as fixed points with the possibility to view 360°C, representing an unrealistic scenario, as real windows would be facing only a particular direction;
- The ZVI calculation is based on the following assumptions:
  - Height contours are used;
  - Eye height: **1.5 m**;
  - Grid Resolution: **10.0 m**;
- The calculated times are "worst-case" given by the following assumptions:
  - The sun is shining continuously during the day, from sunrise to sunset;
  - The rotor plane is always perpendicular to the line from the WTG to the sun; and
  - The WTG is always operating.

Shadow Flicker Grid Map Results

The calculation results presented are for the worst-case shadow flicker. This is because the calculation standards only predict for worst-case scenarios, which represents the optimum conditions for shadow flicker to occur. The shadow flicker is quantified by whether or not the WTG is in operation and WTG rotor position is between the sun and the receptor. In the case of these calculations all WTGs are in operation.

Identification of Surrounding Areas Sensitive Receivers

A total of 35 sensitive receivers (SR) have been identified within the vicinity of Scatec wind farm. The sensitive receptors are domestic dwellings and there is no other type of sensitive receptor identified within the vicinity of Scatec wind farm, including workplaces, learning and/or health care spaces/facilities. The complete list of identified receptors is detailed in Appendix B.

Figure 11-14 shows the SRs in relation to Layout 1 and Figure 11-41 shows the SRs in relation to Layout 2.

