AMUNET
امونت لطاقة الرياح ش.م.م
AMUNET WIND POWER CO. S.A.E

RCREEE
Regional Center for Renewable Energy and Energy Efficiency
المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

# ESIA FOR THE 220kV OVERHEAD TRANSMISSION LINE (OHTL) FOR AMUNET 500MW WIND FARM PROJECT

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**ABBREVIATIONS AND ACRONYMS**

| | |
|---|---|
| BOO | Build, Own, Operate |
| DCT | Double-Circuit Transmission Tower |
| EEAA | Egyptian Environmental Affairs Agency |
| E&S | Environmental and Social |
| EBRD | European Bank for Reconstruction and Development |
| EEAA | Egyptian Environmental Affair Agency |
| EETC | Egyptian Electricity Transmission Company |
| EHS | Environment, Health and Safety |
| EMF | Electric and Magnetic Field |
| ESIA | Environmental and Social Impact Assessment |
| ESMP | Environmental and Social Management Plan |
| GoE | Government of Egypt |
| GoS | Gulf of Suez |
| GWh | Giga-Watt Hour |
| HSE | Health, Safety and Environment |
| ICNIRP | International Commission on Non-Ionizing Radiation Protection |
| IFC | International Finance Corporation |
| IFI | International Financing Institutions |
| ISES | Integrated Sustainable Energy Strategy |
| O&M | Operation and Maintenance |
| OHS | Occupational Health and Safety |
| OHSP | Occupational Health and Safety Plan |
| OHTL | Overhead Transmission Line |
| PR | Performance Requirement |
| PS | Performance Standard |
| RCREEE | Regional Center for Renewable Energy and Energy Efficiency |
| RoW | Right of Way |
| RSWE | Red Sea Wind Energy |
| SCA | Supreme Council of Antiquities |
| SESA | Strategic Environmental and Social Assessment |
| WWTP | Wastewater Treatment Plant |

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# 1 INTRODUCTION

## 1.1 Background

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

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

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

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

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

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

The Project will produce a minimum of 2,200-Gigawatt Hour (GWh) of electricity that will be supplied to the Egyptian National Electricity Grid. However, the ESIA prepared for the Amunet Project did not include the Overhead Transmission line (OHTL) that will connect from the Wind Farm to the National Grid, given that no information was available on its route at that time (the OHTL is referred to as 'the Project' throughout the document). Therefore, EEAA required an ESIA study to be undertaken at a later stage for the OHTL once the route has been confirmed.

At this stage, the route has been determined by the Egyptian Electricity Transmission Company (EETC), whom is responsible for development of the OHTL. Therefore, the Developer and RCREEE, on behalf of EETC, commissioned the consortium of ECO Consult and Green Plus (hereafter referred to as the 'ESIA Team)') to prepare the ESIA study for the OHTL. This report presents the ESIA study for the OHTL.

## 1.2 Environmental and Social Impact Assessment Report

The environmental clearance for this Project is governed by the Egyptian Environmental Affairs Agency (EEAA) as stipulated by the Law No. 4 of 1994 (Law on Protection of the Environment). Executive Regulations 1995 (Prime Ministers Decree 338) issued in accordance with the Law, classifies this Project as "Category B

Scoped Study". Additional details on the Egyptian legal E&S framework and requirements for a "Scoped ESIA Study" is provided in "Chapter 3".

The Developer will be seeking financing for the Project from prospective lenders, including International Financial Institutions (IFIs). Therefore, the Developer wishes to design and manage the Project in accordance with good international industry practice. For the purpose of the ESIA this has therefore been developed in accordance with following requirements. "Chapter 3" provides additional details on the IFI E&S requirements.

- IFC Performance Standards (PSs) of Social and Environmental Sustainability;
- IFC General EHS Guidelines (2007);
- IFC EHS Guidelines for Electric Power Transmission and Distribution (2007); and

## 1.3 Document Structure

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

**Table 1: ESIA Document Structure**

| Chapter | Description of Content |
|---|---|
| Chapter 2 – Project Description | Provides a detailed description of the Project in relation to its location, the key project components and an overview of the proposed activities that are to take place during the various Project phases. |
| Chapter 3 – Regulatory & Policy Framework | Provides an overview of the environmental and social regulatory and policy framework applicable to the Project. |
| Chapter 4 – ESIA Approach and Methodology | Presents the methodology and approach that was adopted for the ESIA study. |
| Chapter 5 – Project Alternatives | This chapter investigates several alternatives to the Project development and the reasons for the preferred choice. This includes alternatives in relation to the Project site, selected technology and design, and finally investigates the 'no action alternative' – which assumes that the Project development does not take place. |
| Chapter 6 – Chapter 16 Assessment of E&S Baseline Conditions and Impacts | These Chapters first presents the baseline conditions within the Project site and surroundings, and then assesses the anticipated impacts from the Project throughout its various phases on such a receptor. Finally, for each identified impact a set of mitigation and monitoring requirements have been identified which aim to eliminate the impact and/or reduce it to acceptable levels. This includes the following: Landscape and Visual (Chapter 6), Land Use (chapter 7), Geology/Hydrology/Hydrogeology (Chapter 8), Biodiversity (Chapter 9), Avi-fauna (Chapter 10), Bats (Chapter 11), Archaeology and Cultural Heritage (Chapter 12), Air Quality and Noise (Chapter 13), Infrastructure and Utilities (Chapter 14), Occupational Health and Safety (Chapter 15), Community Health, Safety and Security (Chapter 16). |
| Chapter 17 – Environmental and Social Management Plan (ESMP) | Presents the Environmental and Social Management Plan (ESMP) for the Project; which mainly summaries the impacts identified as well as the mitigation measures and monitoring requirements to be implemented throughout the various Project phases. In addition, this Chapter describes the institutional framework and procedural arrangement for the ESMP implementation. |

## 1.4 Key Involved Entities

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

- *Amunet Wind Power Co. (AWPC):* The owner and developer of the Project (hereafter referred to as 'the Developer');
- *Regional Centre for Renewable Energy and Energy Efficiency (RCREEE):* is responsible for managing certain aspects of the overall development process on behalf of the Developer. This includes in specific

the overall management of the ESIA process with the Consultant including review of deliverables and submissions;

- *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;
- *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 the entity responsible for qualification of bids and selection of the Wind Farm Developers. In addition, they are also responsible for allocation of the land for the development of the Wind Farm Projects;
- *OHTL Contractor:* will be responsible for the preparation of the detailed design of the OHTL Project; supply of the material and equipment; and construction of the OHTL Project and its various components. At this stage, the Contractor has not been selected yet by EETC;
- *ESIA Consultant (ECO Consult & Green Plus):* the ESIA Practitioner and the consultant commissioned by RCREEE to prepare the ESIA for the Project in accordance with the requirements of the "Law No. 4 of 1994" as well as the IFI E&S requirements.

# 2 PROJECT DESCRIPTION

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

## 2.1 Project Rationale

The OHTL is considered a key component for the 500MW Amunet Wind Farm Project as it will supply the electricity produced by the Wind Farm to the National Grid. Without the OHTL, the Amunet Wind Farm Project cannot be realised.

Such a Wind Farm Project will result in significant and crucial positive environmental and economic impacts on the strategic and national level given the current challenges the energy sector in Egypt is facing, which have serious implications on Egypt's energy security. Such positive impacts are important to highlight, consider, and take into account and are summarised below.

- The development allows for more sustainable development and shows the commitment of the Government of Egypt to realising its energy strategy and meeting the set targets for renewable energy sources;
- The Project will contribute to increasing energy security through reliance on an indigenous, inexhaustible and mostly import-independent energy resource. The estimated electricity generation from the Wind Farm is a minimum of 2,200 GWh per year; which will serve the annual electricity needs of more than 800,000 local households (ECO Consult & Plus Green, 2021); and
- Generating electricity through wind power is rather pollution-free during operation. The clean energy produced is expected to reduce consumption of conventional petroleum products used at thermal power plants for electricity generation. This will help in reducing greenhouse gas emissions as well as air pollutant emissions – the Project is expected to offset more than 1 million metric tons of $CO_2$ annually (ECO Consult & Plus Green, 2021).

## 2.2 Project Location

The Project site as well as the Amunet Wind Farm is located within the Red Sea Governorate, approximately 230km to the southeast of the capital city of Cairo (Figure 1). Administratively, the Red Sea Governorate is divided into 7 Cities (also known as Districts), each headed by a Local City Council. The capital of the Governorate is Hurghada that is located around 150km south of the Project site. The Project site is located within the Ras Ghareb City (or District) and therefore administratively is under the Ras Ghareb City Council. The closest villages include Ras Ghareb City (located 9km to the southeast) and Zaafarana (65km to the north).

Within the Wind Farm boundary, a 33kV/220kV subordinate substation will be constructed. From the substation, a 220kV OHTL will run to the southeast to connect with an existing 220kV substation which is connected to the National Electricity Grid. The total length of the OHTL is approximately 2km.

Figure 2 below presents the OHTL route from the substation until its connection with the National Grid. The route provided below is based on the concept design prepared by EETC.

**Figure 1: Overview of the Wind Farm Project Location**

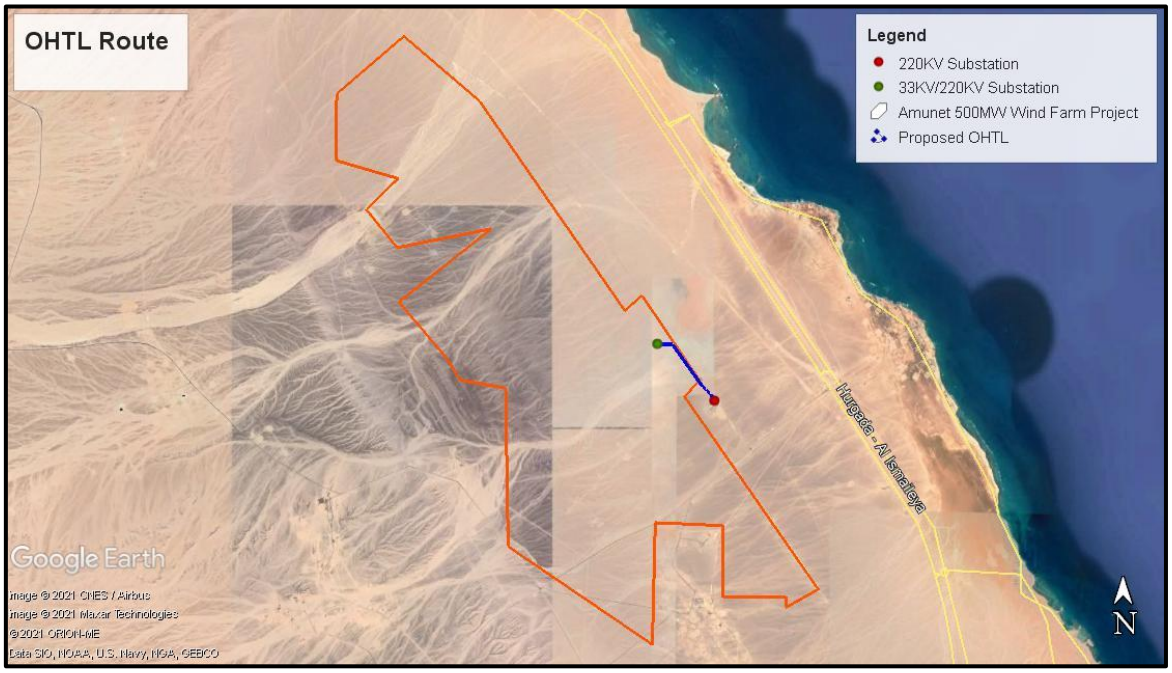


**Figure 2: Layout of the OHTL Route**

## 2.3 Project Components

The following describes the main OHTL (Project) components. This has been based on current available information provided by EETC. It is important to note that such available information is preliminary as more detailed information will be available at a later stage once the detailed design and studies are undertaken by the Contractor.

### 2.3.1 Transmission Towers

The main component of the OHTL is the transmission towers. The transmission tower will be a three (3) phase steel beam Double-Circuit Transmission Towers (DCT), which will transport the electricity from the substation located within the Amunet 500MW Wind Farm to the High Voltage National Grid. The typical structure of the DCT tower is presented in Figure 3 below.

Based on information available from EETC, the OHTL is not expected to exceed 20 towers that will be distributed throughout the route. The height of each tower is expected to be around 50m.

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 3 below).

### 2.3.2 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 3 below). The conductor will be a 220kV line.

### 2.3.3 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.

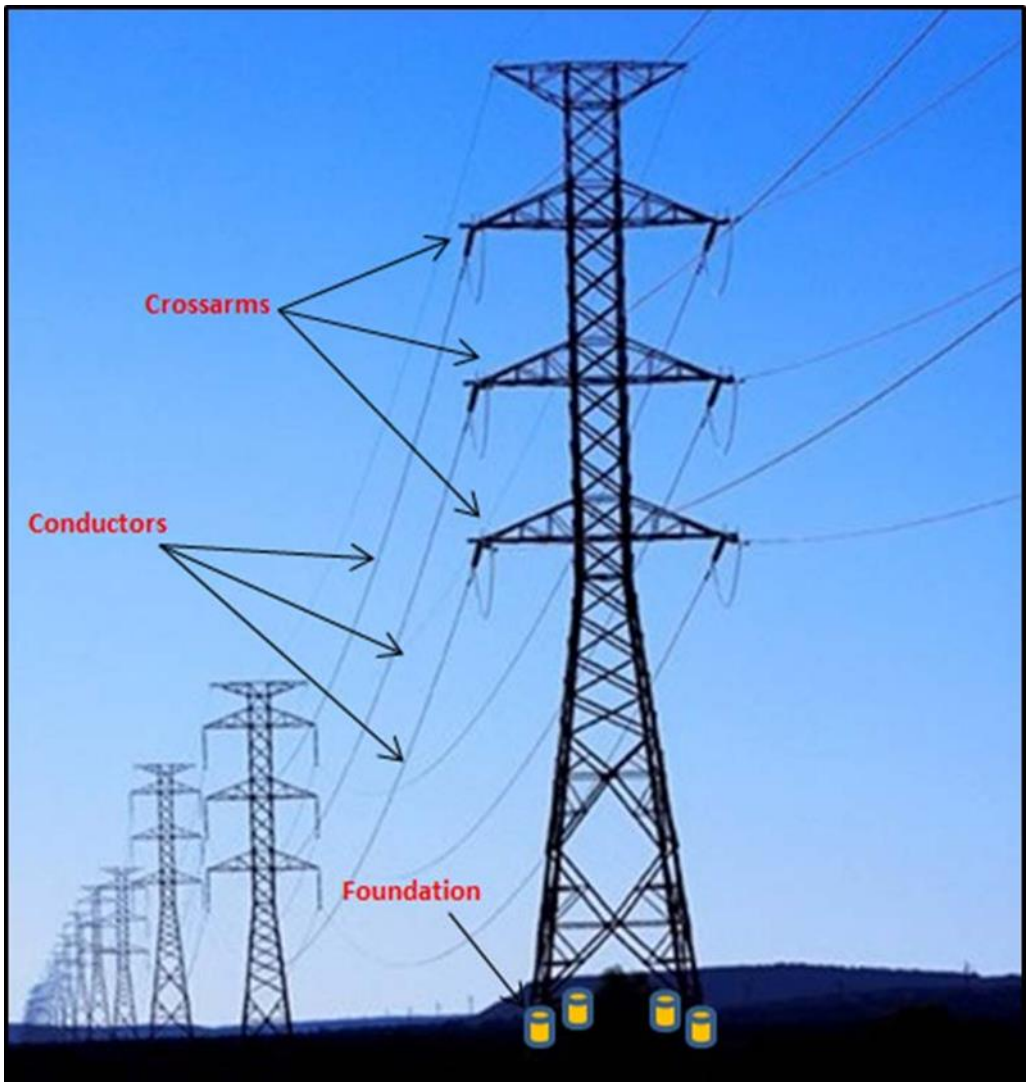


**Figure 3: Typical Structural Components of DCT towers**

## 2.4 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 utilised 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 (more details are provided in Table 2). Any successive buildings, structures or other receptors to be built shall take into account this safety distance/ RoW.

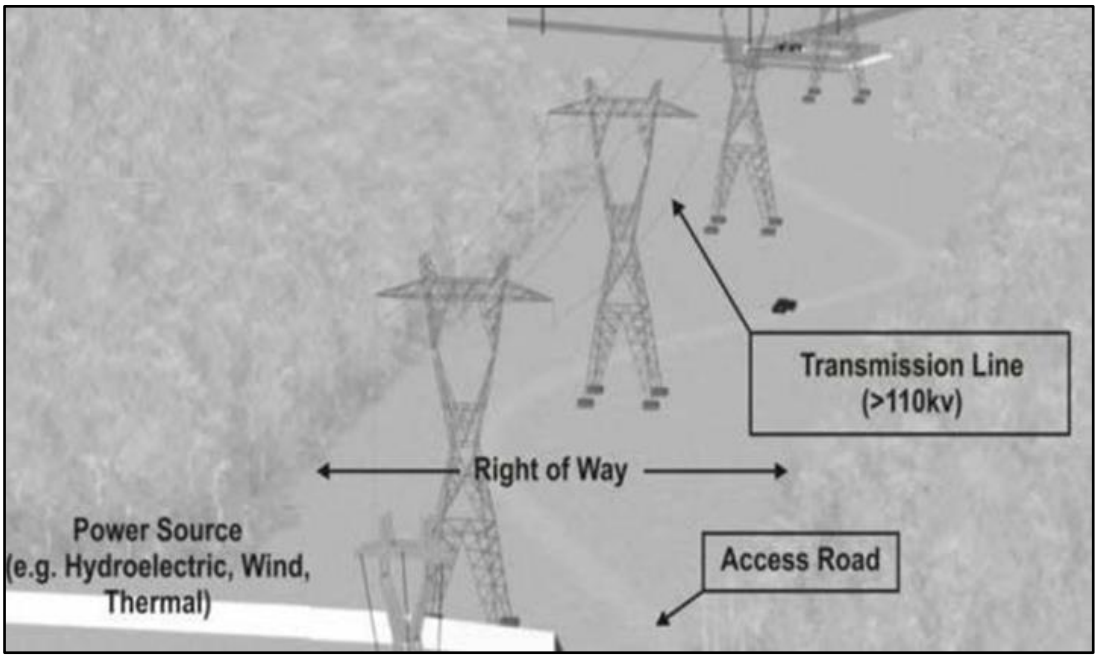


**Figure 4: Right of Way and Access Road for OHTL (IFC, 2007)**

## 2.5 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 summarised below.

### 2.5.1 Planning & Construction Phase

Typical activities during the construction phase for the OHTL include the following. Construciton activities are expected to require 6-7 months.

- 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 (mainly labourers). It is likely that the OHTL Contractor will have his own team to cover such employment opportunities.

### 2.5.2 Operation Phase

The OHTL is expected to remain operational throughout the operation period of the Amunet 500MW 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.

### 2.5.3 Decommissioning Phase

Decommissioning activities will depend on the Amunet 500MW 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).

# 3 REGULATORY & POLICY FRAMEWORK

## 3.1 Egyptian Environmental Clearance Process

ESIA is one of the main requirements of EEAA to assess the impacts of initiatives, projects, or developmental activities, with a view of identifying necessary actions to minimize negative impacts and maximize positive ones. Measures concerning the assessment of environmental impact of projects are stipulated in the Law of Environment No. 4 of 1994 and its amendments in Law No. 9 of 2009.

The Central EIA Department of the EEAA is responsible for supervising the screening process, managing the review of EIA reports, taking decisions on the acceptability of EIA reports, providing feedback on the development and proposals for mitigation measures, and issuing environmental clearances for development projects.

According to the last updated executive regulation and the ministerial decree No. 26 of 2016, the ESIA system classifies the projects into four categories based on different levels of ESIA requirements according to severity of possible impacts and location of the establishment and its proximity to residential settlements. Electricity transmission lines projects in general are categorized as "Category B – Scoped study" (i.e. Projects with limited environmental impacts). The key requirements of the "Category B – Scoped Study" include the direct submission of a scoped ESIA study that includes the following key components:

- Project Description
- Analysis of Alternatives
- Legal review
- Assessment of E&S baseline Conditions (based on secondary data only and does not require site surveys in specific)
- Assessment of E&S Impacts
- Development of an Environmental Management Plan

Based on the submitted study, EEAA either approves it and grants an environmental clearance for the Project, or if it is found that the Project results in significant E&S impacts, could require a comprehensive ESIA study to be undertaken to further investigate such issues.

## 3.2 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 to each of the environmental and social parameter being studied and assessed within this ESIA along with the key requirements set out within such legislations.

**Table 2: National Legislation and Guidelines Governing the E&S Compliance for the Project**

| Legislation | Relevant Article | Requirements |
|---|---|---|
| **Landscape and Visual** | | |
| Law of Environment No. 4 of 1994 and its amendments in Law No. 9 of 2009 | N/A | There are no key or specific legal requirements that govern landscape and visual. Nevertheless, the "Law of Environment No. 4 of 1994 and its amendments in Law No. 9 of 2009" requires assessment of environmental impact of projects as relevant which could include landscape and visual components as well. |
| **Land Use** | | |
| Electricity Law 87/2015 | Article 52 – Article 57 | Concerning the electricity sector installation, the People Assembly passes the bill of Electricity Law 87 that regulates all activities and developments related to the electricity sector. Of particular importance, the law: (i) identifies and requires a fair compensation process for landowners in which associated facilities such as overhead lines are developed and also identifies an objection process that can be followed by such landowners; (ii) identifies the limits of distances to be measured from the axis of the OHTL routes in order to identify the Right of Way (ROW) zone. With regards to this project (220kV), a distance of 25 meters from both sides for OHTL will be kept as a Right of Way (ROW) or buffer zone that should be free for any obstacles at all times such as buildings, trees, gas pipelines, cables, water pipelines (unless agreed with EETC taking into account health and safety requirements). |
| **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 as applicable |
| Waste Management | | |
| Law 4/1994 amended by Law 9/2009 and ER 1095/2011 amended by Decree 710/2012) | Articles 26, 28, 29, 33, 37, 39 | ▪ Identification: using the Hazardous waste lists issued by the competent authority.<br>▪ Minimization: strive to reduce quantitatively and qualitatively the generation of hazardous waste<br>▪ Segregation: hazardous waste is to be separated from other types of non-hazardous waste. In addition, the different types of hazardous waste must not be mixed together.<br>▪ On site Storage: hazardous waste 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.<br>▪ Off-site transportation: hazardous waste is to be submitted to authorized contractors.<br>▪ Obtaining a license from the competent authority to handle hazardous waste<br>▪ The establishment should maintain a register for the hazardous waste should be maintained as well as record for the hazardous substances used |
| | Article 22 and Article 17 of the Executive Regulations | ▪ The establishment should maintain an environmental register of waste streams 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.<br>▪ Article 41: The establishment shall undertake necessary precautions to secure the safe storage and transportation of waste. These precautions include the following: |

| | | |
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| | | - Construction waste storage is to be carried out at site such that it does not obstruct movement of vehicles and personnel.<br>- waste subject to emission should be covered to avoid air pollution<br>- waste is to be submitted to authorized waste contractors |
| 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.<br>▪ Article 14 of the executive regulations set the parameters required regarding the quality of the wastewater discharged to the public sewage network.<br>▪ The owner of the project should abide by the limits stated in article 14 of the Executive regulations of Law 93/1962 |
| **Biodiversity, Avi-Fauna and Bats** | | |
| Law 4 of 1994 | Article 28, as amended by Law 9 of 2009. Annex 4 of the Executive Regulations of law 4/1994, amended by Prime Minister Decree 1095 of 2011 | ▪ Defines fauna and flora which are forbidden to be hunted or disturbed.<br>▪ 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 |
| **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.<br>▪ The Article additionally, states that a buffer zone around the monument or the site is defined as 3kilometres 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).<br>▪ 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.<br>▪ 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.<br>▪ 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].<br>▪ 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. |
| **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 that must not be exceed. The maximum permissible noise level limits for the project area (which can be classified as Areas overlooking public roads more than or equal 12 meters, or industrial areas with light industries) is set at 70 dB(A) during daytime (7 AM – 10 PM) and 60 dB(A) during night-time 10 PM – 7 AM). |
| | 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.<br>▪ Transporting waste and dust resulting from excavation, demolition and construction in special containers or using transport vehicles prepared and licensed for this purpose.<br>▪ 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.<br>▪ The vehicle shall be equipped with special equipment for loading and unloading.<br>▪ The car should be in good condition according to the rules of safety, durability and lights and equipped with all safety devices.<br>▪ 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 in relation to Sulphur Dioxide, Carbon Monoxide, Nitrogen Dioxide, Ozone, Total Suspended Particles (TSP), Particulate Matter less than 10 µm (PM10), Particulate Matter less than 25 µm (PM2.5), Suspended Particles Measured as Black Smokes, Lead and Ammonia |
| | Annex 6 | ▪ Allowable Emission levels from Asphalt mixing units in relation to Total Suspended Solids (TSP), Carbon Monoxide, and Total Volatile Organic Compounds (VOCs)<br>▪ Maximum allowable emissions from vehicles that operate using gasoline fuel in relation to hydrocarbons and Carbon Monoxide |

| | | |
|---|---|---|
| | | ▪ Maximum allowable emissions from vehicles that operate using diesel in relation to Smoke density factor |
| | Annex 8 and Annex 9 | ▪ Maximum allowable limits for air emissions, heat stress, ventilation rates within the work environment |
| **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<br>▪ In case the limits are exceeded, special protective equipment should be made available (earmuffs, masks…) (Annex 9)<br>▪ 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)<br>▪ Conduct regular medical check-ups for workers that are facing noise, vibration or heat stress exceeding the limits |
| Law 12/2003 on Labour and Workforce Safety and Book V on Occupational Safety and Health (OSH) and assurance of the adequacy of the working environment | All | Law 12/2003 on Labour and Workforce Safety and Book V on Occupational Safety and Health (OSH) is the principal law related to Occupational Health and Safety (OHS) in relation to development Projects. The law identifies requires in relation to: (i) overall OHS requirements at the workplace and assurance of the adequacy of the working environment; (ii) Personal Protective Equipment (PPE) to be considered for workers in the workplace; (iii) emergency preparedness and response plan requirements; (iv) workforce management to include contracting requirements, working hours, rest hours, etc.; and (v) other as applicable. Moreover, the following laws and decrees should be considered which also take into account additional details and provisions for workplace OHS requirements<br>▪ Minister of Labour Decree 48/1967.<br>▪ Minister of Labour Decree 55/1983.<br>▪ Minister of Industry Decree 91/1985<br>▪ Minister of Labour Decree 116/1991. |
| Decree 458/2007 | All | ▪ Egyptian Drinking Water Quality Standards should be met for all water bought and stored on site for the workers' use. |

### 3.3 International Agreements

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

**Table 3: Relevant Egyptian International Conventions and Agreements**

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

### 3.4 Requirements for Project Financing

The Developer will be seeking financing for the Project from prospective lenders, including International Financial Institutions (IFIs). Therefore, the Developer wishes to design and manage the project in accordance with good international industry practice. For the purpose of the ESIA this has therefore been developed in accordance with following requirements which are discussed in further details throughout this section.

