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Appendix E (2):

Avifauna Preconstruction Monitoring Assessment

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Scoping Report:

Avifaunal Preconstruction Monitoring Assessment for the proposed Botterblom Wind Energy Facility located North of Loeriesfontein, Northern Cape

July 2021

APPLICANT

FE BOTTERBLOM (PTY) LTD

Enviro-Insight CC

Sam Laurence *(Pr. Sci. Nat.)*

Luke Verburgt (*Pr. Sci. Nat.*)

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Professional Team

The technical team responsible for the pre-construction monitoring surveys and Impact Assessment reporting is presented.

Team member	Qualification	Role on project
Samuel Laurence	*Pr. Sci. Nat.* No. 400450/13	Lead Avifaunal Specialist Field Observer Data analysis Report compilation
Jason Tarr	*Pr. Sci. Nat.* No. 400221/09	Field Observer
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Specialist Declaration

I, Sam Laurence *Pr. Sci. Nat.,* declare that the work presented in this report is our own and has not been influenced in any way by the developer or the EAP. At no point has the developer asked us as specialists to manipulate the results in order to make it more favourable for the proposed development. We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP) and the EIA Regulations (2014, as amended). We have the necessary qualifications and expertise (*Pr. Sci. Nat. Zoological Science)* in conducting this specialist report.

Sam Laurence *Pr. Sci. Nat.*

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY AND ACRONYMS

BA	Basic Assessment
BARESG	Bird and Renewable Energy Specialist Group
CITES	Convention on International Trade in Endangered Species
Cumulative impact	Impacts on a species, ecosystem or resource as a result of the sum of actions in the past, present and foreseeable future, from multiple WEFs or a WEF in combination with other developments.
CWAC	Coordinated Waterbird Counts, a programme of bird censuses at a number of South African wetlands. See http://cwac.adu.org.za for more information.
ESKOM	Electricity Supply Commission (ESCOM), established in 1923.
Environmental Impact Assessment (EIA)	The process of identifying environmental impacts due to activities and assessing and reporting these impacts
GIS	Geographic Information Systems
GN	General Notice
IBA	Important Bird and Biodiversity Area. Part of a global network of sites that are critical for the long-term viability of bird populations. Now known as Important Bird and Biodiversity Areas.
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature.
Rotor swept area	The area where birds are at risk of colliding with turbine blades. The area of the circle or volume of the sphere swept by the turbine blades.
NEPA	National Freshwater Ecosystem Priority Areas
PAOI	Project Area of Influence
Preconstruction Phase	The period prior to the construction of a wind energy facility
Priority species	Threatened or rare birds (in particular those unique to the region and especially those which are possibly susceptible to wind-energy impacts as defined by Ralston Paton *et al*. 2017), which occur in the given development area at relatively high densities or have high levels of activity in the area. These species should be the primary (but not the sole) focus of all subsequent monitoring and assessment.
SABAP	The Southern African Bird Atlas Project. A project in which data on bird distribution and relative abundance are collected by volunteers. There have been two SABAP projects; i.e. SABAP1 (completed in 1991) and SABAP2 (started in 2007 and on-going). See http://sabap2.adu.org.za for more information.

SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SEA	Strategic Environmental Assessment
STC	Strategic Transmission Corridors
TOPS	Threatened or Protected Species Regulations
REDZ	Renewable Energy Development Zones
VP	Vantage point
WEF	Wind energy facility. A power plant that uses wind to generate electricity, also colloquially known as a wind farm

1 INTRODUCTION AND PROJECT BACKGROUND

FE Botterblom WEF (Pty) Ltd ('the Applicant') is proposing to develop the Botterblom Wind Energy Facility (WEF) and associated infrastructure approximately 50 km NNE of Loeriesfontein in the Northern Cape Province. Enviro-Insight CC was appointed to undertake the requisite avifauna preconstruction monitoring and impact assessment associated with the proposed Botterblom WEF.

The proposed Botterblom WEF will cover approximately ~5 600 ha in extent located on the Remaining Extent of Farm Sous 226 where up to 54 wind turbines are proposed to be constructed.

The site is proposed to accommodate up to 54 wind turbines as well as the associated infrastructure which is required for such a facility including, but not limited to:

- The proposed series of turbines would be operated as a single facility with each turbine being up to 6.5 MW in capacity.
- Each wind turbine is expected to consist of a concrete foundation (20 m x 20 m x 4 m), a steel tower, a hub (up to 150 m above ground level, depending on the turbine size decided upon) and rotor diameter of 175 m.
- Internal/ access roads (up to 6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded.
- Security access gates and additional internal fencing.
- Workshop area / office for control, maintenance, and storage (approximately 100 m x 100 m).
- An on-site substation (200 m x 200 m) to facilitate grid connection.

Energy generated by the Botterblom WEF will be evacuated from the site via a proposed 132 kilovolt (kV) overhead transmission line of which alternative routes are currently being investigated. This would feed into the existing national electricity grid at the Helios Main Transmission Substation. The impacts of this overhead transmission line will be assessed separately in an Environmental Impact Assessment/ Basic Assessment process.

1.1 SCOPE OF WORK

The main objective is to fully understand and successfully mitigate the possible negative impacts of wind energy production (and associated infrastructure) on the region's avifauna. This report will provide baseline information to assess avifauna habitat use in a pre-construction (impact) scenario and evaluate the potential impact of the Botterblom WEF on avifauna (such as collision mortality, displacement due to disturbance, barrier effects and habitat loss).

1.2 STUDY AREA

The proposed study area for the WEF development is located approximately 53 km north of Loeriesfontein, 87 km west of Brandvlei and 146 km south of Pofadder in the Northern Cape. The site can be reached via a gravel Granaatboskolk / Zout Dwaggas Road, which branches off the R357 (Figure 1-1). The Botterblom WEF footprint is approximately 5 736 hectares (ha) and will be located on a Portion of the Remainder of the Farm Sous 226 (Figure 1-1). The Khobab WEF is located directly north while Loeriesfontein2 WEF is located north-east of the study area.

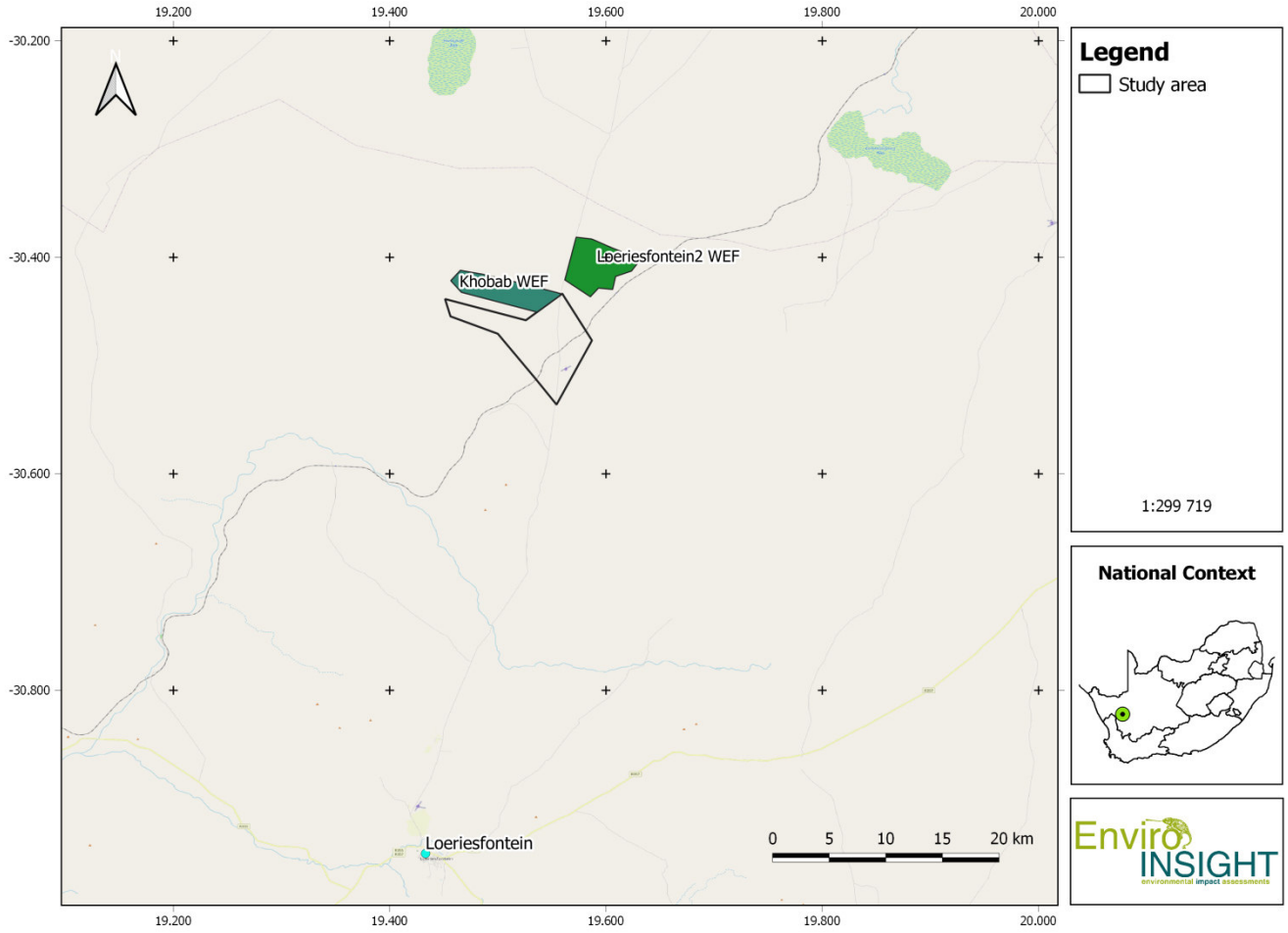

Figure 1-1: Locality map of the proposed Botterblom WEF.

1.3 STUDY LIMITATIONS

- It is assumed that all third-party information acquired is correct (e.g. GIS data, existing facility mortality data and the prescribed scope of work);
- There is still limited information available on the environmental effects of wind energy facilities in South Africa. Only a summary of the results of post-construction monitoring from eight wind farms in South Africa is available (Ralston Paton *et al*. 2017). Estimates of impacts are therefore also based on knowledge gained internationally, which should be applied with caution to local species and conditions;
- While sampling effort was conducted as recommended in the guidelines, to achieve statistically powerful results it would need to be increased beyond practical possibilities. The data was therefore interpreted using a precautionary approach.
- Vantage point surveys are only conducted during daylight. Therefore, any bird movement occurring at night was not recorded. Some waterbirds and night migrants are known to make regular flights and migration movements at night.

- Avifauna mortality data from the existing Khobab WEF adjacent to the study area was requested from BirdLife SA and received prior to submission of this report. These reports are briefly discussed in this scoping report and a more rigorous evaluation of these reports and the data they contain will be provided in the final EIA report.
- This Scoping report is based on an incomplete data set, with two seasons of inputs remaining for the final EIA report.

2 LEGISLATIVE FRAMEWORK

2.1 NATIONAL ENVIRONMENTAL SCREENING TOOL AND ENVIRONMENTAL THEME PROTOCOLS

2.1.1 Screening Report

The Minister of Environment, Forestry and Fisheries, gave notice that the submission of a report generated from the national web-based environmental screening tool[1], as contemplated in Regulation 16(1)(b)(v) of the Environmental Impact Assessment Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, will be compulsory from 4 October 2019 when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the Environmental Impact Assessment Regulations, 2014.

In addition, a set of protocols that an applicant needs to adhere to in the Environmental Authorisation (EA) process were developed and on 20 March 2020 the Minister of Forestry, Fisheries and the Environment gazetted the Protocols for national implementation purposes. The gazette '*Procedures to be followed for the Assessment and Minimum Criteria for Reporting of Identified Environmental Themes in terms of Section 24(5)(a) and (h) of the National Environmental Management Act (1998) when Applying for Environmental Authorisation*', has protocols that have been developed for environmental themes which include agriculture, avifauna, biodiversity (Terrestrial and Aquatic Biodiversity), noise, defence and civil aviation.

The protocols set requirements for the assessment and reporting of environmental impacts of activities requiring EA. The higher the sensitivity rating of the features on the proposed site as identified by the screening tool report, the more rigorous the assessment and reporting requirements.

Based on the generated screening report, the avifauna theme was indicated as Low sensitivity (

[1] https://screening.environment.gov.za/screeningtool/#/pages/welcome

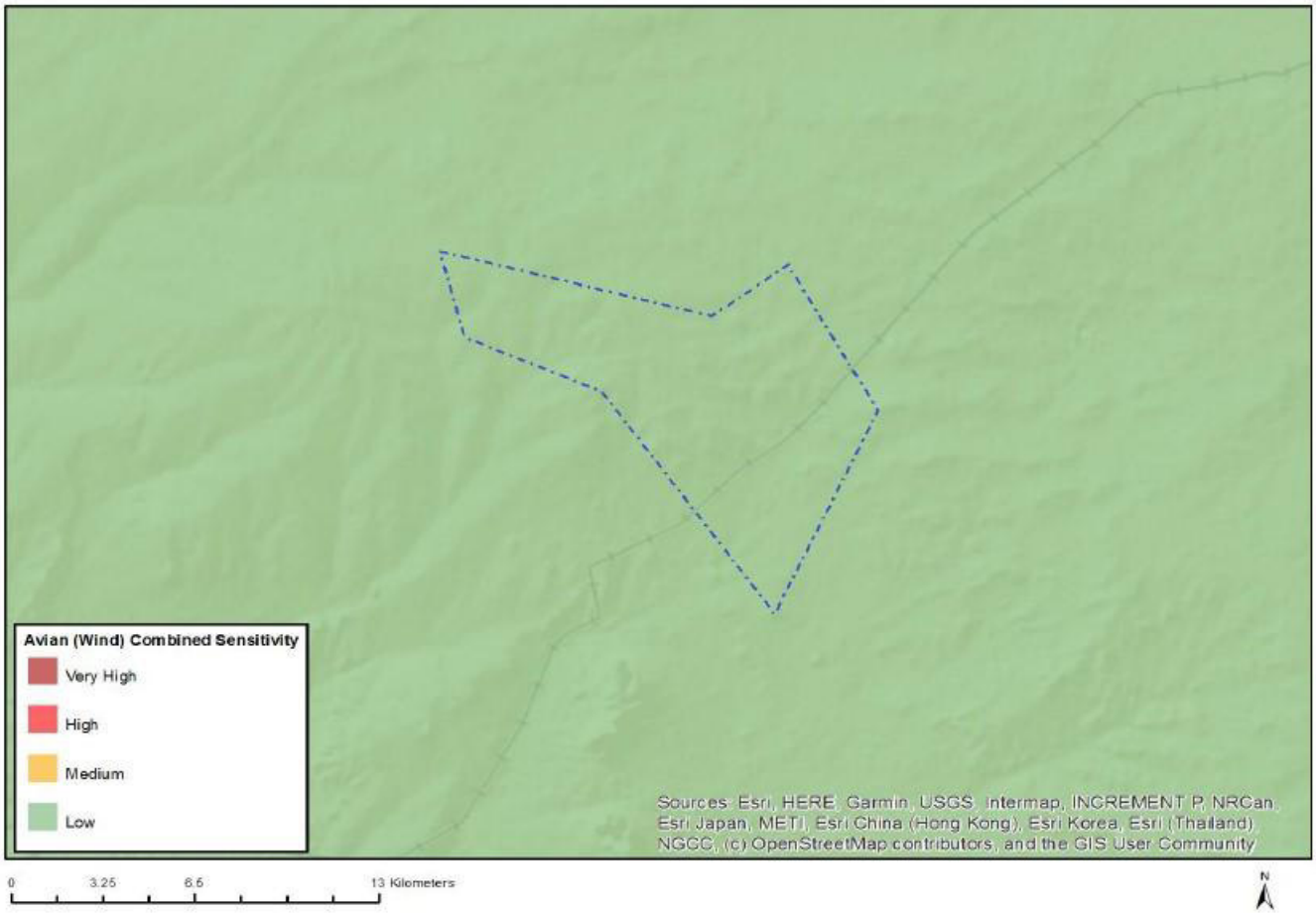

Figure 2-1). This is, however, incorrect based on the site verification that has taken place in September 2020 due to the presence of species of conservation concern, habitat likely to be of importance to endemic and / or restricted -range bird species that are susceptible to impacts from wind energy facilities, and critical habitat for priority bird species sensitive to wind energy developments. Accordingly, the sensitivity has been reclassified as High.