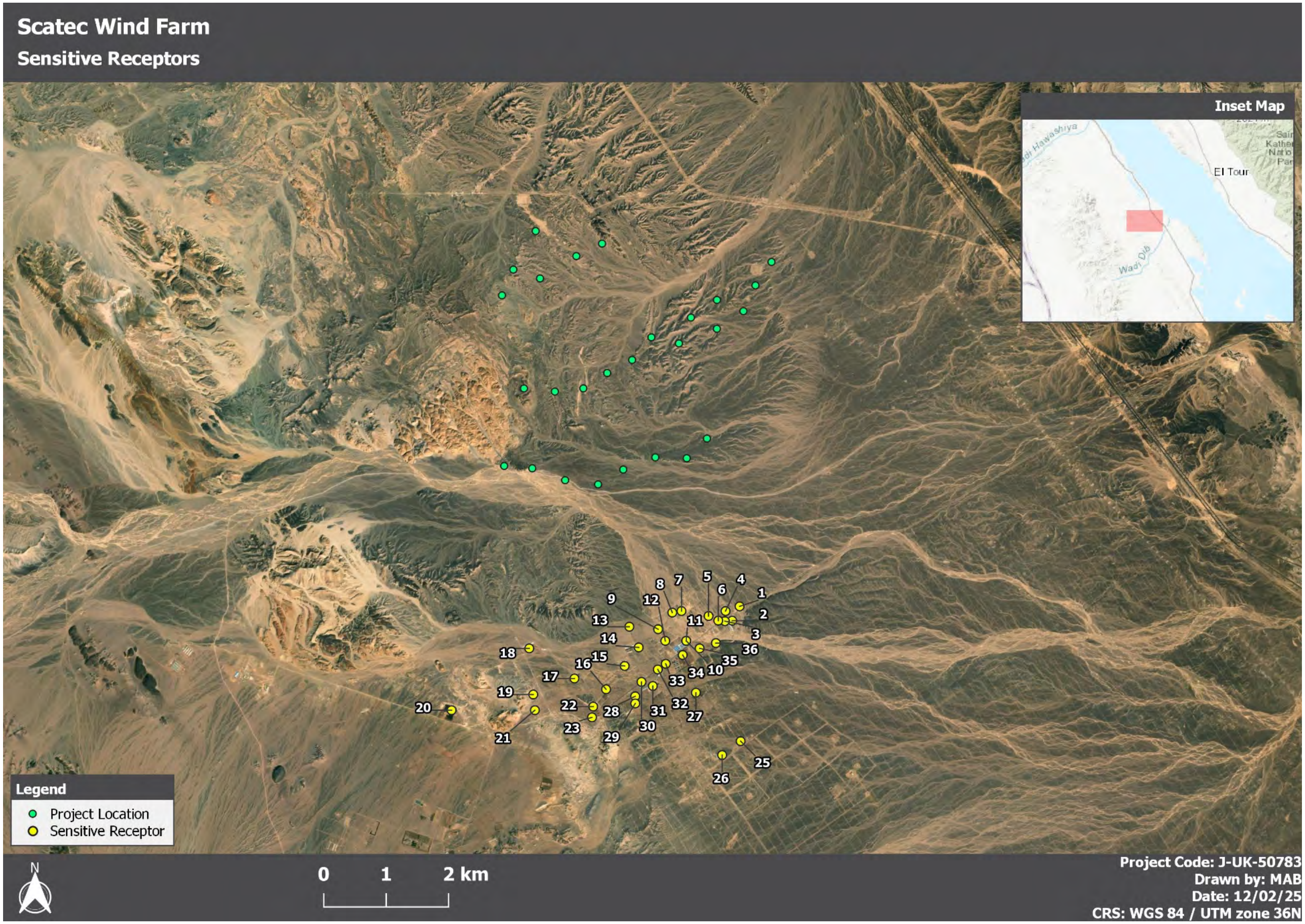

Figure 11-40: Sensitive Receiver Locations – Layout 1

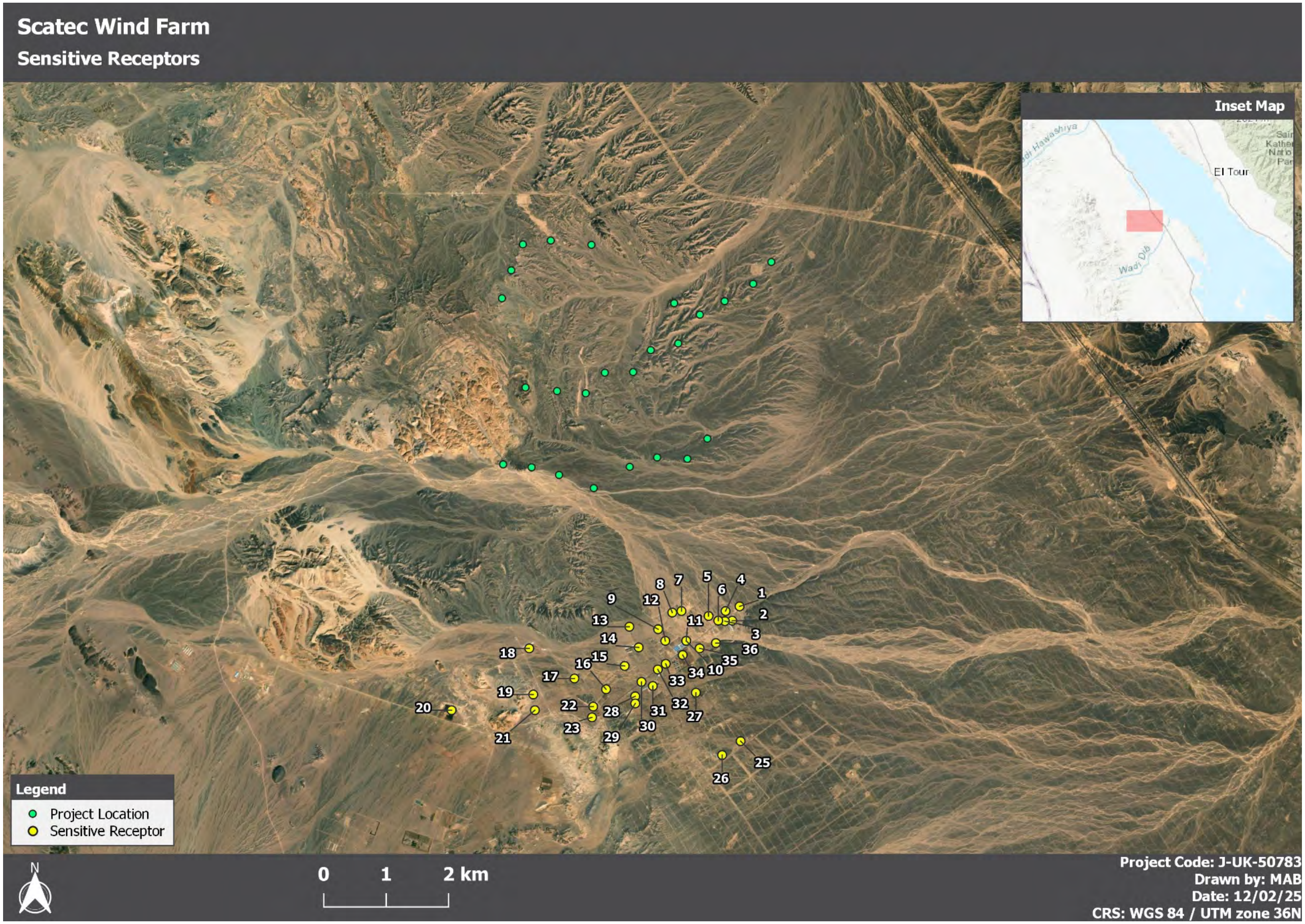

Figure 11-41: Sensitive Receptor Locations – Layout 2

Results for Shadow Flicker at Sensitive Receivers

Layout 1:

- Figure 11-42 presents the worst-case scenario results of the shadow flicker assessment at the identified receptors as total hours per year.
- Figure 11-43 presents the worst-case scenario results of the shadow flicker assessment at the identified receptors as maximum minutes per day.

Layout 2:

- Figure 7-107-10 presents the worst-case scenario results of the shadow flicker assessment at the identified receptors as total hours per year.
- Figure 7-117-11 presents the worst-case scenario results of the shadow flicker assessment at the identified receptors as maximum minutes per day.