- IFC Performance Standards (PSs) of Social and Environmental Sustainability
- IFC General EHS Guidelines (2007) and
- IFC EHS Guidelines for Electric Power Transmission and Distribution (2007)

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

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

**Table 4: IFC Performance Standard Requirements**

| IFC PS | Key Points |
|---|---|
| PS1: Assessment and Management of Environmental and Social Risks and Impacts | PS1 underscores the importance of managing social and environmental performance throughout the life of a project by using a dynamic social and environmental management system. Specific objectives of this Performance Standard are:<br>▪ To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence;<br>▪ To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment;<br>▪ To ensure that affected communities are appropriately engaged on issues that could potentially affect them; and<br>▪ To promote improved social and environment performance of companies through the effective use of management systems. |
| PS2: Labour and Working Conditions | The requirements set out in this PS have been in part guided by a number of international conventions negotiated through the International Labour Organization (ILO) and the United Nations (UN). Specific objectives of this Performance Standard are:<br>▪ To establish, maintain and improve the worker-management relationship;<br>▪ To promote the fair treatment, non-discrimination and equal opportunity of workers and compliance with national labour and employment laws;<br>▪ To protect the workforce by addressing child labour and forced labour; and<br>▪ 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:<br>▪ To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; and<br>▪ To promote the reduction of emissions that contribute to climate change. |
| PS 4: Community Health, Safety and Security | This PS recognizes that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development. However, projects can also increase risks arising from accidents, releases of hazardous materials, exposure to diseases, and the use of security personnel. While acknowledging the public authorities' role in promoting the health, safety and security of the public, this PS addresses the project sponsor's responsibility in respect of community health, safety and security. |

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

*Note: PS 7 (Indigenous Peoples) is not considered to be applicable to this Project. The Indigenous World 2018 Report (IWGIA, 2018) states that Egypt is not classified as a country with indigenous people.*

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

- IFC General EHS Guidelines (2007): identifies detailed EHS management and technical recommendations which are applicable for all development projects
- IFC EHS Guidelines for Electric Power Transmission and Distribution (2007): the Guideline identifies they key E&S impacts that should be investigated and provides detailed management and technical recommendations with regards to Industry-Best Practice. The IFC EHS Guidelines identifies the following key issues:
  - Biodiversity (to include birds and bats)
  - Electric and magnetic fields
  - Hazardous materials
  - Occupational health and safety
  - Community health and safety

# 4 ESIA APPROACH & METHODOLOGY

This Chapter presents the approach and methodology that was undertaken for the ESIA study in accordance with the Egyptian Environmental Affairs Agency's (EEAA) requirements as stipulated by the "Law No. 4 of 1994". In addition, the methodology for the ESIA takes into account international good practice – this mainly includes the IFC Performance Standards and applicable IFC EHS Guidelines.

## 4.1 Analysis of Alternatives

The Egyptian Regulations to include the "Guidelines of Principles and Procedures for Environmental Impact Assessment" (EEAA, 2009) requires that the ESIA identify and analyse alternatives and present the main reason for the preferred choice. The examination of alternatives is also considered to be a key element of the ESIA process under good international practice, including the IFC Performance Standard 1 (IFC, 2012) and the associated "IFC Guidance Note 1" (IFC, 2012).

The analysis of alternatives is presented in "Chapter 5". This chapter investigates and compares several alternatives to the Project development in relation to: (i) the Project site, (ii) the chosen technology and Project design, and (iii) finally investigates the 'no action alternative' – which assumes that the Project development does not take place.

## 4.2 Delineation of Study Boundaries & Scope of Assessment

### 4.2.1 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 blue in the figure below (i.e. within the OHTL route) which was studied along with a 500m buffer on both sides of the route.

However, for certain environmental and social parameters (such as landscape and visual, air quality, 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 section 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.

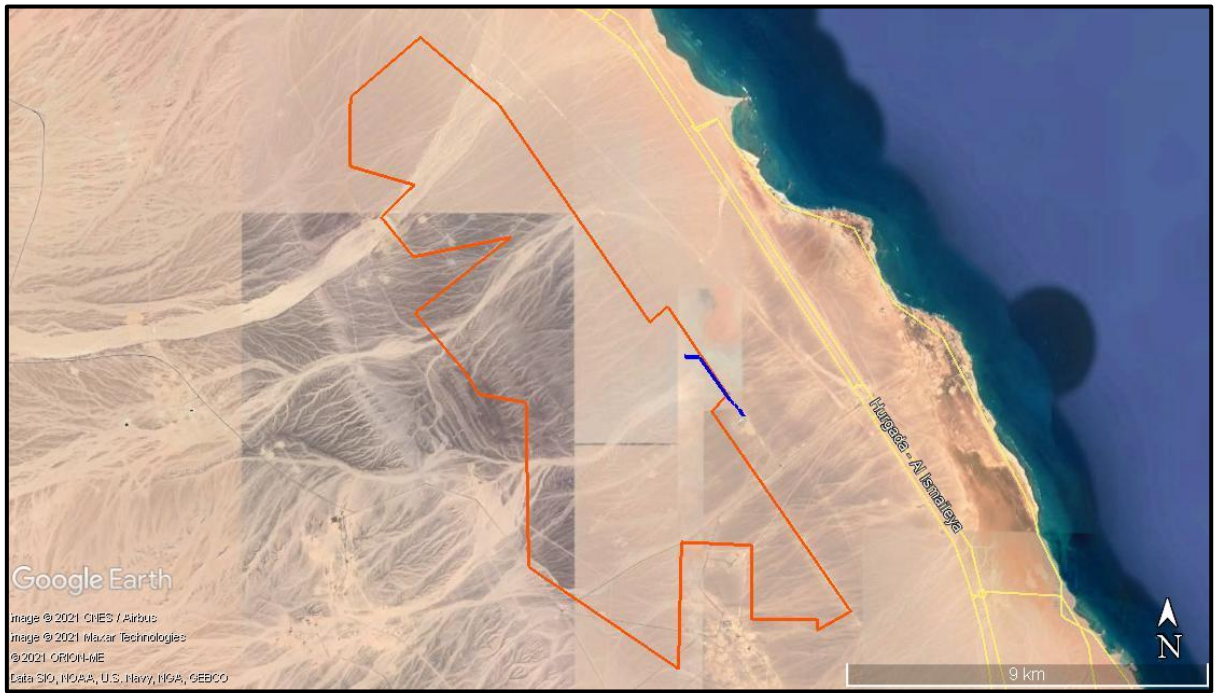


**Figure 5: Study Area (OHTL Route in Blue)**

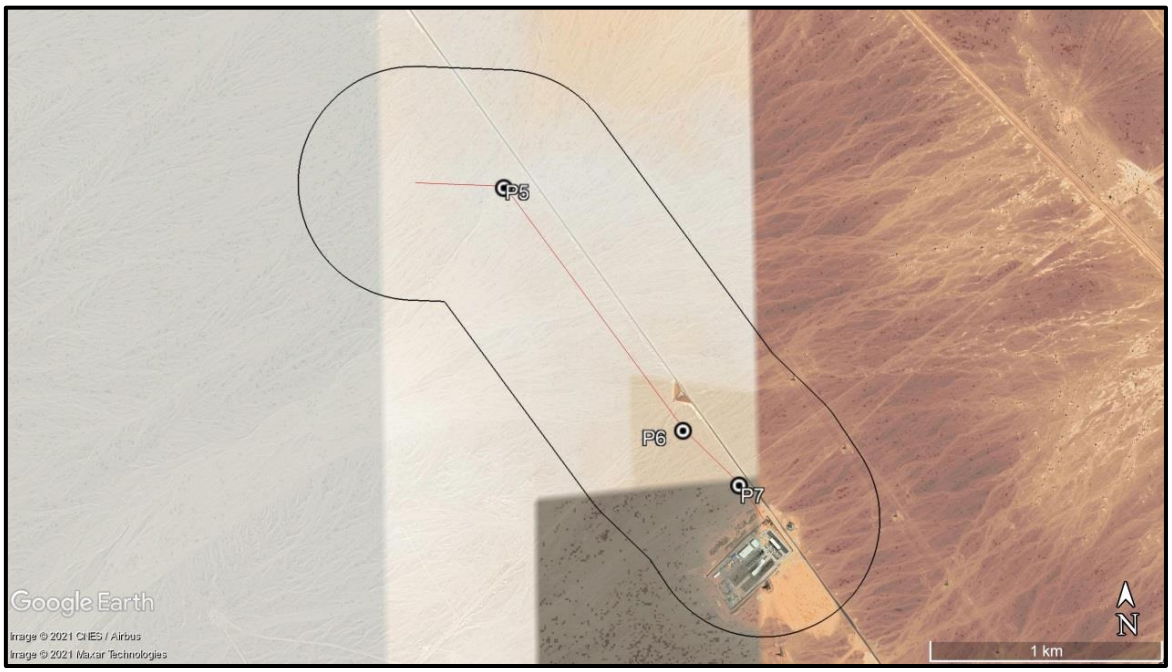


**Figure 6: The Surveyed Study Area (OHTL Route) with the 500m Buffer Area**

### 4.2.2 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.

*(i) Planning and Construction Phase*

This includes onsite construction activities, which will be undertaken by the OHTL Contractor. This mainly includes preparing the detailed design and layout of the Project, transportation of Project components onsite, as well as onsite site preparation and construction activities for installation of the towers, foundations, internal access roads, etc.

*(ii) Operation Phase*

This includes activities to be undertaken by EETC for O&M. Activities expected to take place mainly include routine and /or emergency maintenance activities which do not require any permanent staff onsite.

*(iii) Decommissioning Phase*

As discussed earlier, the Amunet 500MW Wind Farm is expected to remain operational for 20 years after which the Project could be decommissioned. 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 emphasise this throughout this section.

## 4.3 Environment & 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 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.

Studies of the environment and social baseline are described under each section respectively along with the methodology which was undertaken for assessment of the each of those baseline conditions is described in detail. The baseline conditions are treated as those conditions which would prevail in the absence of the Project.

## 4.4 Impact Assessment Methodology

The assessment of impacts on environmental and social parameters for each receptor are discussed under the relevant Chapter, from Chapter 6 to Chapter 16. The following section provides a description of the approach, methodology and process adopted for the impact assessment presented within this ESIA.

### 4.4.1 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.

In general, a qualitative assessment was conducted using professional experience, judgment and available knowledge. Where there were limitations to the data, and/or uncertainties, these have been recorded in the relevant sections, along with any assumptions that were taken during the assessment.

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

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

### 4.4.2 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 environmental parameter to an identified impact. The following categories of sensitivity were applied to the assessment:

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

### 4.4.3 Magnitude & 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 environmental result, such as enhancement of the existing environmental 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 environmental or social 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 environmental or social parameter (e.g. high levels of dust could entail nuisance and health affects to construction workers onsite).

**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 cease Assessing the Significance of the Impacts.

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

**Table 5: Determination of Significance**

| Magnitude and Nature of Impact / Sensitivity of Receiving Parameter/Receptor | Low | Medium | High |
|---|---|---|---|
| **Low** | Not significant | Minor | Minor |
| **Medium** | Minor | Minor | Moderate |

| | | | |
|---|---|---|---|
| **High** | Minor | Moderate | Major |

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

- *Major significance*: requires thorough investigation in the ESIA. These impacts have been studied extensively by consulting expertise in the areas of the identified impacts to design needed mitigation and environmental management measures. Moreover, conducting specific studies and assessments to some of the key issues identified;
- *Moderate significance*: requires reasonable investigation in the ESIA. These impacts have been studied by expertise in the areas of the identified impacts to design needed mitigation and environmental management measures.
- *Minor significance*: must be listed, and addressed in some way, but which did not require detailed assessment in the ESIA.
- *Not significant*: for completeness, impacts which have been included in the assessment but determined not to be significant, are rated formally as 'not significant'.

### 4.4.4 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 could include any of the following:

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

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

## 4.5 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*.

### 4.6 Development of an Environmental & Social Management (ESMP) Plan

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, OHTL Contractor, EEAA, and other responsible parties. The ESMP for the various project phases is presented in “Chapter 17”.

# 5 PROJECT ALTERNATIVES

The Egyptian Regulations to include the "Guidelines of Principles and Procedures for Environmental Impact Assessment" (EEAA, 2009) requires that the ESIA identify and analyse alternatives, including but not limited to project site location, design, and the no project alternative (which assumes that the Project development does not take place), and present the main reason for the preferred choice.

In addition, the examination of alternatives is also considered to be a key element of the ESIA process under good international practice, to include but not limited to the: (i) IFC Performance Standard 1 (IFC, 2012) and the associated "IFC Guidance Note 1" (IFC, 2012); (ii) EBRD Performance Requirement 1.

## 5.1 Site/Design/Technology Alternatives

As discussed earlier, the OHTL will be developed to connect the Amunet 500MW Wind Farm Project with the National Grid in order to supply grid users in Egypt with Electricity. The OHTL is considered a key component for the Wind Farm Project and without it, the Amunet Wind Farm Project cannot be realised.

Therefore, the site and design for the OHTL takes into account the location of the Amunet Wind Farm (and in specific the substation) and its closest connection point to the National Grid. This distance has been optimized and reduced to the extent possible, which entails a lower Project footprint and therefore, in general, lower impacts.

In terms of technology, the EETC will implement the conventional technology utilized for all 220kV OHTLs in Egypt which as discussed earlier under "Chapter 2" includes DCT Towers and conductors. Based on that, there are no site alternatives to be considered for the OHTL.

Note: the current design/route is the only available option allowed by EETC and therefore alternatives, including underground cabling are not possible.

## 5.2 No Project Alternative

The 'no project' alternative assumes that the OHTL will not be developed. However, as discussed earlier the OHTL is considered a key component for the Amunet 500MW Wind Farm Project as it will supply electricity produced from the wind farm to the National Grid, which in turn will supply grid users in Egypt. Without the OHTL, the Wind Farm Project cannot be realized.

Should the Project not move forward, then the Project-related negative environmental impacts discussed throughout this ESIA would be averted. However, as noted throughout the ESIA, generally such impacts do not pose any key issues of concern and can be adequately controlled and mitigated through the implementation of the Environmental and Social Management Plan (ESMP). Nevertheless, should the Project not move forward, then the significant and crucial positive economic and environmental benefits of the Wind Farm would not be realized. Such benefits include the following:

- The development allows for more sustainable development and shows the commitment of the Government of Egypt to realising its energy strategy and meeting the set targets for renewable energy sources;
- The Project will contribute to increasing energy security through reliance on an indigenous, inexhaustible and mostly import-independent energy resource. The estimated electricity generation from the Wind Farm is at a minimum estimated at 2,200 GWh per year; which will serve the annual electricity needs of more than 800,000 local households (ECO Consult & Plus Green, 2021); and
- Generating electricity through wind power is rather pollution-free during operation. The clean energy produced is expected to reduce consumption of conventional petroleum products used at thermal power plants for electricity generation. This will help in reducing greenhouse gas emissions as well as air pollutant emissions – the Project is expected to offset more than 1 million metric tons of $CO_2$ annually (ECO Consult & Plus Green, 2021).

# 6 LANDSCAPE & VISUAL

This Chapter first provides an assessment of baseline conditions within the Project site and surrounds in relation to landscape and visual and then assesses the anticipated impacts 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.

## 6.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of the baseline conditions in relation to landscape and visual receptors and presents the outcomes and results.

### 6.1.1 Baseline Assessment Methodology

The baseline assessment was based on site visit that was undertaken by the 'ESIA Team' to the OHTL route and a 500m buffer on both sides. The objective of the site visit was to characterise the landscape, topography, and visual character and receptors of the Project site and surrounds. In addition, the assessment was also based on secondary data available on landscape and visual character of the area from other available sources – mainly the ESIA for the Amunet 500MW Wind Farm.

### 6.1.2 Results

The OHTL route can be characterized to be located within a desert area that is barren, with a relatively flat topography with no sudden changes throughout the entire route. The elevation ranges from around 41m to 49m above sea level. The figure below presents the general topography and landscape character of the OHTL route.

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

Based on the site visit undertaken for the Project area and the 500m buffer on both sides, no critical visual receptors were identified. In fact, the route and the buffer area are devoid of any receptors as discussed further in "Chapter 7" with the exception of some infrastructure elements such as another existing OHTL and some road networks.

There are several visual receptors within the wider area which include different petroleum activities. Within extended areas (i.e. more than 15km radius) several other receptors are present to include Ras Gharib city (9km to the southeast), air force defence unit, other wind farm development project, dams, and other.

**Figure 7: General Topography and Landscape of the OHTL Route**

## 6.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the Project activities on landscape and visual 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.

### 6.2.1 Potential Impacts during the Construction Phase

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.

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

However, as discussed, there are no key sensitive visual receptors within the Project site and surrounding vicinity.

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

Mitigation Measures

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

- Ensure proper general housekeeping and personnel management measures are implemented which could include:
  - Ensure the construction site is left in an orderly state at the end of each work day.
  - To the greatest extent possible construction machinery, equipment, and vehicles that are not in use should be removed in a timely manner and kept in locations to reduce visual impacts to the area.
  - Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in 'Section 8.2.2'

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

Monitoring and Reporting Requirements

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

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

### 6.2.2 Potential Impacts during the Operation 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, and therefore the addition of this Project will not be a significant impact to the visual and landscape characteristic of the area.

Given all of the above, the potential impacts on landscape and visual are of a long -term duration throughout the Project operation phase. The impacts will be of a negative nature, and low magnitude given that such elements of the Project will be visible. However, there are no key visual receptors in the project route and its surroundings therefore the receiving environment is considered of low sensitivity. Given all of the above, such an impact is considered not significant.

Mitigation Measures

There are no mitigation or monitoring measures to be considered.

# 7 LAND USE

This Chapter first provides an assessment of baseline conditions within the Project site and surrounds in relation to land use and then assesses the anticipated impacts 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.

## 7.1 Assessment of Baseline Conditions

The section below presents the methodology that was undertaken for assessment of baseline conditions in relation to infrastructure and utilities and the outcomes and results.

### 7.1.1 Methodology for Assessment

A field survey was undertaken with the objective of investigating and documenting any land use activities onsite to include physical structures (houses, units, etc.) and/or economical activities (grazing, agriculture, etc.). The survey was undertaken to cover the entire OHTL route as well as 500m buffer on both sites.

In addition, information was obtained to understand formal land uses within the Project area as discussed in further details below.

### 7.1.2 Results

Based on the site survey, no physical structures were noted within the OHTL route and 500m buffer area on both sides nor any indication of such activities. In addition, no economical activities were noted (such as grazing, agricultural, petroleum activities or similar) nor any evidence of any such activities. The entire route is vacant and runs within unoccupied desert and barren lands.

The entire OHTL route is located under state owned lands which include: (i) areas that are part of the 284km$^2$ plot allocated to NREA for wind farm developments by the Government of Egypt through a Prime Ministerial Decree; and (ii) areas allocated by the Government of Egypt for petroleum activities to the General Petroleum Company. A “Work Coordination Agreement” has been signed between NREA and the General Petroleum Company for the area. Therefore, the OHTL route is under state ownership lands that have been allocated to NREA and the General Petroleum Company as discussed above.

The general procedure that EETC will follow for the development of the OHTL is as follows:

- EETC will first obtain an approval for the route from the Egyptian Armed Forces Operations.
- After the approval is obtained, EETC will enter into an agreement with NREA and the General petroleum Company for passage of the OHTL within their allocated areas. However, given that all entities involved are governmental entities (EETC, NREA and General Petroleum Company), there will be no compensation to be paid by EETC for the OHTL route and its RoW.
- Therefore, there is no land acquisition or land compensation measures to be undertaken or implemented.

## 7.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the Project activities on land use during the various phases to include planning and construction 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.

### 7.2.1 Potential Impacts during the Planning, Construction and Operation Phase

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 (to include the OHTL route and 500m 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 and the General Petroleum Company. 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 mitigation or monitoring measures to be considered.

# 8 GEOLOGY, HYDROLOGY AND HYDROGEOLOGY

This Chapter first provides an assessment of baseline conditions within the Project site and surrounds in relation to geology, hydrology, and hydrogeology and then assesses the anticipated impacts from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

## 8.1 Assessment of Baseline Conditions

The section below presents the methodology that was undertaken for assessment of baseline conditions in relation to geology, hydrology and hydrogeology and the outcomes and results.

### 8.1.1 Methodology for Assessment

The assessment was based on review of secondary data to include mainly that available from the ESIA study undertaken for the Amunet 500MW Wind Farm Project – which included detailed information on geology, hydrology and hydrogeology within the Project site and surrounding areas (which cover the OHTL route).

### 8.1.2 Geology

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

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

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

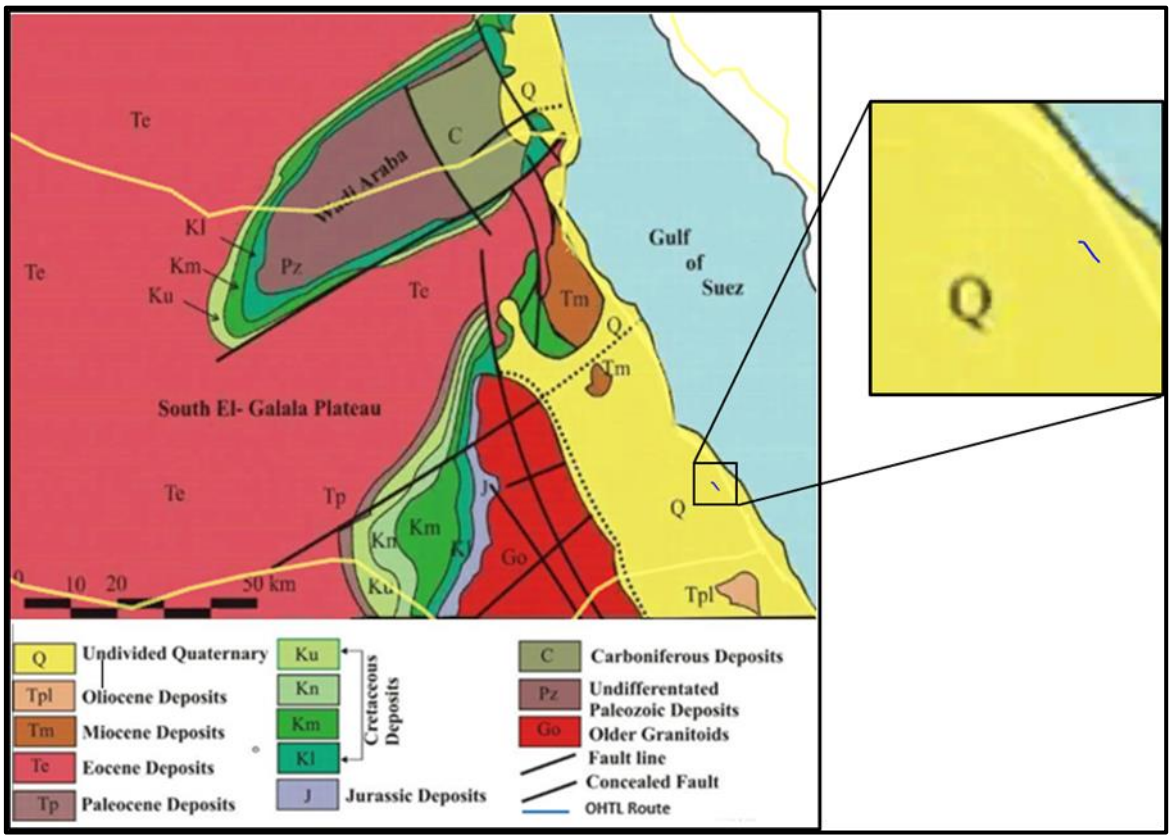


**Figure 8: Geological Formations of the Project Area**

### 8.1.3 Hydrology

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

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

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

- Medium relief unit; this unit extends from the scarp of the plateau toward the Gulf in the east and southeast direction with a distance of about 10 km and a surface ranging from 350 to 800 m A.S.L. The unit is gently curving, or straight (rectilinear) part of a hillslope, possibly interrupted or replaced by cliffs, composed of cretaceous rocks. This unit is characterized by the presence of many small, shallow and wide tributaries that drain the plateau scarp towards Wadi Aldahal and wadi Hawashiya to the north and south of the Project location, respectively. This unit is located away from the site borders in the north,

North-West and west directions. This unit is characterized by the presence of simple heights (low elevated hills) which are spaced from each other through dry and shallow wadies. The average slope gradient of this unit is about 2% toward the Gulf of Suez.

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

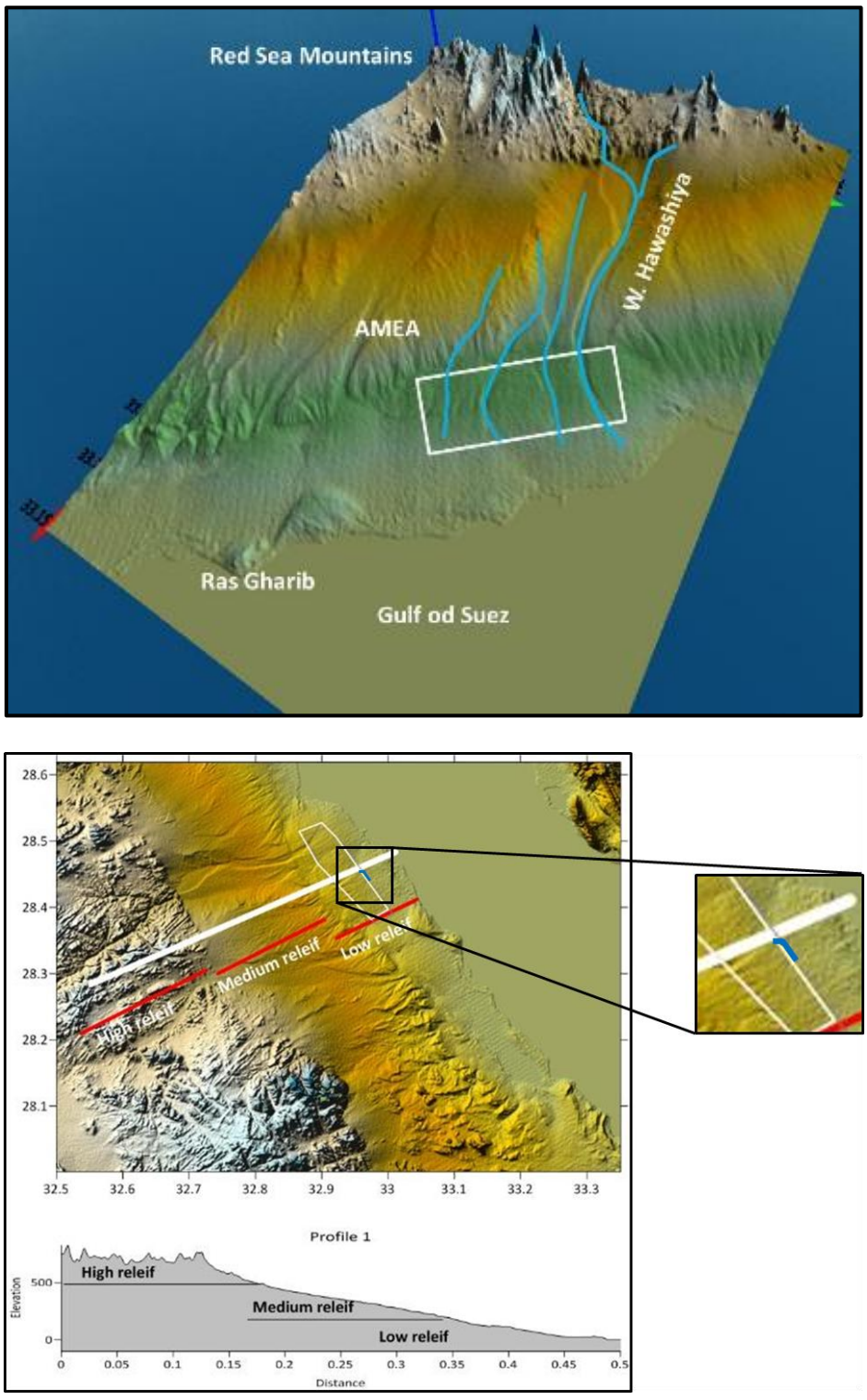


**Figure 9: Hydrology of the Area**

### 8.1.4 Hydrogeology

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

There is no utilization of groundwater in the Project site, even with the petroleum and oil companies operating in the region.