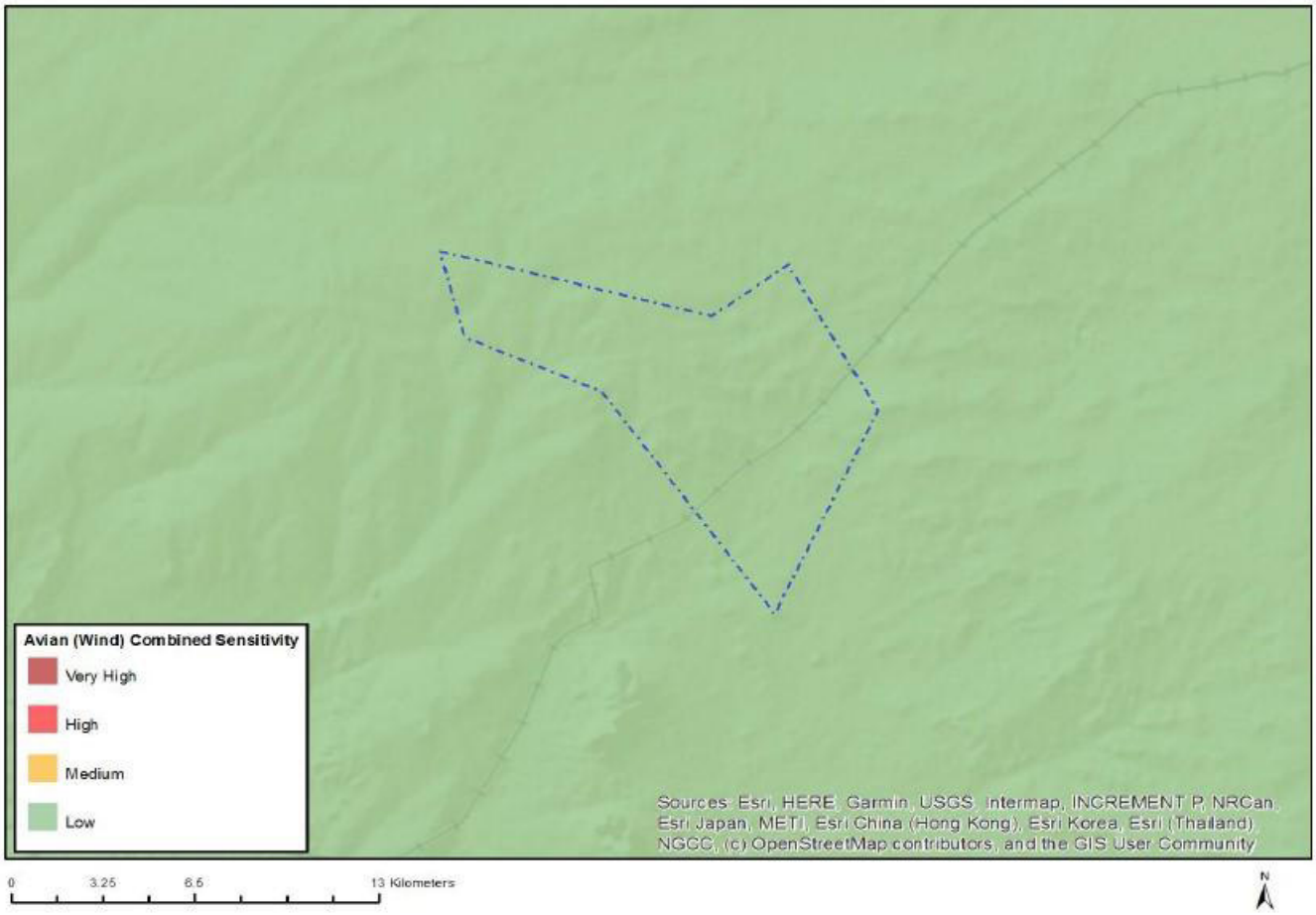

Figure 2-1: Environmental Screening Tool avifauna sensitivity theme map the proposed Botterblom WEF.

2.2 RENEWABLE ENERGY DEVELOPMENT ZONE

On 17 February 2016, Cabinet approved the Renewable Energy Development Zones (REDZs) for large scale wind and solar photovoltaic development and associated Strategic Transmission Corridors (STC) which support areas where long term electricity grid will be developed.

The procedure to be followed in applying for EA for a large-scale project in a REDZ or in a Power Corridor was formally gazetted on 16 February 2018 in GN113 and GN114. On 17 July 2020, Minister Barbara Dallas Creecy, published Government Gazette 43528, Notice 786 for consultation with the intention to identify three additional Renewable Energy Development Zones to the eight Renewable Energy Development Zones published under Government Notice No. 114 in Government Gazette No. 41445 of 16 February 2018. REDZs are also aligned with the powerline corridors that were identified in the Electricity Grid Infrastructure SEA completed in 2016 and gazetted as powerline corridors in February 2018. In this way, the combination of the REDZs and power corridors provides strategic guidance to ESKOM on where to prioritise

investment in grid infrastructure.

New renewable energy projects located within one of the 11 REDZ areas, and new electricity grid expansion within the 5 STCs are subject to a Basic Assessment (BA) and not a full EIA process, as well as a shortened timeframe of 147 days (90 day BA process and 57 decision-making process).

The proposed Botterblom WEF is not located in a REDZ, but is located in the Western Strategic Transmission Corridor.

2.3 BIRDS AND WIND-ENERGY BEST-PRACTICE GUIDELINES (2015)

The "*Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa*" (Jenkins et al., 2015) are followed in order to fulfil the outlined requirements. This document became a legal requirement due to the NEMA Protocols (March 2020).

As per Appendix 2 - *Minimum requirements for avifaunal impact assessment*, an avifaunal impact assessment for a WEF should follow a two-tier process:

1. Scoping - a review of the existing literature and data, as well as a site visit to inform the design of a site-specific survey and preconstruction monitoring plan.
2. Impact assessment – systematic and quantified monitoring over four seasons that will inform a full EIA detailing and analysing the significance of likely impacts and available mitigation options.

3 METHODS

3.1 GIS

Existing data layers were incorporated into a GIS to establish how the proposed WEF layout and associated activities interact with important terrestrial entities. Emphasis was placed on the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018);
- NFEPA wetlands and rivers (CSIR 2011);
- Important Bird Areas (IBAs) (Marnewick *et al*., 2015); and
- GIS layers provided by the client.

All mapping was performed using open source GIS software (QGIS[2]).

3.2 DESKTOP AND LITERATURE SURVEY

Prior to the initiation of field surveys, a desktop survey was conducted to consider the best information available, in order to provide a better evaluation of all conditions present within the study area. An initial literature review was undertaken to assess

[2] http://qgis.osgeo.org/en/site/

which bird species could potentially occur in the vicinity of the Botterblom WEF using data from the second South African Bird Atlas Project (SABAP 2[3]; [SABAP2, 2020]). SABAP 2 records were developed based on records per pentad (i.e., 5' X 5'). A list of species potentially occurring was developed from SABAP 2 data for the pentads within which the study area falls (3025_1930, 3025_1925, 3030_1930, 3025_1935) (

Figure 3-1). The expected species list (Appendix 1) is therefore based on an area much larger than the actual study area and was therefore subsequently refined. This approach was adopted to ensure that all species potentially occurring within the study area, whether resident, nomadic, or migratory, are identified.

From the generated expected species list, the sensitivity of avifauna species towards the potential impacts from the Botterblom WEF was evaluated using the Avian Wind Sensitivity Map (Retief *et al.,* 2012). Other species not listed in the referred document were also considered sensitive because of their abundance, flight characteristics, ecological role, population trend and conservation status. A preliminary list of focal species impacts for this study area was compiled based on existing Avifaunal Environmental Impact Assessment and post-construction mortality monitoring reports for the area (notably for the adjacent Khobab WEF) and supplemented with sensitive species identified in the previous steps.

The following main literature sources have been consulted for the avifauna study:

- The existing preconstruction avifaunal assessments for the Kokerboom 1, 2 and 3 WEFs, Dwarsrug WEF and Loeriesfontein WEF;
- Information relating to avifauna species of conservation concern (SCC) was obtained from Taylor *et al.* (2015) and the IUCN Red List of threatened species (IUCN, 2021);
- del Hoyo *et al.* (1992) and Hockey *et al.* (2005) were consulted for general information on the life history attributes of relevant bird species;
- Distributional data (apart from those obtained during the surveys) was sourced from the Southern Africa Bird Atlas Project (SABAP 2, 2021), del Hoyo *et al.* (1992) and Sinclair & Ryan (2010);
- Nomenclature and taxonomy followed the IOC World Bird Names unless otherwise specified (see www.worldbirdnames.org; Gill & Donsker, 2012); and
- Priority species (including rankings) with regards to wind farms are based on Retief *et al.* (2012) which has been further applied in the region by Ralston-Paton *et al*. (2017).
- Mortality data (Chris van Rooyen Consulting, 2020) from the adjacent existing Khobab WEF were provided by BirdLife South Africa.

[3] http://sabap2.birdmap.africa/

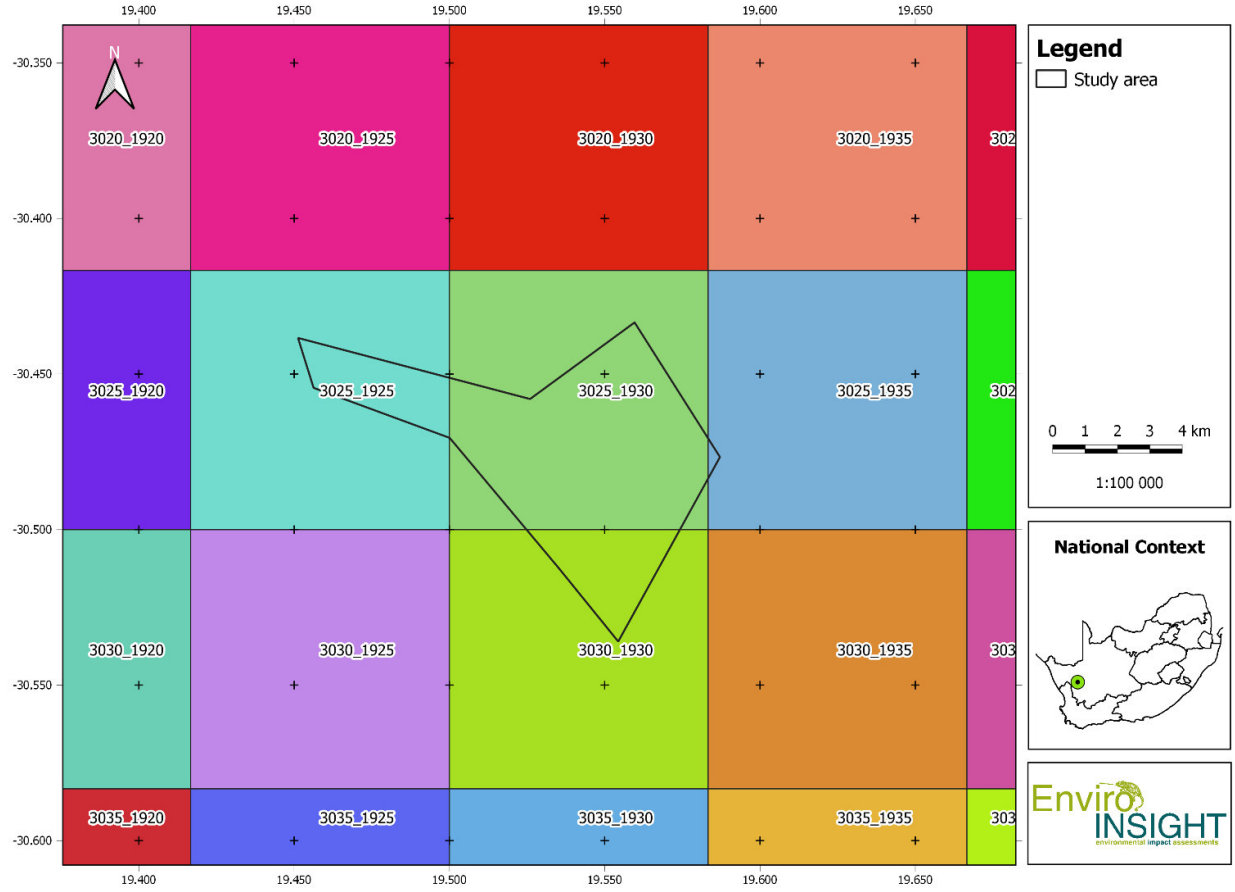

Figure 3-1: The Botterblom WEF in relation to the SABAP2 pentads.

3.3 PRECONSTRUCTION BIRD MONITORING SURVEY DESIGN

The field surveys were arranged so that the study area and control sites would be surveyed for a total of 12 months, due for completion in August 2021. This complies with the requirements of the Best Practice Guidelines available at the time (Jenkins *et al.* 2015). To date, the preconstruction monitoring programme has included a total of two visits to the site, covering the study area through a six month period that included the spring and summer seasons of the (non-calendar) year. The first survey conducted in September 2020 (Spring) was part of the scoping phase and limited methods were applied, i.e. only walk transect (WT) and drive transects (DT) were conducted to establish these sites, in addition to two vantage point (VP) were conducted for a limited time to capture initial data for planning purposes. The second survey conducted in December 2020 (Summer) included VP, WT and DT as indicated in Table 3-1 below. The autumn survey was conducted from 24-29 April 2020 and the winter survey is to commence in mid July 2021. Accordingly, the data for the autumn, winter and updated spring surveys will be included in the final EIA report.