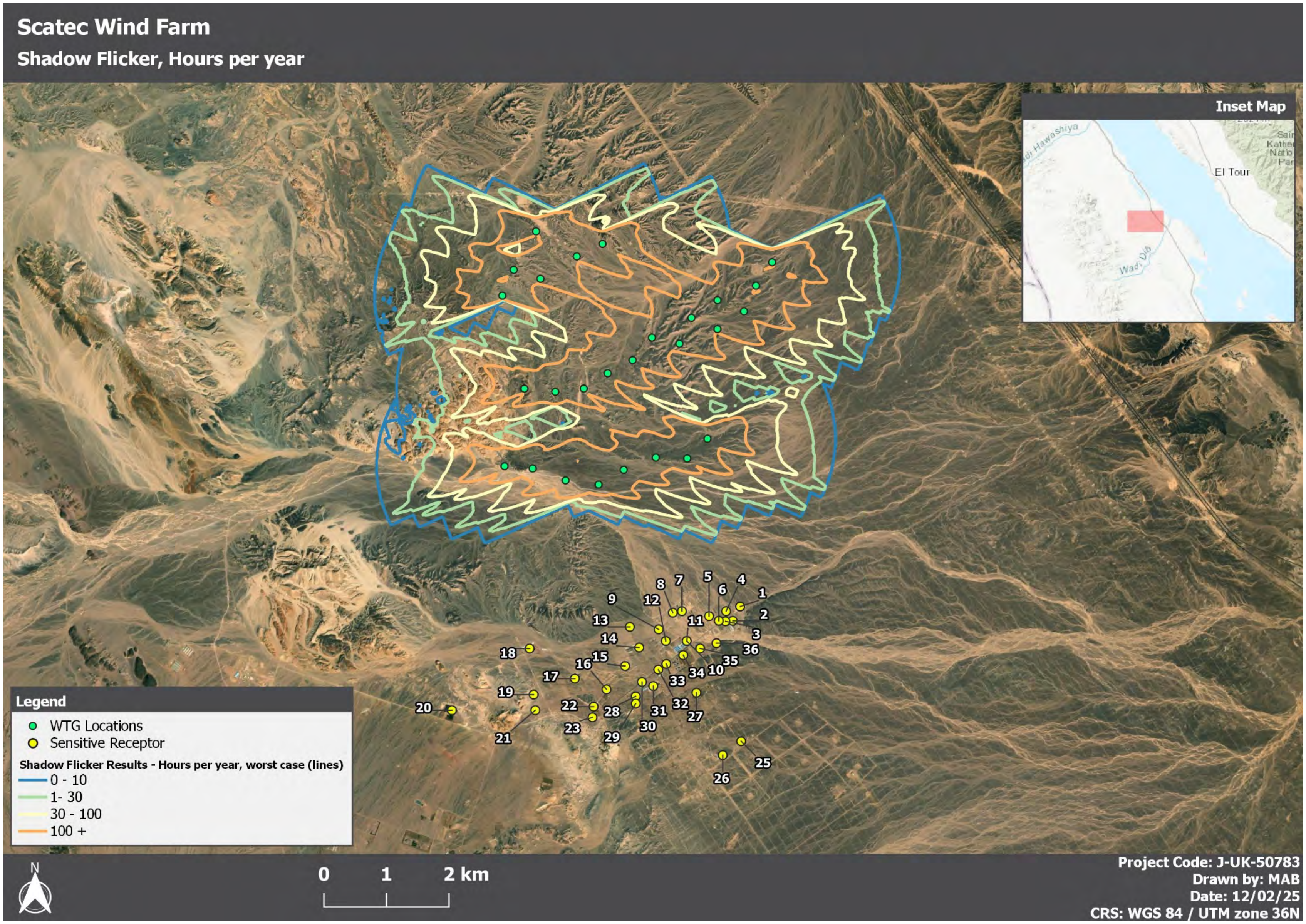

Figure 11-42: Shadow Flicker Map for Worst Case Scenario (hours per year) – Layout 1

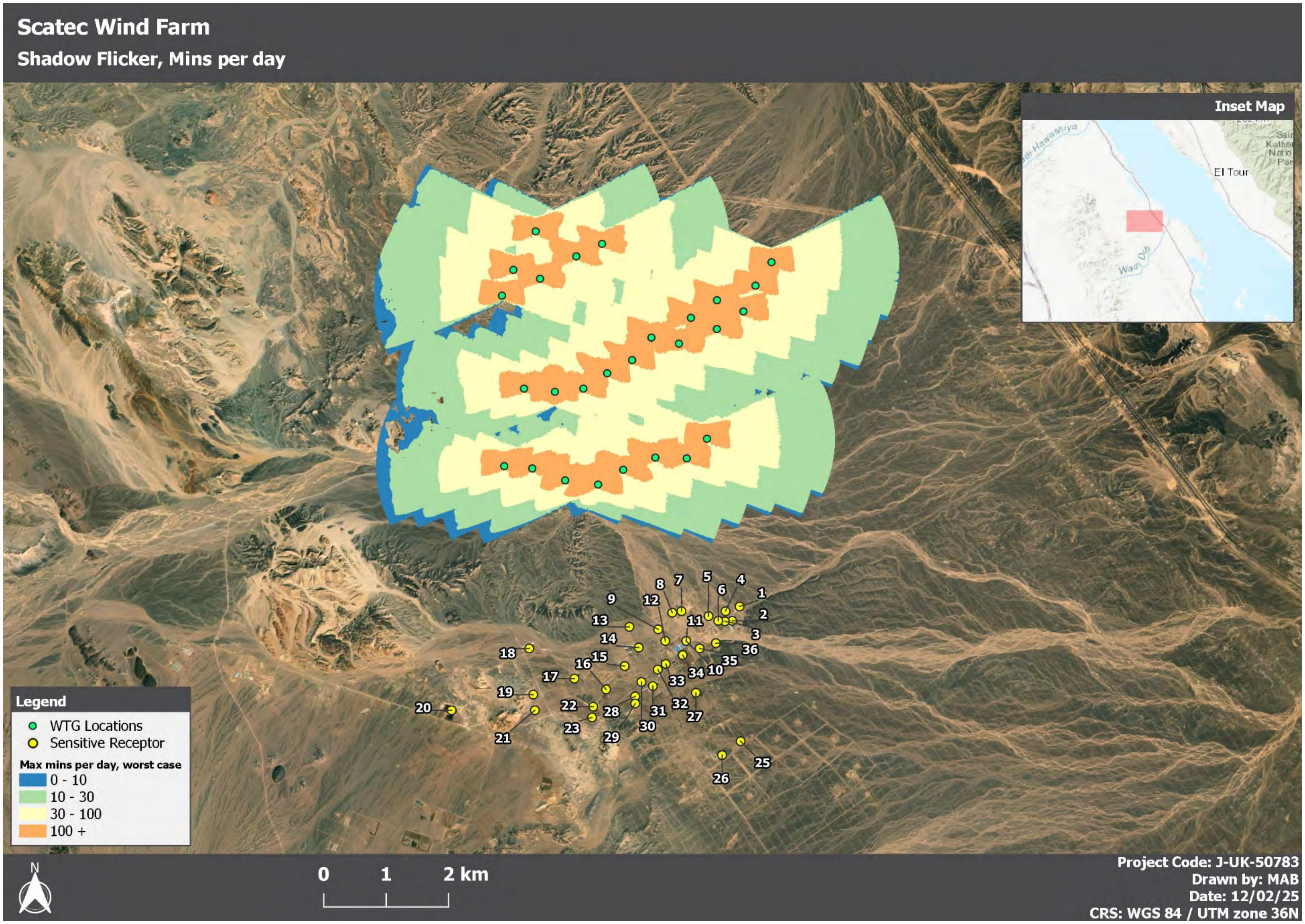

Figure 11-43: Shadow Flicker Map for Worst Case Scenario (mins per day) – Layout 1