In the wide area surrounding the site, the recent well inventory and available literature show that groundwater wells are concentrated within Wadi Araba, located about 50 km north of Project site. Wadi Araba was considered as a wadi with high groundwater possibility (Aggour, 1990). Rocks belonging to Carboniferous and Lower Cretaceous sandstone represent the main source of water in the Wadi Araba Depression. The water is tapped from springs, shallow wells and occasionally deep wells. The collected information from shallow groundwater wells and springs in Wadi Araba reveals that the water salinity varies between 1025 to parts per million (ppm) and 50,233 ppm.

In the GoS, groundwater is used mainly for touristic and industrial purposes. According to the rates of groundwater withdrawal with respect to water requirements, the Gulf province includes areas into which the groundwater represents 10-40% of the utilized water supplies. The daily discharge ranges from 260 to 3000 $m^3$/day at Wadi Araba and El Sukhna-Zafrana localities respectively *(Sewidan and Misak, 1992).* The continuous use of such water potentially stresses its quantity and quality.

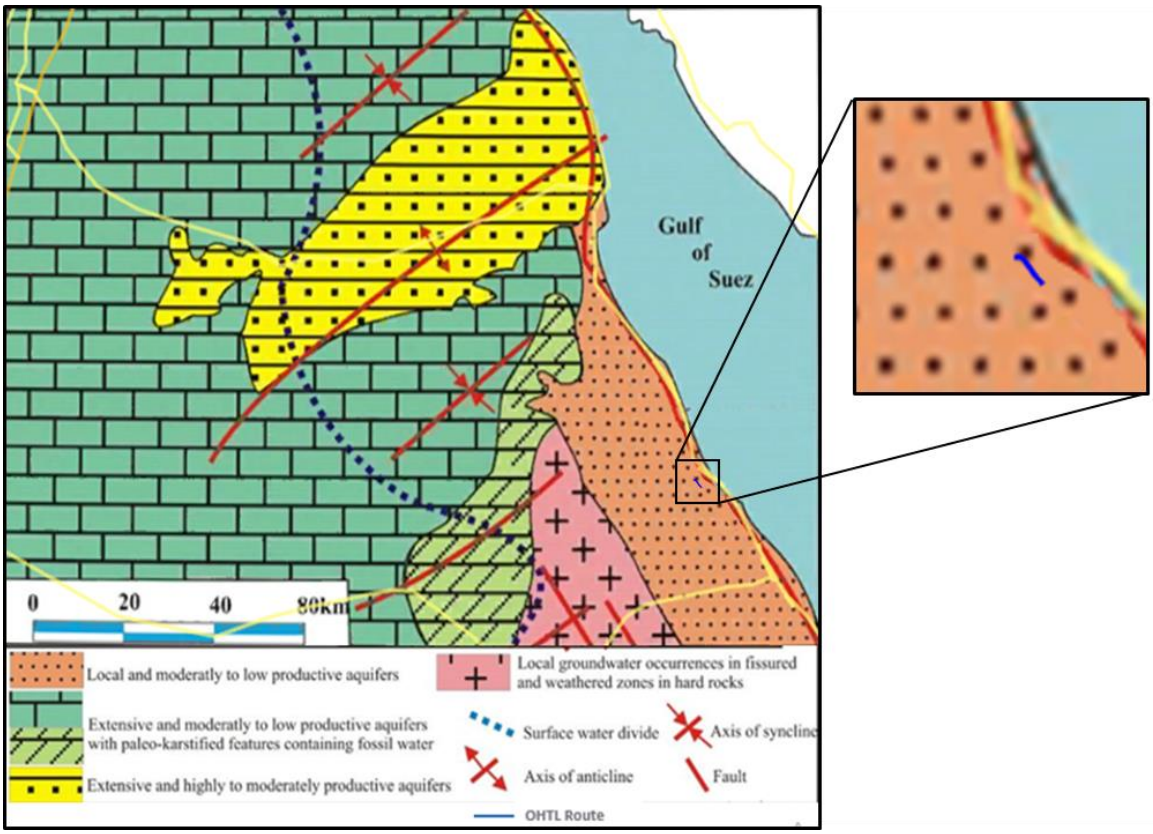


**Figure 10: Hydrogeological Formations within the Project Area**

## 8.2 Assessment of Potential Impacts

This section identifies the anticipated impacts on hydrology and hydrogeology from the Project throughout its various phases. For each impact, a set of management measures (which could include mitigation

measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

### 8.2.1 Potential Impacts from Flood Risks on the Project Site

As discussed earlier, within the area several key and major wadi Systems run as well as several other drainage lines and smaller wadi systems. Such wadi systems could entail potential risks of local flood hazards especially during the rainy season and during flash flood events which in turn could affect the Project components. Such risks must be taken into consideration throughout the planning phase of the Project as they could inflict damage to the Project and its various components.

- The bed rocks of the area are mainly clastic deposits rich in clays, sand, gravels and reworked rock fragments with high porosity and permeability. These deposits extend to great depth. This means, the surface layers of the area have a great tendency to absorb large volume of surface water runoff in times of rain.
- The regional slope of the high mountains is due to East. This means that, many dry wadis are directed to the East, Northeast and Southeast toward the Gulf of Suez and cross the area as noted in the figure above.
- The concession site is in a very simple relief area with a very gentle slope in east and southeast direction.
- There is no sign of deep dray wadis crossing the concession site or even large alluvial fan deposits reflecting strong surface flow.
- The concession site has been crossed by the outlet of a Key Wadi (Wadi Hawashiya) at its northern part that could expect serious flooding. The other drainage lines that drain the Project site are very short, wide and shallow that reflect a complete absence of floods
- Flood protection facilities have been constructed along the course of Wadi Hawashiya to mitigate the flash flood hazards in times of heavy rain fall. This includes in particular 3 key dams as noted in the figure below.
- A flood modelling has been undertaken for the wadi systems that cross the area in general. The model concludes that the risk factor of the project site is medium and limited to the outlet area of Wadi Hawashiya (as presented int figure below in green). This means that mitigation measures for flash floods should be applied in the Wadi Hawashiya only (which does not pass within the OHTL route). However, this has already been implemented on the ground with the construction of three dams along the course of Wadi Hawashiya. These dams are enough to protect the area from any flash floods which may be exposed in the future. Note: the area in green in the figure below is the flood risk area considered before construction of the dams.

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

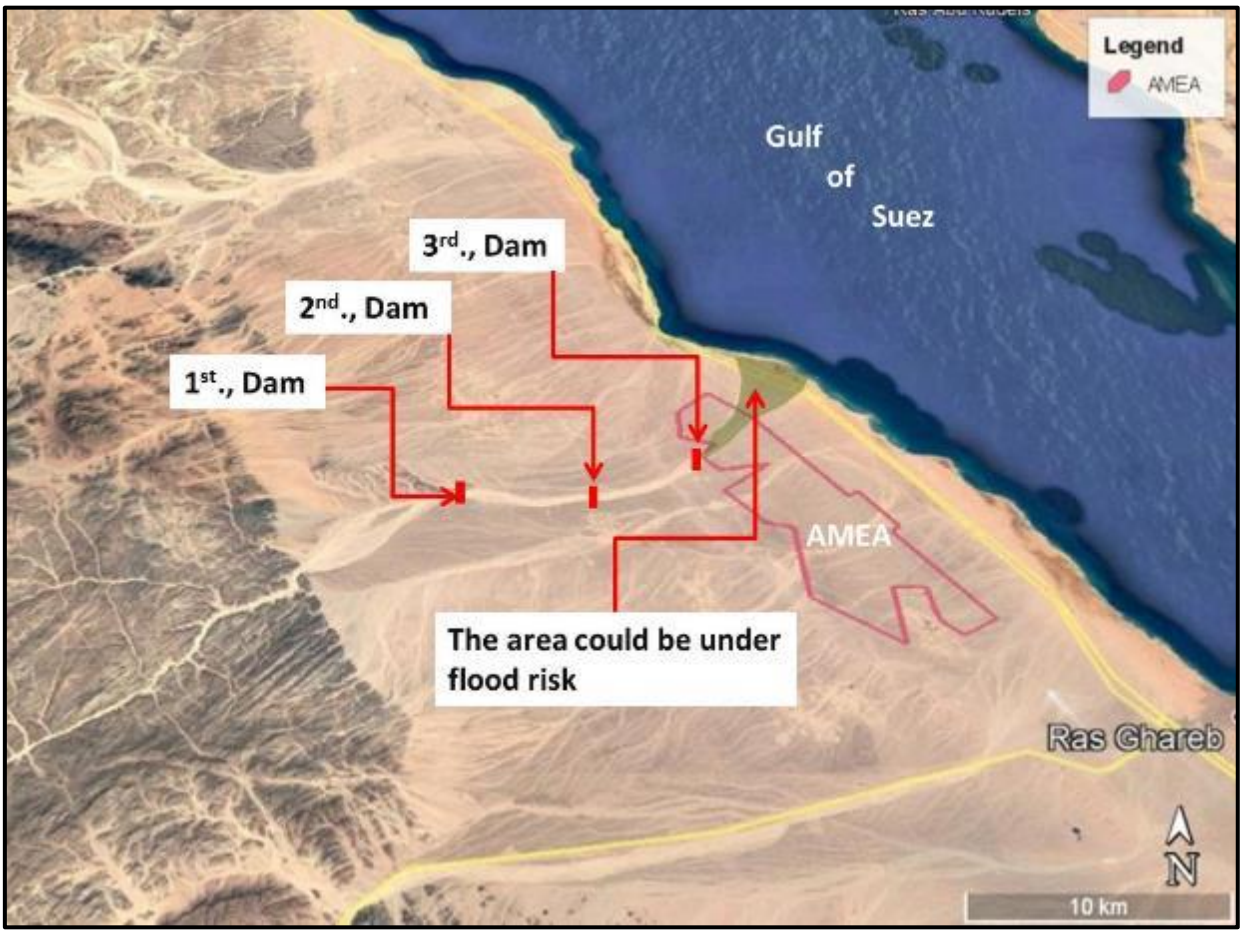


**Figure 11: Flood Risk Areas and Location of Dams**

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

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

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

The potential impacts from improper management of waste steams could be of a long-term duration throughout the construction and operation phase. Such impacts are negative in nature, and could be noticeable and are therefore of medium magnitude. However, they are considered of low sensitivity as they are generally controlled through the implementation of general best practice housekeeping measures. Given all of the above, such an impact is considered to be of minor significance.

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

### *(i) Solid Waste Generation*

Solid waste is expected to be generated from construction 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.

Solid waste is expected to be generated mainly throughout the construction phase. Due to the limited and simple O&M activities, no solid waste is expected during the operation phase.

Mitigation Measures

The following identifies the mitigation measures to be applied by the OHTL Contractor during the construction phase:

- Coordinate with Ras Gharib City Council for the collection of solid waste from the site to the municipal approved dumpsite;
- Prohibit fly-dumping of any solid waste to the land;
- Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste";
- Distribute a sufficient number of properly contained containers clearly marked as "Construction Waste" for the dumping and disposal of construction waste.
- Implement proper housekeeping practices on the construction site at all times; and
- Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill. The numbers within the records are to be consistent to ensure no illegal dumping at the site or other areas.

Monitoring and Reporting Requirements

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

- 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. 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).

Wastewater is expected to be generated mainly throughout the construction phase. Due to the limited and simple O&M activities, no wastewater is expected during the operation phase.

Mitigation Measures

The following identifies the mitigation measures to be applied by all the OHTL Contractor during the construction phase:

- Coordinate with Ras Gharib Water Company to hire a private contractor for the collection of wastewater from the site to the closest WWTP (being Ras Gharib WWTP);

- Prohibit illegal disposal of wastewater to the land;
- Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the WWTP. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas;
- Ensure that septic tanks are used during construction that are well contained and impermeable to prevent leakage of wastewater into soil; and
- Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing.

Monitoring and Reporting Requirements

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

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

### *(iii) Hazardous Waste Generation*

Hazardous waste is expected to be generated throughout the construction phase 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.

Hazardous waste is expected to be generated mainly throughout the construction phase. Due to the limited and simple O&M activities, no hazardous waste is expected during the operation phase.

Mitigation Measures

The following identifies the mitigation measures to be applied by the OHTL Contractor during the construction phase:

- 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 the OHTL Contractor during the construction phase:

- 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 activities entails 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.

Hazardous materials are expected to be used mainly throughout the construction phase. Due to the limited and simple O&M activities, no hazardous materials are expected during the operation phase.

Mitigation Measures

The following identifies the mitigation measures to be applied by the OHTL Contractor during the construction phase:

- Ensure that hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of hard impermeable surface, flame-proof, accessible to authorized personnel only, locked when not in use, and prevents incompatible materials from coming in contact with one another;
- Maintain a register of all hazardous materials used and accompanying Material Safety Data Sheet (MSDS) must present at all times. Spilled material should be tracked and accounted for;
- Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.);
- Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refuelling) must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material;
- Ensure that a minimum of 1,000 litters of general-purpose spill absorbent is available at hazardous material storage facility. Appropriate absorbents include zeolite, clay, peat and other products manufactured for this purpose; and
- If spillage on soil occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.

Monitoring and Reporting Requirements

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

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

### 8.2.3 Potential Impacts from Erosion and Runoff during the Construction Phase

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

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

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

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

Mitigation Measures

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

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

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the OHTL Contractor during the construction phase:

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

# 9 BIODIVERSITY

This section provides an assessment of baseline conditions within the Project site and its surroundings in relation to biodiversity. It is important to note that biodiversity assessed in this section excludes birds (avi-fauna) and bats, which are discussed separately in "Chapter 10" and "Chapter 11" respectively.

## 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 in detail below.

*(i) Literature Review*

This was based on previous studies, data, surveys, and records available in published scientific papers, books, and journals on flora and fauna species recorded within the study region in general. It is important to note that since the available literature on the Project site and its vicinity is relatively limited, the literature reviewed included a wide spectrum of references including international references that have a wider focus than the region of the Project.

*(ii) Field Survey*

A field survey was undertaken for the OHTL Route during August 2020. The route was examined for the presence of flora and vegetation as well as active animals, animal signs and tracts, active burrows, remains or any other vital signs that indicate the activity of animals.

*(iii) Fauna and Flora Species status*

All species recorded as part of the literature review or on-site during the field survey had their conservation status identified according to International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2019), which provides the global conservation status of evaluated species. Since Egypt does not have national Red Lists for most taxon, the regional assessments of the Mediterranean region and North African region were reviewed for any species that could be of conservation value on the regional level.

## 9.2 Results

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

*(i) Flora*

According to Olson et al (2001), the Project area is located in the Desert and Xeric Shrublands Biome and more specifically in the Ecoregion of Red Sea Coastal Desert, see Figure 12. Applying the classification elaborated by Harhash et al. (2015) to the habitats found in the Project area can be attributed to the main habitat system "Desert". The vast majority of the project area can be classified as "Hamada Desert" (Sub-System: "Plain Land") that is crossed by "Valleys and Canyons" (i.e. wadis) which belong to the Sub-System "Low Land".

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

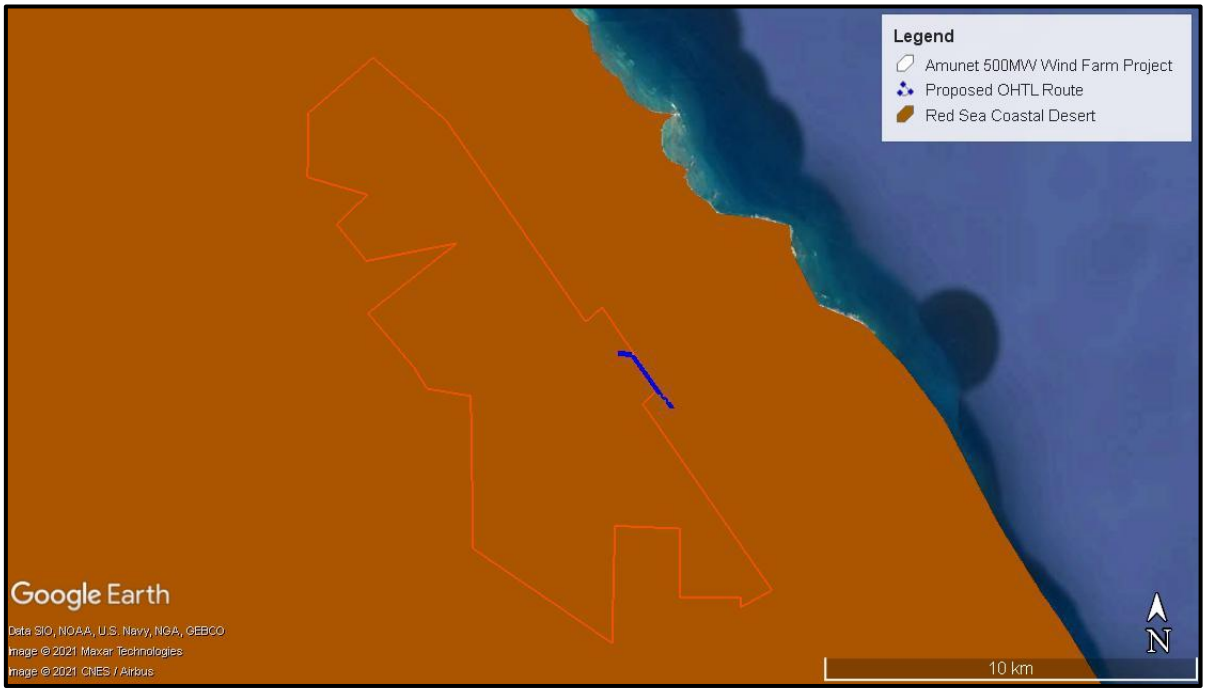


**Figure 12: Location of Project in reference to Ecoregions of the world (TEOW) (Olson et al, 2001)**

According to literature review of the flora recorded along the coastal desert of the Red Sea, a total of 68 species were recorded in the Project site and its vicinity (Abd El-Ghani et al, 2014), see Table 6. Out of the 68 species, only five were found to be evaluated on the global level of IUCN's Red List of Threatened Species (IUCN, 2019), all of which are evaluated as Least Concern.

During the field survey, only one (1) common floral species (*Arthrocnemum macrostachyum*) was recorded dispersedly as seen in Figure 13 below.

**Figure 13: Arthrocnemum macrostachyum Recorded during the Field Survey**

**Table 6: List of Plant Species Recorded Based on Literature Review**

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

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

*(ii) Fauna*

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

a. Mammals

The study site in particular was not studied in detail in previous faunal studies. According to SESA (RCREEE, 2018), mammals' distribution is associated with the distribution and abundance of vegetation cover and therefore most species are found in vegetated wadis, rocky hillsides or mountain slopes.

However, literature review has shown that 23 species occur in the project site and its vicinity (Hoath, 2004), see Table 7. It should be mentioned that some of the species are listed since their distribution range maps have shown that they are present in the general area of the project site although no specific studies have confirmed that. Additionally, some of the species listed are known to be present in the highlands to the east of the project site and therefore are considered to be present in the vicinity of the project site, even if small numbers.

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

**Table 7: Mammal species (excluding bats) Recorded in Project Site and its Vicinity**

| Family | Scientific name | Common name | IUCN Red List of Threatened Species (2020) |
|---|---|---|---|
| Erinaceidae | *Hemiechinus auritus* | Long-eared Hedgehog | Least Concern |
| Leporidae | *Lepus capensis* | Cape Hare | Least Concern |
| Muridae | *Jaculus jaculus* | Lesser Egyptian Jerboa | Least Concern |
| | *Gerbillus gerbillus* | Lesser Egyptian Gerbil | Least Concern |
| | *Gerbillus henleyi* | Pygmy Gerbil | Least Concern |
| | *Gerbillus dasyurus* | Wagner's Gerbil | Least Concern |
| | *Gerbillus pyramidum* | Greater Egyptian Gerbil | Least Concern |
| | *Gerbillus floweri* | Flower's Gerbil | Least Concern |

| Family | Scientific name | Common name | IUCN Red List of Threatened Species (2020) |
|---|---|---|---|
| Muridae (cont.) | *Sekeetamys calurus* | Bushy-tailed Jird | Least Concern |
| | *Acomys russatus* | Golden Spiny Mouse | Least Concern |
| | *Acomys cahirinus* | Cairo Spiny Mouse | Least Concern |
| | *Meriones crassus* | Sundevall's Jird | Least Concern |
| Herpestidae | *Herpestes ichneumon* | Egyptian Mongoose | Least Concern |
| Canidae | *Felis silvestris* | Wild Cat | Least Concern |
| | *Vulpes rueppellii* | Ruppell's Fox | Least Concern |
| | *Vulpes zerda* | Fennec Fox | Least Concern |
| | *Canis lupaster / Canis aureus* | African Wolf / Golden Jackal | Least Concern |
| | *Hyaena hyaena* | Striped Hyena | Near Threatened |
| Procaviidae | *Procavia capensis* | Rock Hyrax | Least Concern |
| Bovidae | *Capra nubiana* | Nubian Ibex | Vulnerable |
| | *Gazella dorcas* | Dorcas Gazelle | Vulnerable |

b. Reptiles and Amphibians

Virtually no previous specific studies on the reptiles and amphibians were conducted within the boundaries of the project site. According to SESA (RCREEE, 2018), reptiles are the most diverse vertebrate group in the desert habitats like the project area, and consist entirely of typical desert species. This herpetofauna is composed of lizards and snakes that are adapted to rocky and sandy desert habitats. Additionally, according to Baha El Din (2006), there are 34 species that are documented, or at least expected, to be present in the project area and its vicinity, Table 8. On the other hand, the 34 species listed belong to eight families. Out of all those species, twelve are assessed on the global level of the IUCN Red List of Threatened Species. Eleven of these species are evaluated as Least Concern while one species is evaluated as threatened (Vulnerable); *Uromastyx aegyptia*. Neither reptiles nor amphibians were recorded onsite during the field survey undertaken.

**Table 8: Reptilian Species Known to Occur within Study Area**

| Family | Scientific name | Common name | IUCN Red List of Threatened Species (2019) |
|---|---|---|---|
| Gekkonidae | *Cyrtopodion scabrum* | Keeled Rock Gecko<br>Rough Bent-toed Gecko | Least Concern |
| | *Hemidactylus flaviviridis* | Yellow-bellied Gecko | Not Evaluated |
| | *Hemidactylus turcicus* | Turkish Gecko | Least Concern |
| | *Ptyodactylus guttatus* | Spotted Fan-toed Gecko | Not Evaluated |
| | *Ptyodactylus hasselquistii* | Egyptian Fan-toed Gecko | Not Evaluated |
| | *Ptyodactylus siphonorhina* | Saharan Fan-toed Gecko | Not Evaluated |
| | *Stenodactylus petrii* | Sand Gecko | Not Evaluated |
| | *Stenodactylus stenodactylus* | Elegant Gecko | Not Evaluated |
| | *Tropiocolotes steudneri* | Steudner's Pigmy Gecko | Not Evaluated |
| Agamidae | *Agama spinosa* | Spiny Agama | Least Concern |
| | *Pseudotrapelus sinaitus* | Sinai Agama | Not Evaluated |
| | *Trapelus mutabilis* | Changeable Agama | Not Evaluated |
| | *Trapelus pallidus* | Pallid Agama | Not Evaluated |
| | *Uromastyx aegyptia* | Egyptian Dabb Lizard | Vulnerable |
| Lacertidae | *Acanthodactylus boskianus* | Bosc's Lizard | Not Evaluated |
| Lacertidae (cont.) | *Acanthodactylus scutellatus* | Nidua Lizard | Not Evaluated |
| | *Mesalina guttulata* | Small-spotted Lizard | Not Evaluated |
| | *Mesalina olivieri* | Olivier's Lizard | Least Concern |
| | *Mesalina rubropunctata* | Red-spotted Lizard | Not Evaluated |
| Varanidae | *Varanus griseus* | Desert Monitor | Not Evaluated |
| Scnincidae | *Chalcides ocellatus* | Ocellated Skink | Least Concern |
| | *Scincus scincus* | Sandfish | Not Evaluated |
| | *Sphenops sepsoides* | Audouin's Sand-skink | Least Concern |
| Colubridae | *Lytorhynchus diadema* | Diademed Sand Snake | Least Concern |
| | *Malpolon moilensis* | Moila Snake | Not Evaluated |
| | *Platyceps rogersi* | Spotted Racer | Least Concern |
| | *Platyceps saharicus* | Saharan Cliff Racer | Not Evaluated |

| | | | |
|---|---|---|---|
| | *Psammophis aegyptius* | Saharan Sand Snake | Not Evaluated |
| | *Psammophis schokari* | Schokari Sand Snake | Not Evaluated |
| | *Spalerosophis diadema* | Diadem Snake | Not Evaluated |
| Elapidae | *Walterinnesia aegyptia* | Black Desert Cobra | Least Concern |
| Viperidae | *Cerastes cerastes* | Horned Viper | Least Concern |
| | *Cerastes vipera* | Sand Viper | Least Concern |
| | *Echis coloratus* | Burton's Carpet Viper | Not Evaluated |

*(iii) Summary*

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

## 9.3 Assessment of Potential Impacts

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

### 9.3.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the OHTL Contractor are expected to include land clearing activities, levelling, excavation, grading, etc. Such activities are limited to the relatively small individual footprints of the powerline towers and accompanying facilities and therefore the actual area of disturbance is relatively minimal. Nevertheless, such activities would likely result in the alteration of the site's habitat and thus potentially disturb existing habitats. Other impacts on the biodiversity of the site are mainly from improper management of the site which could include improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc.).

As discussed in the baseline section, generally the site is considered of low ecological significance due to its natural setting; characterized by having scattered vegetation cover in an arid environment. However, special consideration should be given to the globally threatened to the Egyptian Dabb Lizard *Uromastyx aegyptia* since the project site provides a typical habitat for such species.

Given all of the above, the potential impacts on biodiversity created during the construction phase would of a long-term duration as they would result in a permanent change in the natural biodiversity of the site. Such impacts are considered of negative nature and of a low magnitude given that the change in the natural biodiversity of the site will be noticeable in limited individual footprints. However, as the site is considered of medium ecological significance, the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

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

- Before the start of construction phase activities a survey to identify Egyptian Spiny-tailed 'Dabb' Lizard *Uromastyx aegyptia* burrows will be conducted in areas where construction will disturb the ground surface. If the species is present in these areas a qualified ecologist will design and implement a pre-construction capture and relocation programme based on demonstrated good practice for the relocation of this type of species.
- Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping which include the following:
  - Prohibit hunting at any time and under any condition by construction workers onsite;
  - Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in "Section 8.2.2";
  - Restrict activities to allocated construction areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances; and
  - Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures as detailed in "Section 13.2".

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 additional studies and mitigation measures to be applied by the OHTL Contractor during the construction phase and which include:

- Submission of a relocation report which includes coordinates, relocation measures, phot documentation
- Visual inspections to ensure mitigation measures are implemented

## 10 BIRDS (AVI-FAUNA)

This section first provides an assessment of baseline conditions within the Project site and its surroundings in relation to birds (avi-fauna) and then assesses the anticipated impacts from the Project throughout its various phases. For each impact, a set of management measures (including mitigation and monitoring measures, additional requirements, etc.) have been identified to eliminate or reduce the impact to acceptable levels.

### 10.1 Assessment of Baseline Conditions

It is important to note that the assessment provided below is undertaken from the Amunet Wind Farm ESIA. As part of the assessment undertaken for the wind farm, the OHTL was also covered given that it passes within the Wind Farm boundary. Additional details on the methodology and outcomes of the avifauna assessment of the Amunet Wind Farm ESIA is provided below.

According to the methodology outlined in the Environmental Impact Assessment Guidelines and Monitoring Protocols for Wind Energy Development Projects along the Rift Valley/Red Sea Flyway with a particular reference to wind energy in support of the conservation of Migratory Soaring Birds (MSB) (2013) and the methodology applied in the Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program for Wind Power Projects in the Gulf of Suez (2019), the assessments used specific pre-assigned observation points (OPs) throughout the seasons in order to achieve the objectives of the monitoring.