Table 3-1: Avifauna monitoring sampling period for Botterblom WEF and Control Site.

Date	Season	Methodology applied*
2-5 September 2020	Spring	WT, DT – scoping phase
8-10 December 2020	Summer	VP, WT, DT, NE
24-29 April 2020	Autumn	VP, WT, DT, NE, WB
July 2021(dates to be confirmed)	Winter	VP, WT, DT, NE, WB
September 2021 (dates to be confirmed)	Spring	VP, WT, DT, NE, WB

*** VP – Vantage points; WT – Walked transects; DT – Drive transects; NE – Nest searches, inspection and monitoring; WB – Water body inspections.**

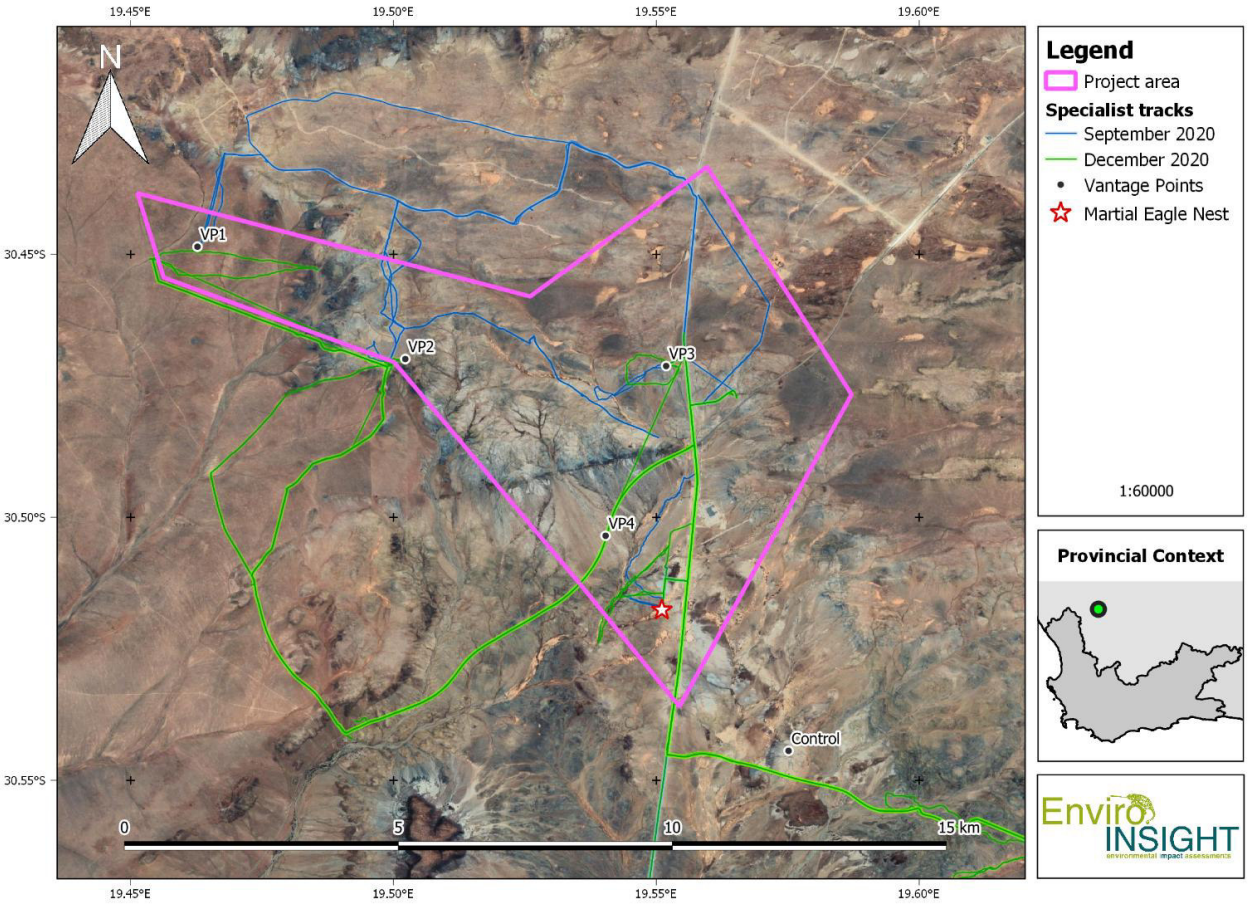

Figure 3-2: Avifauna survey sites and specialist coverage (GPS tracks) for the proposed Botterblom WEF.

3.3.1 Vantage Points

Four vantage points (VPs) within the project study area were identified based on the preliminary desktop and scoping survey in the Botterblom WEF, and one identified at the control area, to record the flight altitude and patterns of priority species (totaling five VPs). These sampling points were located at strategic locations within the Botterblom WEF and set up to allow the visual coverage of the wind farm (placing special emphasis on the proposed turbine locations) and its immediate surroundings. VP surveys were conducted accordingly to the most recent recommendation from the best practice guidelines at the time (Jenkins *et al.* 2015). Each location was surveyed for a minimum of 12 hours of observation per season divided through the early morning, midday and late afternoon times of day (Jenkins *et al.* 2015). For more information on each VP, refer to Table 3-2.

Table 3-2: Description of the five Vantage Points surveyed

Vantage Point	Location	Number of observers	Angle of survey	Line of site	Season
VP1	30°26'54.80"S, 19°27'45.70"E	One	180	>1000 m	Spring, Summer
VP2	30°28'11.67"S, 19°30'8.01"E	One	180	>1000 m	Spring, Summer
VP3	30°28'16.45"S, 19°33'6.65"E	Two	360	>1000 m	Summer
VP4	30°30'12.62"S, 19°32'25.19"E	Two	360	>1000 m	Summer
VP5 (control)	30°32'39.83"S, 19°34'30.50"E	One	180	>1000 m	Summer

3.3.2 Walked Transects

This method is utilised to monitor small bird species within the major habitat types within a study area. Transects were positioned at varying distances away from the proposed turbine arrays (see Figure 3-3) to maximise the comparative value of the data which will be compared with the surveys from the post-construction phase results.

Four linear transects ranging from 1.4 km to 3.3 km in length, three located in the Botterblom WEF and one within the control area, were walked in order to characterize the passerine and small bird communities (Table 3-3). These transects are representative of the biotopes present within the study area. These transects (excluding that in the control area) were located within the turbine area of influence available at the time (Drewitt & Langston, 2006). To avoid pseudo-replication, transects were located at a minimum distance of 400 m apart from one another (Sutherland, 2006). Each transect was conducted by one expert bird observers at a time (more than one observer for all transects were used), who recorded all bird contacts (both seen and heard) by walking slowly along the predetermined transect. Observations were made on both the left and right side of the predetermined transect. Birds were only recorded (seen or heard) within a fixed maximum width of 150 m on either side if the transect line. The same transects were repeated in every season. Surveys started after sunrise and were performed throughout the day to account for temporal variation in activity.

As a general rule, transects were not walked in adverse conditions, such as heavy rain, strong winds or thick mist. During the first two surveys, no adverse conditions were recorded.

Table 3-3: Walk transect lengths and total length.

Transect	Length (km)
Walk - Control	1.82
Walk - WT1	1.50
Walk - WT2	1.39
Walk - WT3	3.34
Total	**8.05**

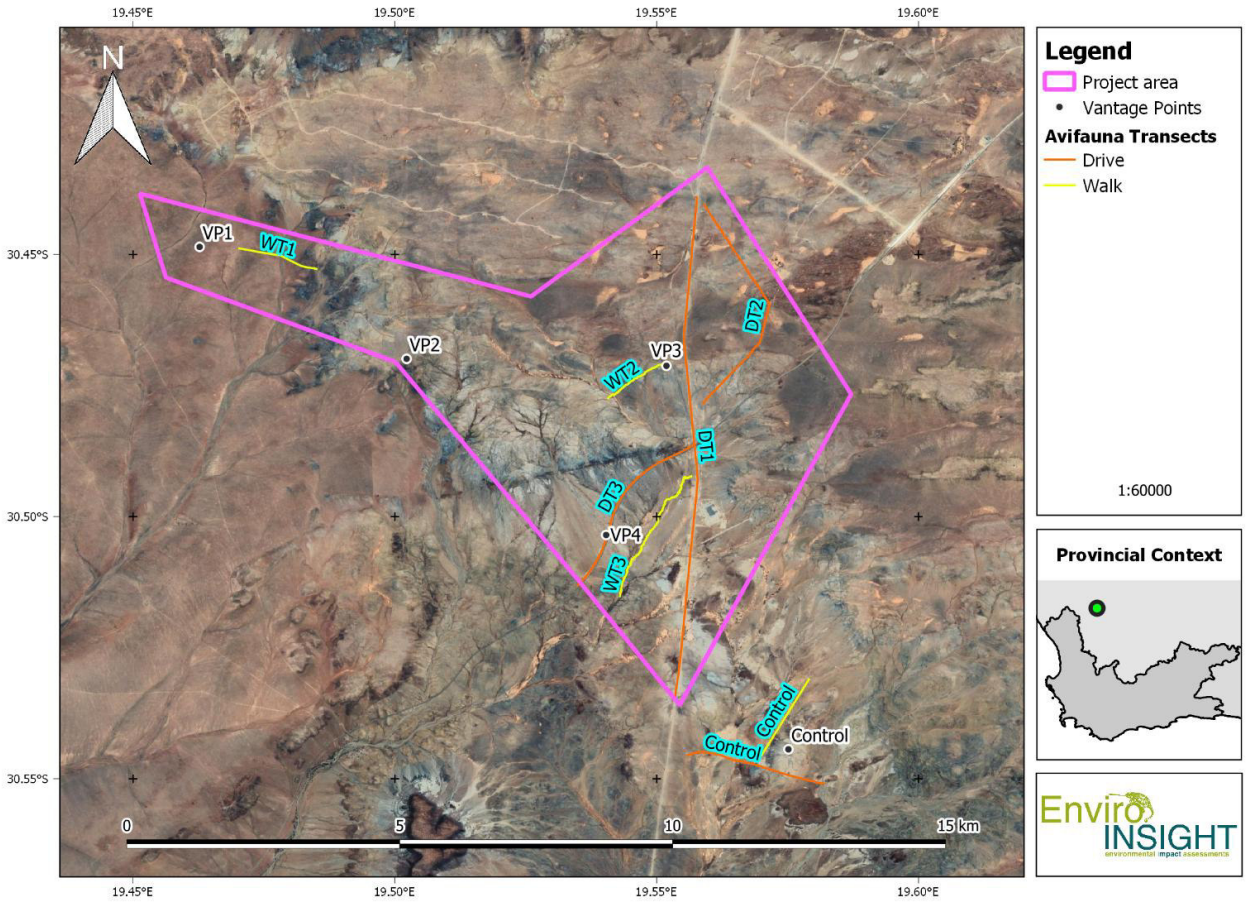

Figure 3-3: Avifauna walk transects (WT) and drive transects (DT) for the proposed Botterblom WEF.

3.3.3 Driven Transects

Large terrestrial birds (e.g., cranes, bustards, and most raptors) cannot be adequately surveyed using walked transects. Populations of such birds should be estimated on each visit to the project area by means of road counts (vehicle-based sampling; best applied for relatively large proposed WEFs, especially those with good networks of roads and tracks).

Road counts of large terrestrial birds and raptors require that one or a number of driven transects be executed (depending on site size, terrain and infrastructure), comprising one or a number of set routes, limited by the existing roadways but as far as possible directed to include a representative cross section of habitats within the project area of influence (PAOI).

These transects were driven at a constant and slow speed (± 15 km/h), and all sightings of large terrestrial birds and raptors were recorded in terms of the same data-capture protocols used for walked transects (above), and in general compliance with the road-count protocols described for large terrestrial species (Young et al., 2003) and raptors (Malan, 2009). Three drive transects were identified in the Botterblom WEF and one drive transect in the control area with a combined total length of 22 km (Figure 3-3; Table 3-4). One observer travelling slowly in a vehicle recorded all species on both sides of the drive transect. The observer stopped at regular intervals (every 100 to 300 m) to scan the environment with binoculars.

Table 3-4: Drive transects lengths and total length.

Transect	Length (km)
Drive - Control	2.62
Drive - DT1	10.63
Drive - DT2	4.91
Drive - DT3	3.81
Total	**21.97**

3.3.4 Wetlands

Prior to the initiation of the preconstruction monitoring campaign, the main water bodies (including wetlands) present within the study area were identified on a Geographical Information System (GIS) by using 1:50 000 topographic maps and aerial photos. Several significant water bodies were identified on and surrounding the study area. These identified and mapped water bodies were surveyed and will continue to be surveyed to determine their level of utilisation by water birds.

Due to seasonality, the birds were and will only be surveyed during periods with some prevailing inundation or rainfall. The first two surveys showed dry conditions with no water present on site. However, some drainage lines within the greater PAOI were inundated during the 2020 spring surveys and were observed accordingly.

3.3.5 Specialist Nest Survey

Any habitats within the PAOI of the proposed WEF, or equivalent habitats around the study area, deemed likely to support nest sites of key raptor and other species of conservation concern, including power lines, stands of large trees, marshes and drainage lines, were surveyed. All potential breeding sites, once identified fully, will continue to be mapped, and checked during each survey to confirm occupancy, and all evidence of breeding and the outcomes of such activity, where possible, recorded.

3.3.6 Incidental Observations

All other sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) on the WEF and control site as well as within the broader study area were recorded, along with additional relevant information such as habitat type, abundance, habits and weather data. These observations were used as complementary data to characterise the bird community and its utilisation of the site, as recommended by the Best Practice Guidelines (Jenkins *et al*., 2015).

3.4 SPECIES OF CONSERVATION CONCERN

The Red List of threatened species generated by the IUCN (http://www.iucnredlist.org/) provided the global conservation status of avifauna. However, Taylor *et al*. (2015) produced a regional conservation status assessment following the IUCN criteria which was used for this scoping report. The first three categories i.e., Critically Endangered, Endangered and Vulnerable, are collectively called 'threatened' species.

The conservation status categories defined by the IUCN, which are considered here to represent species of conservation concern (SCC), are defined as follows:

- **Critically Endangered (CR)** - Critically Endangered refers to species facing immediate threat of extinction in the wild.
- **Endangered (EN)** - Endangered species are those facing a very high risk of extinction in the wild within the foreseeable future.
- **Vulnerable (VU)** - Vulnerable species are those facing a high risk of extinction in the wild in the medium-term.
- **Near Threatened (NT)** - any indigenous species which does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. NEMBA also deals with endangered, threatened and otherwise controlled species, under the Threatened or Protected Species Regulations (ToPS). A ToPS permit is required for any activities involving the removal or destruction of any ToPS-listed species.

Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

4 RESULTS

4.1 REGIONAL CONTEXT

The study area is located in the Bushmanland Basin Shrubland vegetation type (Figure 4-1; Table 4-1; Mucina & Rutherford, 2010). Bushmanland Basin Shrubland occurs on the extensive basin centered on Brandvlei and Van Wyksvlei, spanning Granaatboskolk in the west to Copperton in the east, and Kenhardt in the north to around Williston in the south. The area is characterised by slightly irregular plains dominated by a dwarf shrubland, with succulent shrubs or perennial grasses in places. The geology consists largely of mudstones and shales of the Ecca group and Dwyka tillites with occasional dolerite intrusions. Soils are largely shallow to non-existent, with calcrete present in most areas. The mean annual rainfall ranges from 100-200 mm and occurs mostly during the summer months as intermittent thunderstorms. As a result of the arid nature of the area, very little of this vegetation type has been affected by intensive agriculture and it is classified as Least Concern. None of the vegetation type is conserved in statutory conservation areas. According to Mucina & Rutherford (2006 as amended) no signs of serious transformation are present for the vegetation type, but scattered individuals of exotic and invasive *Prosopis* sp. occur in some areas (e.g. in the vicinity of the Sak River drainage system), and some localised dense infestations form closed 'woodlands' along the eastern border of the vegetation type with Northern Upper Karoo (east of Van Wyksvlei) (Mucina & Rutherford, 2006 as amended).

There are few endemic and biogeographically important species present at the site and only *Tridentea dwequensis* is listed as biogeographically important while *Cromidon minimum*, *Ornithogalum bicornutum* and *O.ovatum* subsp *oliverorum* are listed as being endemic to the vegetation type (Mucina & Rutherford, 2006 as amended).

Other vegetation types which occur in the wider area include Hantam Karoo, some small pans in the area which fall within the Bushmanland Vloere and Namaqualand Riviere vegetation types. These are however outside of the study area and would not be affected directly by the proposed Botterblom WEF.

Table 4-1: Attributes of the Bushmanland Basin Shrubland vegetation type (Mucina & Rutherford, 2006 as amended)

Name of vegetation type	Bushmanland Basin Shrubland
Code as used in the Book	NKb6
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	%
Remaining (percent of area) from NSBA	99.5%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Not protected
Area (km^2) of the full extent of the Vegetation Type	34690.68
Name of the Biome	Nama-Karoo
Name of Bioregion	Bushmanland Bioregion

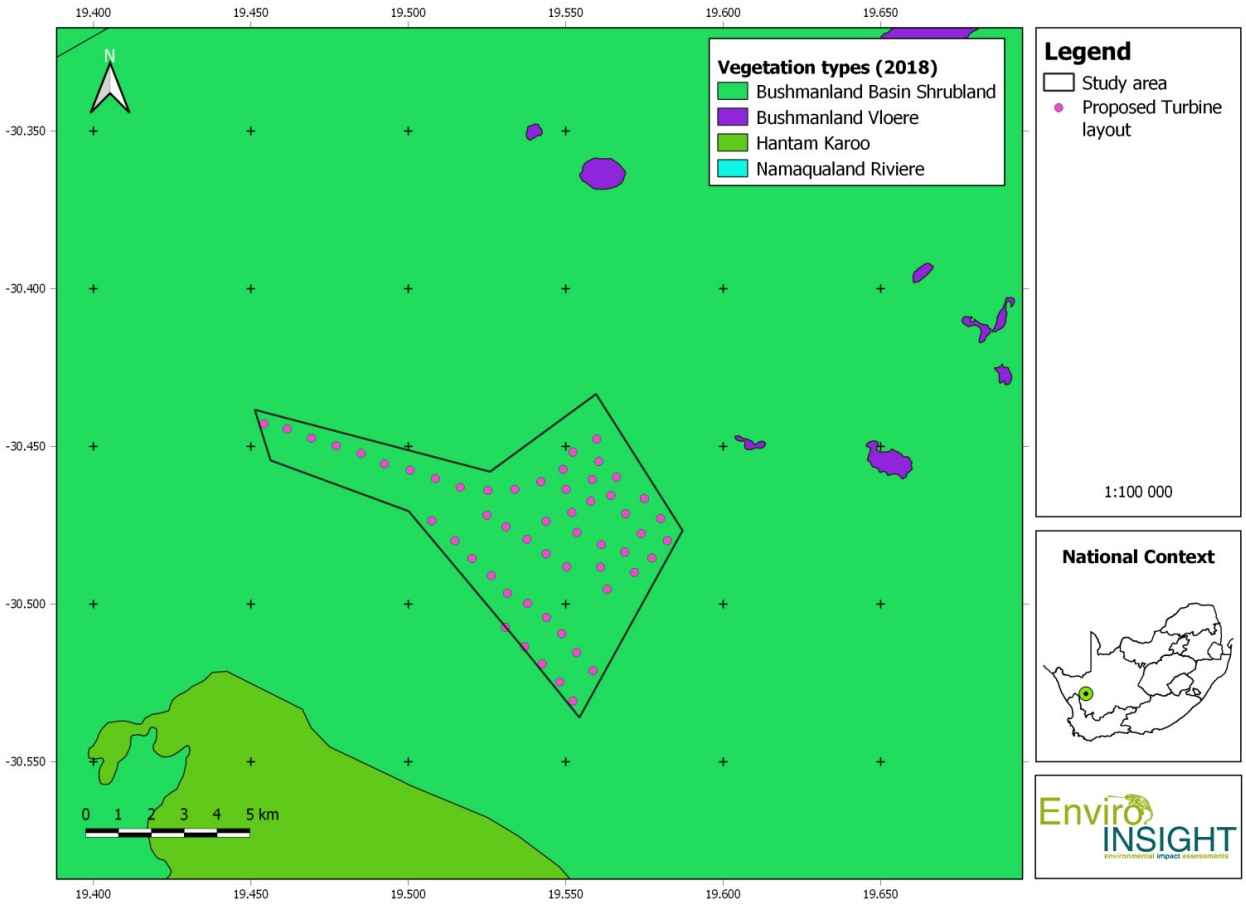

Figure 4-1: The proposed Botterblom WEF in relation to regional vegetation types (SANBI, 2018).

4.2 PROTECTED AREAS AND IMPORTANT BIRD AREAS

The Botterblom WEF is not located in or directly adjacent to an Important Bird Area (IBA) or protected area. The closest IBA to the Botterblom WEF is Bitterputs Conservation Area which is approximately 72 km north-west of the study area.

The Bitterputs Conservation Area (SA036) is an arid landscape which consists of extensive sandy and gravel plains covered with sparse, perennial desert grassland. A few large salt pans are a unique habitat type in this IBA. The conservation area falls within the Bushmanland Bioregion and the Nama Karoo Biome. Three vegetation types are present: the Bushmanland Vloere (salt pans), Bushmanland Arid Grassland and Bushmanland Sandy Grassland. The ecosystem status for the entire area is Least Concern.

The Bitterputs Conservation Area is one of a few sites protecting both the globally threatened Red Lark (*Calendulauda burra)*, which inhabits the red sand dunes and sandy plains where there is mixed cover of grasses and dwarf shrubs, and the near-threatened Sclater's Lark (*Spizocorys sclater)i*. This site also holds 16 of the 23 Namib-Karoo biome-restricted assemblage species and a host of other arid-zone birds. Other priority species, including globally threatened species, within this IBA include Ludwig's Bustard (*Neotis ludwigii),* Kori Bustard (*Ardeotis kor)i*, Karoo Korhaan (*Eupodotis vigorsii)*, Secretarybird (*Sagittarius serpentarius)* and Lanner Falcon (*Falco biarmicus)*. Restricted-range and biome-restricted species are Stark's Lark (*Spizocorys starki)*, Karoo Long-billed Lark (*Certhilauda subcoronata)*, Black-eared Sparrow-lark (*Eremopterix australis)*, Tractrac Chat (*Cercomela tractrac)*, Sickle-winged Chat (*C. sinuate)*, Karoo Chat *C. schlegelii*, Karoo Eremomela *Eremomela gregalis*, Cinnamon-breasted Warbler (*Euryptila subcinnamomea)* and Black-headed Canary (*Serinus alario)*.

The Bitterputs Conservation Area is one of three Bushmanland IBAs important for the conservation of endemic lark species. There has been a c. 75% loss of optimal habitat for the Red Lark over the past 100 years. The disappearance of this species from ranches where dune grassland has been replaced by ephemerals is probably linked to the reduction in grass awns for nesting, shelter and invertebrate and plant foods.

There is a serious threat from climate change and it is predicted that temperatures will increase and rainfall decrease sharply in arid areas such as Bushmanland. Locally resident endemic larks, in particular, are at risk. Increased CO_2 can lead to the increase of C3 plants (shrubs) at the expense of C4 plants (mainly grasses), causing a shift in vegetation diversity and structure and making the habitat unsuitable for some species. It is expected that the Red Lark will not meet the challenge of global warming (BirdLife International, 2021).

Currently no part of this IBA is formally conserved and no conservation actions have been implemented. Bitterputs falls within the Central Astronomy Advantage Area, which has restrictions on activities that can take place in it. This could result in some protection for the IBA.

4.2.1 Flagship species for the region

Flagship species are defined as species that may be highly conspicuous, readily identifiable, of high conservation value (SCC), of high tourism value or are endemic to the region. The Northern Cape is home to the South African (and Northern Cape Province) endemic Red Lark. It is a highly range restricted species that occurs on red dune (Nama Grassland as defined

by the habitat delineation) habitat that provides a variety of vegetation requirements, including annual grasses, perennial grasses and woody vegetation. This species is currently poorly represented within existing protected areas across its range and is threatened by habitat loss and fragmentation primarily through intensive stock farming activities and most recently, renewable energy developments.

This province hosts a significant populations of arid-adapted large terrestrial birds which have been recorded (and are expected) within the PAOI such as Kori Bustard, Ludwig's Bustard and Karoo Korhaan. Additional "flagship" bird species include Martial Eagle, Verreaux's Eagle, Secretary Bird, with occasional incursions within the PAOI such as Lappet-faced Vulture (incidental sighting) and indeed, other vulture species.

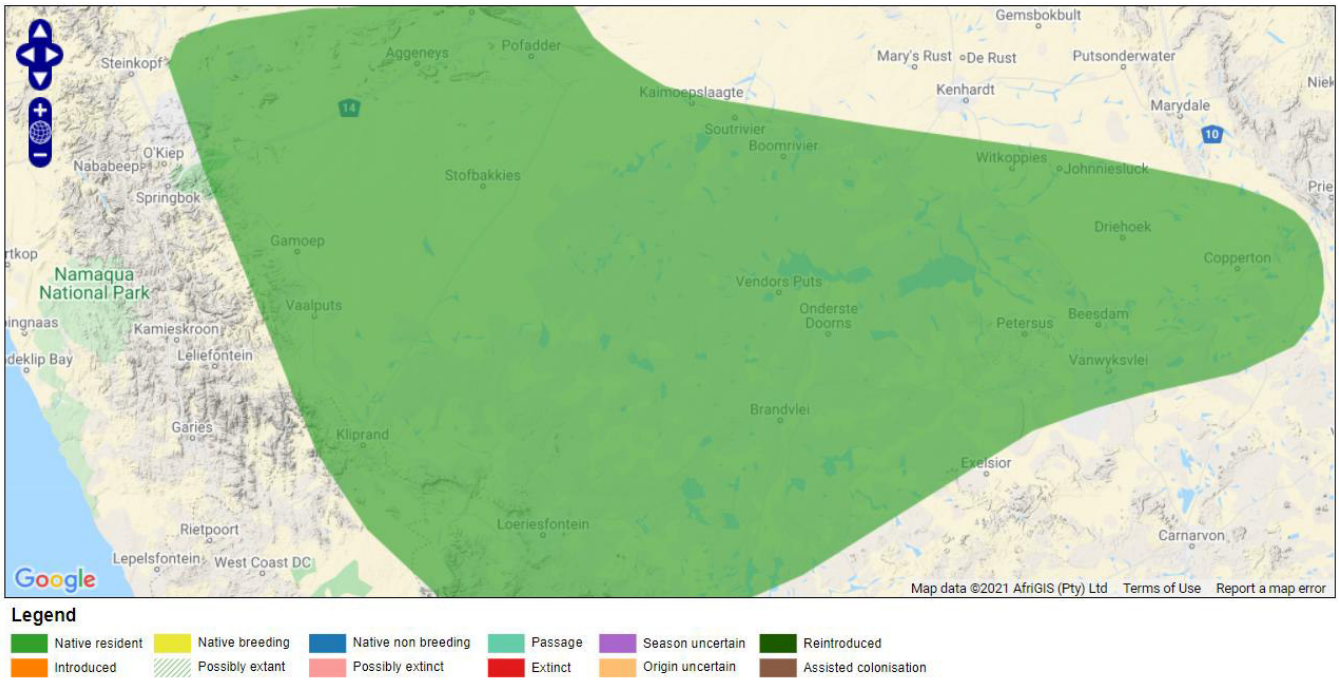

Figure 4-2: Red lark (Calendulauda burra) distribution map (BirdLife International, 2021[b]).

4.3 DESCRIPTION OF MAJOR BIRD HABITATS

A refined habitat map was created in order to relate the delineation to avifaunal habitats in the study area. Some avifaunal habitats are merged from multiple vegetation types for the sake of ecological understanding. The primary avifaunal habitats are described in tabular formats below with accompanying representative photographs. The delineated sensitivity of the avifaunal habitats will not be fully understood until the completion of the 12 month monitoring period. Sensitivity will largely be based upon "Avifaunal value" which relates to species diversity, endemism and the presence of topographical features or primary habitat units with the intrinsic ability to sustain certain avifaunal assemblages (with specific reference to SCC), their food supply and breeding habits. It is apparent throughout the study area that most of the habitats are generic in their ability to support general avifaunal species and Red-Listed / SCC with little differentiation. However, unique geological (such as red dunes) geographical or topographical features exist which may cause the areas these areas to be buffered from proposed

development. Due to the high diversity and density of the above mentioned Red-Listed species recorded during the survey, (including regionally and globally listed Endangered and Vulnerable birds), the PAOI as a whole is considered to be an area of avifaunal importance and the EIA will be strongly associated with Guidelines at a policy level, prioritising avoidance mitigation and the monitoring of avifaunal SCC.