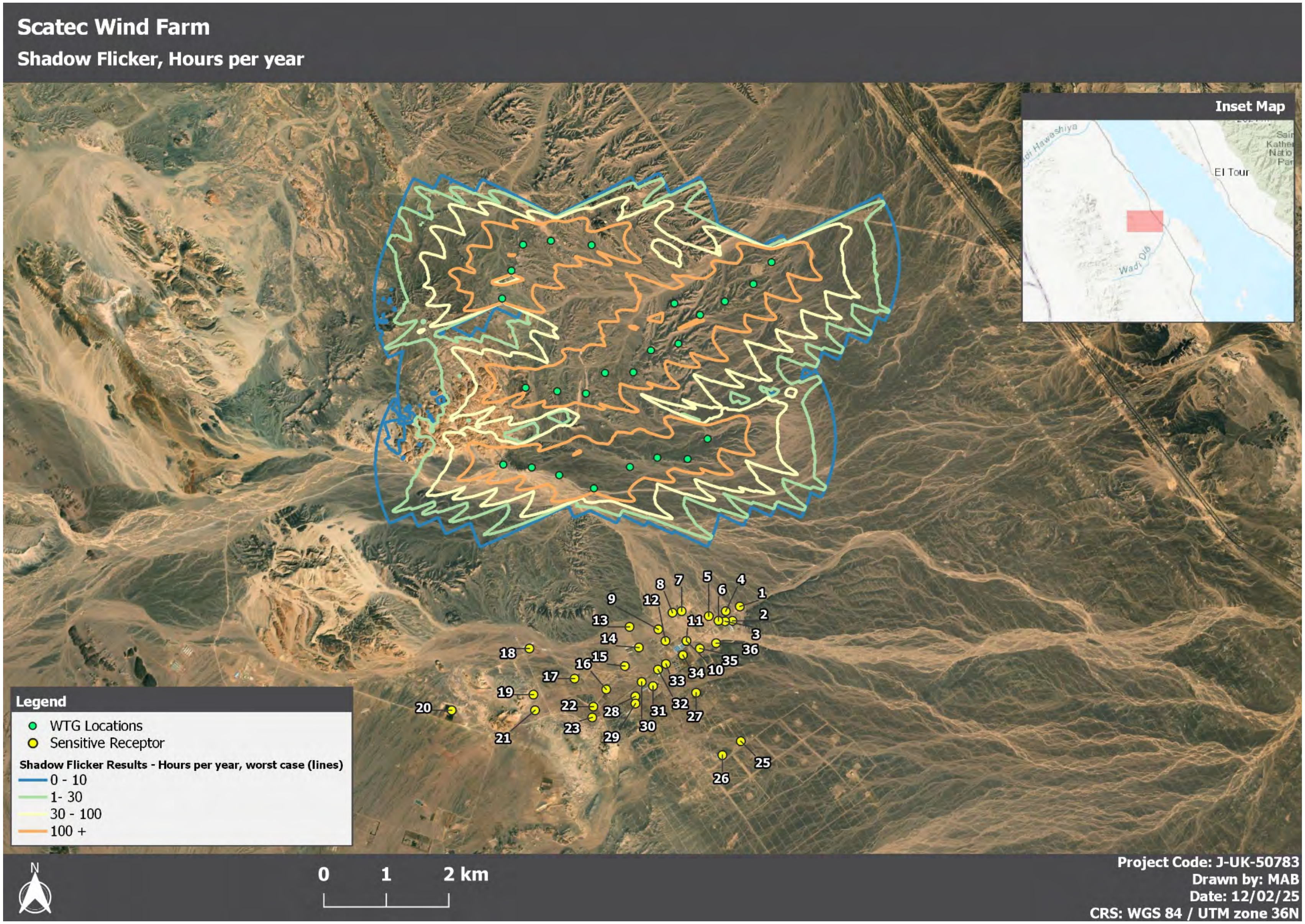

Figure 11-44: Shadow Flicker Map for Worst Case Scenario (hours per year) – Layout 2