Observation point (OP) watches are a means of quantifying flight activity of bird species of conservation importance that take place within a wind farm area. Following a desktop analysis for the topography of the area, eight observation points were needed to cover the Amunet Wind Farm, see Figure 14. The locations of these observation points are set on the fact that they will provide the most comprehensive coverage for the Amunet Wind Farm – however OP-05 & OP-06 in specific cover the OHTL route.

A rotation system was applied where four observation points, out of the overall eight observation points, were monitored every day of all migration seasons. Since the observation points, as shown in the figure below, are overlapping, the four observation points that are covered on the same day were selected in a manner to avoid any points that are overlapping so as to minimize the chances of double-counting as much as possible. Therefore, OPs 1, 3, 5 and 8 were covered on one day while OPs 2, 4, 6 and 7 were covered on the other and so forth.

Each observation point covered a view of 360 degrees extending for a maximum of 2.5km as required. This distance should be sufficient for a qualified bird observer to identify the bird into the species level in good visibility conditions. The field assessment team was composed of four qualified observers with previous experience in avifaunal assessments for wind farms. Each observation point was covered by a single observer over observation periods.

Observation periods from each observation point were for a maximum of three hours in order to ensure that the quality of monitoring does not get affected by the observers' exhaustion. A minimum of a one-hour break was provided between each two observation periods. In total, a maximum of four observation points were covered every day, where each observation period covered a minimum of six hours per day; three hours in the morning followed by a maximum of one-hour break and three hours in the afternoon. As required, depending on bird activity, observers would stay at observation points for more than the required time. The start and end of observation periods will vary depending on the following conditions:

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

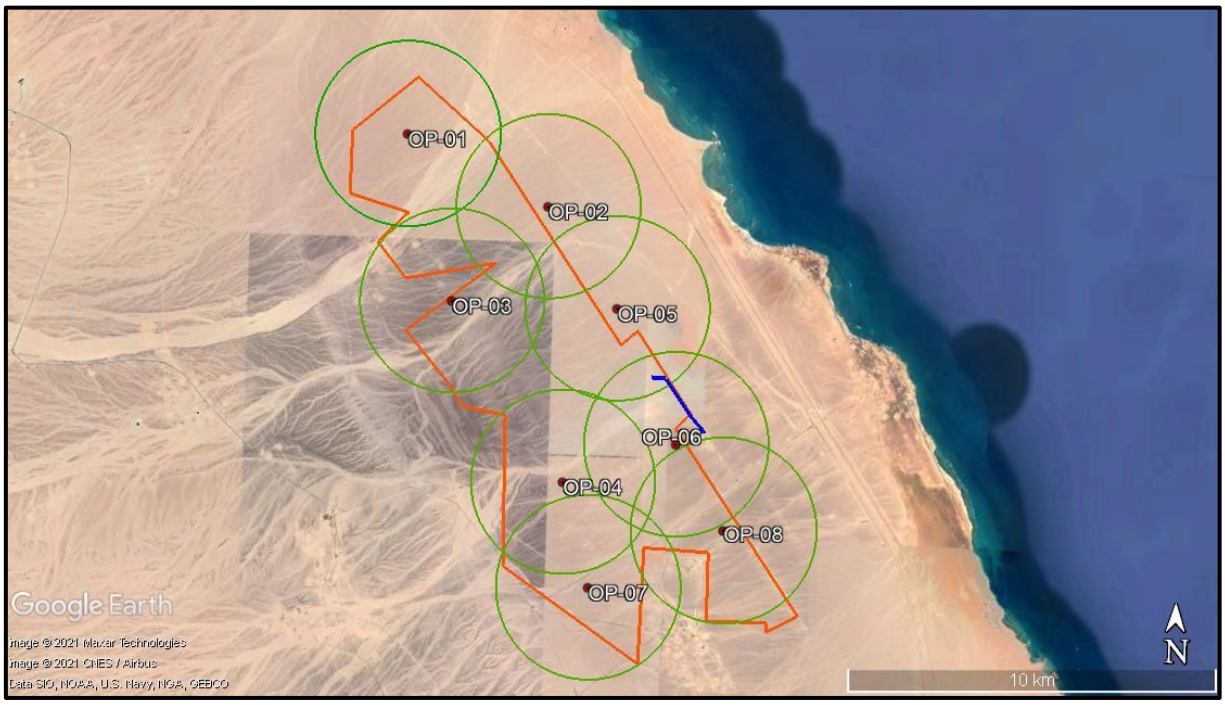


**Figure 14: Location of Observation Points (OP) at the Project area and the Amunet Project Site**

Generally, observation started within one hour of sunrise and finished within one hour of sunset. Observers were equipped with binoculars. On average, each observation point was covered for a total of 2,558 09 min hours in spring, and 2,812 hr and 55 min in autumn, see tables below. Coordinates for the locations of the observation points are listed in the table that follows.

**Table 9: Level of Effort during Avifaunal Assessments**

| Season | OP | Total OP/season |
|---|---|---|
| Spring 2020<br>91 days<br>(20 Feb.–20 May) | OP-1 | 290 h 24 min |
| | OP-2 | 324 h 09 min |
| | OP-3 | 312 h 08 min |
| | OP-4 | 299 h 27 min |
| | OP-5 | 321 h 21 min |
| | OP-6 | 317 h 28 min |
| | OP-7 | 354 h 45 min |
| | OP-8 | 338 h 27 min |
| **Total** | | **2,558 h 9 min** |

| Season | OP | Total OP/season |
|---|---|---|
| Autumn 2020<br>88 days<br>(15 Aug.–11 Nov) | OP-1 | 314 hr 49 min |
| | OP-2 | 330 hr 47 min |
| | OP-3 | 335 hr 47 min |
| | OP-4 | 323 hr 42 min |
| | OP-5 | 371 hr 29 min |
| | OP-6 | 354 hr 31 min |
| | OP-7 | 393 hr 30 min |
| | OP-8 | 388 hr 20 min |
| **Total** | | **2,812 h 55 min** |

**Table 10: Coordinates of Observation Points (OPs)**

| Vantage Point | Coordinates (UTM) | |
|---|---|---|
| | Easting | Northing |
| OP-1 | 488438.6 | 3154410 |
| OP-2 | 492295.2 | 3152563 |
| OP-3 | 489767.7 | 3149952 |

| Vantage Point | Coordinates (UTM) | |
|---|---|---|
| | Easting | Northing |
| OP-4 | 492912.8 | 3145163 |
| OP-5 | 494247.0 | 3149872 |
| OP-6 | 495947.7 | 3146264 |
| OP-7 | 493681.7 | 3142342 |
| OP-8 | 497296.3 | 3143981 |

Weather conditions (wind direction and strength, cloud cover, precipitation and visibility) were recorded at start of watch, then at every subsequent hour and at the end of the watch. Ideally such observations were made in a range of wind conditions. This is particularly important in the case of soaring birds when wind direction and strength is likely to affect migration behaviour and flight routes. During each monitoring period weather conditions were recorded by a single observer nominated by the team leader

Information on bird flight activity was collected during timed watches from strategic observation points (OPs). The recording of observations broadly followed methods described by Band et al. (2007)

- Observers at OPs were positioned to minimize their effects on bird behaviour. A complete circle of 360 degrees will be scanned using a combination of naked and 10x binoculars[1].
- If a target species is detected, it will be followed until it ceases flying or is lost from view. For each observation of a target species, date collected will include the following:
  - The time the target species was detected,
  - The flight duration of the target species to the nearest 15-second interval,
  - Estimate of the bird's flight height above ground level at the point of first detection and thereafter at 15-second intervals, where flight heights to be classified based on turbine specifications and to be at least divided into two classes; at collision risk and above collision risk. Although at the time of the undertaking of the survey the specifications of turbines were not finalized, the scenarios proposed all present a small area below collision risk, while above collision risk is above 120m above ground for all scenarios. Based on this, the two classes will be used for collision risk height from 0-120m above ground while above collision risk height will be from 120m and above.
- Survey data was entered in the field onto specially designed recording formats.

Flight activity monitoring was principally designed to provide information for a turbine blade collision risk assessment, however, the methods used including the collision risk height band of 0-120m, can provide some information about the scale of collision risk for the OHTL. The 0-120m risk height band will be an overestimate of the number of birds potentially impacted by the OHTL as pylons and OHTL wires are expected to be no higher than approximately 50m. Collision risk model routines for OHTL are not well developed compared to those for wind turbines and no attempt has been made to conduct formal OHTL collision rate estimates. Turbine collision rate estimates are unlikely to be comparable with OHTL collision rates due to the different characteristics of turbines and OHTLs. Instead, the likelihood of collision is broadly assessed based on the number of individuals passing through the airspace at low altitude (<120m) in the vicinity of the OHTL.

**Spring survey effort modification during the COVID-19 pandemic**

The spring season survey has coincided with the COVID-19 pandemic, which has affected almost all activities worldwide. The survey team has ensured to cover the level of effort required during the survey, taking into consideration all required health and safety procedures required while also abiding by the national regulations of curfew hours that were enforced nationwide across Egypt. During the spring survey, the nationwide curfew started at 18:00 until 06:00 in the morning of the next day. In order to abide by this, the team would head to the Project site as soon as the curfew is lifted by 6:00. All observers would be expected to be starting their

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

monitoring maximum by 8:00. In order to cover the required hours, the observer who started monitoring the earliest would end his observation while the last observer would stop the observation maximum by 16:00. By this, the team would ensure that the required hours have been covered while also ensuring that the team would be back to the town of Ras Gharib before the curfew is imposed again.

### 10.1.1 Overall results

This section is based on the results and findings of the monitoring that was carried out along the whole project site. The results present a compilation of the species recorded, the number of records and number of individuals over the different years and over both seasons of migration; spring and autumn.

**Location of Project site**

The OHTL route is located within the Wind Farm Boundary along with another 500m just outside of the border. However, the OHTL route does not overlap with any protected areas; established or proposed, especially with Gebel El Zeit Important Bird Area (IBA), see Figure 15.

**Figure 15: The location of the OHTL in relation to Gebel El Zeit IBA**

**Baseline Assessment for in-flight movement of soaring birds during the spring season of 2020**

**Species records and individuals**

During the spring season of 2020, 21 species were recorded with a total of 196,026 individual birds recorded in a total of 3,898 records, see table below (however please note that table does not include misidentified species). Overall, 59,311 individuals were recorded flying at 0-120m. This makes up 30.26% of all individual birds recorded throughout the reporting period.

Five species (the Great White Pelican, White Stork, Steppe Eagle, Steppe Buzzard, and Honey Buzzard) account for around 93% of bird numbers. According to IUCN Red List of Threatened Species (IUCN, 2019), out of the 21 species recorded, five are globally threatened; Egyptian Vulture *Neophron percnopterus* (Endangered), Steppe Eagle *Aquila nipalensis* (Endangered), Eastern Imperial Eagle *Aquila heliaca* (Vulnerable), Greater Spotted Eagle *Clanga clanga* (Vulnerable) and Sooty Falcon *Falco concolor* (vulnerable), while one species is Near Threatened; Pallid Harrier *Circus macrourus*. The remaining species are evaluated as Least Concern.

The analyses below only uses data on individuals that were identified to the species level. Those classified more generally as eagle species, “harrier species” or “buzzard species”, were not include in the analysis. To avoid

identification errors no attempt was made to assign these partially identified individuals to a specific species. 1,673 individuals (0.9% of the total birds recorded) were not assigned to a specific species.

Overall, we have a series of species that migrate in very large groups but occurring from time to time like the Great White Pelican, and the White Stork. Others migrate more frequently like the Honey Buzzard, Black Kite or Steppe Eagle and S. Buzzard also forming groups. Other species migrate solitary like the Short-toed and Booted eagles. Finally, there are occasional ones like the Osprey or the Sooty Falcon.

**Table 11: A Summary of the Bird Observation Records during the Spring Season 2020**

| Species Name | Status according to IUCN Red List of Threatened Species (2019) | National Status | Amunet Wind Farm ESIA Spring 2020 | | |
|---|---|---|---|---|---|
| | | | # records | # individuals | % of individuals flying at 0-120m |
| Egyptian Vulture *Neophron percnopterus* | Endangered | Passage migrant | 41 | 58 | 12.07 |
| Black Kite *Milvus migrans* | Least Concern | Passage migrant | 753 | 6,711 | 22.44 |
| Osprey *Pandion heliaetus* | Least Concern | Passage migrant | 6 | 6 | 33.33 |
| European Honey-buzzard *Pernis apivorus* | Least Concern | Passage migrant | 255 | 6,728 | 8.77 |
| Booted Eagle *Hieraaetus pennatus* | Least Concern | Passage migrant | 99 | 131 | 19.08 |
| Steppe Eagle *Aquila nipalensis* | Endangered | Passage migrant/ winter visitor | 709 | 4,581 | 11.64 |
| Eastern Imperial Eagle *Aquila heliaca* | Vulnerable | Passage migrant | 13 | 19 | 5.26 |
| Greater Spotted Eagle *Clanga clanga* | Vulnerable | Passage migrant | 19 | 21 | 4.76 |
| Lesser Spotted Eagle *Clanga pomarina* | Least Concern | Passage migrant | 82 | 173 | 7.51 |
| Western Marsh-harrier *Circus aeruginosus* | Least Concern | Passage migrant | 14 | 16 | 11.64 |
| Montagu's Harrier | Least Concern | Passage migrant | 5 | 5 | 80.0 |

| Species Name | Status according to IUCN Red List of Threatened Species (2019) | National Status | Amunet Wind Farm ESIA Spring 2020 | | |
|---|---|---|---|---|---|
| | | | # records | # individuals | % of individuals flying at 0-120m |
| *Circus pygargus* | | | | | |
| Pallid Harrier *Circus macrourus* | Near Threatened | Passage migrant/ winter visitor | 21 | 26 | 50.0 |
| Short-toed Snake-eagle *Circaetus gallicus* | Least Concern | Passage migrant/ summer breeder | 264 | 523 | 16.48 |
| Eurasian Sparrowhawk *Accipiter nisus* | Least Concern | Passage migrant | 20 | 36 | 16.67 |
| Levant Sparrowhawk *Accipiter brevipes* | Least Concern | Passage migrant | 2 | 198 | 0.00 |
| Long-legged Buzzard *Buteo rufinus* | Least Concern | Passage migrant/ winter visitor | 71 | 149 | 10.74 |
| Steppe Buzzard *Buteo buteo vulpinus* | Least Concern | Passage migrant | 1087 | 24,482 | 12.54 |
| Sooty Falcon *Falco concolor* | Vulnerable | Passage migrant/ summer breeder | 1 | 1 | 100 |
| White Pelican *Pelecanus onocorotalus* | Least Concern | Passage migrant | 27 | 19,616 | 73.67 |
| Black Stork *Ciconia nigra* | Least Concern | Passage migrant | 69 | 3,202 | 22.44 |
| White Stork *Ciconia ciconia* | Least Concern | Passage migrant | 177 | 127,607 | 29.16 |

**Spatial distribution of birds flying at risk height over observation points**

With the raw data we cannot compare the number of birds passing per OP. The longer the time spent monitoring, the higher chance of recording more birds and species. This is more noticeable for the most elusive birds or those migrating in lower numbers. Thus, we had to transform the raw numbers from Table 11 (all species pooled) into passing rates, as birds seen per observation time for comparisons. We obtained a rate (birds /hr) that allowed us to see that the central part of Wind Farm had the higher passage of birds in the spring 2020; mainly OPs 2, 4 and 7 – check Figure 16 below. This is a figure for 2020, meaning that this is not a fixed movement every year. Later studies should demonstrate or if, after building the wind farm, the birds shift or react to its presence. All the remaining OPs showed similar overall passing rates.

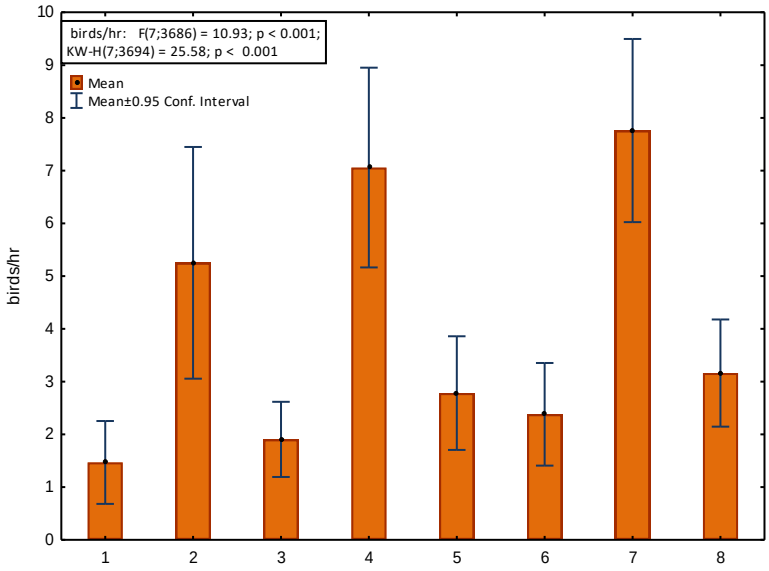


**Figure 16: Bird Passage Expressed as birds/hr. at Observation Points**

**Table 12: Distribution of Records Across the Observation Points**

| OP | risk | number of records | number of birds | % birds at risk |
|---|---|---|---|---|
| 1 | no risk | 203 | 3,754 | |
| | risk | 74 | 1,046 | 21.79% |
| 2 | no risk | 210 | 7,080 | |
| | risk | 108 | 4,680 | 39.80% |
| 3 | no risk | 389 | 17,468 | |
| | risk | 129 | 2,352 | 11.87% |
| 4 | no risk | 468 | 31,165 | |
| | risk | 93 | 5,387 | 14.74% |
| 5 | no risk | 274 | 5,675 | |
| | risk | 104 | 3,797 | 40.09% |
| 6 | no risk | 288 | 13,626 | |
| | risk | 155 | 9,887 | 42.05% |
| 7 | no risk | 618 | 45,814 | |
| | risk | 176 | 9,946 | 17.84% |
| 8 | no risk | 482 | 12,133 | |
| | risk | 127 | 22,216 | 64.68% |
| **Totals** | | **3,898** | **196,026** | |

Figure 17 shows the spatial distribution of the above-mentioned numbers. However, if most of the birds pass through OPs 2, 4, and 7 it does not mean that more birds were at risk. For this, we must calculate the same passing rate but only considering risk flights.

Looking at the spatial distribution of the number of birds on passage over the Project area and the Amunet Project site as a whole and building on the collective numbers of birds on passage as recorded from the OP, it can be clearly seen that the eastern part of the Wind Farm site has higher number of passage while the numbers continue to decrease heading northeast while the north-eastern part had the lowest numbers of birds passage. At the same time, it can be noticed that the eastern part had a higher percentage of birds flying at risk height with the south-eastern part having the highest percentage of almost half the birds flying at collision risk height.

The OHTL is in an area where the passing rates during spring 2020 were assessed as relatively low compared to the central part of the project site (Figure 17). However, the numbers recorded at OP6 where the OHTL is located have a relatively high % of birds passing at <120m, a proportion of which will be exposed to collision risk with OHTL wires (see Figure 18)

**Figure 17: Areas of Bird Passage Based on the Overall Number of Birds recorded across The Amunet Project Site during the spring season of 2020**

For the overall risk, however, risk passing rates remain almost equal throughout the Project area.

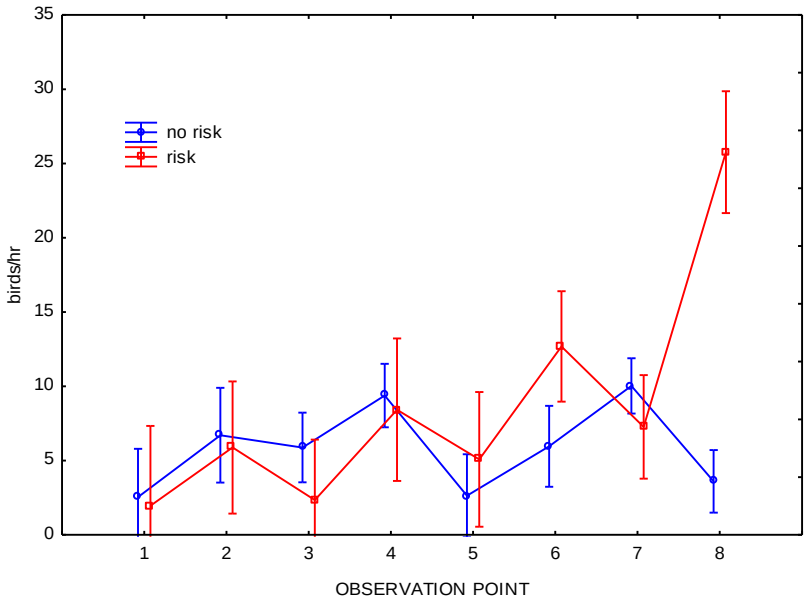


**Figure 18: Mean passing rates (birds/hr.) plus standard errors per Observation point for risk and non-risk flights**

**Distribution of species flying at risk height**

Table 13 below shows the numbers of individuals at risk and non-risk height per OP plus the percentage of birds flying at risk height.

As mentioned earlier, there were five species that comprise the bulk of the birds recorded during the spring season survey. Nevertheless, the species with the highest number of individuals recorded is White Stork *Ciconia ciconia* with a total of 127,607 birds, making up 65.1% of the total birds. The second most abundant species is the Steppe Buzzard *Buteo buteo* with a total of 24,482 birds (12.49%). The third species is the Great White Pelican (19,616 birds representing 10.01%). At lower numbers but representing > 1% of recorded individuals there were the Honey Buzzard (6,728), Black Kite (6,711), Steppe Eagle (4,581), and the Black Stork (3,202 birds).

There were a second group of species exceeding 100 individuals. They migrate solitary or in very small groups: Short-toed, Booted, and Lesser Spotted eagles and Long-legged Buzzard. The Levant Sparrowhawk falls within this group but is a species that does migrate in groups. The reason of the low numbers could be a true lack of the species due to ecological requirements that make it migrate over other regions or a lack of detectability by observers. This is one of the smallest sized species, and therefore could be subject to less detectability by observers. As a general rule, none of the pre-construction bird studies at wind farms consider the distance at which observers detect target species. Because of its size, it could be less recorded compared to other large soaring birds and the reason of lower numbers.

Finally, species of great concern migrate in reduced numbers, less than 100 birds over the 91 days of the migratory season (Egyptian vulture, Pallid Harrier or Greater Spotted Eagle). These are species that fly mostly individually or in groups 1-3 individuals.

In the airspace where the OHTL is located (OP6 -see Table 13) only 6 species exceeded 100 individuals recorded. These were White Stork, Black Stork, Great White Pelican, Black Kite, European Honey Buzzard, Eurasian 'Steppe' Buzzard and Steppe Eagle, and of these, only White Stork, Great White Pelican and 'Steppe' Buzzard were recorded in numbers that exceeded 1000 individuals. For these 3 species the % of birds flying at below <120m differed. White Stork had both the highest number of individuals recorded (16,493) and the highest % at <120 (52%, 8,576 individuals). For 'Steppe' Buzzard 2946 individuals were recorded and of these 24% (701) were flying below 120m. Great White Pelican had similar numbers recorded 2656 but only 6% (156 individuals) of these were flying below <120m. Importantly, flight activity patterns change between years according to weather and other environmental conditions and both the number of birds recorded and the % at <120m reported for this specific area in spring 2020 may be higher or lower in future seasons.

**Table 13: Species Numbers and Percentages of Total Numbers at Collision Risk Height at the Different Vantage Points**

| OBSERVATION POINT | | OP1 | | | OP2 | | | OP3 | | | OP4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SPECIES** | **risk** | **n records** | **n individuals** | **% at risk** | **n records** | **n individuals** | **% at risk** | **n records** | **n individuals** | **% at risk** | **n records** | **n individuals** | **% at risk** |
| White Stork | nr | 6 | 424 | | 9 | 5107 | | 12 | 13537 | | 21 | 20969 | |
| | r | 4 | 605 | 58.79% | 6 | 2378 | 31.77% | 6 | 1635 | 10.78% | 6 | 4950 | 19.10 % |
| Black Kite | nr | 36 | 230 | | 44 | 354 | | 84 | 721 | | 76 | 936 | |
| | r | 6 | 11 | 4.56% | 20 | 197 | 35.75% | 29 | 110 | 13.24% | 26 | 93 | 9.04% |
| Black Stork | nr | 1 | 41 | | 5 | 15 | | 3 | 36 | | 13 | 670 | |
| | r | 1 | 7 | 14.58% | 5 | 1443 | 98.97% | 0 | | 0.00% | 3 | 28 | 4.01% |
| Booted Eagle | nr | 3 | 3 | | 10 | 18 | | 5 | 6 | | 10 | 15 | |
| | r | 0 | | 0.00% | 0 | | 0.00% | 2 | 2 | 25.00% | 2 | 3 | 16.67 % |
| Common Kestrel | nr | 0 | | | 0 | | | 0 | | | 3 | 10 | |
| | r | 6 | 6 | 100.00 % | 7 | 7 | 100.00 % | 4 | 4 | 100.00 % | 1 | 1 | 9.09% |
| Eastern Imperial Eagle | nr | 1 | 1 | | 0 | | | 1 | 1 | | 3 | 5 | |
| | r | 0 | | 0.00% | 0 | | | 0 | | 0.00% | 0 | | 0.00% |
| Egyptian Vulture | nr | 5 | 6 | | 1 | 1 | | 5 | 6 | | 2 | 5 | |
| | r | 0 | | 0.00% | 1 | 1 | 50.00% | 1 | 1 | 14.29% | 1 | 1 | 16.67 % |
| Eurasian Sparrowhawk | nr | 1 | 1 | | 0 | | | 0 | | | 5 | 12 | |
| | r | 0 | | 0.00% | 0 | | | 0 | | | 2 | 2 | 14.29 % |
| European Honey Buzzard | nr | 19 | 193 | | 13 | 462 | | 8 | 114 | | 27 | 1640 | |
| | r | 3 | 17 | 8.10% | 13 | 48 | 9.41% | 16 | 167 | 59.43% | 14 | 131 | 7.40% |
| Great White Pelican | nr | 1 | 1500 | | 0 | | | 0 | | | 1 | 500 | |
| | r | 1 | 150 | 9.09% | 2 | 330 | 100.00 % | 1 | 57 | 100.00 % | 1 | 50 | 9.09% |
| Greater Spotted Eagle | nr | 1 | 1 | | 1 | 1 | | 1 | 1 | | 2 | 3 | |
| | r | 0 | | 0.00% | 0 | | 0.00% | 0 | | 0.00% | 0 | | 0.00% |
| Lesser Spotted Eagle | nr | 3 | 4 | | 4 | 7 | | 7 | 10 | | 15 | 34 | |

| OBSERVATION POINT | | OP1 | | | OP2 | | | OP3 | | | OP4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | r | 0 | | 0.00% | 0 | | 0.00% | 0 | | 0.00% | 1 | 3 | 8.11% |
| Levant Sparrowhawk | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | |
| Long-legged Buzzard | nr | 5 | 8 | | 6 | 22 | | 8 | 22 | | 9 | 30 | |
| | r | 1 | 2 | 20.00% | 4 | 5 | 18.52% | 1 | 1 | 4.35% | 2 | 3 | 9.09% |
| Montagu's Harrier | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | |
| Osprey | nr | 0 | | | 0 | | | 0 | | | 1 | 1 | |
| | r | 0 | | | 0 | | | 0 | | | 1 | 1 | 50.00 % |
| Pallid Harrier | nr | 1 | 1 | | 1 | 1 | | 1 | 1 | | 3 | 7 | |
| | r | 0 | | 0.00% | 3 | 3 | 75.00% | 3 | 3 | 75.00% | 3 | 3 | 30.00 % |
| Short-toed Snake Eagle | nr | 9 | 13 | | 22 | 40 | | 32 | 62 | | 39 | 107 | |
| | r | 4 | 7 | 35.00% | 9 | 14 | 25.93% | 6 | 8 | 11.43% | 4 | 5 | 4.46% |
| Sooty Falcon | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | |
| Steppe Buzzard | nr | 61 | 1019 | | 47 | 783 | | 129 | 2490 | | 106 | 4888 | |
| | r | 32 | 194 | 15.99% | 24 | 176 | 18.35% | 41 | 295 | 10.59% | 13 | 75 | 1.51% |
| Steppe Eagle | nr | 37 | 141 | | 44 | 201 | | 85 | 451 | | 108 | 963 | |
| | r | 13 | 44 | 23.78% | 8 | 48 | 19.28% | 18 | 68 | 13.10% | 11 | 35 | 3.51% |
| Western Marsh Harrier | nr | 1 | 1 | | 0 | | | 0 | | | 2 | 2 | |
| | r | 3 | 3 | 75.00% | 3 | 4 | 100.00 % | 0 | | | 1 | 1 | 33.33 % |