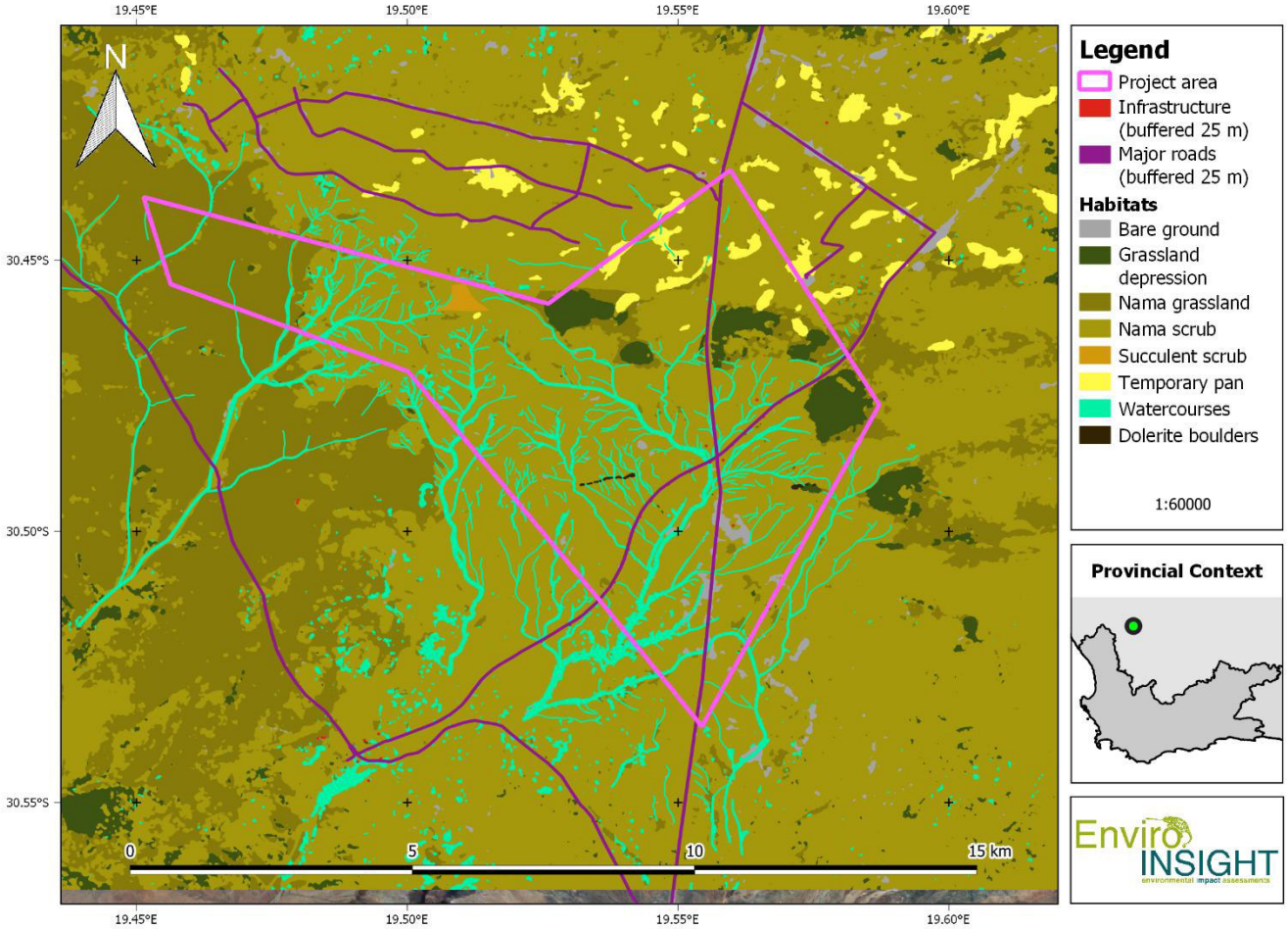

Figure 4-3: Avifauna habitat map for the proposed Botterblom WEF PAOI.

4.3.1 Watercourses and Drainage Lines

Photographs	Watercourses and Drainage Lines
 	**Classification:** Ephemeral and endorheic drainage lines **Hydrology:** No major hydrological impacts are expected from the development and the current hydrological features will be addressed in the final EIA. **Geomorphology:** Channels varying in width and depth from large multi-channeled sandy gullies to shallow narrow channels. **Vegetation:** Vegetation varies depending on channel width and depth, where larger deep-rooted trees line larger channels with lower shrub layers characterising smaller drainage line systems. **Avifaunal Characteristics:** Avifaunal assemblages differed depending on the classification of the drainage line system as well as the season. Most of the drainage line systems are seasonally ephemeral or dry. Thus, most of the bird associations are linked to the prevailing vegetation and soil types within the delineated drainage line habitats. In summary, drainage lines with taller shrub and tree layers showed a much higher diversity of passerine species as well as sand-associates and ground-dwelling birds such as coursers and thick-knees. Species of conservation concern such as Red Lark and Sclater's lark were observed in varying densities. The seasonal drainage lines and accompanying riparian trees are linear dispersal corridors for terrestrial bird species. Much higher species diversity (as well as a unique composition) was observed in this habitat and therefore, these systems are classified to be of high avifaunal importance. The drainage lines act as important flight corridors for passerines and raptors between foraging and roosting sites.

4.3.2 Nama Grassland/ Grassland Depression

Photographs	Nama Grassland
	**Classification:** Nama Grassland/ Grassland Depressions **Hydrology:** No major hydrological impacts are expected from the development and the current hydrological features will be addressed in the final EIA. **Geomorphology:** Undulating sandy karroid habitat with fewer flat areas and variable basal layer. **Vegetation:** Vegetation varies depending on slope and depth of topsoil and is characterized by grassland dominated and interspersed by succulent/ Nama/ scrub (in varying ratios) karroid vegetation **Avifaunal Characteristics:** The open grassed karoo habitats show a reduced structural complexity and vegetation which provides for a more generic species diversity albeit often higher densities of avifauna. The habitat contains features similar to the Nama Scrub, namely open karoo habitats (including old cultivated lands and some grassland areas) that provide suitable foraging habitat for Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*) and Secretary bird (*Sagittarius serpentarius*). However, the habitat is characterised by a much-reduced rocky substrate and a higher prevalence of grassed red sand infusions which provides optimal habitat for Red Larks. .

4.3.3 Transformed areas

Photographs	Transformed areas
 	**Classification:** Roads, bridges, verges, powerlines, rail tracks, homesteads, existing infrastructure, kraals **Hydrology:** No major hydrological impacts are expected from the development **Geomorphology:** Highly varied depending on location, especially for linear infrastructure. **Vegetation:** Vegetation varies depending on infrastructure type. **Avifaunal Characteristics:** Low density permanent structures, including bridges, railway tracks, gravel roads, homesteads consisting of houses, and kraals are present. These locations may be important for several bird species which use them for roosting and/or nesting, such as owls and swallows as well as valuable roosting and nesting habits for a wide spectrum of species ranging from the synanthropic (Pied Crows) to the Red-Listed (Martial Eagles). Observations confirmed that a high density of birds, mainly raptors, can frequently be found associated with road infrastructure, possibly due to the prevalence of perching locations, such as electric or telephone lines running alongside available roads, or due to road kills (attracting scavenging species). However, species such as Ludwig's bustard would fly directly above large linear structures such as train tracks, presumably for the purpose of navigation. Finally, homestead and livestock related transformed areas act as attractants for both synanthropic and some Red-Listed species that seek water or food.

4.3.4 Nama Scrub/ Succulent Scrub/ Dolerite Boulders

Photographs	Nama Scrub/ Succulent Scrub
	**Classification:** Nama Scrub/ Succulent Scrub/ Dolerite Boulders **Hydrology:** No major hydrological impacts are expected from the development **Geomorphology:** Undulating scrub Nama and semi-succulent karroid habitat with large extents of flat terrain. **Vegetation:** Vegetation varies depending on slope and depth of topsoil and varies between Nama Scrub dominated and succulent dominated (in varying rations) karroid vegetation **Avifaunal Characteristics:** The stony and rocky ridges (ridges found more within the PAOI and not prevalent on the study area) act as prominent landmarks and foraging habitat for diurnal birds of prey. It also provides potential hunting habitat for the all SCC eagles which hunts rock hyrax (common in these habitats) and rock rabbits as a staple of their dietary requirements. The localised high population densities of small mammals such as rock rabbits within the PAOI as well as the regional linkage to the koppie habitats, elevates the importance of this habitat for avifauna. The rocky habitats provide structural complexity not available in the open karoo vegetation which provides for an increase in species diversity and often higher densities of avifauna due to the prey species that are found in this habitats;. Boulder and/ or rocky habitats intersperse much of the Nama Scrub and provide suitable foraging habitat for the Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*) and Secretary bird (*Sagittarius serpentarius*).

4.4 OBSERVED AND EXPECTED AVIFAUNA

4.4.1 Total species composition and abundance

The study area supports a relatively low diversity and abundance of avifauna, which is to be expected in an arid area like Loeriesfontein. A total of 93 species have been observed to date, as shown in Appendix 1. This low diversity is predominantly due to a number of factors including:

- High regional aridity which reduces the overall species diversity;
- Somewhat generic habitat types (albeit with some highly sensitive habitat such as red sands and temporary pans within the PAOI).
- Climate change which is characterised by lower rainfall and increased temperatures.
- A lack of standing water.
- An incomplete survey period (one year, still to be completed) which omits migrant species and seasonal water associates.
- Sub-optimal climate conditions experienced during the survey.

It must be noted that stochastic high rainfall events and other atypical prevailing influences (persistent cold) may influence the local avifaunal assemblages and that the dataset is currently not complete for all four seasons. The expected species list will thus be refined for the final EIA report following the collection of more data.

4.4.2 Priority species list

A list of expected and observed priority species (Retief *et al.* 2012) in the project area is provided in Table 4-2. A total of 24 priority species are expected to occur on and surrounding the study area, of which 14 have been recorded within the study area to date during this study. Lappet-faced Vulture is included given the sighting of two individuals within the greater PAOI although the species is a highly uncommon vagrant within the region.

Despite only completing two season's worth of fieldwork to date, it is clear from Table 4-2 that numerous priority avifauna species occur within the PAOI and can be expected to interact with the proposed Botterblom WEF. The recorded mortality incidence due to priority species colliding with turbines from the adjacent Khobab WEF over 2 years is considered to be of low concern due to a very small number (four) of threatened and identified priority species being killed (Chris van Rooyen Consulting, 2020). The four priority species mortalities were one incidence each of the Near Threatened Karoo Korhaan and priority species Spotted Eagle Owl with two Greater Kestrel mortalities. This was deemed not to be ecologically significant (Table 4-2). However and as with all proposed WEF developments, it is vital to consider the context within which these species are observed in the current study, as congregatory behaviour, nesting behaviour and foraging behaviour may differ from that at the adjacent existing WEF facility. Indeed, Van Rooyen (2020) suggests that displacement effects of the WEF are more significant than direct mortality which can greatly affect habitat specific species such as Red Lark and Ludwig's Bustard. Consequently, all applicable data of priority species observed within the forthcoming monitoring seasons of field surveys will be collected in order to allow for careful evaluation of potential impacts and application of suitable mitigation measures to reduce these impacts where possible.

Table 4-2: Priority avifauna species list (both expected and recorded as defined by Retief et al. 2012) for the study area.

Common name	Scientific name	Priority species rank	Global Status	Regional Status	South African Endemic	Khobab WEF obs.	Khobab WEF collision mortalities[4]	Current pre-construction monitoring
Bustard, Kori	*Ardeotis kori*	39	NT	NT				X
Bustard, Ludwig's	*Neotis ludwigii*	14	EN	EN		X		X
Buzzard, Jackal	*Buteo rufofuscus*	43	LC	LC	X			
Courser, Burchell's	*Cursorius rufus*	69	LC	VU	X			
Courser, Double-banded	*Rhinoptilus africanus*	72	LC	NT				X
Eagle, Booted	*Aquila pennatus*	59	LC	LC				
Eagle, Martial	*Polemaetus bellicosus*	4	EN	EN		X		X
Eagle, Verreaux's	*Aquila verreauxii*	2	LC	VU				
Eagle-owl, Cape	*Bubo capensis*	42	LC	LC				
Eagle-owl, Spotted	*Bubo africanus*	98	LC	LC			X	X
Falcon, Lanner	*Falco biarmicus*	24	LC	VU				X
Goshawk, Southern Pale Chanting	*Melierax canorus*	75	LC	LC	X	X		X
Kestrel, Greater	*Falco rupicoloides*	95	LC	LC		X	X	X
Kestrel, lesser	*Falco naumanni*	64	LC	LC				
Kite, Black-winged	*Elanus caeruleus*	94	LC	LC		X		X
Korhaan, Karoo	*Eupodotis vigorsii*	51	LC	NT	X	X	X	X

[4] Confirmed collision mortalities for the SEN WEF as reported in Arcus (2020) for the 4 year post-construction monitoring period May 2016 - May 2020.

Common name	Scientific name	Priority species rank	Global Status	Regional Status	South African Endemic	Khobab WEF obs.	Khobab WEF collision mortalities[4]	Current pre-construction monitoring
Korhaan, Southern Black	*Afrotis afa*	37	VU	VU				X
Korhaan, Northern Black	*Afrotis afraoides*	90	LC	LC				X
Lark, Red	*Calendulauda burra*	40	VU	VU		X		X
Lark, Sclater's	*Spizocorys sclateri*	50	NT	NT				X
Secretarybird	*Sagittarius serpentarius*	13	EN	VU				
Snake- Eagle, Black-chested	*Circaetus pectoralis*	60	LC	LC				
Stork, Black	*Circonia nigra*	10	LC	VU				
Vulture, Lappet-faced	*Torgos tracheliotus*	19	CR	CR				

According to the literature, 15 Red-Listed species are known to occur in the region with nine species confirmed during the completed surveys, representing a very high success rate given the short study period (and taking into account the absence of migrants). Of the expected species and according to Taylor *et al.* (2015), two of the species are Endangered, seven of the species are Vulnerable species and four are Near-Threatened. For the current study, it was deemed unnecessary that all SCC should be discussed in greater detail until all the four monitoring seasons have been completed (Table 4-3). Specifically excluded from initial discussions was Lappet-faced Vulture (rare vagrant). Therefore, the selected relevant species that are possibly susceptible to the proposed development will be discussed in greater detail during the EIA phase, which will include specific (Guideline-based) recommendations for monitoring and mitigation. Photographic evidence of SCC observed during the current study is provided in Figure 4-4.