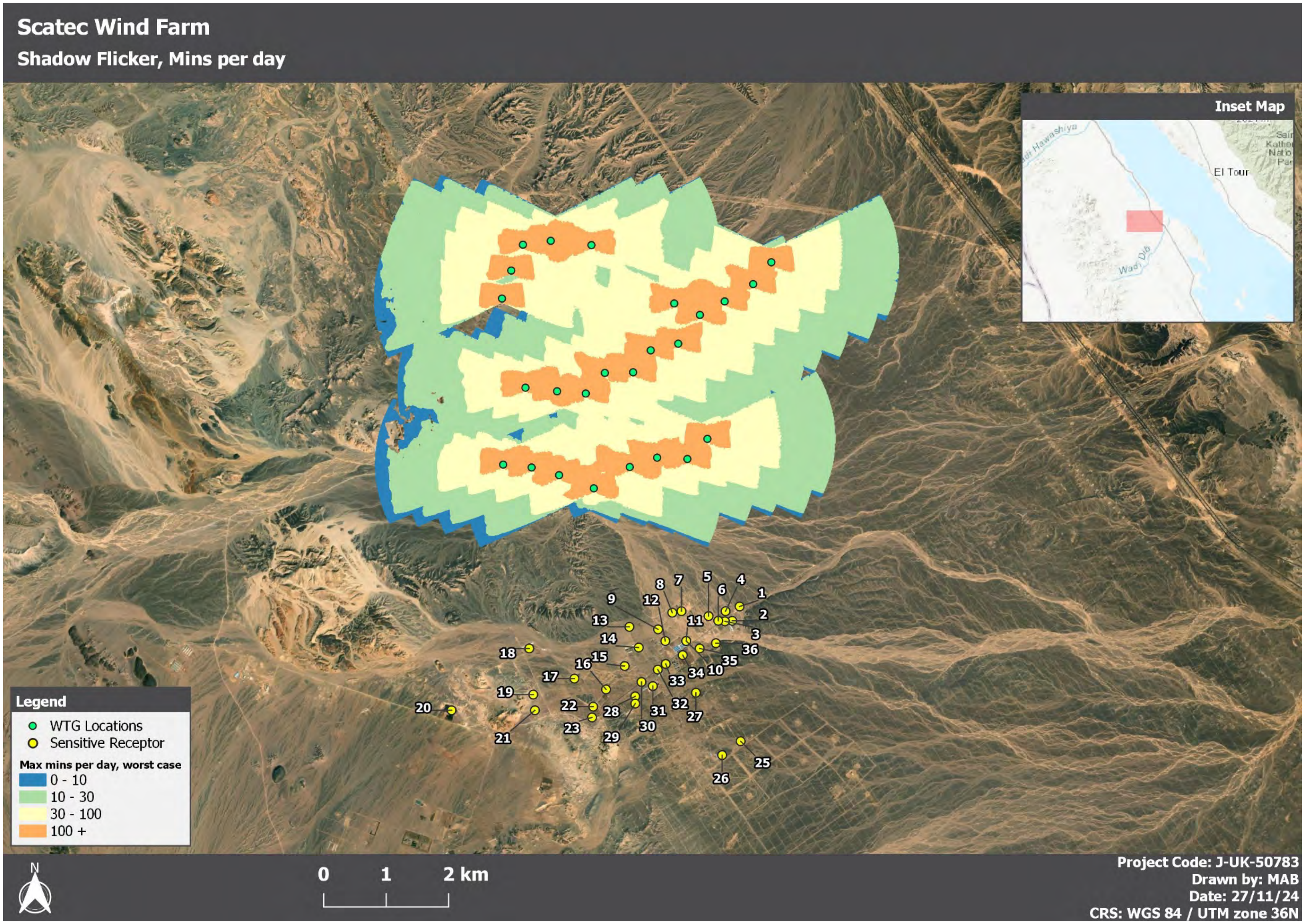

Figure 11-45: Shadow Flicker Map for Worst Case Scenario (mins per day) – Layout 2

Shadow Flicker Results and Impact Assessment

Shadow Flicker Impact Assessment

The maximum possible duration of shadow flicker was calculated at the nearest dwellings with full time residents (sensitive receivers) and compared to the limits set by the Project standards for shadow flicker according to the following parameters:

- Accumulated exposure on sensitive receptors should not exceed a total of 30 hours per year;
- Exposure on sensitive receptors should not be longer than 30 minutes per day.

The comparison for the above limits is presented in the following assessment tables:

- Table 354: Shadow flicker impacts in terms of hours per year for Layout 1.
- Table 365: Shadow flicker impacts in terms of minutes per day for Layout 1
- Table 7-67-4: Shadow flicker impacts in terms of hours per year for Layout 2.
- Table 7-757-5: Shadow flicker impacts in terms of minutes per day for Layout 2

As noted within the table below, none of receptors are impacted by shadow flicker. In fact, the entire Wadi Dara village is outside of the shadow flicker limits from the turbines.

Table 11-35: Assessment of shadow flicker for 'hours per year' limitation for Layout 1

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

Table 11-36: Assessment of shadow flicker for 'minutes per day' limitation for Layout 1

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM minutes per day]	Limit – Minutes per day	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM minutes per day]	Limit – Minutes per day	Shadow Flicker Exceedance
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

Table 11-37: Assessment of shadow flicker for 'hours per year' limitation for Layout 2

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

Table 11-38: Assessment of shadow flicker for 'minutes per day' limitation for Layout 2

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM minutes per day]	Limit – Minutes per day	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM minutes per day]	Limit – Minutes per day	Shadow Flicker Exceedance
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

<u>Summary of Shadow Flicker Exceedances</u>

The limits set by the Project Standard for 'hours per year' and 'minutes per day' were not exceeded at any of the sensitive receivers in relation to either of the proposed WTG development layouts located within the surrounding area.

Cumulative Impact Assessment

Cumulative Impact Assessment

Cumulative shadow flicker impacts from Scatec Wind Farm proposed layouts and the nearby SWE Wind Farm were considered. Cumulative shadow flicker impact refers to the combined shadow flicker impact from multiple wind farms on specific SRs. The shadow flicker impact from one or multiple WTGs at one wind farm could be combined with additional shadow flicker impact from one or multiple WTGs at another wind farm, and therefore increase the total shadow flicker exposure at a particular SR.

SWE Wind Farm consists of 70 wind turbine generators, each with a rated power of 6.5 MW. **Error! Reference source not found.** details the Envision EN171-8.0 MW turbine type basic specifications:

Table 11-39: Envision EN171-8.0 MW Wind Turbine Specification

Manufacturer	Envision
Model Type	Envision EN171-8.0 MW
Rated Power	8000 kW
Rotor Diameter	171 m
Hub Height	100 m

Cumulative Impact Results

Figure 11-17 and Figure 7-147-15 show the limit of shadow flicker extent from the Scatec Wind Farm Layout 1 and SWE Wind Farms. It is demonstrated that shadow flicker impacts between the two wind farms do not overlap at any of the identified receptors.

Figure 11-48 and Figure 11-49show the limit of shadow flicker extent from the Scatec Wind Farm Layout 2 and SWE Wind Farms. It is demonstrated that shadow flicker impacts between the two wind farms do not overlap at any of the identified receptors.

It can be concluded that no further action is necessary regarding cumulative shadow flicker impact.