Continued…

| | OP5 | | | | OP6 | | | OP7 | | | OP8 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SPECIES** | **risk** | **n records** | **n individuals** | **% at risk** | **n records** | **n individuals** | **% at risk** | **n records** | **n individuals** | **% at risk** | **n records** | **n individuals** | **% at risk** |
| White Stork | nr | 4 | 865 | | 15 | 7917 | | 23 | 36805 | | 17 | 4778 | |
| | r | 8 | 2297 | 72.64% | 12 | 8576 | 52.00% | 12 | 6031 | 14.08% | 16 | 10733 | 69.20 % |
| Black Kite | nr | 49 | 568 | | 69 | 438 | | 118 | 1223 | | 92 | 735 | |
| | r | 19 | 83 | 12.75% | 26 | 187 | 29.92% | 27 | 484 | 28.35% | 32 | 341 | 31.69 % |
| Black Stork | nr | 2 | 3 | | 9 | 165 | | 14 | 582 | | 7 | 59 | |
| | r | 1 | 10 | 76.92% | 3 | 84 | 33.73% | 0 | | 0.00% | 2 | 59 | 50.00 % |
| Booted Eagle | nr | 8 | 12 | | 4 | 4 | | 24 | 27 | | 17 | 21 | |
| | r | 2 | 2 | 14.29% | 3 | 4 | 50.00% | 8 | 13 | 32.50% | 1 | 1 | 4.55% |
| Common Kestrel | nr | 1 | 1 | | 0 | | | 1 | 1 | | 1 | 1 | |
| | r | 7 | 7 | 87.50% | 10 | 11 | 100.00 % | 7 | 8 | 88.89% | 7 | 7 | 87.50 % |
| Eastern Imperial Eagle | nr | 3 | 7 | | 1 | 1 | | 1 | 1 | | 2 | 2 | |
| | r | 0 | | 0.00% | 0 | | 0.00% | 1 | 1 | 50.00% | 0 | | 0.00% |
| Egyptian Vulture | nr | 3 | 3 | | 2 | 2 | | 10 | 19 | | 7 | 9 | |
| | r | 2 | 2 | 40.00% | 0 | | 0.00% | 1 | 2 | 9.52% | 0 | | 0.00% |
| Eurasian Sparrowhawk | nr | 0 | | | 1 | 1 | | 7 | 15 | | 1 | 1 | |
| | r | 0 | | | 1 | 1 | 50.00% | 2 | 3 | 16.67% | 0 | | 0.00% |
| European Honey Buzzard | nr | 10 | 85 | | 17 | 129 | | 44 | 2392 | | 35 | 1123 | |
| | r | 3 | 5 | 5.56% | 16 | 80 | 38.28% | 6 | 26 | 1.08% | 11 | 116 | 9.36% |
| Great White Pelican | nr | 0 | | | 1 | 2500 | | 3 | 315 | | 1 | 350 | |
| | r | 3 | 760 | 100.00 % | 3 | 156 | 5.87% | 3 | 2370 | 88.27% | 6 | 10578 | 96.80 % |
| Greater Spotted Eagle | nr | 2 | 2 | | 2 | 2 | | 4 | 4 | | 5 | 6 | |
| | r | 1 | 1 | 33.33% | 0 | | 0.00% | 0 | | 0.00% | 0 | | 0.00% |
| Lesser Spotted Eagle | nr | 10 | 21 | | 2 | 2 | | 17 | 55 | | 16 | 27 | |

| | | OP5 | | | OP6 | | | OP7 | | | OP8 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | r | 0 | | 0.00% | 2 | 3 | 60.00% | 5 | 7 | 11.29% | 0 | | 0.00% |
| Levant Sparrowhawk | nr | 0 | | | 0 | | | 0 | | | 2 | 198 | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | 0.00% |
| Long-legged Buzzard | nr | 4 | 6 | | 8 | 13 | | 7 | 11 | | 12 | 21 | |
| | r | 0 | | 0.00% | 1 | 1 | 7.14% | 2 | 3 | 21.43% | 1 | 1 | 4.55% |
| Montagu's Harrier | nr | 0 | | | 0 | | | 0 | | | 1 | 1 | |
| | r | 0 | | | 1 | 1 | 100.00 % | 2 | 2 | 100.00 % | 1 | 1 | 50.00 % |
| Osprey | nr | 0 | | | 0 | | | 2 | 2 | | 1 | 1 | |
| | r | 0 | | | 1 | 1 | 100.00 % | 0 | | 0.00% | 0 | | 0.00% |
| Pallid Harrier | nr | 0 | | | 0 | | | 0 | | | 2 | 3 | |
| | r | 2 | 2 | 100.00 % | 1 | 1 | 100.00 % | 0 | | | 1 | 1 | 25.00 % |
| Short-toed Snake Eagle | nr | 23 | 49 | | 14 | 24 | | 45 | 98 | | 31 | 43 | |
| | r | 3 | 3 | 5.77% | 7 | 10 | 29.41% | 13 | 36 | 26.87% | 3 | 3 | 6.52% |
| Sooty Falcon | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 1 | 1 | 100.00 % | 0 | | |
| Steppe Buzzard | nr | 79 | 3027 | | 84 | 2245 | | 163 | 3275 | | 132 | 3685 | |
| | r | 40 | 477 | 13.61% | 45 | 701 | 23.79% | 61 | 820 | 20.02% | 30 | 332 | 8.26% |
| Steppe Eagle | nr | 61 | 427 | | 48 | 162 | | 113 | 654 | | 93 | 1049 | |
| | r | 13 | 148 | 25.74% | 21 | 66 | 28.95% | 21 | 82 | 11.14% | 15 | 42 | 3.85% |
| Western Marsh Harrier | nr | 0 | | | 0 | | | 0 | | | 1 | 1 | |
| | r | 0 | | | 1 | 1 | 100.00 % | 1 | 2 | 100.00 % | 1 | 1 | 50.00 % |

**Temporal distribution of records and individuals**

To understand the migratory pattern, the data (number of birds) per week of observation was analysed instead of the individual date. This is a common methodology for the migration studies that provides a better understanding. Figure 19 below presents the number of birds migrating through the study area since week #8 (around 20th February). March occupies weeks 13-14, and April 14-18 and May 18-19 to 21. Overall, the peak of the migration occurs around weeks 16-17 (mid-April), the time coincident with White storks and Great White pelicans.

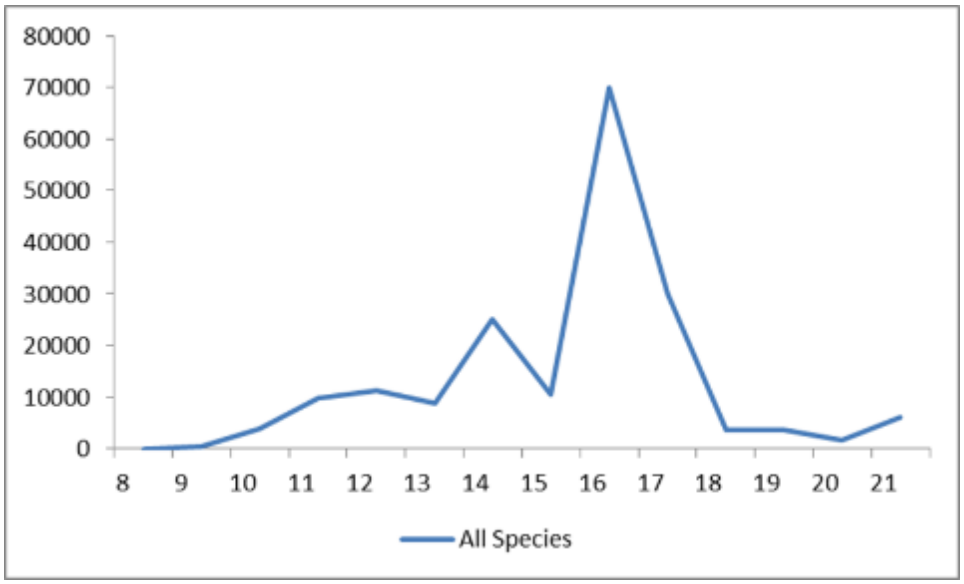


**Figure 19: Total Bird numbers per week along the migration season**

For the mitigation purposes, there is an interest to know which species migrates when. The Figure below shows the distribution of bird numbers for the Black Kite and Black Stork. Both share similar patterns but kites have a smaller additional peak in week 11th (early March).

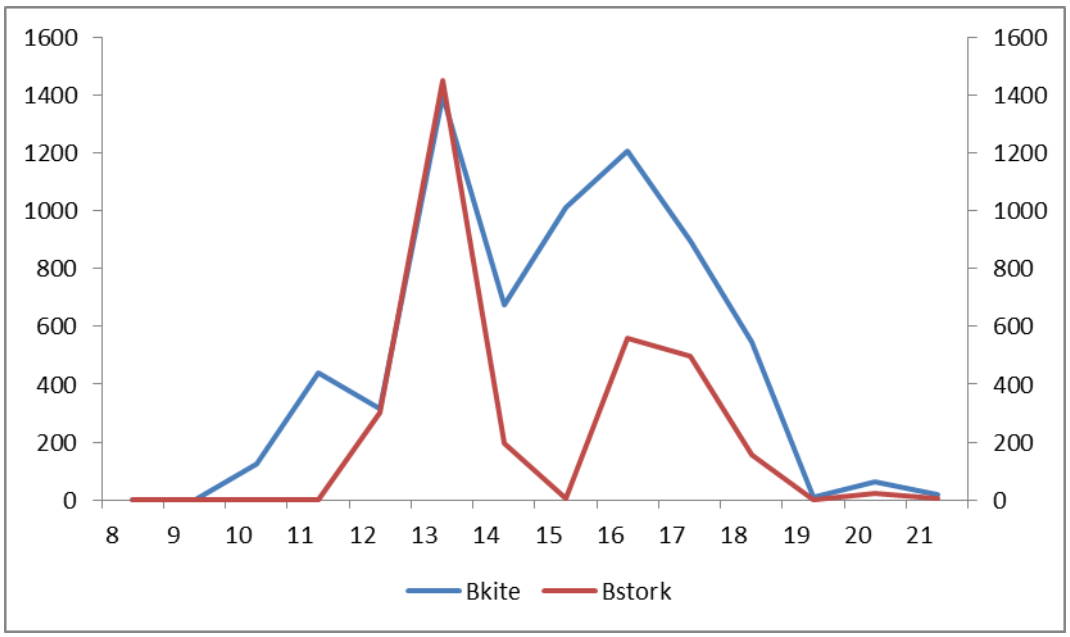


**Figure 20: Number of Black Kites and Black Storks per week, spring 2020**

A different figure is that of the Honey and Steppe buzzards. The Steppe Buzzard extends its migration over several weeks 9 to 17, whilst the Honey Buzzard is a late migrant, probably the latest, that delays the passage till May. This is a very similar trend as it happens in the Western Atlantic migration route.

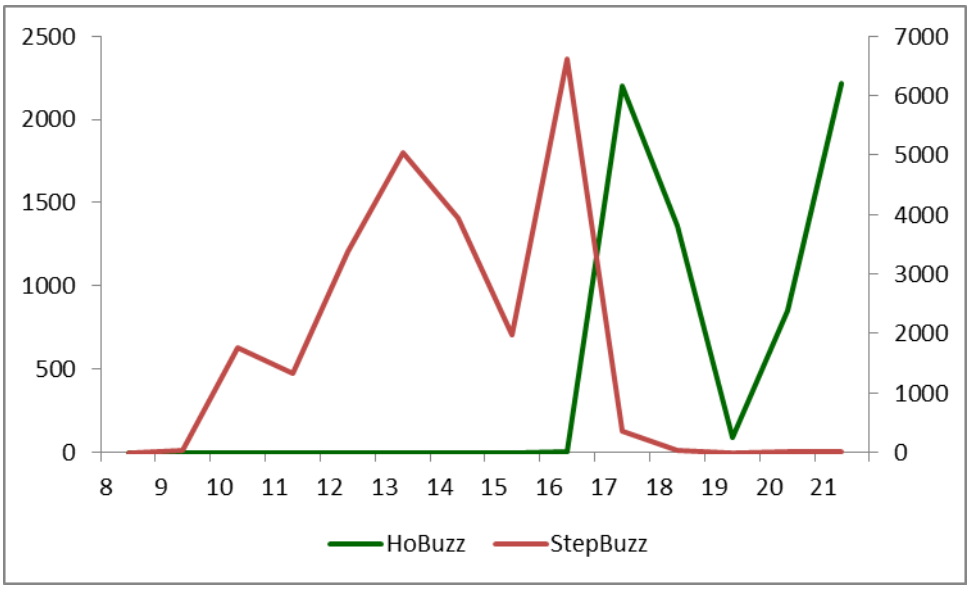


**Figure 21: Number of Honey and Steppe Buzzards per week, spring 2020**

Finally, we have another two eagle species, the Short-toed and the Steppe eagles. The Steppe eagle has two peaks in early March, then a constant trend and another peak in mid-April, at the same time of the White Stork and Pelicans as showed above.

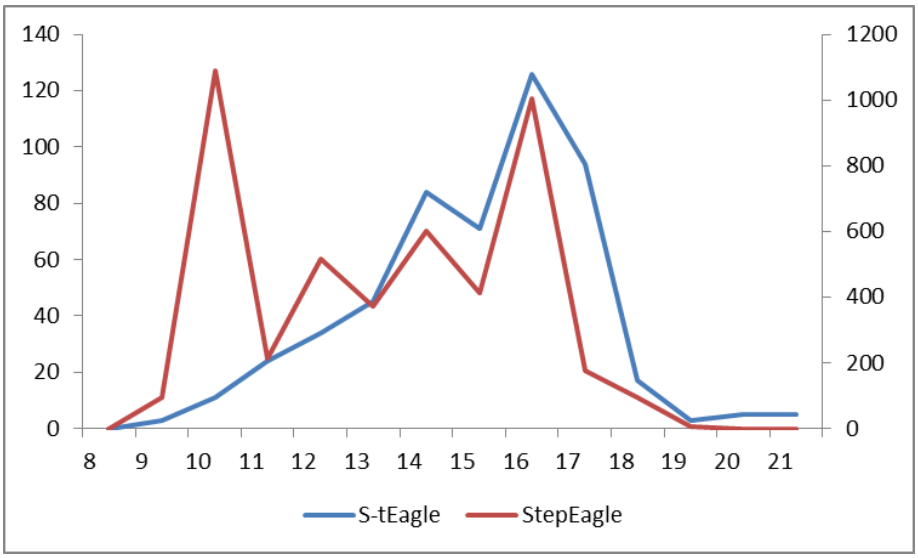


**Figure 22: Number of Short-toed and Steppe eagles per week, spring 2020**

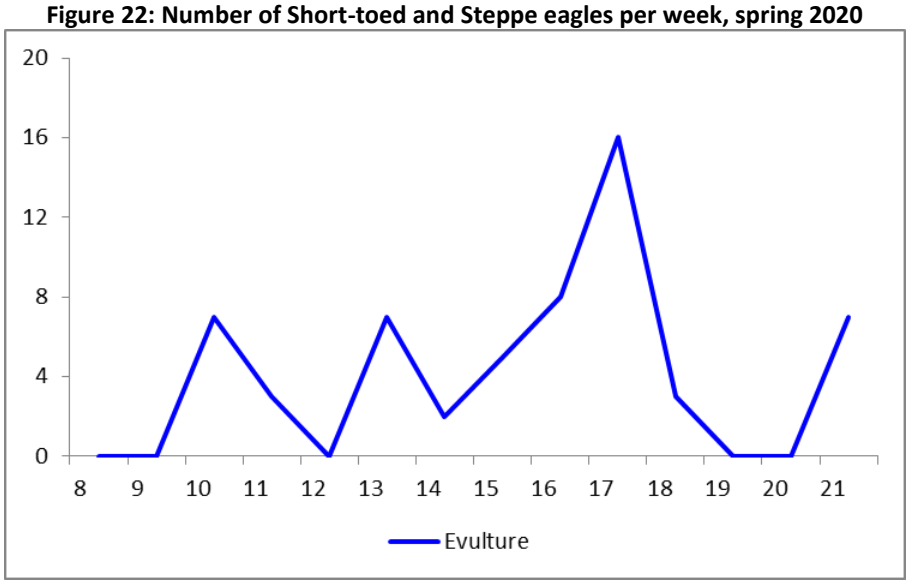


**Figure 23: Number of Egyptian vultures per week, spring 2020**

Figure 23 shows the migration numbers of the Egyptian vulture. This graph allows the explanation in more details of the different migration of adult vs. immature or non-breeding birds. Adult birds migrate earlier, as they must breed. The numbers of weeks 10 to 13-14 could belong to such group. However, the non-breeding birds, without breeding requirement, do later as showed during weeks 16-18.

Related to time in the day, all species show a very similar mean and median passing times. Except the Black Kite all the species migrate within a short confidence interval of time ranging from less than one hour to around three hours. Interesting to see is the Black Kite for which the hours of passage extend over a longer time interval from early morning to late evening. The table below shows the mean and median passage times per species, to better show the preferred hours in the observations. The quartile 25 and 75 reflect the time for which 25% and 75% of birds crossed The Amunet Project footprint.

**Table 14: Mean time passage per species, confidence interval for the mean, number of observations, median and Quartiles 25 and 75.**

| SPECIES | mean +OT | Confidence - 95% | Confidence +95% | n | Q25 | Median | Q75 |
|---|---|---|---|---|---|---|---|
| Black Kite | 13:55 | 7:17 | 20:32 | 751 | 9:28 | 10:28 | 11:30 |
| Steppe Eagle | 10:59 | 10:52 | 11:05 | 703 | 9:58 | 10:55 | 11:50 |
| Short-toed Snake Eagle | 11:01 | 10:49 | 11:14 | 263 | 9:54 | 10:55 | 11:56 |
| Lesser Spotted Eagle | 10:48 | 10:27 | 11:09 | 82 | 9:40 | 10:37 | 11:35 |
| Steppe Buzzard | 10:54 | 10:48 | 11:00 | 1086 | 9:45 | 10:47 | 11:52 |
| Great White Pelican | 10:53 | 10:16 | 11:29 | 27 | 9:40 | 10:47 | 12:00 |
| Long-legged Buzzard | 10:49 | 10:28 | 11:10 | 71 | 9:58 | 10:33 | 11:37 |
| Greater Spotted Eagle | 10:42 | 10:05 | 11:19 | 19 | 9:40 | 10:40 | 11:18 |
| Common Kestrel | 10:23 | 9:48 | 10:57 | 55 | 8:35 | 9:41 | 12:03 |
| Egyptian Vulture | 10:57 | 10:31 | 11:23 | 41 | 9:57 | 10:50 | 11:30 |
| Black Stork | 10:58 | 10:33 | 11:23 | 69 | 9:43 | 10:45 | 11:38 |
| White Stork | 11:13 | 10:55 | 11:32 | 177 | 9:33 | 11:00 | 12:33 |
| Eastern Imperial Eagle | 11:07 | 9:39 | 12:35 | 13 | 8:55 | 10:48 | 12:28 |
| Western Marsh Harrier | 10:06 | 8:53 | 11:19 | 14 | 7:59 | 9:51 | 11:02 |
| Booted Eagle | 10:44 | 10:24 | 11:04 | 99 | 9:30 | 10:37 | 11:52 |
| Montagu's Harrier | 7:44 | 6:28 | 9:00 | 5 | 7:00 | 7:25 | 8:48 |
| Pallid Harrier | 11:14 | 10:05 | 12:23 | 21 | 9:20 | 10:59 | 13:01 |
| Eurasian Sparrowhawk | 11:36 | 10:33 | 12:38 | 20 | 9:44 | 11:27 | 13:11 |
| Osprey | 10:30 | 8:11 | 12:48 | 6 | 8:56 | 9:45 | 11:10 |
| European H. Buzzard | 9:39 | 9:29 | 9:50 | 254 | 8:35 | 9:40 | 10:39 |
| Pallid/ Montagu's Harrier | 11:58 | - | - | 1 | 11:58 | 11:58 | 11:58 |
| Levant Sparrowhawk | 11:15 | 10:36 | 11:53 | 2 | 11:12 | 11:15 | 11:18 |

**Flight direction for bird individuals**

As expected in a spring migration survey, the general direction of birds recorded was generally northward. More than 59% of the birds recorded were flying northwest while almost 32% were flying northeast. The direction birds are flying relative to the OHTL is important in the assessment of risk. If bird flight direction is aligned with the OHTL then risk of colliding is likely to be lower than if flight direction is at 90 degrees i.e., toward the OHTL wires. Over half the flights (59%) were recorded flying in a direction broadly aligned with the OHTL orientation i.e., NW. A lower number of birds 32% were recorded flying at approximately 90 degrees to the OHTL (NE)

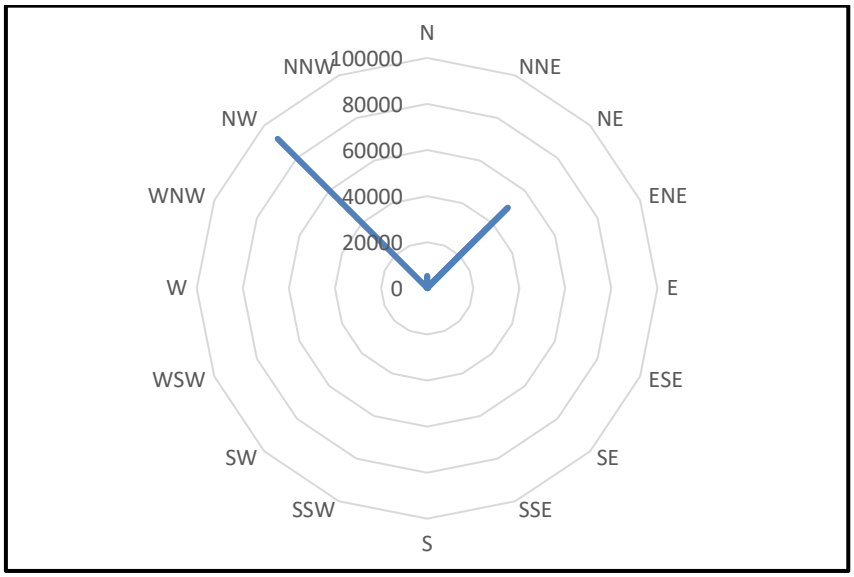


**Figure 24: Flight Direction of Birds Recorded during the Survey**

**Birds Behaviour**

Documenting the behaviour of birds during in-flight monitoring would normally provide figures that far exceed the total number of the birds recorded. This is due to the fact that birds could display one or more behaviours. The largest number of birds showing a single behaviour were 152,773 birds gliding followed by 137,704 soaring, see table below. All soaring birds were showing the combined behaviour of soaring and gliding while passing through the Project site within the Amunet Project site. Not all records have been used for the table below.

**Table 15: Number of Birds Recorded According to Behaviour**

| Behaviour | Number of Records | No. of Individuals |
|---|---|---|
| Active Flight | 1801 | 107909 |
| Gliding | 3532 | 152773 |
| Soaring | 2459 | 137704 |
| Resting / Landing | 15 | 176 |

Birds resting or landing within or close the project study area are potentially susceptible to collision with both turbines and OHTL as they are flying at altitudes that may bring them into contact with these structures when they land or take off. During spring 2020 the number of birds recorded resting or landing was very low at 0.09% of the 196,026 total birds recorded.

**Autumn Migration 2020**

***Baseline Assessment for in-flight movement of soaring birds during the autumn season of 2020***

Species records and individuals

During the autumn season, 16 species were recorded with a total of 18,319 birds and 810 records, see table below. Three species were recorded at large numbers as to be considered of greater collision risk (W. Stork, GW Pelican & H. Buzzard) > 1,000 birds. These three species comprised around 98% of the total birds.

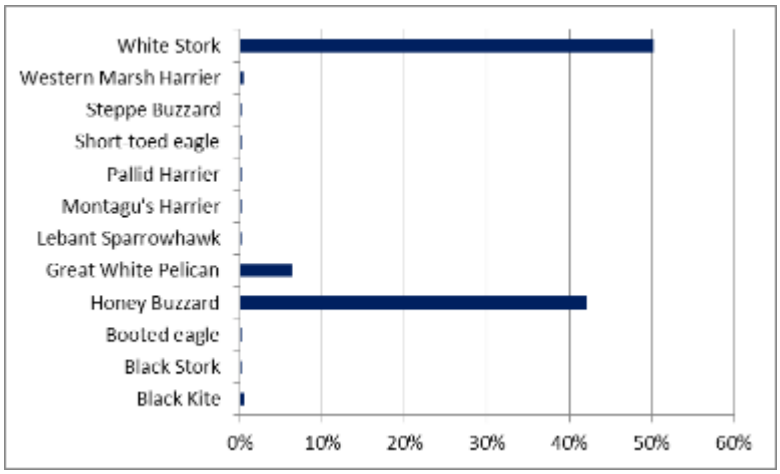


**Figure 25: Percentages over the total number of individuals recorded**

By large, the White Storks and the Pelicans outnumber all the remaining species (>40% of the individuals). From now on in the analyses, all individuals that have not been identified to species level, e.g. those classified as eagle sp., "harriers", "buzzard species", have been removed. The reason for this is because potential misidentification and assignment to erroneous groups. This includes a total of 144 individuals. Although such species could be individuals of priority species but in general it is too risky to assign such numbers to a certain species as a single count as it could impact the overall results.

### Spatial distribution of birds flying at risk height over observation points

As we did for the spring, the passing rates were used instead of the total counts, as the monitoring time was not equally distributed over the OPs. OPs 2 and 5 had the higher passing rates.

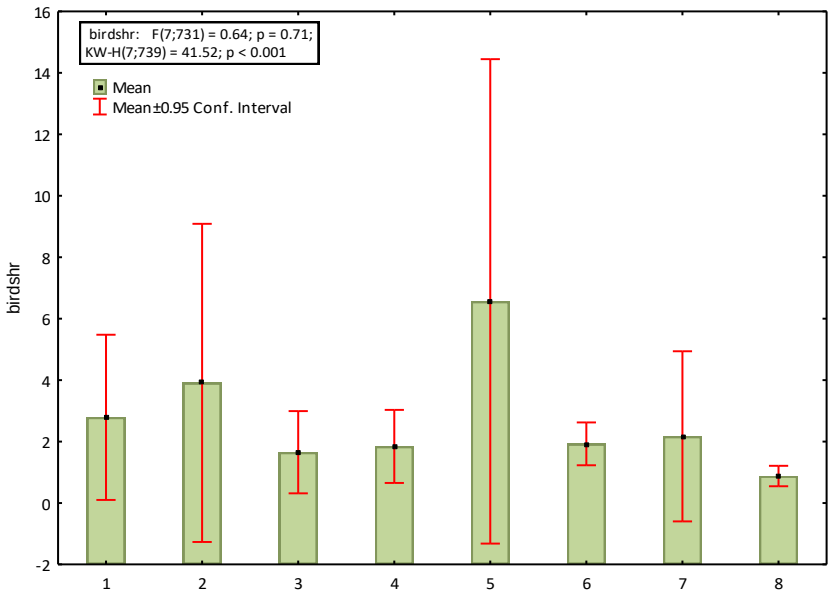


**Figure 26: Bird per hour per OP in autumn 2020 after standardizing the raw bird numbers**

OPs 2 and 5 are those located closer to the coast and also oriented to the north east, to the area from where most of the birds could come after crossing the Red Sea. All the remaining OPs had similar passing rates. The table below shows the number of birds and records at risk or non-risk height per OP.