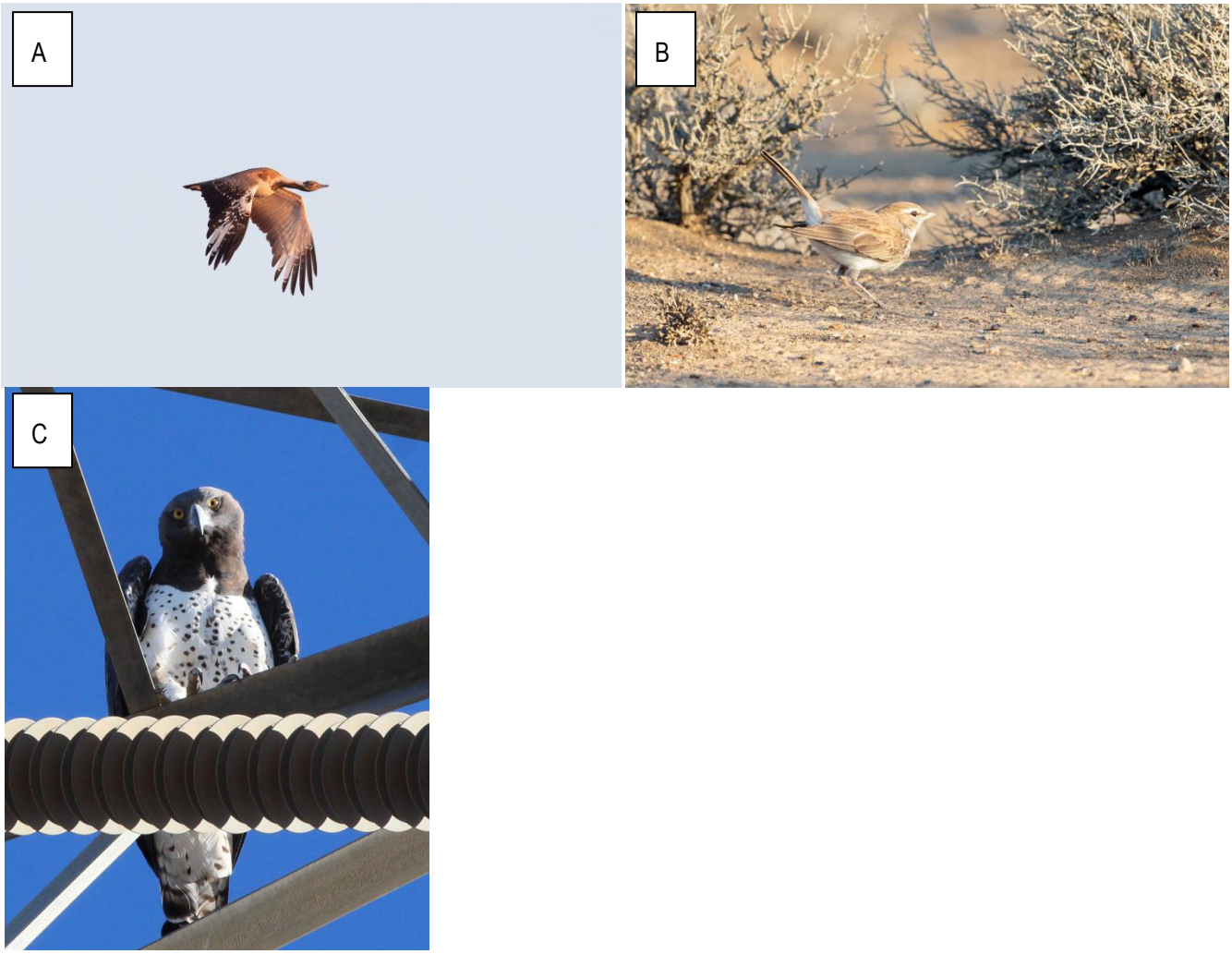

Figure 4-4: Avifauna SCC observed within the proposed Botterblom WEF PAOI[5].

[5] A = Ludwig's Bustard *Neotis ludwigii*; B = Red Lark *Calendulauda burra*; C = Martial Eagle *Polemaetus bellicosus*

Table 4-3: Summary of avifauna species of conservation concern of known distribution, previously recorded in or adjacent to the study area pentads.

Species	Global Conservation Status[6]	National Conservation Status[7]	Preferred Habitat	Potential likelihood of occurrence on study area and potential risk posed from the WEF
Ardeotis kori (Kori Bustard)	Near Threatened	Near Threatened	Primary upland grassland, desert savanna and karoo with foraging and roosting particularly on rocky/ hilly terrain.	**Confirmed**: Moderate densities throughout the region and PAOI but surprisingly low densities within the study area. The species is likely to be a breeding resident within or adjacent to the study area. A large bodied species, it is highly susceptible to WEF development activities.
Spizocorys sclateri (Sclater's lark)	Near Threatened	Near Threatened	Dry shrubland, karroid drainage lines and karoo shrubveld	**Confirmed**: High densities throughout the region but uncommon in the study area The species is likely to be a breeding resident within or adjacent to the study area. A localised low flying passerine, it is not highly susceptible to WEF development activities but is threatened by habitat loss
Calendulauda burra (Red lark)	Vulnerable	Vulnerable	Red dune open shrubland/ grassy duneveld	**Confirmed**: Low densities throughout the region but locally common in the study area The species is likely to be a breeding resident within or adjacent to the study area. A localised low flying passerine, it is susceptible to WEF development activities (high display flights) but is more threatened by habitat loss.
Aquila verreauxii (Verreaux's' Eagle)	-	Vulnerable	Mountainous areas or areas with prominent outcrops with a high prey base (e.g. hyrax)	Moderately Likely: Frequent foraging resident throughout the PAOI but far less frequent within the study areas due to the large distances to the mountainous preferred habitats and a general lack of localised abundant prey. Localised areas exhibiting high abundance of hyraxes and rock rabbits should be considered highly sensitive to the species. The species is susceptible to poisoning events and WEF facilities with a low risk from proposed activities.
Polemaetus bellicosus (Martial Eagle)	Endangered	Endangered	Open bushveld, desert savanna and karoo with adequate roosting and foraging potential.	**Confirmed:** A rare breeding resident and foraging visitor dependent on adequate food supply and roosts. At least one breeding pair nesting within the proposed WEF boundary (Figure 3-2), but limited sightings in terms of foraging activity on the development footprint area. Typically, the species would exhibit a Low to Moderate risk to the proposed development

[6] IUCN 2021
[7] Taylor et al. 2015

Species	Global Conservation Status[6]	National Conservation Status[7]	Preferred Habitat	Potential likelihood of occurrence on study area and potential risk posed from the WEF
				activities although the presence of a permanent nest site and foraging juveniles significantly increases the risk to local individuals.
Rhinoptilus africanus (Double-banded Courser)	Least Concern	Near Threatened	Flat, stony or gravelly, semi-desert terrains with firm, sandy soil and tufty grass or thorn scrub	**Confirmed**. A fairly common breeding resident recorded in the current study. Not highly vulnerable to the proposed activities due to ground dwelling habitats. .
Ciconia nigra (Black Stork)	-	Vulnerable	Breeds on steep cliffs within mountain ranges; forages on ephemeral wetlands, pastures and agricultural fields. .	Unlikely: A highly irregular to rare foraging visitor dependent on the wetland systems located throughout the study area and potentially vulnerable to the proposed development activities. The proposed WEF is not situated adjacent to large tracts of the preferred habitat of the species.
Falco biarmicus (Lanner Falcon)	-	Vulnerable	Varied, but prefers to breed in mountainous areas.	**Confirmed:** A fairly common foraging migrant recorded in the current study and expected periodically to occur. Not highly vulnerable to the proposed activities.
Neotis ludwigii (Ludwig's Bustard)	Endangered	Endangered	Primary upland grassland, desert savanna and karoo with foraging and roosting particularly on rocky/ hilly terrain.	**Confirmed:** High densities throughout the study areas. The species is likely to be a breeding resident within or adjacent to the study area. A large bodied species, it is highly susceptible to WEF development activities as shown by direct interactions with the existing Khobab turbines (although no mortalities have been recorded).
Sagittarius serpentarius (Secretarybird)	Vulnerable	Vulnerable	Prefers open grassland or lightly wooded habitat although forages extensively in open karroid savannah.	Moderate to Highly Likely: Regular low-density resident which is most likely of lower risk to the proposed development activities given ground foraging habitats. In addition, persistent long term regional drought may have significantly decimated local prey sources (especially snakes) thus further reducing the likelihood of persisting local populations of significant densities.
Eupodotis vigorsii (Karoo Korhaan)	Near threatened	Near threatened	Karroid habitats, large saline pans and shallow impoundments.	**Confirmed:** Common resident occurring near areas with drainage lines (including ephemeral) and open areas. Individually susceptible to WEF development activities but as a species is considered low risk.
Afrotis afra (Southern	Vulnerable	Vulnerable	Prefers open grassland, succulent and nama	**Confirmed:** Only two sightings within the PAOI as the study area overlaps with the far more common Northern Black

Species	Global Conservation Status[6]	National Conservation Status[7]	Preferred Habitat	Potential likelihood of occurrence on study area and potential risk posed from the WEF
Black Korhaan			karoo as well as cultivated fields and lightly wooded habitat although forages extensively in open karroid savannah associated with the study area.	Korhaan. Within the survey area regular breeding resident which is most likely of moderate risk to the proposed development activities given the species proclivity to fly at lower heights within the rotor sweep zone.
Falco naumanni (Lesser Kestrel)	Near Threatened	Near Threatened	Widespread species prefers open grassland or lightly wooded habitat although forages extensively in open karroid savannah. Roosts collectively in locations with tall trees.	Highly Likely: Regular migrant of fluctuating seasonal density which is most likely of lower risk to the proposed development activities due to most pressures occurring with breeding grounds and migration routes.

4.5 PRECONSTRUCTION MONITORING MAIN RESULTS

Due to the ongoing preconstruction monitoring, the final data will be presented in the final EIA report. An example of the data capture for the Summer Vantage Points has been provided as Appendix 2, which clearly shows that priority species, their direction of flight, height of flights and general behaviour was able to successfully be recorded by the observers. Thus, flight patterns, risks and minimum preconstruction monitoring requirements will be fulfilled and as mentioned, inputted into the the EIA. A general descriptive summary of the monitoring programme is provided below.

4.5.1 Walked Transects counts

During the walked transects, the total number of individual birds (per species) were recorded regardless of if they are listed as priority or not. Due to the limited information currently, the Index of Kilometric Abundance (IKA = birds/km) was not calculated for each priority species. This information will be presented in the final EIA report. Notable Priority Species recorded included Ludwig's Bustards that were often flushed from foraging positions as well as Northern Black Korhaans and Karoo Korhaans.

4.5.2 Drive Transect counts

The main focus of drive transects were the recording of large birds and raptors. These species were recorded during driven transects on the WEF site during two seasons. Raptors and korhaans and Red Lark were the most frequently recorded priority species. On some sample days, the observers returned at night and priority species were recorded (such as owls, coursers

and thick knees). Once sampling for all four season has been completed a more accurate representation of avifauna species, especially large birds and raptors can be presented.

4.5.3 Vantage Points

Up to the current point of the one-year survey, the Vantage Point data collection appeared to provide the richest avifaunal observations. Priority species recorded during VP surveys were divided into three flight height categories (Low 0 to 50 m, Medium 50 to 150 m and High with all observations of birds flying more than 150 m). The summer data capture is indicated in Appendix 2.

Due to its abundance and conservation status, the Ludwig's Bustard is a priority species of concern since it may be prone to collision at certain times (e.g. when commuting between roosting and feeding sites, following rainfall events, invertebrate outbreaks (locusts) or commuting after farming activities which increase food availability). The species has been observed flying at rotor height multiple times during very brief survey periods. This included a (photographed) sighting of two individual bustards which were observed flying in a west to east directions directly between the existing turbines (Khobab WEF) within the rotor sweep area (Figure 4-5). In the remaining observations, Ludwig's Bustards were mostly observed close to drainage lines, adjacent to roadsides, in adjacent livestock fields and flying above linear structures such as the large railway line that bisects the PAOI. On multiple occasions, the observers' presence flushed some birds (presumably breeding pairs and/ or breeding pairs with a juvenile). Flights were most often generally very low (less than 50 m height) and short distanced although twice, individuals would take flight and leave the vicinity (+/- 2 km). In order to gain some understanding of which species are likely to be most at risk of collision, the collisions risk rating for each priority species recorded during VP watches will be presented in the final EIA report once data have been collected for all seasons.

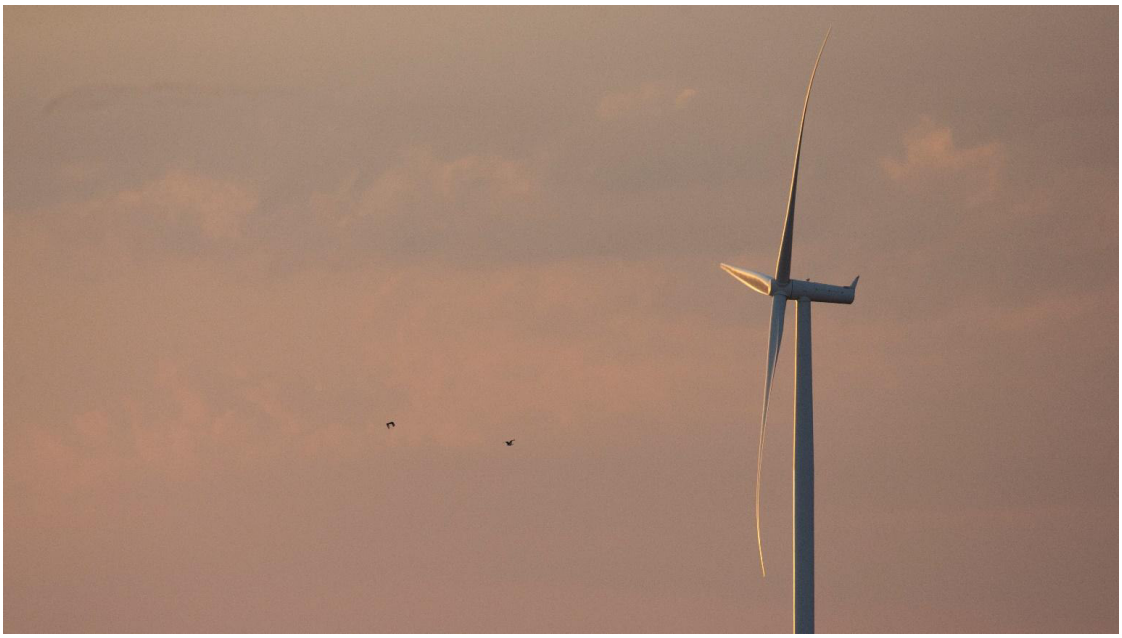

Figure 4-5: A photo showing Ludwig's Bustards flying at rotor sweep height through the existing Khobab WEF.

4.5.4 Focal Sites

The drainage line system outside the western boundary of the project study area contained a relatively high density (and higher diversity) of passerines, including Sclater's Lark. However, this species was not directly associated with the project development footprint but was associated with the PAOI and a static bat recorder point.

The existing power lines were also surveyed, and the only noticeable species of concern is the Martial Eagle and its nest (see section below). More information will be gathered during the ongoing surveys.

4.5.5 Nest Survey

Nest sites were searched for during the initial surveys, and will continue to be actively searched for in the forthcoming surveys. Windmills, trees, pylons, bridges and masts represent potential roost and nesting sites for raptors, while water bodies are potential roost and nesting sites for multiple species. Including the active Martial Eagle nest (Figure 4-6 and Figure 4-7), breeding and foraging activity has been noted and will continue to be monitored during the forthcoming surveys. Ludwig's Bustard is considered a resident and to be breeding on site although no nests have been located. The winter and final spring survey will provide more data.

Figure 4-6: Active Martial Eagle nest on the southern portion of the study area.

Figure 4-7: Bones and skulls of foraged species associated with the active Martial Eagle nest.

4.6 WEF SITE SENSITIVITY

It is important to note that currently, due to incomplete data collection, the sensitive areas that have been designated must be interpreted with caution. Each demarcated sensitive feature (of which more may be added) will still be evaluated for the degree of sensitivity based on the complete 12 month data set and presented in the final EIA report. Figure 4-8, which represent the preliminary sensitive features, needs to be carefully interpreted in the absence of a complete data set.