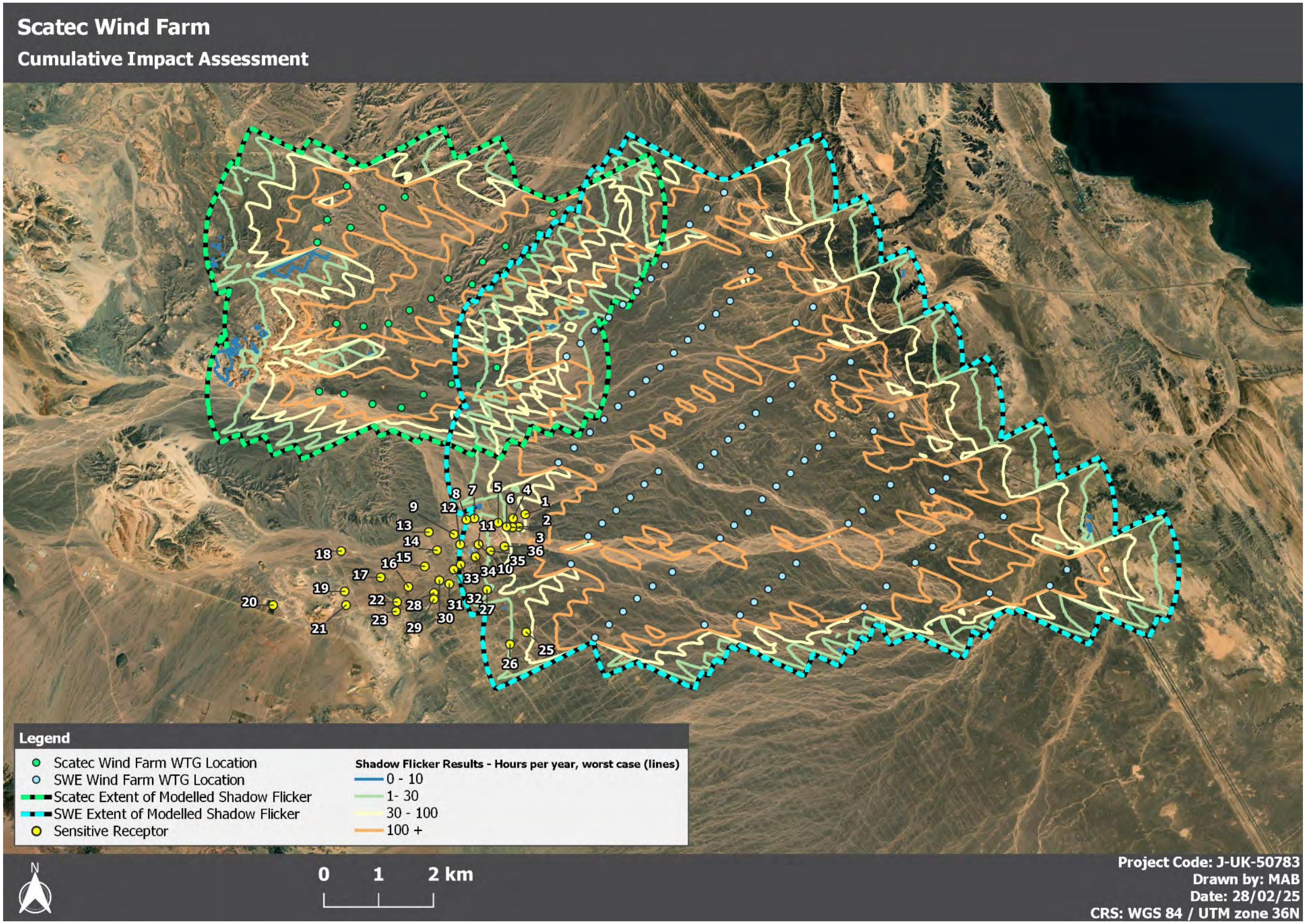

Figure 11-46: Cumulative Impact Assessment for Worst Case Scenario (hours per year) – Layout 1

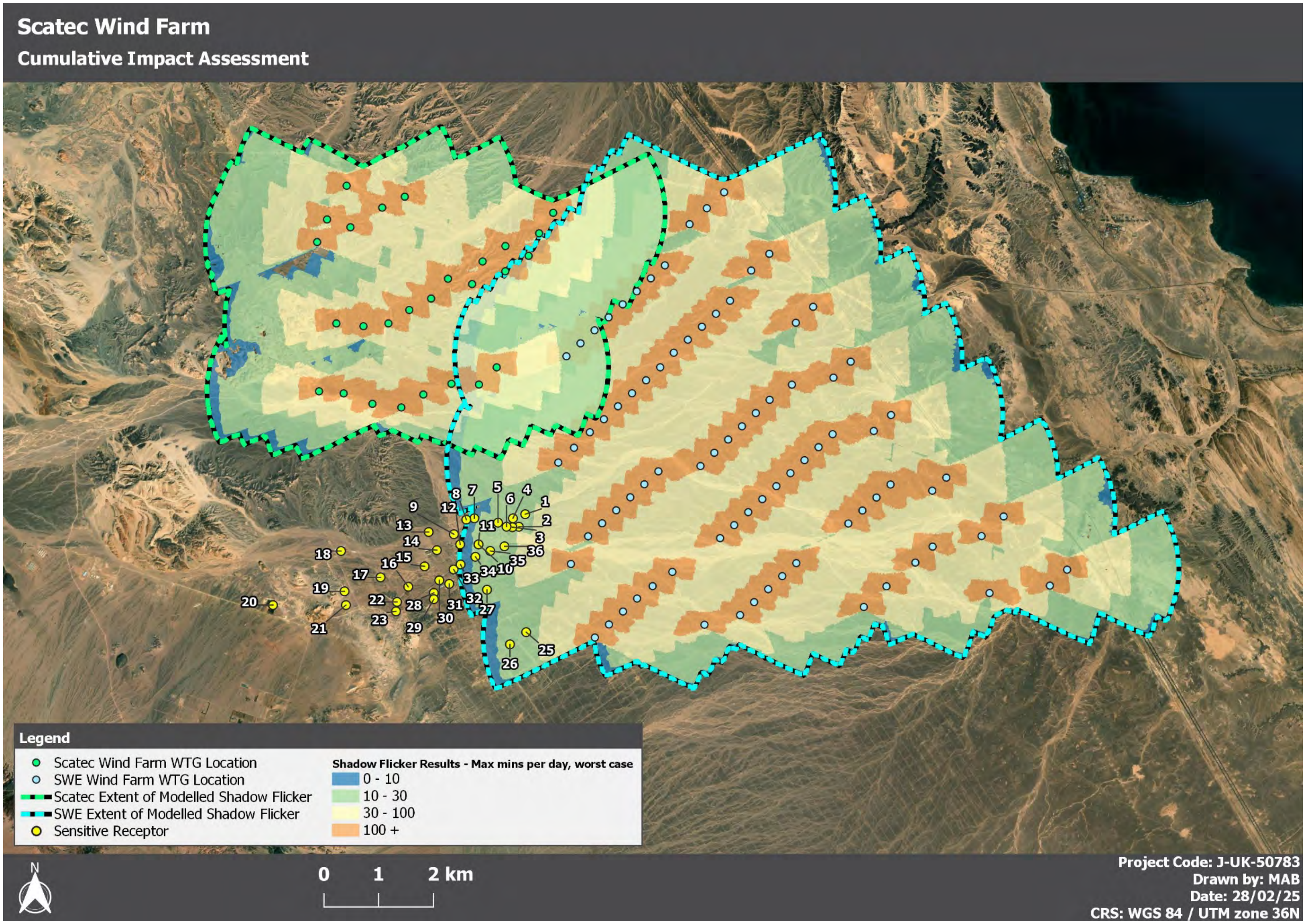

Figure 11-47: Cumulative Impact Assessment for Worst Case Scenario (mins per day) – Layout 1