**Table 16: Overall distribution of Records and Individual Birds across OP**

| OP | Risk (r) | n records | number of birds | % birds at risk |
|---|---|---|---|---|
| **1** | nr | 56 | 682 | |

| OP | Risk (r) | n records | number of birds | % birds at risk |
|---|---|---|---|---|
| | r | 38 | 1109 | 61.92% |
| **2** | nr | 69 | 890 | |
| | r | 78 | 3537 | 79.90% |
| **3** | nr | 64 | 663 | |
| | r | 23 | 484 | 42.20% |
| **4** | nr | 47 | 1074 | |
| | r | 31 | 52 | 4.62% |
| **5** | nr | 65 | 1464 | |
| | r | 51 | 5076 | 77.61% |
| **6** | nr | 70 | 1248 | |
| | r | 41 | 446 | 26.33% |
| **7** | nr | 11 | 688 | |
| | r | 47 | 309 | 30.99% |
| **8** | nr | 35 | 423 | |
| | r | 37 | 126 | 22.95% |

Opposite to what was recorded during the spring survey, looking at the spatial distribution of the number of birds, it can be clearly seen that the north eastern part had the highest number of passages, check figure below.

The OHTL is in an area where the mean passing rates in autumn 2020 were assessed as moderate compared with higher rates to the north and south (Figure 27). Approximately a quarter of the individuals (26%) recorded at OP6 where the OHTL is located were flying at <120m, of which a proportion will be exposed to collision risk with OHTL wires (Table 16)

**Table 17: A Summary of the Bird Observation Records During the Reporting Period of autumn season 2020**

| Species Name | Status according to IUCN Red List of Threatened Species (2019) | National Status | Amunet ESIA – autumn 2020 | | |
|---|---|---|---|---|---|
| | | | # records | # individuals | % of individuals flying at <120m |
| Black Kite *Milvus migrans* | Least Concern | Passage migrant | 56 | 93 | 74.2 |
| Osprey *Pandion heliaetus* | Least Concern | Passage migrant | 1 | 1 | 100 |
| European Honey-buzzard *Pernis apivorus* | Least Concern | Passage migrant | 546 | 7,651 | 22.2 |
| Booted Eagle *Hieraaetus pennatus* | Least Concern | Passage migrant | 4 | 5 | 60.0 |
| Western Marsh-harrier *Circus aeruginosus* | Least Concern | Passage migrant | 54 | 70 | 82.9 |
| Montagu's Harrier *Circus pygargus* | Least Concern | Passage migrant | 26 | 29 | 86.2 |
| Pallid Harrier *Circus macrourus* | Near Threatened | Passage migrant/ winter visitor | 13 | 17 | 58.8 |
| Short-toed Snake-eagle *Circaetus gallicus* | Least Concern | Passage migrant/ summer breeder | 3 | 4 | 75.0 |
| Eurasian Sparrowhawk *Accipiter nisus* | Least Concern | Passage migrant | 2 | 4 | 50.0 |
| Levant Sparrowhawk *Accipiter brevipes* | Least Concern | Passage migrant | 1 | 1 | 0.0 |
| Steppe Buzzard *Buteo buteo vulpinus* | Least Concern | Passage migrant | 10 | 17 | 29.4 |
| Sooty Falcon *Falco concolor* | Vulnerable | Passage migrant/ summer breeder | 2 | 2 | 50.0 |
| Crane *Grus grus* | Least Concern | Passage migrant | 1 | 16 | 0.0 |
| White Pelican *Pelecanus oncrotalus* | Least Concern | Passage migrant | 11 | 1,133 | 83.7 |
| Black Stork *Ciconia nigra* | Least Concern | Passage migrant | 2 | 2 | 0 |
| White Stork *Ciconia ciconia* | Least Concern | Passage migrant | 13 | 9,130 | 90.3 |

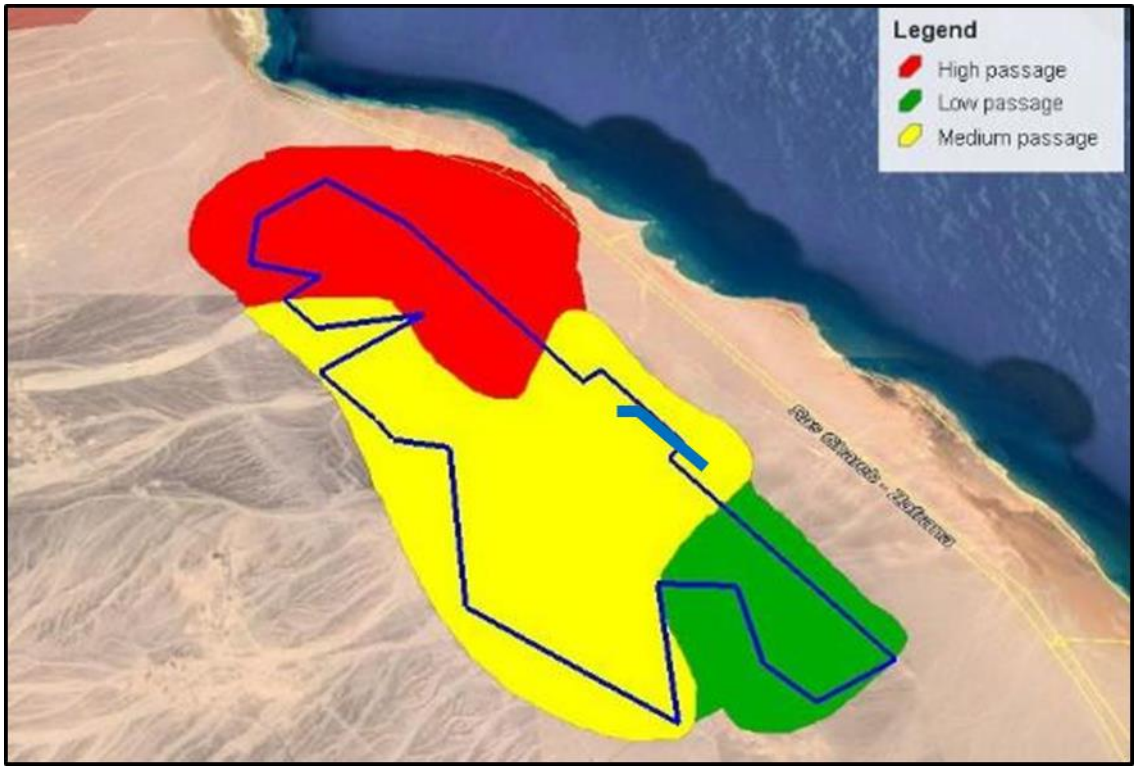


**Figure 27: Areas of bird passage based on the overall number of birds recorded across The Amunet Project site**

**Spatial distribution of species flying at risk height**

As said previously, there are two species that make up almost 91.8% of the birds recorded. The species with the highest number of individuals is White Stork *Ciconia ciconia* with a total of 9,130 (49.9%), while the second most recorded is European Honey-buzzard *Pernis apivorus* with a total of 7,651 (and almost 41.8% of the birds counted).

Regarding White Stork *Ciconia ciconia,* a total of 7,285 birds of the species were recorded by the eastern part of site (79.8%). Out of those birds, a total of 7002 birds were flying at risk height (96.1%). On the other hand, the birds that were recorded by the western part of the site (1053 birds, 11.5%) had 453 birds flying at risk height (43.0% of birds recorded in this part of the site). In total 81.6% of the white storks recorded were flying at risk height. In summary, the north-eastern part of the site has the highest collision risk with the highest passage of white storks. Generally, the collision risk is moderate to high in the north and northeast while collision risk and passage is at its lowest at the southwestern part of the site.

The second most commonly species recorded is the European Honey-buzzard *Pernis apivorus* with a total of 7,651 birds (41.8% of the total birds recorded). A total of 4,828 birds (63.1% of the total of the species) were recorded in the eastern side with around 24.2% of the birds flying at collision risk height. The western part of the area had lower numbers of birds passing through (1,976 birds making up 25.8% of total birds) but with a higher number passing at collision risk height (30.4%). In summary, the eastern part had the highest numbers of passage but with relatively moderate numbers passing at collision risk height while the western part had lower number of birds passing but with a similar number passing at collision risk height.

In the airspace where the OHTL is located (OP6 -see Table 18) only 2 species - European Honey-buzzard and Great White Pelican - exceeded 10 individuals recorded. For European Honey-buzzard 1237 individuals were recorded and of these 10% (133) were flying below 120m. For Great White Pelican, 297 birds were recorded all of which were flying at <120m. Importantly, flight activity patterns change between years according to weather and other environmental conditions and both the number of birds recorded and the % at <120m reported for this specific area in autumn 2020 may be higher or lower in future seasons. To highlight the caution required when interpreting figures for a small area such as that around the OHTL, in autumn 2020 the number of White

Storks recorded in OP6 was negligible (2 individuals) however at adjacent OP5 4000 individuals, all flying at <120m were recorded.

**Table 18: Species Numbers and Percentages of Total Numbers at Collision Risk Height at the Different Vantage Points**

| | | OP1 | | | OP2 | | | OP3 | | | OP4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **risk** | **n records** | **n birds** | **% risk** | **n records** | **n birds** | **% risk** | **n records** | **n birds** | **% risk** | **n records** | **n birds** | **% risk** |
| Black Kite | nr | 1 | 1 | | 4 | 5 | | 3 | 4 | | 3 | 3 | |
| | r | 1 | 2 | 66.67% | 5 | 10 | 66.67% | 0 | | 0.00% | 3 | 3 | 50.00% |
| Black Stork | nr | 0 | | | 1 | 1 | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | 0.00% | 0 | | | 0 | | |
| Booted Eagle | nr | 0 | | | 1 | 1 | | 0 | | | 1 | 1 | |
| | r | 1 | 2 | 100.00% | 1 | 1 | 50.00% | 0 | | | 0 | | 0.00% |
| Common Crane | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | |
| Eurasian Sparrowhawk | nr | 0 | | | 1 | 1 | | 0 | | | 0 | | |
| | r | 0 | | | 1 | 1 | 50.00% | 1 | 1 | 100.00% | 0 | | |
| European Honey Buzzard | nr | 47 | 603 | | 60 | 880 | | 59 | 643 | | 38 | 938 | |
| | r | 20 | 241 | 28.55% | 54 | 480 | 35.29% | 9 | 19 | 2.87% | 13 | 33 | 3.40% |
| Great White Pelican | nr | 0 | | | 0 | | | 1 | 15 | | 1 | 120 | |
| | r | 1 | 58 | | 1 | 13 | 100.00% | 0 | | 0.00% | 0 | | 0.00% |
| Levant Sparrowhawk | nr | 0 | | 0.00% | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | |
| Montagu's Harrier | nr | 0 | | | 1 | 1 | | 0 | | | 0 | | |
| | r | 1 | 1 | 100.00% | 5 | 6 | 85.71% | 0 | | | 4 | 4 | 100.00% |
| Montagu's/Pallid Harrier | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | ! | 0 | | | 0 | | | 0 | | |
| Osprey | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 1 | 1 | 100.00% | 0 | | |
| Pallid Harrier | nr | 1 | 2 | | 1 | 1 | 100.00% | 0 | | | 0 | | |
| | r | 0 | | | 2 | 2 | | 3 | 3 | 100.00% | 1 | 2 | 100.00% |
| Short-toed Snake Eagle | nr | 0 | | | 0 | | | 0 | | | 1 | 1 | |

| | | OP1 | | | OP2 | | | OP3 | | | OP4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | r | 2 | 3 | 100.00% | 0 | | | 0 | | | 0 | | 0.00% |
| Steppe Buzzard | nr | 2 | 2 | | 0 | | | 0 | | | 1 | 7 | |
| | r | 0 | | 0.00% | 1 | 2 | 100.00% | 0 | | | 1 | 1 | 12.50% |
| Western Marsh Harrier | nr | 4 | 4 | | 0 | | | 0 | | | 0 | | |
| | r | 5 | 5 | 55.56% | 5 | 19 | 100.00% | 6 | 7 | 100.00% | 7 | 7 | 100.00% |
| White Stork | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 4 | 793 | 100.00% | 1 | 3000 | 100.00% | 3 | 453 | 100.00% | 0 | | |

(Cont…)

| | | OP5 | | | OP6 | | | OP7 | | | OP8 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **risk** | **n records** | **n birds** | **% risk** | **n records** | **n birds** | **% risk** | **n records** | **n birds** | **% risk** | **n records** | **n birds** | **% risk** |
| Black Kite | nr | 3 | 5 | | 5 | 5 | | 0 | | | 1 | 1 | |
| | r | 11 | 23 | 82.14% | 1 | 1 | 16.67% | 7 | 16 | 100.00% | 8 | 14 | 93.33% |
| Black Stork | nr | 0 | | | 0 | | | 0 | | | 1 | 1 | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | 0.00% |
| Booted Eagle | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | |
| Common Crane | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 1 | 16 | 100.00% | 0 | | |
| Eurasian Sparrowhawk | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 1 | 1 | 100.00% | 0 | | |
| European Honey Buzzard | nr | 57 | 1175 | | 62 | 1237 | | 9 | 87 | | 27 | 361 | |
| | r | 30 | 466 | 28.40% | 25 | 133 | 9.71% | 22 | 259 | 74.86% | 14 | 96 | 21.01% |
| Great White Pelican | nr | 0 | | | 0 | | | 0 | | | 1 | 50 | |
| | r | 2 | 580 | 100.00% | 4 | 297 | 100.00% | 0 | | | 0 | | 0.00% |

| | | OP5 | | | OP6 | | | OP7 | | | OP8 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Levant Sparrowhawk | nr | 0 | | | 0 | | | 0 | | | 1 | 3 | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | 0.00% |
| Montagu's Harrier | nr | 0 | | | 1 | 2 | | 1 | 1 | | 0 | | |
| | r | 2 | 2 | 100.00% | 2 | 3 | 60.00% | 5 | 5 | 83.33% | 4 | 4 | 100.00% |
| Montagu's/Pallid Harrier | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 1 | 2 | 100.00% | 0 | | |
| Osprey | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | |
| Pallid Harrier | nr | 0 | | | 0 | | | 0 | | | 1 | 2 | |
| | r | 0 | | | 3 | 4 | 100.00% | 1 | 1 | 100.00% | 0 | | 0.00% |
| Short-toed Snake Eagle | nr | 0 | | | 0 | | | 0 | | | 0 | | |
| | r | 0 | | | 0 | | | 0 | | | 0 | | |
| Steppe Buzzard | nr | 1 | 1 | | 0 | | | 0 | | | 1 | 1 | |
| | r | 1 | 1 | 50.00% | 1 | 1 | 100.00% | 1 | 1 | 100.00% | 0 | | 0.00% |
| Western Marsh Harrier | nr | 2 | 2 | | 0 | | | 0 | | | 1 | 1 | |
| | r | 4 | 4 | 66.67% | 4 | 5 | 100.00% | 7 | 7 | 100.00% | 9 | 9 | 90.00% |
| White Stork | nr | 1 | 280 | | 0 | | | 1 | 600 | | 0 | | |
| | r | 1 | 4000 | 93.46% | 1 | 2 | 100.00% | 0 | | 0.00% | 1 | 2 | 100.00% |

**Temporal distribution of records and individuals**

As we did for the spring season the figures below show the migration pattern expressed over weeks. The overall pattern revealed that most of the birds passed soon after starting the monitoring in mid-August, with a peak during the last week of such month. This is caused by the early migration of the White Stork.

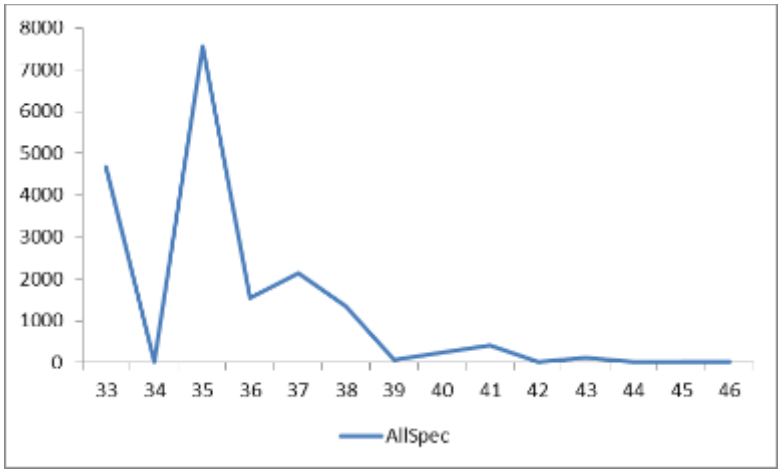


**Figure 28: Number of all species per week, autumn 2020**

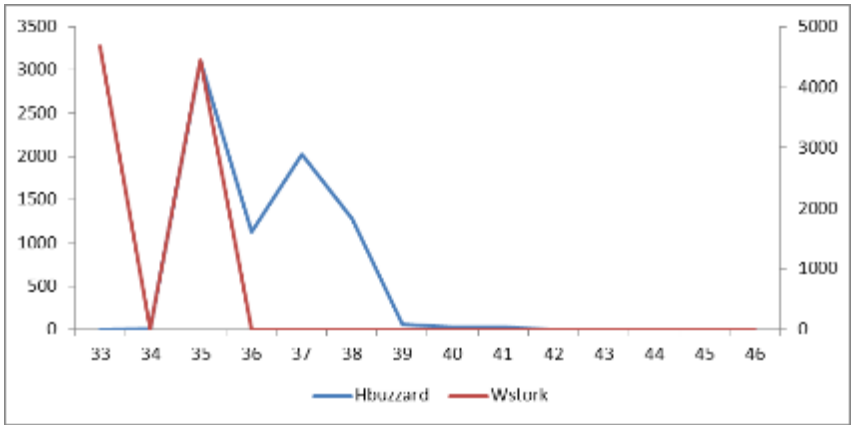


**Figure 29: Number of Honey Buzzards and White Storks per week, autumn 2020**

The figure above shows the graphs for the Honey Buzzard and the White Stork. Storks as said before are the first to migrate. The Honey Buzzard passes in September, not doing later anymore in the season.

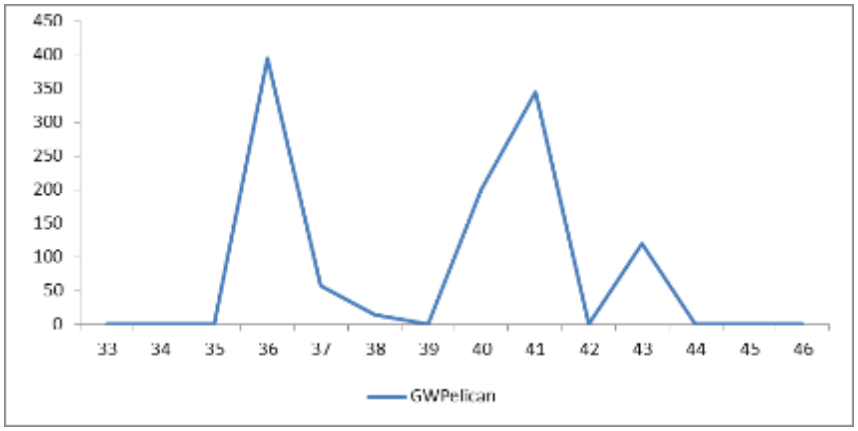


**Figure 30 Number of Great White Pelicans per week, autumn 2020**

The Great White Pelican exhibited two major peaks and a smaller one. Migration extends over a longer period compared with the remaining species. It would be useful to record the age of the birds to go deeper into this scheme.

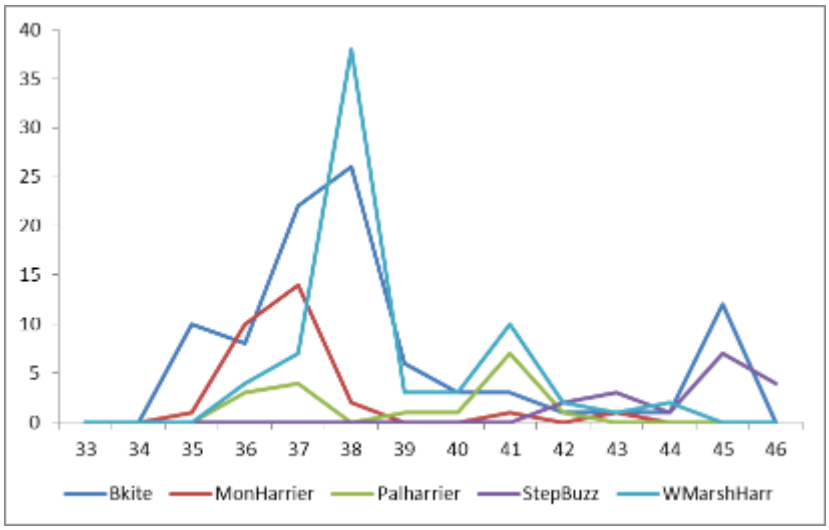


**Figure 31: Number of Black Kites, some harrier species and the Steppe Buzzard per week, autumn 2020**

The figure above shows the Black Kite, three species of harriers (Montagu`s, Pallid, and Western Marsh), and the Steppe Buzzard. Numbers are small (< 40 individuals each) also extending in August and September.

Related to timing there were variations in the observed migration times. Those soaring birds seemed to select central hours in a day, when thermals are more predictable, compared to species that are not so thermal dependent, like Honey Buzzards.

**Table 19: Mean time passage per species, confidence interval for the mean, number of observations, median and Quartiles 25 and 75**

| Species | Mean | Confidence -95% | Confidence +95% | n records | Q25 | Median | Q75 |
|---|---|---|---|---|---|---|---|
| Black Kite | 12:11 | 11:29 | 12:53 | 56 | 10:10 | 13:04 | 14:06 |
| Black Stork | 13:30 | 14:01 | 17:01 | 2 | 11:20 | 13:30 | 15:40 |
| Booted Eagle | 12:48 | 10:37 | 14:58 | 4 | 11:53 | 13:10 | 13:42 |
| European Honey Buzzard | 16:35 | 7:51 | 1:20 | 542 | 10:20 | 12:36 | 14:07 |
| Great White Pelican | 10:34 | 9:08 | 12:00 | 11 | 8:32 | 10:22 | 12:41 |
| Levant Sparrowhawk | 15:50 | | | 1 | 15:50 | 15:50 | 15:50 |
| Montagu's Harrier | 9:10 | 8:12 | 10:07 | 26 | 7:27 | 8:07 | 10:23 |
| Pallid Harrier | 11:10 | 9:14 | 13:07 | 13 | 8:03 | 9:42 | 14:40 |
| Short-toed Snake Eagle | 12:43 | 9:40 | 15:45 | 3 | 11:57 | 12:05 | 14:08 |
| Steppe Buzzard | 12:08 | 8:57 | 15:20 | 9 | 10:32 | 14:25 | 14:35 |
| Western Marsh Harrier | 10:17 | 9:26 | 11:07 | 53 | 7:45 | 9:00 | 13:12 |
| White Stork | 10:45 | 8:44 | 12:46 | 13 | 7:58 | 8:32 | 14:11 |

### Flight direction for bird individuals

As expected, the general direction of birds recorded was generally southward. More than 52% of the birds recorded were flying southwest; around 45% were recorded flying southeast. Over half the flights (>52%) were recorded flying at approximately 90 degrees to the OHTL (SW). A slightly lower proportion (45%) were flying in a direction broadly aligned with OHTL (SE)

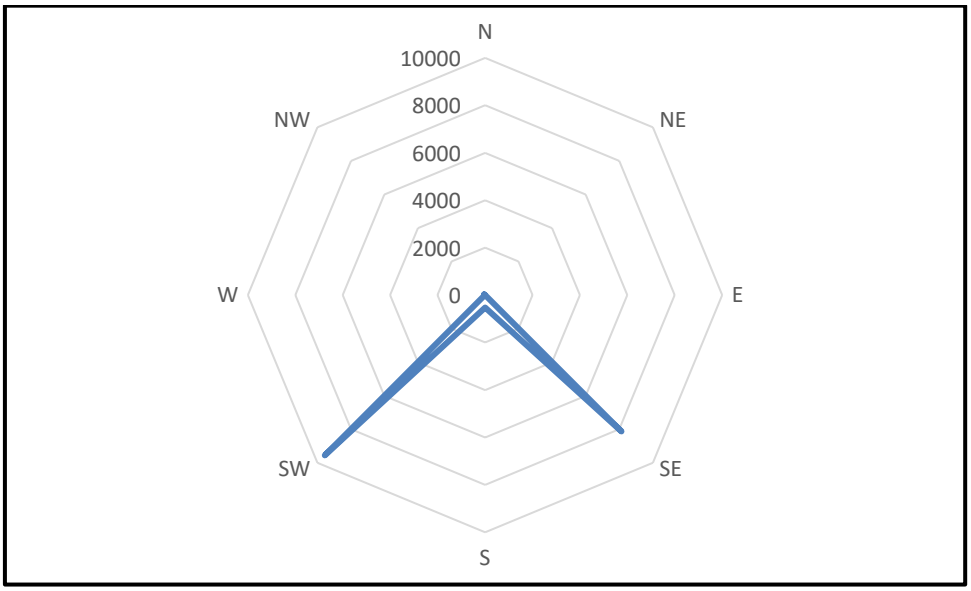


**Figure 32: Flight Direction of Birds Recorded during the autumn survey**

**Birds Behaviour**

As mentioned earlier, documenting the behaviour of birds during in-flight monitoring would normally provide figures that may exceed the total number of the birds recorded. This is because birds could exhibit more than a single behaviour. The largest number of birds showing a single behaviour were 17,524 birds gliding followed by 17,249 in active flight, see table below. Birds showing soaring behaviour were also recorded in high number reaching up to 16,996. These are all high numbers for all behaviour and makes up a high percentage of the total birds recorded which shows that most of the birds flying over were showing a combination of the three main behaviour classes while passing through; soaring, gliding and active flight.

**Table 20: Number of Birds Recorded According to Behaviour**

| Behaviour | Number of Records | No. of Individuals |
|---|---|---|
| Active Flight | 622 | 17,249 |
| Gliding | 579 | 17,524 |
| Soaring | 575 | 16,996 |
| Resting / Landing / Roosting | 27 | 91 |

During autumn 2020 the number of birds recorded resting or landing was very low 0.5% of the 18,319 total birds recorded.

## 10.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the Project activities on birds 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.

### 10.2.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the OHTL Contractor for installation of the transmission line, including the right-of-way are expected to include land clearing activities, levelling, excavation, grading, etc.

Such activities in particular could impact avi-fauna which use the site for foraging and as a breeding ground– to include soaring and non-soaring resident and migratory species. Nevertheless, such construction activities would not result in any major alteration of the site's habitats and thus would not affect the foraging and

feeding area of such species, given that such activities are limited to the relatively small individual footprint of these facilities and where the actual area of disturbance is relatively minimal. In addition, the Project site does not hold any specific or significant value as a feeding habitat for birds. Based on desk-based assessments and a field survey of the project site in spring 2020, the area is considered of low ecological significance due to its natural setting; characterized by being barren and heavily degraded (Refer to section 7.4.1 in the Amunet ESIA for details)

On the other hand, there are additional potential impacts during the construction phase on breeding birds within the site. Construction activities could disturb existing habitats of birds breeding and/or nesting within the Project site. Such potential impacts are created during the construction phase only and thus are of short-term duration. However, such impacts are considered of negative nature and of a low magnitude given that the construction activities' actual area of disturbance is relatively minimal. In addition, given that breeding activities are likely within the Project site, the receiving environmental is determined to be of a medium sensitivity. Given all of the above, such an impact is considered to be minor significance.