There is an important presence of a number of SCC in the study area, recorded regularly and widespread through the proposed WEF area. In addition, there are several raptors utilising the PAOI, some of them priority species and/or of conservation concern, such as the Martial Eagle, Lanner Falcon, Pale-chanting Goshawk and Black-winged Kite.

Areas of drainage lines and natural vegetation which are vital to maintaining populations of habitat obligate sensitive species (such as Sclaters' Lark and Red Lark) are associated to have a high probability of collision consistently throughout the year. Furthermore, natural drainage line vegetation represents an important habitat to maintain natural geohydrological processes of the PAOI. A 50 m buffer around these areas must be considered NO-GO where no turbines and associated infrastructure may be located. A 200 m buffer is also applied around seasonally inundated watercourses in the PAOI, as these features attract birds under certain conditions and could be the only locations were certain sensitive species such as the ducks, herons, storks and water birds are likely to occur. These areas must be avoided by the developer where no turbines and associated infrastructure may be located. Several of the proposed turbine positions and associated infrastructure coincide with areas

currently demarcated as sensitive features within the prescribed buffers and consequently may have to be relocated outside of these sensitive areas. The layout will have to be carefully re-evaluated in order to mitigate against negative interaction with priority species such as Red Lark.

4.6.1 Martial Eagle Nest Site

At this point in the survey, a preliminary buffer of 3 km is recommended as an exclusion area around the active Martial Eagle nest, which is to be confirmed after the completion of the 12 month pre-construction monitoring. There is currently no species-specific guideline for the Martial Eagle, and buffer areas around nest sites remains a scientifically contentious topic of discussion in the industry without rigorous scientific studies providing necessary guidance (for example, Murgatroyd, Bouten & Amar 2021). The only published recommended buffer to implement around raptor nests in South Africa is for the Verreauxs' Eagle (Ralston-Paton, 2017), which dictates that a precautionary buffer of 3 km is recommended and may be reduced or increased based on the results of rigorous avifaunal surveys, but nest buffers should never be less than 1.5 km.

A recent paper from Murgatroyd, Bouten & Amar (2021) indicated that by using predictive models to account for habitat use instead of simple buffers around a nest, a greater area of land can be made available for wind energy development without increased mortality risk to raptors. Accordingly, this tool can be used to provide robust guidance on wind turbine placement in a way which minimises the conflict between raptor species and the development of wind energy facilities in South Africa. It must be noted that the study species for this research was Verreaux's Eagle which was tracked at only four locations (not including the current habitat or region), and accordingly the interpretation of the results needs to be considered as species- and site-specific, even though the same principle can be extrapolated to other raptor species in various regions. The study recommended that nest buffers should never be <3.7 km radius, but also indicated that additional site-specific specialist input or mitigation methods might allow a limited amount of development for high-risk developments. Based on the preliminary data collected during the pre-construction monitoring (see above), the breeding pair of martial eagles do not appear to be foraging regularly over the proposed Botterblom WEF development area.

The current survey, in accordance with the accepted methods shows limited use of the proposed development footprint area by the two Martial Eagles. Only one individual was recorded at any one time, and always from VP4 and DT1 which were close to the nest site, and VP5 (control) which is located approximately 3.8 km southeast of the nest site. This could be due to there being very low densities of livestock and limited preferred prey on or immediately adjacent to the proposed development footprint area, which forces the eagles to hunt further away from the study area. However, the specialists agree that sporadic monitoring information, as has been collected to date, is not a definitive substitute for robust telemetry-based home range data. Therefore, the absence of observations of these eagles flying over the proposed development footprint area does not provide conclusive evidence that they do not utilise this area for foraging purposes.

Considering that only four collision-caused fatalities for Martial Eagles have occurred at 20 WEFs across South Africa between 2014 and 2018 (Perold *et al*., 2020), coupled with the proposed development footprint not being within a core regional stronghold (Taylor *et al*. 2015), and the significance of the Martial Eagle nest being located in an unnatural situation (having nested on a pylon), the impact of the proposed development for the species may be classified as moderate to low significance. The presence of the eagles is a direct result of the existing and planned WEFs and solar PV facilities because

they are nesting on artificial structures (transmission line pylon) specifically built for the transmission of electricity generated from these renewable energy projects (via the Helios substation). Sterilizing large sections of the proposed renewable energy developments due to the unnatural presence of these eagles is therefore not advisable, especially since the eagles may at any moment willingly decide to abandon or relocate their nest for natural reasons (e.g. low prey availability). As a result, it is strongly recommended that a Martial Eagle specialist (we propose Dr. Gareth Tate of the EWT) should be consulted to investigate the potential mitigation option of removing the Martial Eagle nest when no egg or fledgling is present so that the adults may disperse and rebuild a nest further away from the proposed Botterblom WEF and the other existing and planned WEFs in the immediate vicinity. Such a mitigation measure would need to ensure:

- appropriate dispersal of the parents away from the current and planned WEFs (not increased likelihood of flying into existing and proposed WEF space);
- prevention of re-nesting on the same or nearby electricity pylons of the Helios-Juno Line 1 transmission line.

Collision-caused fatalities of birds at wind power facilities create a 'green versus green' conflict between wildlife conservation and renewable energy. These fatalities can be mitigated through several interventions, including informed curtailment whereby turbines are slowed or stopped when birds are considered at increased risk of collision (McClure *et al*., 2021). Automated monitoring systems (radar detection systems) could improve efficacy of informed curtailment, especially when considered in conjunction with other mitigation actions such as painting one turbine blade black (May *et al*., 2020). McClure *et al*., (2021) showed that automated curtailment of wind turbine operation substantially reduce (not fully eliminate) eagle fatalities. This technology therefore has the potential to significantly reduce the conflict between wind energy and raptor conservation.

Should automated monitoring systems not be feasible then the use of full time (shift work based) designated Martial Eagle observers can be considered which may serve to both ensure local job creation as well as supplement the above-mentioned mitigation measures while reducing the size of the nest buffer, should it not be possible to remove the nest. Permanent observers can be assigned to both the nest site as well as the affected WEF area where Martial Eagle behaviour can be monitored and emergency actions (e.g., turbine shutdowns) can be initiated based upon the breach of pre-approved risk criteria.

The authors of this report therefore argue that should the eagle nest not be removable (pending input from a species-specialist) a precautionary 3 km buffer for this project would be sufficient, but only if the accompanied mitigation measures are implemented (this will be further expanded on in the EIA report).

The combined sensitivity for avifauna has been indicated in the map below (Figure 4-8). The buffer and sensitivity map will be finalised after the full 12 month pre-construction monitoring has been completed.

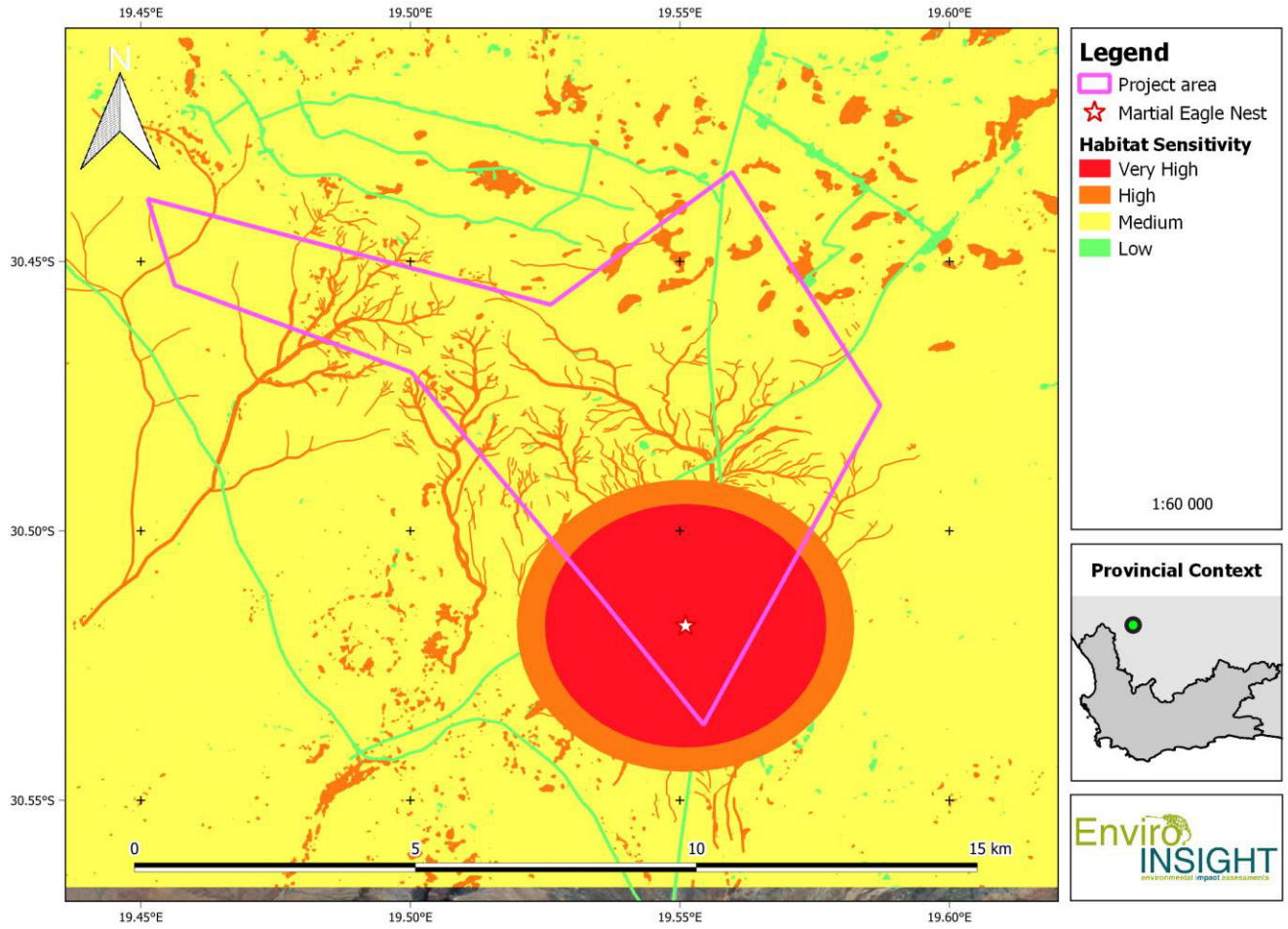

Figure 4-8: Preliminary avifaunal sensitive features.

5 POTENTIAL IMPACTS

5.1 BACKGROUND TO INTERACTIONS BETWEEN WIND ENERGY FACILITIES, POWER LINES AND BIRDS

The effects of a wind farm on birds are highly variable and depend on a wide range of factors including the design and specification of the development, the topography of the surrounding land, the habitats affected and the number and species of birds present.

Typical potential impacts include (but are not necessarily limited to):

- Collision mortality with wind turbines and above-ground power transmission lines;
- Electrocution from above-ground power transmission lines;
- Habitat loss (including foraging and breeding) and fragmentation due to displacement (avoidance of disturbance);
- Disturbance due to lights, noise, dust, machinery movements and maintenance operations;

These potential impacts will be assessed in the EIA phase of the project with specific reference to priority species and other

non-priority species at high risk of negative impact from the proposed facility.

5.2 CUMULATIVE IMPACTS

The existing Khobab WEF to the east of the current project area already has quantified negative impacts on the avifauna community in the region (Arcus, 2020; Table 4-2). Therefore, any impacts anticipated from the proposed WEF will add to these existing impacts. As such, the results obtained during this preconstruction survey and from the subsequent impact analysis should be considered in conjunction with the impacts created by the Khobab WEF.

5.3 MITIGATION OF IMPACTS

Due to the global demand for renewable energy, a strong research emphasis has been placed on describing and defining mitigation measures to negate or minimise the negative impacts associated with such facilities. In particular, much research is focused on bird-turbine collisions prevention/minimisation at wind energy facilities (see May *et al.*, 2015; Gartman *et al.*, 2016 a & b; May *et al.*, 2020; McClure *et al.*, 2021). New mitigation measures range from simple (e.g. painting one turbine blade black; May *et al.*, 2020) to complex (detecting approaching birds with cameras and artificial intelligence to slow turbines down; McClure *et al.*, 2021). However, by far the best mitigation option remains the first step of the mitigation hierarchy which is "avoidance". Consequently, all attempts will be made to avoid potential impacts arising from the proposed WEF through the application of necessary buffers for sensitive areas, where placement of turbines may not occur. Additional remaining impacts will be minimised through the application of known and previously tested mitigation measures (e.g. May *et al.*, 2015). Finally, there is strong support from the developer to apply experimental minimisation mitigation measures (e.g. painting of one blade) and to utilise the facility to generate important research data.

Alternative additional mitigation measures may include change of the current land use to minimise attraction for priority species.

6 CONCLUSIONS

The study area is located in a region dominated by natural karoo vegetation types with some transformed/ agricultural. Several drainage lines and small dams can be found scattered across the study area with most being mostly dry with some seasonal flow.

Fourteen priority species were recorded during the initial surveys, including Martial Eagle, Ludwig's Bustard, Lanner Falcon, Red Lark and Black-winged Kite. Of these, the Ludwig's Bustard was the most concerning large bird species and was observed flying within the rotor sweep area. The high densities of other Korhaan species (many flying at rotor height) also represent a concern. Additional data is required prior to drawing any final conclusions.

One current concern regarding the bird community observed is the presence of potential collision sensitive raptors species, of which one of them is considered a species of conservation concern, namely the Martial Eagle. Currently, this species has been observed at heights of >50 m, and therefore in the absence of additional data significance cannot be established with any certainty. In addition, it is perhaps noteworthy that in four years of monitoring no observed mortalities of this species was recorded at the adjacent Khobab WEF. However, the presence of an active nest within the OAI and proposed Botterblom

WEF is of great concern and requires intensive attention to mitigation measures and development footprint placement (avoidance).

The occurrence of several passerine species that might potentially be affected by collision was confirmed, namely endemic and/or range-restricted larks (Red Lark and Sclater's Lark representing the highest profile and frequently observed) which are widespread species in the area. These species are considered to have a "Vulnerable and Near threatened" conservation status respectively. As habitat obligates, the potential impact on these passerines may be mitigated via avoidance.

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8 APPENDIX

8.1 APPENDIX 1: EXPECTED AVIFAUNA SPECIES LIST

Avifauna predicted to potentially occur within the study area according to SABAP1 and SABAP2.