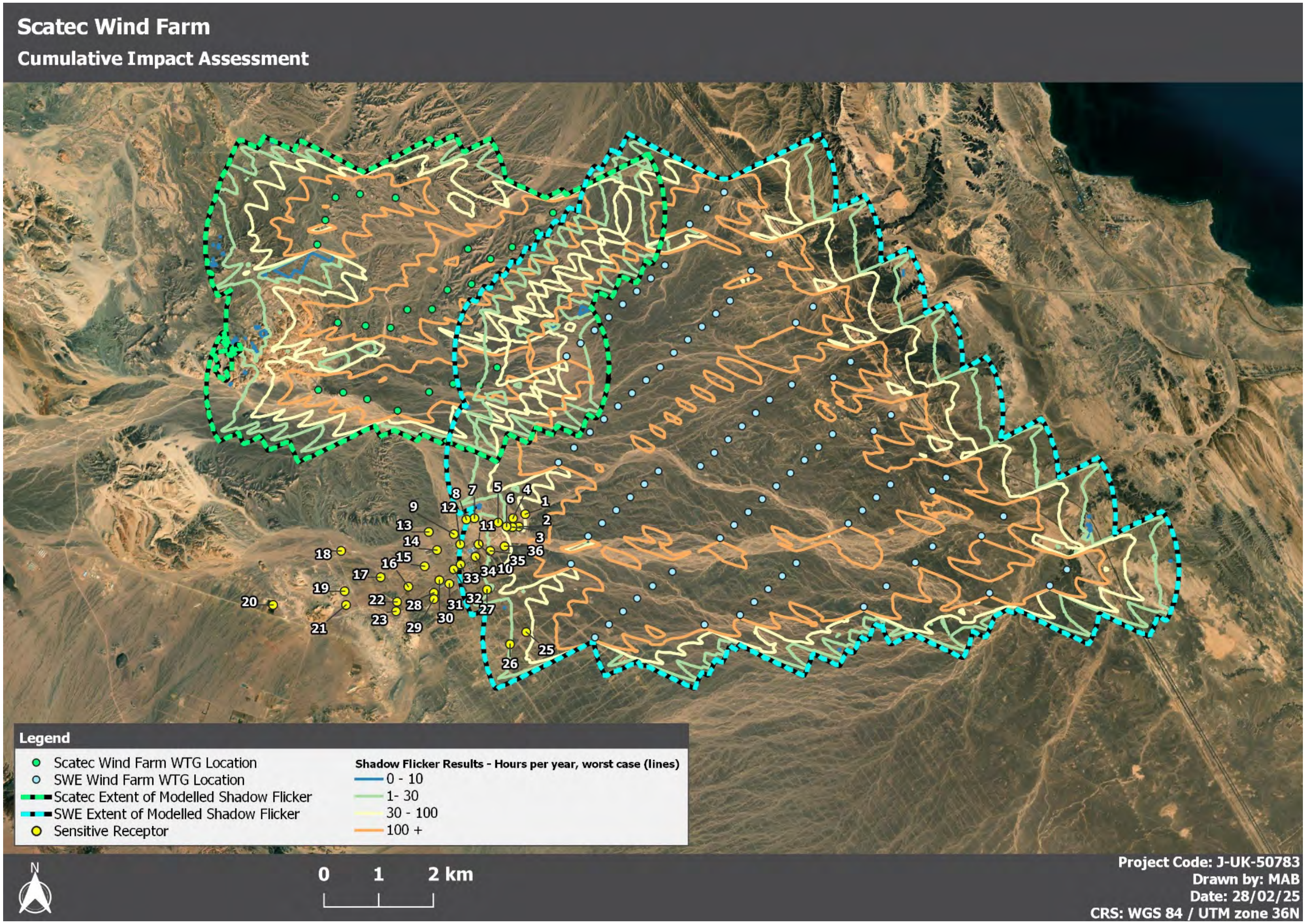

Figure 11-48: Cumulative Impact Assessment for Worst Case Scenario (hours per year) – Layout 2