Mitigation Measures

The following identifies the construction phase related mitigation measures to be applied by the OHTL Contractor:

- Follow good practice guidelines for pylon and wire design to minimize the risk of collision/electrocution of birds. (see Prinsen *et.al* 2011)
- Implementation of proper housekeeping measures to reduce impacts including:
  - Prohibit hunting of birds at any time and under any condition by construction workers onsite.
  - Implement proper measures, which would prevent attraction of birds to the site. This includes measures such as prohibiting illiterate dumping and ensuring waste streams are disposed appropriately in accordance with the measures identified in "Section 8.2.2".
  - Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level, etc.
- Ensure that all reinstatement of areas around turbines and under OHTL are completed before the operational phase or outside bird migration seasons to avoid interfering with bird fatality monitoring activities.

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 additional studies and mitigation measures to be applied by the OHTL Contractor during the construction phase and which include:

- Visual inspections to ensure mitigation measures are implemented

### 10.2.2 Potential Impacts during the Operation Phase

Transmission lines 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 fall migration seasons) and resident soaring birds in the area. This section provides a qualitative assessment of such impacts. As discussed previously, to determine the significance of an impact it is important to understand the sensitivity of the receiving environment and the magnitude of the impact both of which are discussed in further details below.

*(i) Sensitivity of the Project Site*

The baseline assessments have recorded high numbers of migratory soaring birds over the Project site and its vicinity. Some of those recorded species have an important status on the international or national levels. The baseline assessment concludes that the site is considered within a highly sensitive area in terms of avi-fauna. Additionally, the Project site is considered to be located along an intensive migration route. Taking all of the above into account, the receiving environment is considered of **high sensitivity**.

*(ii) Magnitude of the Impact*

To assess the impact potential on each MSB recorded during the baseline monitoring (spring/autumn 2020) 3 parameters were assessed:

1. The IUCN global conservation status
2. The Birdlife 'Species Vulnerability Index'[2]
3. The maximum seasonal total number of individuals recorded flying at <120m at the project site

Flight activity data from the whole project site rather than just the area immediately surrounding the OHTL was used to assess the impact. This was to the reduce the effect on the assessment of flight activity varying spatially between years.

The three parameters were scored and summed for each species and the final scores partitioned into 'Low', 'Moderate' and 'High' impact potential.

Scoring of individual parameters

| 1. IUCN | | 2. SVI | | 3. Max. seasonal total flying at <120m | |
|---|---|---|---|---|---|
| IUCN global conservation status | Scoring | SVI rating | Scoring | Number of individuals | Scoring |
| LC | 1 | 6 | 1 | <50 | 1 |
| NT | 2 | 7 | 2 | <100 | 2 |
| VU | 3 | 8 | 3 | <500 | 3 |
| EN | 4 | 9 | 4 | <1000 | 4 |
| CR | 5 | 10 | 5 | >1000 | 5 |

Final scoring of the impact potential

| Final Score (sum of parameters 1,2 and 3 | Sensitivity/Impact Rating |
|---|---|
| >10 | High |
| =>5 and <10 | Moderate |
| <5 | Low |

Results of the assessment of sensitivity/impact

[2] The Species Vulnerability Index scores species' vulnerability (on a scale of 1-10) to collisions based on body mass, flight style, behaviour and documented incidents of collision with wind turbines and powerlines.

| Species | Magnitude (Values) | | | Magnitude Rating | | | | |
|---|---|---|---|---|---|---|---|---|
| | IUCN | SVI | Max seasonal total flying at <120m | IUCN | SVI | Max seasonal total flying at <120m | Total score | Impact potential rating |
| Black Stork | LC | 10 | 1631 | 1 | 5 | 5 | 11 | High |
| Egyptian Vulture | EN | 10 | 7 | 4 | 5 | 1 | 10 | High |
| Great White Pelican | LC | 10 | 14451 | 1 | 5 | 5 | 11 | High |
| Steppe Eagle | EN | 9 | 671 | 4 | 4 | 4 | 12 | High |
| White Stork | LC | 10 | 36805 | 1 | 5 | 5 | 11 | High |
| Black Kite | LC | 8 | 1617 | 1 | 3 | 5 | 9 | Medium |
| Booted Eagle | LC | 9 | 26 | 1 | 4 | 1 | 6 | Medium |
| Common Crane | LC | 10 | 0 | 1 | 5 | 1 | 7 | Medium |
| Eastern Imperial Eagle | VU | 9 | 1 | 3 | 4 | 1 | 8 | Medium |
| European Honey Buzzard | LC | 7 | 1704 | 1 | 2 | 5 | 8 | Medium |
| Greater Spotted Eagle | VU | 9 | 1 | 3 | 4 | 1 | 8 | Medium |
| Lesser Spotted Eagle | LC | 9 | 14 | 1 | 4 | 1 | 6 | Medium |
| Montagu's Harrier | LC | 8 | 4 | 1 | 3 | 1 | 5 | Medium |
| Pallid Harrier | NT | 8 | 13 | 2 | 3 | 1 | 6 | Medium |
| Short-toed Snake Eagle | LC | 7 | 88 | 1 | 2 | 2 | 5 | Medium |
| Sooty Falcon | VU | 6 | 1 | 3 | 1 | 1 | 5 | Medium |
| Steppe Buzzard | LC | 7 | 3621 | 1 | 2 | 5 | 8 | Medium |
| Western Marsh Harrier | LC | 8 | 12 | 1 | 3 | 1 | 5 | Medium |
| Common Kestrel | LC | 6 | 51 | 1 | 1 | 2 | 4 | Low |
| Eurasian Sparrowhawk | LC | 6 | 6 | 1 | 1 | 1 | 3 | Low |
| Levant Sparrowhawk | LC | 6 | 0 | 1 | 1 | 1 | 3 | Low |
| Long-legged Buzzard | LC | 7 | 21 | 1 | 2 | 1 | 4 | Low |
| Osprey | LC | 7 | 2 | 1 | 2 | 1 | 4 | Low |
| Red-footed Falcon | LC | 6 | 0 | 1 | 1 | 1 | 3 | Low |

The magnitude of impact assessment indicates that 5 species have the highest potential for impacts compared to the baseline. Of these species 3, White Stork, Black Stork and Great White Pelican are likely to be particularly susceptible to collision with the OHTL.

The potential scale of impact (predicted annual number of collisions) is not formally assessed in this ESIA. However, a preliminary qualitative assessment is possible based on the number of fatalities occurring at existing OHTLs along the flyway within the Gulf of Suez.

Table ? below gives the number of fatalities recorded at the Lekela Wind Project OHTL (LE) (approximately 10 km) and Ras Ghareb/Zaafaran OHTL (RG) (approximately 16km) across 3 seasons (1 spring, 2 autumn) for the 5 species with a 'high' impact potential (Table ? above).

The number of fatalities that might be expected to occur at the Amunet OHTL is calculated as:

((*Amunet OHTL length ÷ (mean OHL length RG & LE)) x Mean number of fatalities RG/LE*
(TBC 2022).

This type of assessment has several assumptions that could affect the result. For example, the number of individuals passing through the project could change between years, weather and climatic conditions could

result in more low altitude flights or more birds landing close to OHTL; the number of individuals flying at 90 degrees to the OHTL wires may vary between years and this may have an influence on the number of fatalities.

It is also relevant that for the spring 2021 season at Lekela appropriate flight diverters were installed on OHTL resulting in zero fatalities. Therefore, the figures in table below are partly a result of implemented mitigation.

Finally, all OHTL collision susceptible species tend to migrate in flocks which increases the probability of single-event multiple collisions

Fatality estimates for the Amunet Wind Farm (see Table 3 - TBC 2022)

| Species | Transmission line fatalities at Lekela (one year's data) | Transmission line fatalities at RasGareb / Zaafaran (only autumn 2021) | Assumed annual transmission line fatalities for Amunet |
|---|---|---|---|
| Black Stork | 0 | 0 | 0 |
| Egyptian Vulture | 0 | 0 | 0 |
| Great White Pelican | 0 | 0 | 0 |
| Steppe Eagle | 0 | 0 | 0 |
| White Stork | 11 | 17 | ~2 |

Summarizing, the fatality rate for these species will vary between years and it is likely that the number of fatalities could be higher than the assessment provided here. The short length of the Amunet OHTL, and the evidence from existing OHTLs indicate that the impacts on these five species are likely to be low, however given the uncertainties around this assessment there is potential for noticeable change to occur and for accepted thresholds to be exceeded therefore the assessment concludes a **medium magnitude of impact.**

Based on the above**, the impact significance for the Amunet OHTL is assessed as Moderate** based on a high receptor sensitivity and a medium magnitude of effect.

Mitigation and Monitoring Measures

The following identifies the mitigation and monitoring measures to be applied throughout the operation phase of the Project.

- Install bird diverters on the OHTL to reduce bird collisions and spikes to deter birds from perching on OHTL structures to reduce electrocution risk during the operation phase of the Project.
- Undertake on-site avifauna fatality monitoring and roosting survey along the powerlines during migration seasons. Both could be carried out in parallel to document any fatalities/injuries for birds while also documenting the use of the pylons as roosting and resting sites. Both surveys should be implemented as part of the Active Turbine Management Plan that is being undertaken for all wind farms in the Gulf of Suez. As part of the roosting survey, flight behaviour and movements should also be documented so that bird movement, including height, direction and behaviour is documented.

Evidence of the effectiveness of OHTL bird diverters indicate that this type of mitigation could reduce fatalities for OHTL collision susceptible species by around 50% (Bernardino *et. al.* 2018). Based on the assessment of possible fatality rates in section 10.2.2, reducing fatalities by this scale would in theory result in a residual annual fatality impact of 1 or 2 individuals for White Stork and no fatalities for Black Stork, Great White Pelican, or the other 2 species with 'high' impact potential (Egyptian Vulture and Steppe Eagle). Accounting for the uncertainty in the estimates provided in 10.1.1, and given the large numbers of White

Storks migrating through this area a more precautionary annual fatality rate would be <5 for this species, and occasional fatalities for the other species with high impact potential, equating to less than 1 individual per year. Following the implementation of these mitigation measures therefore, the significance of the residual impact can be reduced to **not significant**.

## 11 BATS

This section first provides an assessment of baseline conditions within the Project site and surrounds in relation to bats and then assesses the anticipated impacts 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.

### 11.1 Assessment of Baseline Conditions

This section discusses the methodology for the assessment of the baseline conditions in relation to bats and presents the outcomes and results.

#### 11.1.1 Baseline Assessment Methodology

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

*(i) Literature Review*

The baseline assessment of the Project site was based on a literature review, which is discussed in detail below. This was based on previous studies, data, surveys, and records available in published scientific papers, books, and journals on bats of Egypt and the Gulf of Suez.

*(ii) Bats Species status*

The conservation status of the bat species listed from the literature review are based on IUCN's Red List of Threatened Species (IUCN, 2019).

### 11.2 Results

Based on literature, a total of 22 bat species are known to occur in Egypt as a whole. Out of which, at least ten species are known to have a presence within the Project site and its vicinity as part of their distribution range. In addition to those ten species, there are at least four more species that have their distribution range adjacent to the area of Gulf of Suez. All ten species listed in the literature are species of Least Concern according to the IUCN Red List of Threatened Species, see Table 21.

**Table 21: List of Bat Species Recorded in Project Site and Vicinity Based on Literature Review**

| Family | Scientific name | Common name | IUCN Red List of Threatened Species (IUCN, 2019) |
|---|---|---|---|
| Hipposideridae | *Allesia tridens* | Geoffroy's Trident Leaf-nosed Bat | Least Concern |
| Nycteridae | *Nycteris thebaica* | Cape Long-eared Bat | Least Concern |
| Vespertilionidae | *Pipistrellus kuhlii* | Kuhl's Pipistrelle | Least Concern |
| | *Pipistrellus rueppellii* | Ruppel's Pipistrelle | Least Concern |
| | *Nycticeinops schliefenni* | Schlieffen's Bat | Least Concern |
| | *Eptescisu bottae* | Botta's Serotine | Least Concern |
| Rhinopomatidae | *Rhinopoma microphyllum* | Greater Mouse-tailed Bat | Least Concern |
| | *Rhinopoma hardwickii* | Lesser Mouse-tailed Bat | Least Concern |
| | *Rhinopoma cystops* | Egyptian Mouse-tailed Bat | Least Concern |
| Emballonuridae | *Taphozous nudiventris* | Naked-rumped Tomb Bat | Least Concern |

It important to note that bat activity in general is correlated to insect activity. Where insects are present it is likely that bat activity will be present given that they feed on them. Within the site, nocturnal insect activity is expected to be very low, if not absent, due to the arid nature of the Project site and the very low vegetation

coverage (as discussed in Chapter 9). Vegetation coverage is the main source for many insects (e.g. moths) where they breed and feed.

In addition, based on the biodiversity survey undertaken earlier, it does not seem that the Project site supports any roosting sites for bats. Potential areas for roosting could be within the mountainous areas to the west of the Project site.

## 11.3 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the Project activities on bats during the various phases to include planning and construction phase and operation phase. For each impact, a set of management measures (which includes mitigation measures, additional requirements, etc.) and monitoring measures have been identified to eliminate or reduce the impact to acceptable levels.

### 11.3.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the OHTL Contractor for installation of the power lines are expected to include land clearing activities, levelling, excavation, grading, etc. Such activities are limited to the relatively small individual footprints of these facilities and the actual area of disturbance is relatively minimal. Nevertheless, such activities would likely result in the alteration of the site's habitat and thus potentially impacts bats; particularly through loss of hunting habitats for bats as well as roosting sites.

However, as discussed in the baseline section, the natural characteristics of the site do not offer an attractive feeding habitat for bats. In addition, as discussed in the baseline section, no roosting sites for bats were recorded within the Project site.

Given all of the above, the potential impacts on bats created during the construction phase would of a short-term duration as they would result in a permanent change in the natural biodiversity of the site. However, such impacts are considered of negative nature and of a low magnitude given that the site is not used by bats as a feeding ground and no roosting sites were recorded. Based on the assessment of habitat, a biodiversity survey in spring 2020 and literature review (see section 7.4.1/7.6.1 of the Amunet ESIA) bat activity is likely to be limited, the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be not significant. To this extent, no mitigation measures have been identified.

### 11.3.2 Potential Impacts during the Operation Phase

Evidence of OHTL collision and electrocution impacts relates to large fruit bat species that do not occur at the project site (e.g. Chouhan & Shrivastava 2019). with the potential to occur at the project site are small insectivorous species. There is very little evidence that small insectivorous species, with the potential to occur at the project are at risk from OHTL.

The natural characteristics of the Project site being arid with very low vegetation coverage do not offer an attractive feeding habitat for bats. Based on such a rationale, bat activity is expected to be low given the arid nature of the site.

Given all of the above, the potential impacts on bats created during the operation phase would be of a long-term duration. Such impacts are considered of negative nature and of a low magnitude, given that a risk of collision of the species recorded does not entail any significant impacts (species recorded is very common and considered of least concern). In addition, given the very limited bat activity the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be not significant.

Additional Studies/Surveys and Mitigation and Monitoring Measures

Document and report bat fatalities as part of the avi-fauna carcass search programme and report results accordingly.

# 12 ARCHEOLOGY AND CULTURAL HERITAGE

This Chapter first provides an assessment of baseline conditions within the Project site and surrounds in relation to archaeology and cultural heritage and then assesses the anticipated impacts 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.

## 12.1 Assessment of Baseline Conditions

The section below presents the methodology that was undertaken for assessment of baseline conditions in relation to archaeology and cultural heritage and the outcomes and results.

### 12.1.1 Methodology for Assessment

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 OHTL route as well as 500m buffer on both sites. The surface area was walked by the expert in order to inspect the entire ground surface.

### 12.1.2 Results

Based on the site survey undertaken, no archaeology and cultural heritage sites were identified or recorded within the OHTL route as well as the 500m buffer area.

## 12.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the Project activities on archaeology and cultural heritage during the various phases to include planning and construction 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. It is important to note that there are no anticipated impacts related to the operational phase of the Project.

### 12.2.1 Potential Impacts during the Construction Phase

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 in the baseline, 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.

Given all of the above, the potential impacts on archaeology created during the construction period would of a short-term duration as they are limited to the construction phase only. The impacts will be of a negative nature, and medium magnitude as if improperly managed as it is possible once a site is damaged or disturbed it cannot be restored. In addition, due to the lack of archaeological remains in the Project area, the receiving

environment is considered of low sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the 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.

## 13 AIR QUALITY & NOISE

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

### 13.1 Assessment of Baseline Conditions

Based on the survey undertaken for the Project area as discussed earlier, it is concluded that there are no key nearby sensitive receptors in relation to the Project site. In addition, as discussed in the section below, the Project's nature will not result in any key air quality or noise emissions. Therefore, no air quality and noise monitoring program has been undertaken.

### 13.2 Assessment of Potential Impacts

This section identifies and assesses the anticipated impacts from the Project activities on air quality and noise during the construction 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.

#### 13.2.1 Potential Impacts during the Construction Phase

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 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.

The above impacts are anticipated to be temporary and of short-term nature as they are limited to the construction period only. Such impacts are of a negative nature, and will be noticeable and therefore of medium magnitude. However, the impacts will be dispersed and are reversible as air quality would revert back to baseline conditions after construction works is completed and thus the receiving environment is considered of low sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the 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.

Following the implementation of these mitigation measures, the significance of the residual impact is categorised 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 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 minimise the impact and prevent it from occurring again.

# 14 INFRASTRUCTURE AND UTILITIES

This Chapter first provides an assessment of baseline conditions within the Project site and surrounds in relation to infrastructure and utilities and then assesses the anticipated impacts 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.

## 14.1 Assessment of Baseline Conditions

The section below presents the methodology that was undertaken for assessment of baseline conditions in relation to infrastructure and utilities and the outcomes and results.

### 14.1.1 Methodology for Assessment

A field survey was undertaken with the objective of identifying any infrastructure and utility elements within the Project site. The survey was undertaken to cover the entire OHTL route as well as 500m buffer on both sites.

### 14.1.2 Road Networks

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

- The access to the Project area is via the Suez-Hurghada road, a four-lane road, runs at distances of 2.8 km to the eastern boundary of the OHTL route. The Suez-Hurghada Road is connected with Ras Ghareb-El Shaikh Fadel road, an asphalt road with two lanes, running at distances of at least 14 km south of the OHTL route. This road has very little traffic load compared to its capacity and it is fit for heavy transports.
- The Project site itself can be reached via asphalt roads owned by West Ras Bakr Petroleum Company and Petro Dara Company starting from the Suez-Hurghada Road north of Ras Ghareb and by single tracks already built in the context of wind farm development. The roads have sufficient strength and width.
- Unpaved tracks cross the Project area and these can be accessed via off-road tracks and by the use of 4-wheel drive cars.

The following table provides description for the closest existing roads.

**Table 22: Description of the Existing Roads in the Project Area**

| Name of Road | Distance to the site (km) | Direction | Number of lanes/directions | Status |
|---|---|---|---|---|
| Zaafarana- Hurghada Road | 2.8 km | East | 2 | In operation |
| External road 1 | 0.50km | East | 1 | In operation |
| External road 2 | 0.50km | West | 1 | In operation |
| Internal road | 0 km | South, passes through farm areas | 1 | In operation |

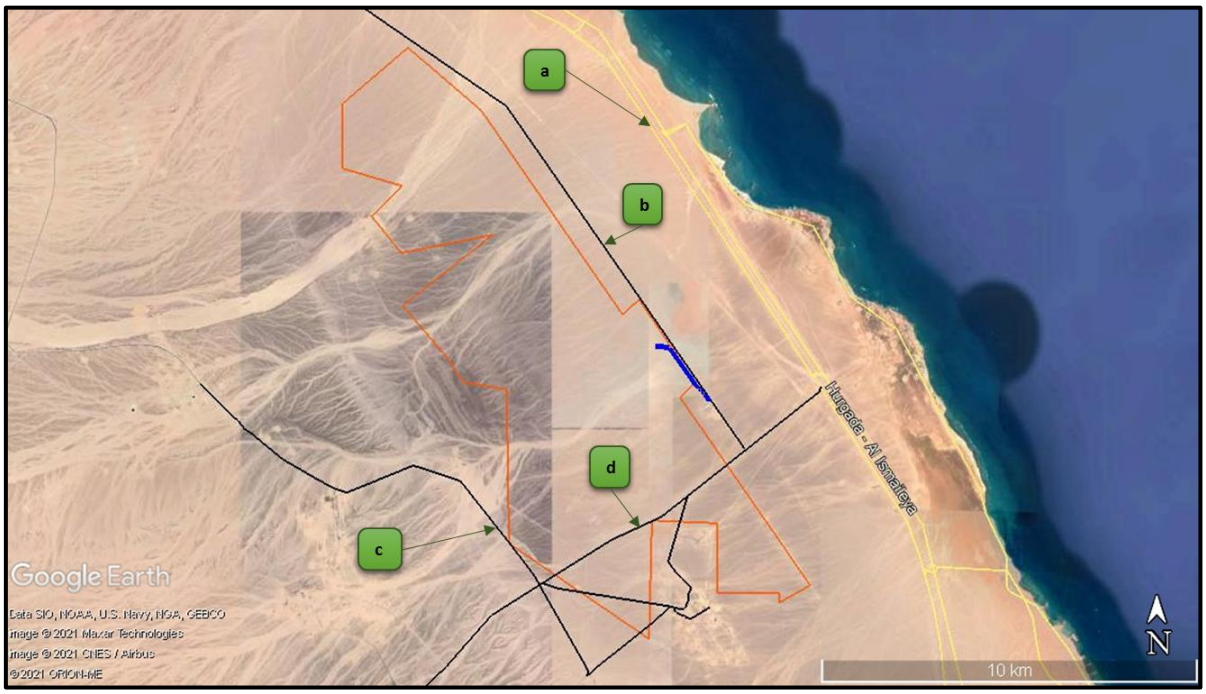


**Figure 33: Routes of the Existing Roads in the Project Area**

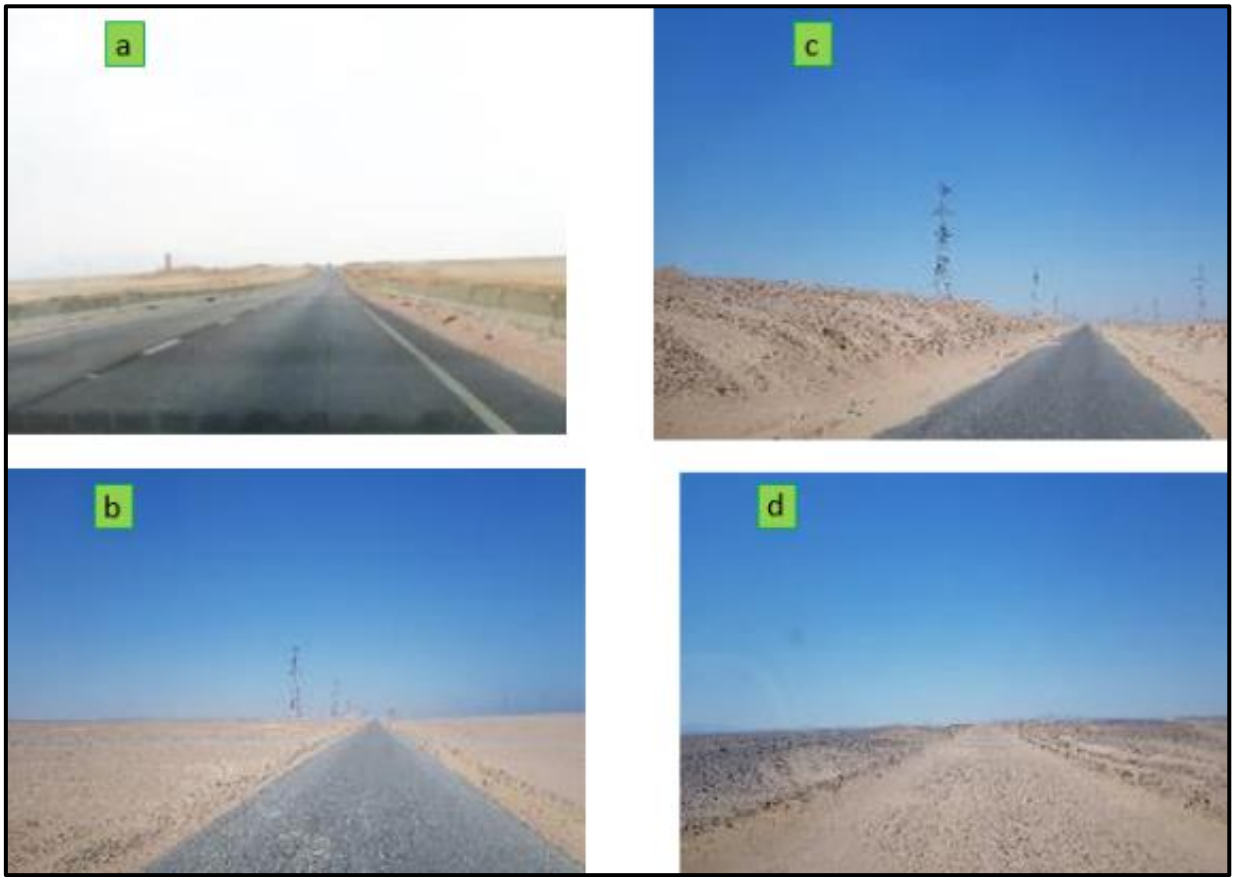


**Figure 34: A) Zaafarana-Hurghada Road, B) External Road 1, C) External Road 2 and D) Internal Road**

In addition to the above, a dirt and unpaved road crosses the OHTL route. The dirt route is also most likely used by the petroleum activities in the area. The route of petroleum the dirt road is presented in the figure below.

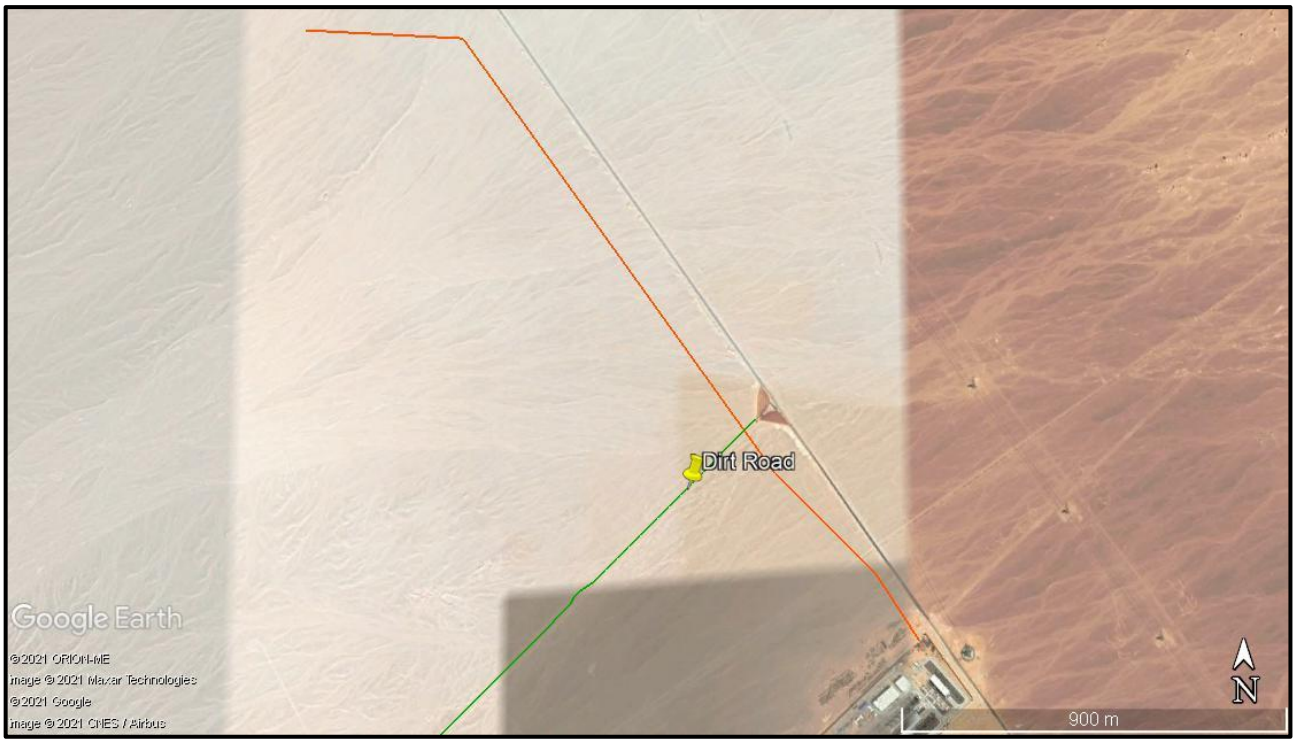


**Figure 35: Dirt Route within the OHTL**

**Figure 36: Dirt Road**

### 14.1.3 Electricity Lines and Substations

Based on the survey undertaken on the Project site it was indicated that there is several other OHTL lines with the closest pylon running around 35m to the east of the proposed OHTL for the Amunet Wind Farm (noted in blue in the figure below) and another located 400m from the proposed OHTL (noted in brown in the figure below). The routes for the nearby OHTL lines are provided in the figure below along with a photo.