#	Scientific Name	Common Name	# pentads
1	*Afrotis afraoides*	Northern Black Korhaan	2
2	*Alopochen aegyptiaca*	Egyptian Goose	2
3	*Amadina erythrocephala*	Red-headed Finch	1
4	*Anas capensis*	Cape Teal	1
5	*Anthoscopus minutus*	Cape Penduline Tit	4
6	*Anthus cinnamomeus*	African Pipit	3
7	*Anthus nicholsoni*	Nicholson's Pipit	3
8	*Apus affinis*	Little Swift	3
9	*Apus apus*	Common Swift	2
10	*Apus caffer*	White-rumped Swift	2
11	*Ardea melanocephala*	Black-headed Heron	1
12	*Ardeotis kori*	Kori Bustard	1
13	*Bubo africanus*	Spotted Eagle-Owl	4
14	*Burhinus capensis*	Spotted Thick-knee	3
15	*Buteo rufofuscus*	Jackal Buzzard	3
16	*Calandrella cinerea*	Red-capped Lark	4
17	*Calendulauda burra*	Red Lark	3
18	*Caprimulgus rufigena*	Rufous-cheeked Nightjar	1
19	*Cecropis cucullata*	Greater Striped Swallow	1
20	*Cercotrichas coryphoeus*	Karoo Scrub Robin	4
21	*Certhilauda subcoronata*	Karoo Long-billed Lark	4
22	*Charadrius pecuarius*	Kittlitz's Plover	1
23	*Charadrius tricollaris*	Three-banded Plover	2
24	*Chersomanes albofasciata*	Spike-heeled Lark	4
25	*Cinnyris chalybeus*	Southern Double-collared Sunbird	1
26	*Cinnyris fuscus*	Dusky Sunbird	3
27	*Circaetus pectoralis*	Black-chested Snake Eagle	3
28	*Cisticola subruficapilla*	Grey-backed Cisticola	4
29	*Colius colius*	White-backed Mousebird	2
30	*Columba guinea*	Speckled Pigeon	4

31	*Corvus albus*	Pied Crow	4
32	*Corvus capensis*	Cape Crow	4
33	*Coturnix coturnix*	Common Quail	1
34	*Crithagra albogularis*	White-throated Canary	4
35	*Crithagra flaviventris*	Yellow Canary	4
36	*Curruca layardi*	Layard's Warbler	3
37	*Curruca subcoerulea*	Chestnut-vented Warbler	1
38	*Cursorius rufus*	Burchell's Courser	2
39	*Emarginata schlegelii*	Karoo Chat	4
40	*Emarginata sinuata*	Sickle-winged Chat	3
41	*Emarginata tractrac*	Tractrac Chat	4
42	*Emberiza capensis*	Cape Bunting	3
43	*Emberiza impetuani*	Lark-like Bunting	4
44	*Eremomela gregalis*	Karoo Eremomela	4
45	*Eremomela icteropygialis*	Yellow-bellied Eremomela	4
46	*Eremopterix australis*	Black-eared Sparrow-Lark	4
47	*Eremopterix verticalis*	Grey-backed Sparrow-Lark	4
48	*Eupodotis vigorsii*	Karoo Korhaan	4
49	*Falco biarmicus*	Lanner Falcon	3
50	*Falco rupicoloides*	Greater Kestrel	4
51	*Falco rupicolus*	Rock Kestrel	4
52	*Galerida magnirostris*	Large-billed Lark	4
53	*Hieraaetus pennatus*	Booted Eagle	2
54	*Himantopus himantopus*	Black-winged Stilt	1
55	*Hirundo rustica*	Barn Swallow	4
56	*Lamprotornis bicolor*	Pied Starling	1
57	*Lanius collaris*	Southern Fiscal	4
58	*Malcorus pectoralis*	Rufous-eared Warbler	4
59	*Melaenornis infuscatus*	Chat Flycatcher	4
60	*Melaniparus afer*	Grey Tit	4
61	*Melierax canorus*	Pale Chanting Goshawk	4
62	*Merops apiaster*	European Bee-eater	2
63	*Motacilla capensis*	Cape Wagtail	3
64	*Muscicapa striata*	Spotted Flycatcher	1
65	*Myrmecocichla formicivora*	Ant-eating Chat	4
66	*Myrmecocichla monticola*	Mountain Wheatear	2
67	*Nectarinia famosa*	Malachite Sunbird	1

68	*Neotis ludwigii*	Ludwig's Bustard	4
69	*Oena capensis*	Namaqua Dove	4
70	*Oenanthe familiaris*	Familiar Chat	4
71	*Oenanthe pileata*	Capped Wheatear	4
72	*Passer domesticus*	House Sparrow	3
73	*Passer melanurus*	Cape Sparrow	4
74	*Plectropterus gambensis*	Spur-winged Goose	1
75	*Ploceus velatus*	Southern Masked Weaver	4
76	*Polemaetus bellicosus*	Martial Eagle	3
77	*Prinia maculosa*	Karoo Prinia	4
78	*Pterocles namaqua*	Namaqua Sandgrouse	4
79	*Ptyonoprogne fuligula*	Rock Martin	4
80	*Pycnonotus nigricans*	African Red-eyed Bulbul	1
81	*Rhinoptilus africanus*	Double-banded Courser	4
82	*Serinus alario*	Black-headed Canary	4
83	*Spilopelia senegalensis*	Laughing Dove	4
84	*Spizocorys sclateri*	Sclater's Lark	4
85	*Spizocorys starki*	Stark's Lark	3
86	*Stenostira scita*	Fairy Flycatcher	1
87	*Streptopelia capicola*	Cape Turtle Dove	4
88	*Tadorna cana*	South African Shelduck	3
89	*Telophorus zeylonus*	Bokmakierie	4
90	*Torgos tracheliotos*	Lappet-faced Vulture	1
91	*Tricholaema leucomelas*	Acacia Pied Barbet	3
92	*Vanellus armatus*	Blacksmith Lapwing	1
93	*Vanellus coronatus*	Crowned Lapwing	2

8.2 APPENDIX 2: PRIORITY SPECIES DATA COLLECTION EXAMPLE

	Species	Number	Category	Discernible flight patterns	Specific notable behaviours
VP1 Morning	Northern Black Korhaan	1	2	W-E	High flying
	Karoo Korhaan	1	1	N/A	Single karoo korhaan calling (mating behaviour).
	Red Lark	8+	1	Indeterminate	Flocking and foraging
	Greater Kestrel	1	1	N-S	Perching and then foraging
	Red Lark	1	2	N/A	Mating behaviour (display)
	Northern Black Korhaan	1	2	NW-SE	High flying
	Karoo Korhaan	2	0	N/A	Foraging
	Namaqua Sandgrouse	5	2	SE-NW	Flocking
	Red Lark	1	2	N/A	Mating behaviour (display)
	Karoo Korhaan	1	1	N/A	Foraging
	Black-winged kite	1	2	W-E	Foraging
	Grey-backed Sparrowlark	7	2	NE-SW	Flocking
	Pied Crow	2	3	E-W	High flying
	Red Lark		6	N/A	Flocking and foraging
VP 1 Midday	Pied Crow	1	3	S-N	High flight
	Namaqua Sandgrouse	4	1	NW-SE	Fast Movement to and from water
	Red lark	4	1	N/A	Flocking and foraging
	Pied Crow	2	2	SW-NE	Medium flying
	Namaqua Sandgrouse	4	2	NW-SE	Fast Movement to and from water
	Pied Crow	2	3	SW-NE	High Flying
	Grey-backed Sparrowlark	10	7	N-S	Medium flocking
	Pale-chanting Goshawk	1	2	W-E	Steady straight flight
VP 1 Afternoon	Red Lark	1	2	N/A	Mating Display
	Northern-black Korhaan	1	1	SE-NW	Ground calling
	Namaqua Sandgrouse	6	1	N-S	Low Flocking and Foraging

	Pied Crow	3	2	E-W	Medium flying
	Karoo Korhaan	2	1	N/A	Foraging
	Red Lark	5	1	Indeterminate	Flocking and Foraging
	Pied Crow	2	2	S-N	Medium flying
	Red Lark	1	2	N/A	Mating Display
	Black-winged kite	1	2	Variable with overall SW-NE pattern	Hovering and Foraging
	Northern-black Korhaan	1	3	SE-NW	High Flying
	Red Lark	1	1	N/A	Display
	Namaqua Sandgrouse	4	2	NW-SE	Flocking and Foraging
	Grey-backed sparrowlark	8	2	S-N	Flocking and Foraging
	Pied Crow	4	3	E-W	High Flying
	Northern-black Korhaan	1	3	NW-SE	High Flying and calling
VP 2 Morning	Northern Black Korhaan	1	1	N/A	Ground
	Pied Crow	2	3	E-W	High Flying and Calling
	Namaqua Sandgrouse	5	2	N-S	Flocking and Foraging
	Ludwig's Bustard	2	3	WNW-SE	Pair flying towards turbines
	Northern black Korhaan	3	2	S-N	High Flying and Calling
	Karoo Korhaan	1	1	N/A	Individual mating call
	Namaqua Sandgrouse	4	2	NNW-SSE	Flocking and Foraging
	Grey-backed sparrowlark	6	2	NW-SE	Flocking and Foraging
	Karoo Korhaan	2	1	N/A	Ground foraging
	Ludwig's Bustard	1	2	W-E	Single individual flying low to medium
	Pied Crow	1	2	SW-NE	Medium straight flight
	Pied Crow	3	3	SW-NE	High Straight flight
VP 2 Midday	Pied Crow	3	3	SW-NE	High Straight flight
	Pied Crow	1	2	SW-NE	Medium straight flight
	Pale-chanting Goshawk	1	2	E-W	Medium straight flight
	Karoo Korhaan	1	1	N/A	Individual mating call

	Pied Crow	3	2	N-S	Medium straight flight
VP 2 Afternoon	Karoo Korhaan	2	1	N/A	Foraging on ground
	Lanner Falcon	1	2	NE-SSW	Medium straight slow flight (foraging)
	Pied Crow	3	3	SW-NE	High Straight flight
	Pied Crow	1	2	SW-NE	Medium straight flight
	Grey-backed sparrowlark	9	1	Circular	Circular foraging flight
	Greater Kestrel	1	2	W-E	Medium straight flight with intermittent perching
VP 3 Morning	Ludwig's Bustard	1	2	E-W	Towards Koppies
	Black-eared Sparrowlark	15+	1	SE-NNW	Flocking and Foraging
	Pied Crow	3	3	NE-SW	High Straight flight
	Pied Crow	1	2	NE-SW	Medium straight flight
	Pied Crow	1	3	E-W	High Straight flight
	Pale-chanting Goshawk	1	2	E-W	Foraging
	Grey-backed Sparrowlark	8	1	S-N along road	Straight low flight with periodic landings
	Namaqua Sandgrouse	4	1 and 2	Circuluar but in an overal W-E	Swift circular flight
VP 3 Midday	Pied Crow	2	3	NE-SW	High Straight flight
	Namaqua Sandgrouse	2	2	W-E	Medium straight flight
	Pied Crow	1	3	NE-SW	High Straight flight
VP 3 Afternoon	Pied Crow	1	3	E-W	High Straight flight
	Ludwig's Bustard	1	2 and 3	NE-SW	Low to Mediium flight
	Black-eared Sparrowlark	12+	2	W-E	Medium Straight Flight
	Pied Crow	4	3	N-S	Medium Straight Flight
	Grey-backed sparrowlark	10+	2	W-E	Medium Straight Flight
	Namaqua Sandgrouse	2	1 and 2	S-N	Low to Mediium flight foraging and landing
	Pied Crow	1	2	N-S	Medium Straight flight
VP 4 Morning	Pale-chanting Goshawk	1	2	E-W	Foraging

	Namaqua Sandgrouse	3	1 and 3	S-NE	Low to Mediium flight foraging and landing
	Pied Crow	2	2	SE-NNW	Medium straight flight
	Karoo Korhaan	3	1	N/A	between the road and the railway line exhibiting territorial, mating behaviour (2 males competing)
	Martial Eagle	1	3	N-S	Soaring
	Pied Crow	1	3	NNW-SE	High soaring flight
	Namaqua Sandgrouse	4	1	N-SW	Low foraging
	Pied Crow	1	2 and 3	S-N	Medium to High soaring flights
	Karoo Korhaan	2	1	ESE-WNW	Low flight
	Namaqua Sandgrouse	2	1	Circular	Foraging flight
	Pied Crow	1	3	S-N	High soaring flight
	Northern Black Korhaan	1	1	N/A	Ground
VP 4 Midday	Pied Crow	1	2	SSE-NNW	Medium straight flight
	Pale-chanting Goshawk	1	2	NNE-SSW	Medium Soaring
	Pied Crow	1	2	E-W	Medium straight flight
	Namaqua Sandgrouse	2	1 and 2	S-N	Low to Mediium flight foraging and landing
VP4 Afternoon	Northern-black Korhaan	1	1	N/A	Ground foraging West of the VP
	Namaqua Sandgrouse	4		SW-NE	Ground foraging West of the VP
	Northern-black Korhaan	1	2	E-W	Medium calling flight
	Red lark	6	1	Circular	Flocking behaviour
	Pied Crow	2	3	SW-NE	High soaring flight
	Northern-black Korhaan	1	1 and 2	W-E	Low calling flight
	Red lark	1	2	N/A	Display flight
	Namaqua Sandgrouse	4	1	NE-SW	Flocking behaviour
	Namaqua Sandgrouse	2	1	Circular	Flocking behaviour
	Northern-black Korhaan	1	2	E-W	Medium calling flight

	Northern-black Korhaan	1	2	E-W	Medium calling flight
	Black-winged Kite	1	2	W-E	Hovering and Foraging
	Pied Crow	2	2	SW-NE	Medium straight flight
	Red lark	1	1 and 2	N/A	Display
	Northern-black Korhaan	1	1	W-E	Medium calling flight
	Karoo Korhaan	2	1	W-E	Low flight
	Karoo Korhaan	1	1	N/A	Ground calling
VP 5 Morning	Pale-chanting Goshawk	1	2 and 3	E-W	Slow soar
	Martial Eagle	1	1	Low foraging flight	Martial Eagle foraging at 10 metres
	Karoo Korhaan	2	1	N/A	2 x Karoo Korhaan calling from grounded positions indicating possible courtship or nesting behaviour
	Pied Crow	1	2	E-W	Medium straight flight
	Karoo Korhaan	1	1	S-N	Medium straight flight
	Namaqua Sandgrouse	6	1	W-E	Low Straight flight to water
	Namaqua Sandgrouse	3	1	E-W	Low straight flight from water
VP 5 Midday	Pied Crow	1	3	E-W	High soaring flight
	Karoo Korhaan	2	1	N/A	2 x karoo Korhaan calling from grounded positions indicating possible localised territorial behaviour or nest
	Namaqua Sandgrouse	5		W-E	Low Straight flight to water
VP 5 Afternoon	Pale-chanting Goshawk	1	2 and 3	E-W	Slow soar
	Pied Crow	1	2	W-E	Medium straight flight
	Pied Crow	1	2	W-E	Medium straight flight to roosts
	Karoo Korhaan	2	1	N/A	2 x karoo Korhaan calling from grounded positions indicating possible localised territorial behaviour or nest
	Namaqua Sandgrouse	3	2	N-S	Flocking

	Namaqua Sandgrouse	6	2	NW-SE	Flocking and Foraging
	Grey-backed sparrowlark	8	2	S-N	Flocking and Foraging
	Pied Crow	4	3	E-W	High Flying