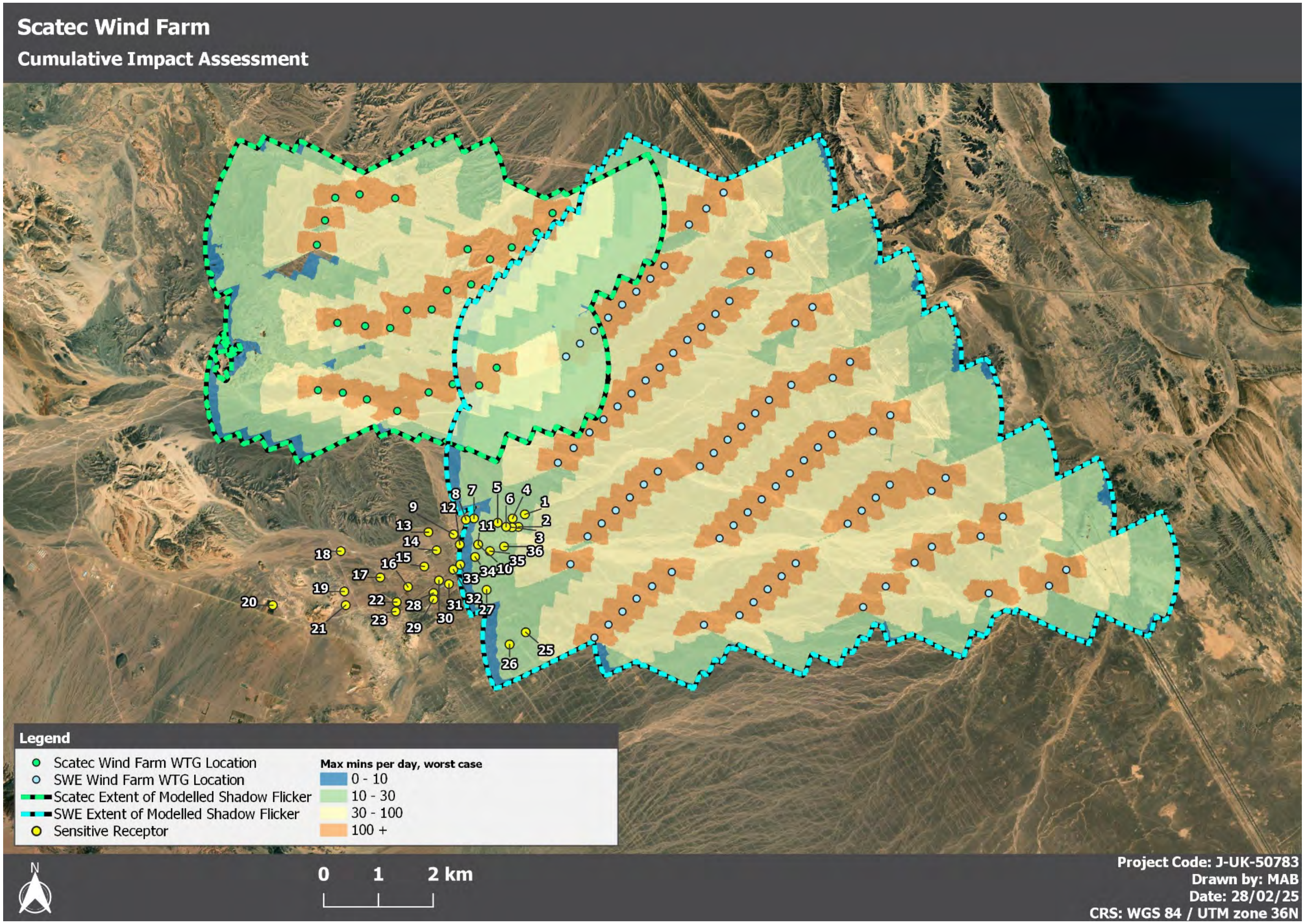

Figure 11-49: Cumulative Impact Assessment for Worst Case Scenario (mins per day) – Layout 2

Conclusions and Recommendations

A shadow flicker assessment was undertaken for the Scatec Wind Farm Project in accordance with the assessment criteria of the German guideline for shadow flicker. WindPRO 3.6 industry standard software was utilised to predict the worst-case scenario.

The results of the prediction calculations showed that under worst-case conditions for Scatec Wind Farm Layout 1, and for Scatec Wind Farm Layout 2, shadow flicker does not occur over the recommended maximum of 30 days per year and/or 30 minutes per day, at any of the identified sensitive receptors.

Taking the above into account, no curtailment measures are deemed necessary for either proposed layout.

The following mitigation measures are recommended for both proposed layouts:

- Grievance mechanism to be established to follow up any shadow flicker related grievance.

In case limit values provided in Project Standards are exceeded due to the contribution of the Project operation, mitigation measures (e.g. improving the curtailment conditions at the receptor, limiting the operational hours of the certain WTGs for the certain hours at certain dates/seasons) to be decided with grievance holder.

Scatec WTG Coordinates

Table 11-40: Scatec WTG Coordinates – Layout 1

Wind Turbine Generator (WTG)	(UTM Easting) (mE)	(UTM Northing) (mN)
A01	519593.3	3101832.3
A02	519774.8	3102245.4
A03	520202.1	3102103
A04	520132.4	3102861
A05	520782.7	3102460.4
A06	521195.5	3102661.1
B07	519945.2	3100343.6
B08	520439.6	3100292.9
B09	520895.6	3100344.3
B10	521277.5	3100589.5
B11	521676.5	3100799.3
B12	521985.1	3101160.8
B13	522425.8	3101063.6
B14	522618	3101477
B15	523033	3101297.6
B16	523034.7	3101758.6
B17	523458.7	3101579.9
B18	523650.9	3101991.4
B19	523908.1	3102366.7
C20	519628.4	3099103.1
C21	520077.7	3099065.4
C22	520604.3	3098874.7
C23	521132	3098807.8
C24	521534.1	3099044.6
C25	522048.1	3099240.4
C26	522550.8	3099226.4
C27	522874.9	3099541.6

Table 11-41: Scatec WTG Coordinates – Layout 2

Wind Turbine Generator (WTG)	(UTM Easting) (mE)	(UTM Northing) (mN)
A01	519593.1	3101785.8
A02	519741.4	3102233.7
A03	519927.8	3102647.5
A04	520373.7	3102709.6
A05	521025.1	3102640.9
B06	519968.8	3100358.5
B07	520475.1	3100301.3
B08	520934.2	3100265
B09	521240	3100595.1
B10	521692.4	3100605.4
B11	521974.3	3100956.4
B12	522414	3101063.1
B13	522350.2	3101706.8
B14	522761.1	3101523.5

B15	523157.8	3101739.8
B16	523614.4	3102017.2
B17	523905.2	3102366.4
C18	519611.5	3099127.8
C19	520066.9	3099081
C20	520506.9	3098958.4
C21	521062.5	3098748.4
C22	521637.9	3099088.8
C23	522077	3099238.1
C24	522561.1	3099216.9
C25	522881.4	3099538.9

Sensitive Receptor Identificiation

Table 11-42: Sensitive Receptor Locations for Shadow Flicker Assessment

SR	SR Coordinates	
	(UTM Easting) (mE)	(UTM Northing) (mN)
SR1	523397	3096856
SR2	523279	3096627
SR3	523162	3096619
SR4	523172	3096781
SR5	522900	3096702
SR6	523055	3096628
SR7	522467	3096781
SR8	522320	3096757
SR9	522093	3096490
SR10	522542	3096304
SR11	522542	3096304
SR12	522207	3096304
SR13	521633	3096530
SR14	521782	3096199
SR15	521557	3095902
SR16	521259	3095529
SR17	520753	3095702
SR18	520030	3096184
SR19	520094	3095446
SR20	518786	3095195
SR21	520120	3095195
SR22	521054	3095253
SR23	521035	3095080
SR25	523414	3094699
SR26	523118	3094477
SR27	522698	3095475
SR28	521726	3095417
SR29	521727	3095302
SR30	521827	3095647
SR31	522008	3095582
SR32	522088	3095846
SR33	522215	3095936
SR34	522487	3096077
SR35	522757	3096184
SR36	523017	3096269

SR24 not included as building was not occupied.