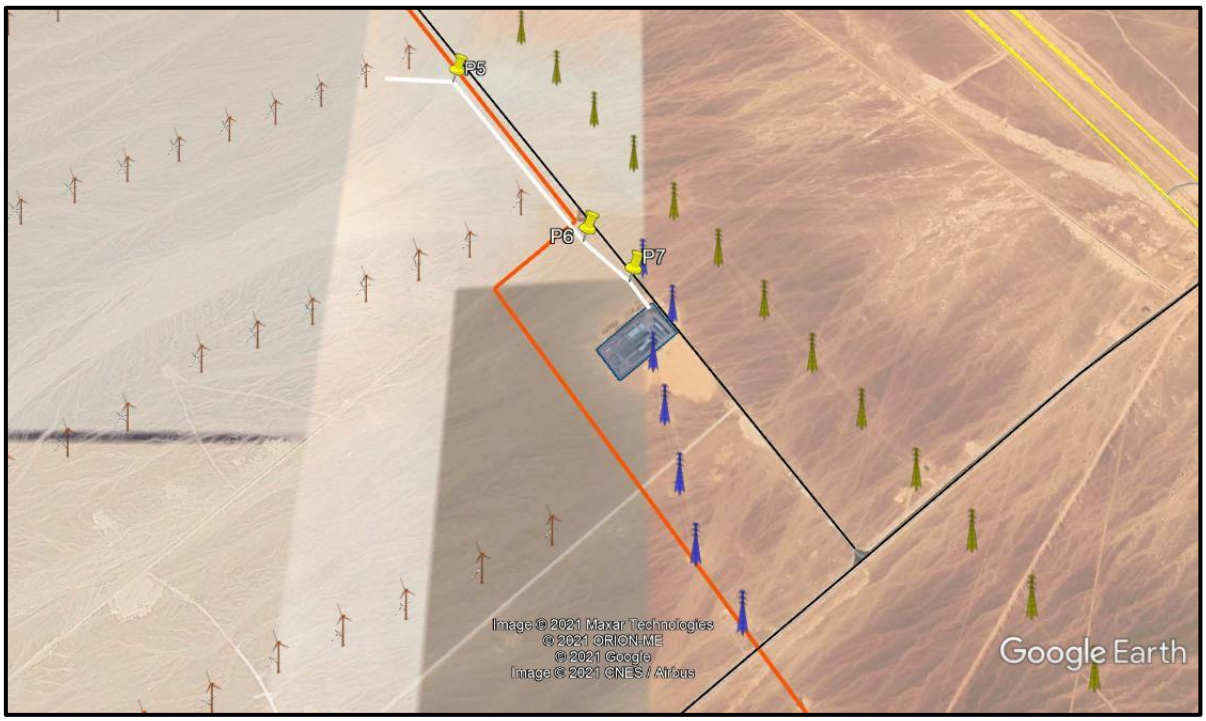


**Figure 37: Route of Nearby OHTL**

**Figure 38: Base of the constructed pylons of the main OHTL in the surveyed route**

In addition, as discussed earlier, the Amunet OHTL will connect with an existing 220kV substation which is connected to the National Electricity Grid as noted in the figure below. Near the substation there is currently a backyard that includes some temporary waste due to dismantling of some equipment during the substation construction. This is expected to be removed and cleared accordingly.

**Figure 39: The Amunet Project Main Power Sub-station**

### 14.1.4 Other

Based on the site survey undertaken for the OHTL and 500m buffer area no additional infrastructure and utility elements were recorded. This includes pipelines, petroleum activities, lines, or other.

## 14.2 Assessment of Potential Impacts during Planning and Construction Phase

Inappropriate design of the OHTL could affect the infrastructure and utility elements noted onsite to include the road and the electricity networks. This could include for example inappropriate vertical height of the transmission line from roads which could be a public safety concern for vehicles on the road, or inappropriate horizontal height of the transmission lines from other nearby OHTL lines which could also entail public safety concerns.

Apart from the above, as noted in the baseline sections there are no existing infrastructure and utility elements within the OHTL route.

Taking all of the above into account, the anticipated impacts on infrastructure and utility road networks are considered of long-term duration. 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. Given the above impact is considered of moderate significance.

Mitigation Measures

The following identified the mitigation measures that should be undertaken by EETC in particular:

- Formal discussion should be undertaken with General Petroleum Company to determine if there are any specific requirements that should be considered as part of the OHTL route design from the road networks utilized by the company in the area (e.g. appropriate horizontal distance requirements from the road network).
- As discussed earlier, the Electricity Law 87/2018 identifies a 25m buffer distances as Right of Way (ROW) zone for 220kV lines, that should be free from any obstacles at all times such as buildings, trees, gas pipelines, cables, water pipelines (unless agreed with EETC taking into account health and safety requirements). As noted earlier, there is another OHTL which runs around 35m from the proposed Amunet OHTL line. EETC must confirm that developing a new proposed OHTL (which will also require a 25m buffer RoW) does not affect the RoW of the existing OHTL.

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 EETC during the planning phase:

- Submission of proof coordination with the General Petroleum Company
- Submission of formal confirmation by EETC on establishing the proposed OHTL within existing OHTL developments in the area

# 15 OCCUPATIONAL HEALTH AND SAFETY

This Chapter assesses 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.

## 15.1 Assessment of Baseline Conditions

Assessment of baseline conditions related to occupational health and safety is considered irrelevant.

## 15.2 Assessment of Potential Impacts during Construction and Operation Phase

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.

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. OHTL construction and operation activities are associated with an inherently high occupational health and safety risks some of which have considerable consequences (fatality through fall from heights) – but such impacts are generally controlled through the implementation of general best practices; to this extent such impacts are considered of medium magnitude and high sensitivity. Given the above such an impact is considered of moderate significance.

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. 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 OHTL Contractor and EETC 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; and
- 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.

# 16 COMMUNITY HEALTH, SAFETY AND SECURITY

This Chapter assesses the anticipated impacts from the Project throughout its various phases on community health, safety and security. 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.

## 16.1 Assessment of Baseline Conditions

As discussed earlier, the closest community settlements are considered to be located at a distance from the Project site. This includes Ras Gharib (located 9km to the southeast) and Zaafarana (65km to the north).

**Figure 40: Closest Community Settlements to the Project Site**

## 16.2 Assessment of Potential Impacts

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.

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).

### 16.2.1 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).

Such impacts are considered of long-term duration throughout the Project operation phase, of a negative nature, and are expected to be of medium magnitude and high sensitivity given that it entails potential public safety concerns which in extreme cases they could entail permanent impacts (e.g. death or permanent disability). Given the above, such an impact is considered of moderate significance.

Mitigation Measures

The following presents the mitigation measures that are to be implemented by EETC during the operation phase of the Project and which include:

- Post informative signs on the transmission towers about public safety hazards and emergency contact information in both Arabic and English language. Signs, especially warnings need to be pictorial as well as written to ensure they are understood by those unable to read

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to *not significant.*

Monitoring and Reporting Requirements

The following presents the monitoring and reporting requirements that are to be implemented by EETC during the operation phase of the Project and which include:

- Inspections and visual monitoring to ensure above measures are in place.

### 16.2.2 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 23: 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 |

The National Grid (an international electricity and gas company based in the UK and north-eastern US) provides typical electric and magnetic field limits for various voltage lines (132kV, 275kV, and other). The values indicate that electric and magnetic fields are within the ICNIRP limits and even reach negligible amounts at around 50m – 100m from the OHTL (source: http://www.emfs.info/sources/overhead/specific/132-kv/)

In addition, 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.

Taking the above into account, as noted earlier in "Chapter 7", the Project area and 500m buffer on both sides is completely vacant and no activities or receptors were recorded (e.g. permanent settlements or similar) which could be impacted by EMF.

Such impacts are considered of long-term duration throughout the Project operation phase, of a negative nature, and are expected to be of low magnitude and low sensitivity given the distance from the OHTL to the closest village boundaries. Given the above such an impact is considered of not significant.

Mitigation Measures

There are no mitigation or monitoring measures to be considered.

### 16.2.3 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.

Noise impacts from the OHTL are expected to be negligible. As noted earlier in "Chapter 7", the Project area and 500m buffer on both sides is completely vacant and no activities or receptors were recorded (e.g. permanent settlements or similar) which could be impacted by EMF.

Such impacts are considered of long-term duration throughout the Project operation phase, of a negative nature, and are expected to be of low magnitude and low sensitivity given the distance from the OHTL to the closest village boundaries. Given the above, such an impact is considered of not significant.

Mitigation Measures

There are no mitigation or monitoring measures to be considered.

# 17 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

## 17.1 Institutional Framework and Procedural Arrangement for ESMP Implementation

Generally, two main pillars govern the successful implementation of any Environmental and Social Management Plan (ESMP):

- Proper identification of roles and responsibilities for the entities involved; and
- Effective control of the process.

All management practices are interlinked, and this section describes how these two pillar criteria could be fulfilled, which in turn helps ensure that the overall objectives of the ESMP are met.

Defining roles and responsibilities of the involved entities in any ESMP identifies where and when each entity should be engaged, their degree of involvement, and the tasks expected of the entity. This in turn eliminates any overlap of jurisdiction or authority and ensures proper communication and effective management of ESMP components. Control processes mainly include training and awareness for entities involved and control of non-conformances that might occur throughout the process.

The aim of this section is to ensure that ESMP recommendations are considered during the construction and operation, as well as examining how environmental resources are influenced. Table 24 shows a matrix of the overall proposed institutional and procedural arrangements to be implemented upon putting the ESMP into effect. Meanwhile, Table 25 identifies the specific roles and responsibilities of each of the concerned entities.

A self-compliance methodology is encouraged, the party undertaking the responsibility for causative action should ensure that the appropriate measures articulated in the ESMP are enforced – the underlying implication points towards the need of appointing an HSE Officer by the OHTL Contractor throughout the Construction Phase, and though the Operational Phase is not majorly labour intensive except for maintenance procedures, the mitigation/monitoring measures can be supervised by a competent staff within the Project Developer Team (i.e. EETC).

Furthermore, it is recommended that the Developer (i.e. Amunet) review and report ESMP practices and undertake an auditing exercise to assess and reinforce requirements of the ESMP are met by the OHTL Contactor (mainly during the construction phase). This can be conducted by appointing an HSE Officer as part of the Developer team or via a third-party Employer representative. The auditing exercise can be conducted on regular basis (e.g. monthly) and at maintenance instances. Most of the responsibilities within the ESMP are for EETC and/or the OHTL Contractor.

Finally, the Regulator (being EEAA), will be responsible for undertaking compliance monitoring to ensure that the responsible entity is adhering to the ESMP requirements.

**Table 24: Overall proposed institutional and procedural arrangement for ESMP Implementation**

| Issue | Self-Compliance | Review/Checks | Compliance Monitoring/ Inspection by Regulator |
|---|---|---|---|
| **Construction Phase** | | | |
| Compliance with ESMP Requirements | OHTL Contractor – HSE Officer | EETC | EEAA |
| Compliance with environmental legislations | OHTL Contractor – HSE Officer | EETC | EEAA |
| **Operation Phase** | | | |
| Compliance with ESMP Requirements | Project Operator – Project Staff Member | N/A | EEAA |
| Compliance with environmental legislations | Project Operator - Project Staff Member | N/A | EEAA |

**Table 25: Roles and Responsibilities of Entities Involved in ESMP**

| Designation | Entity | Project Role | Environmental and Social Responsibilities |
|---|---|---|---|
| Project (OHTL) Developer | EETC | Developer of the OHTL | ▪ Selection of OHTL Contractor<br>▪ Undertake O&M activities for the Project<br>▪ Check performance of the OHTL Contractor's work onsite. Theoretically, this should include ensuring action items under the ESMP are implemented. |
| 500 MW Wind Farm Owner and Developer | Amunet | Owner and Developer of the Wind Farm | ▪ Review and report ESMP practices and undertake an auditing exercise to assess and reinforce requirements of the ESMP are met by the OHTL Contactor<br>▪ The auditing exercise can be conducted on regular basis (e.g. monthly) and at maintenance instances. |
| OHTL Contractor | TBD | Undertake detailed design and construction of the project | ▪ Appoint a competent HSE officer responsible for implementing the ESMP.<br>▪ Implement mitigation and monitoring requirements as detailed in the ESMP. |
| Environmental Regulator | EEAA | Granting environmental clearance to the Project | ▪ Undertake compliance monitoring |

## 17.2 Training and Awareness Raising

Effective and efficient implementation of any ESMP requires that all personnel involved in the Project (construction/operation staff across all levels) understand its objectives and requirements. A proper training and awareness program ensure that applying mitigation measures is more of a sense of responsibility rather than an enforcing protocol.

Training and awareness is an ongoing process, but most importantly must take place before the commencement of any activity in any phase of the Project. EETC and the OHTL Contractor are responsible, each for his own staff, for conducting inductions, training requirements and awareness raising which should include at a minimum the following:

- Ensure that staff understand all requirements, measures, and protocols stipulated within the ESMP;
- Ensuring that all personnel engaged in activities that may have an impact on the environment are competent to carry out their duties, or, where necessary, arrange for suitable training to be undertaken;
- Cultural change towards environmental perception;
- Waste, wastewater, and hazardous waste management practices as identified throughout the ESMP;
- Occupational health and safety; and
- Emergency response procedures.

## 17.3 Compilation of Environmental and Social Management Plan

The tables below present the ESMP for the planning and construction and operation phase respectively and which include the following:

- The environmental attribute (e.g. Soil and Groundwater) that is likely to be impacted;
- A summary of the potential impact and/or likely issue;
- The identified management measures that aim to eliminate and/or reduce the potential impact to acceptable levels. Management measures include mitigation actions, further requirements, additional studies, and compensation measures;
- Monitoring actions to ensure that the identified mitigation measures are implemented. Monitoring actions include: inspections, review of reports/plans, reporting, etc.;
- The frequency for implementing the monitoring actions, which include: once, continuously throughout the construction/operation period (depending on the mitigation measure identified this could include daily, weekly, or monthly), or upon occurrence of a certain issue; and
- The responsible entity for implementing the mitigation measures and monitoring actions identified

**Table 26: ESMP for the Planning and Construction Phase**

| Environmental Attribute | Potential Impact | Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.) | Type of Action | Monitoring Action | Parameters to be monitored / location | Frequency | Responsible Entity |
|---|---|---|---|---|---|---|---|
| Landscape and Visual | Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery. | Ensure proper general housekeeping and personnel management measures are implemented which could include: (i) ensure the construction site is left in an orderly state at the end of each work day; (ii) to the greatest extent possible construction machinery, equipment, and vehicles that are not in use should be removed in a timely manner and kept in locations to reduce visual impacts to the area. | Mitigation | Visual inspections | At construction active areas | Daily / Weekly | OHTL Contractor |
| Geology, Hydrology and hydrogeology | Solid waste management | Coordinate with Ras Gharib City Council for the collection of solid waste from the site to the municipal approved dumpsite | Mitigation | Submit contract | Not applicable | Once before commencement of construction | OHTL Contractor |
| | | Prohibit fly-dumping of any solid waste to the land | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste | Mitigation | Visual inspections | At construction active areas | Once before commencement of construction | |
| | | Distribute a sufficient number of properly contained containers clearly marked as "Construction Waste" for the dumping and disposal of construction waste | Mitigation | Visual inspections | At construction active areas | Once before commencement of construction | |
| | | Implement proper housekeeping practices on the construction site at all times | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill | Mitigation | Submit manifests | Not applicable | Throughout construction period | |
| | Wastewater management | Coordinate with Ras Gharib Water Company to hire a private contractor for the collection of wastewater from the site to the closest WWTP | Mitigation | Submit contract | Not applicable | Once before commencement of construction | OHTL Contractor |
| | | Prohibit illegal disposal of wastewater to the land | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Ensure that constructed septic tanks during construction are well contained and impermeable to prevent leakage of wastewater into soil | Mitigation | Visual inspections | At applicable area | Once before commencement of construction | |
| | | Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing | Mitigation | Visual inspection | At applicable area | Daily/weekly | |
| | | Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the WWTP | Mitigation | Submit manifests | Not applicable | Throughout construction period | |
| | Hazardous Waste Management | Hire approved private contractor for the collection of hazardous waste from the site to the approved hazardous waste disposal facilities | Mitigation | Submit contract | Not applicable | Once before commencement of construction | OHTL Contractor |
| | | Ensure that hazardous waste is disposed in a dedicated area that is enclosed, of hard surface, with proper signage and suitable containers as per hazardous waste classifications and that they are labelled for each type of hazardous waste | Mitigation | Visual inspections | At applicable area | Once before commencement of construction | |
| | | Ensure hazardous waste storage area is equipped with spill kit, fire extinguisher and anti-spillage trays and a hazardous waste inventory is available | Mitigation | Visual inspections | At applicable area | Daily / weekly | |
| | | Prohibit illegal disposal of hazardous waste to the land | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Possibly contaminated water (e.g. runoff from paved areas) must be drained into appropriate facilities (such as sumps and pits). Contaminated drainage must be orderly disposed of as hazardous waste | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the hazardous waste disposal facilities | Mitigation | Submit manifests | Not applicable | Throughout construction period | |

| Environmental Attribute | Potential Impact | Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.) | Type of Action | Monitoring Action | Parameters to be monitored / location | Frequency | Responsible Entity |
|---|---|---|---|---|---|---|---|
| | Hazardous material management | Ensure that hazardous materials are stored in an area that is of hard impermeable surface, flame-proof, accessible to authorized personnel only, locked when not in use, and prevents incompatible materials from coming in contact with one another | Mitigation | Visual inspections | At applicable area | Once before commencement of construction | OHTL Contractor |
| | | Maintain a register of all hazardous materials used and accompanying MSDS must present at all times. Spilled material should be tracked and accounted for | Mitigation | Visual inspections | At applicable area | Daily / weekly | |
| | | Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.) | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refuelling) must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Ensure that a minimum of 1,000 litters of general-purpose spill absorbent is available at hazardous material storage facility. | Mitigation | Visual inspections | At applicable area | Daily / weekly | |
| | | If spillage on soil occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste | Mitigation | Visual inspection | At applicable area | Upon occurrence | |
| | Erosion and runoff management | Avoid executing excavation works under aggressive weather conditions | Mitigation | Visual inspections | At construction active areas | Upon occurrence | OHTL Contractor |
| | | Place clear markers indicating stockpiling area of excavated materials to restrict equipment and personnel movement, thus limiting the physical disturbance to land and soils in adjacent areas | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Erect erosion control barriers around work site during site preparation and construction to prevent silt runoff where applicable | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Return surfaces disturbed during construction to their original (or better) condition to the greatest extent possible | Mitigation | Visual inspections | At construction active areas | Upon occurrence | |
| Biodiversity | Damage to the biodiversity of the site | Should as part of the construction activities the Egyptian Dabb Lizard Uromastyx aegyptia or burrows of such species be identified, relocation activities must be undertaken by a qualified ecologist. | Mitigation | Submission of report | At construction active areas | Upon occurrence | OHTL Contractor |
| | | Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping | Mitigation | Visual inspections | Not applicable | Upon occurrence | OHTL Contractor |
| Avi-fauna | Disturbance to avi-fauna and avi-fauna habitats | Implementation of proper housekeeping measures | Mitigation | Visual inspections | Not applicable | Upon occurrence | OHTL Contractor |
| Archaeology and Cultural Heritage | Improper management of construction activities could disturb/damage archaeological remains which could be buried in the ground (if any). | If potential archaeological remains in the ground are discovered, appropriate measures for such chance find procedures are implemented. Those mainly require that construction activities be halted and the area fenced along with proper signage, while immediately notifying the Ministry of Tourism and Antiquities/Red Sea and Suez Antiquities Inspection Office. No additional work will be allowed before the Ministry/Inspection Office assesses the found potential archaeological site and grants a clearance to resume the work. Construction activities can continue at other parts of the site if no potential archaeological remains were found. If found, same procedures above apply | Mitigation | Visual inspections and submittal of chance find report | At applicable area | Upon occurrence | OHTL Contractor |
| Air Quality and Noise | Construction activities will likely result in an increased level of dust, particulate matter and pollutant emissions as well as noise which in turn will directly impact ambient air quality and noise levels. | If dust or pollutant emissions were found to be excessive due to construction activities, the source of such emissions should be identified and adequate control measures must be implemented (as identified below) | Mitigation | Visual inspections | At construction active areas and other receptors to include nearby road networks | Upon occurrence | OHTL Contractor |
| | | Comply with the Occupational Safety and Health Administration (OSHA) requirements and the Egyptian Codes to ensure that for activities associated with high dust and noise levels, workers are equipped with proper Personal Protective Equipment | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Apply basic dust control and suppression measures which could include: (i) regular watering of roads for dust suppression; (ii) proper planning of dust causing activities to take place simultaneously in order to reduce the dust incidents over the construction period; (iii) proper management of stockpiles and excavated material (e.g. watering, containment, covering, bundling); (iv) proper covering of trucks transporting aggregates and fine materials (e.g. through the use of tarpaulin); and (v) adhering to a speed limit of 15km/h for trucks on the construction site. | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| | | Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issue to avoid unnecessary pollutant and noise emissions | Mitigation | Submission of maintenance program | Not applicable | Monthly | |

| Environmental Attribute | Potential Impact | Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.) | Type of Action | Monitoring Action | Parameters to be monitored / location | Frequency | Responsible Entity |
|---|---|---|---|---|---|---|---|
| | | If noise levels were found to be excessive from construction activities, the source of such excessive noise levels should be identified and adequate control measures must be implemented | Mitigation | Visual inspections | At construction active areas and other receptors to include nearby road networks | Upon occurrence | |
| | | Apply adequate general noise suppressing measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level, etc. | Mitigation | Visual inspections | At construction active areas | Daily / weekly | |
| Infrastructure and Utilities | Inappropriate design of the OHTL could affect the infrastructure and utility elements noted onsite to include the road and the electricity networks. | Establish coordination with the General Petroleum Company to discuss the OHTL route design and identify appropriate horizontal distance requirements from the road networks to ensure health and safety measures are maintained. | Additional requirement | Submit formal communication letter (or similar) with relevant entity | Not applicable | Once before commencement of construction | EETC |
| | | There is another OHTL which runs around 35m from the proposed Amunet OHTL line. EETC must confirm that developing a new proposed OHTL (which will also require a 25m buffer RoW) does not affect the RoW of the existing OHTL. | Additional requirement | Submission of confirmation | Not applicable | Once before commencement of construction | EETC |
| Occupational Health and Safety | There will be some generic risks to workers health and safety from working on construction sites, as it increases the risk of injury or death due to accidents. | Develop and submit an Occupational Health and Safety Plan (OHSP) that is project and site specific to ensure the health and safety of all personnel in order to concur and maintain a smooth and proper progress of work at the site and prevent accident which may injure personnel or damage property. | Additional study | Submit OHSP plan | Not applicable | Once before commencement of construction | OHTL Contractor |

**Table 27: ESMP for the Operation Phase**

| Environmental Attribute | Potential Impact | Management Action (mitigations, additional requirements, additional studies, compensation measures, etc.) | Type of Action | Monitoring Action | Parameters to be monitored / location | Frequency | Responsible Entity |
|---|---|---|---|---|---|---|---|
| Avi-Fauna | Bird fatalities due to collision / electrocution | Install spikes and bird diverters along the OHTL route | Mitigation | Visual inspections | Fatalities as part of carcass search program implemented during the ATMP | Once before commencement of operation | OHTL Contractor |
| | | Undertake fatality monitoring for birds/bats as part of carcass search program implemented during the ATMP | Monitoring | Submit monitoring protocol | Fatalities | Weekly during migration seasons by commencement of operation | OHTL Contractor |
| Bats | Bat fatalities die to collision | Undertake fatality monitoring for birds/bats as part of carcass search program implemented during the ATMP | Monitoring | Submit monitoring protocol | Fatalities | In parallel with bird fatality survey | OHTL Contractor |
| Community Health and Safety | Public access of unauthorized personnel to the various Project components. | Post informative signs on the transmission towers about public safety hazards and emergency contact information. | Mitigation | Visual inspections | transmission towers | Once before commencement of operation | EETC |
| Occupational Health and Safety | There will be some generic risks to workers health and safety during the repair and maintenance activities of the Project. | Develop and submit an Occupational Health and Safety Plan (OHSP) to ensure the health and safety of all personnel in order to concur and maintain a smooth and proper progress of work at the site and prevent accident which may injure personnel or damage property. | Additional study | Submit OHSP plan | Not applicable | Once before commencement of operation | EETC |

## 18 REFERENCES


- Allinson, T. (2017). Introducing a new avian sensitivity mapping tool to support the siting of wind farms and power lines in the Middle East and Northeast Africa. In J. Köppel (Ed.), Wind energy and wildlife interactions: presentations from the CWW2015 conference. Springer International Publishing.

- Bernardino, J., Martins, R. C., Bispo, R., & Moreira, F. (2019). Re-assessing the effectiveness of wire-marking to mitigate bird collisions with power lines: A meta-analysis and guidelines for field studies. Journal of Environmental Management, 252, 109651. https://doi.org/https://doi.org/10.1016/j.jenvman.2019.109651

- Chouhan, R., & Shrivastava, S. (2019). Observation on Electrocution of Indian Flying Fox (Pteropus Giganteus) in Ramganjmandi, Kota, (Rajasthan) and their Conservation Strategies. International Journal of Research in Engineering, Science and Management, 2(5), 648-649.

- International Finance Corporation (IFC), Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution, April 30, 2007

- International Renewable Energy Agency (IRENA), Renewable Energy Outlook: Egypt, 2018

- National Institute of Environmental Health Sciences (NIEHS), Electric and Magnetic Fields Associated with the Use of Electric Power, 2012

- Prinsen, H. A. M., Smallie, J. J., Boere, G. C., & Píres, N. (2012). Guidelines on how to avoid or mitigate impact of electricity power grids on migratory birds in the African-Eurasian region [AEWA Conservation Guidelines No. 14, CMS Technical Series No. 29, AEWA Technical Series No. 50, CMS Raptors MOU Technical Series No. 3].

- RCREEE, ECO Consult and Plus Green, Environmental and Social Impact Assessment (ESIA) for Amunet Wind Power Plant 500MW at the Gulf of Suez, 2021

- TBC (2022). AMEA Power Amunet Wind Farm. Draft Biodiversity Action Plan and Offset Feasibility Study. Cambridge, UK: The Biodiversity Consultancy.