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AVIFAUNAL SPECIALIST ASSESSMENT REPORT FOR THE PROPOSED SOYUZ 3 WIND ENERGY FACILITY NEAR BRITSTOWN, NORTHERN CAPE PROVINCE

on behalf of

Soyuz 3 (Pty) Ltd

March 2023

Prepared By:

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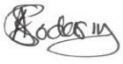
Registered in South Africa No. 2015/416206/07

QUALITY MANAGEMENT SYSTEM

Issue/Revision	**First Issue**	**Revision 1**	**Revision 2**
Version Number	v1-1		
Date	6 March 2023		
Arcus Review and Approval	Ashlin Bodasing		
Signature			

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GLOSSARY OF TERMS AND ABBREVIATIONS

BLSA: BirdLife South Africa
CBA: Critical Biodiversity Area
CWAC: Coordinated Waterbird Counts
DT: Drive Transect
ESA: Ecological Support Area
GPS: Global Positioning System
kV: Kilovolt
MW: Megawatt
OHTL: Over-head Transmission Line
PAAMP: Pre-Application Avifaunal Monitoring Plan
WTG: Wind Turbine Generator
SCC: Species of Conservation Concern
Threatened: CR, EN and VU species
VU: Vulnerable
CAR: Coordinated Avifaunal Road-count
CR: Critically Endangered
DD: Data Deficient
EN: Endangered
EWT: Endangered Wildlife Trust
IBA: Important Bird Area
MTS: Main Transmission Substation
NT: Near Threatened
RSH: Rotor Swept Height
SABAP2: South African Bird Atlas Project 2
SEI: Site Ecological Importance
VP: Vantage Point
WEF: Wind Energy Facility
WT: Walk Transect

Priority species: all species occurring on the Birdlife South Africa (BLSA) and Endangered Wildlife Trust (EWT) Avian Sensitivity Map priority species list[1]. This list consists of 107 species with a priority score of 170 or more. The priority score was determined by BLSA and EWT after considering various factors including bird families most impacted upon by WEFs including physical size, species behaviour, endemism, range size and conservation status.

Red Data species: Species whose regional conservation status is listed as Near Threatened, Vulnerable, Endangered or Critically Endangered in the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor et al. 2015)[2].

Endemic or Near-endemic: Endemic or near endemic (i.e., ~70 % or more of population in RSA) to South Africa or endemic to South Africa, Lesotho and Swaziland. Taken from BLSA Checklist of Birds in South Africa, 2022.

Species of Conservation Concern (SCC): all species that are assessed according to the IUCN Red List Criteria as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD), as well as range-restricted species which are not declining and are nationally listed as Rare or Extremely Rare (also referred to in some Red Lists as Critically Rare)[3]. These species and subspecies are important for South Africa's conservation decision-making processes.

Target species: those particular bird species that are to be recorded by a specific survey method. Target species per survey method:

- Vantage Point (VP) Surveys: All raptors; all large (non-passerine) priority species;
- Drive Transects (DT): All raptors; all large (non-passerine) priority species;
- Walked Transects (WT): All birds; and
- Incidental Observations: All raptors; all large (non-passerine) priority species.

CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

Government Notice No. 320 in Government Gazette No. 43110 of 20 March 2020	Section of Report
Avifaunal Specialist Assessment Report	
The SACNASP registration number of the avifaunal specialist preparing the assessment and their curriculum vitae;	Appendix I
A signed statement of independence by the specialist;	Appendix I
A description of the study area including a map of all the aspects identified in the duration, dates and seasons of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1, 3, Figure 1, 2
The outcome of the reconnaissance study and the resultant site-specific pre-application avifaunal monitoring;	Appendix B
A description of the methodology used to undertake the site specific preapplication avifaunal monitoring program inclusive of the equipment used;	Section 3.1
A map showing the Global Positioning System (GPS) coordinates for each of the monitoring points for both the preferred site as well as the control site;	Figure 1, 2
The monitoring intervals for both sites;	Appendix D, E, F, Section 3
Where relevant, a map showing the areas to be avoided;	Figure 6
Fatality prediction for target species and general species on the preferred site;	Section 5
A map showing the existing renewable energy facilities within a 10 km radius of the proposed development;	Figure 1
Where relevant, the outcomes of the cumulative impact assessment;	Section 5
A discussion based on the pre-application monitoring of the expected impact of the proposed development on avifaunal species;	Section 6
A substantiated statement from the avifauna specialist, indicating the acceptability or not of the proposed development and a recommendation on the approval, or not, of the proposed development;	Section 7
Any conditions to which this statement is subjected;	Section 7
A detailed post construction monitoring programme;	Appendix H
The outcomes of the post-construction monitoring, including data and specialist's reports, must be uploaded onto the national bird monitoring database, to be accessed at https://www.environment.gov.za/birddatabase, once operational;	Not Operational
Where required, proposed mitigation measures or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and	Section 5
A description of the assumptions made and any uncertainties or gaps in knowledge or data.	Section 4
Discussion on bird abundance and movement within the site;	Section 4
Discussion on presence of target or threatened species and their occurrence on the site at heights which could pose risks to collision;	Section 4
Assessment of risk of identified target species to collision including the expected fatality rates of the target species based on a suitable model commonly used for risk determination, per species and for the site;	Section 5
Identification and mapping where relevant, of any migratory or preferential bird routes or corridors;	Figure 5
Where relevant, discussion on the risk of displacement;	Section 5
Where relevant, areas identified within the site as having a very high sensitivity for bird collision or displacement and in which the development of turbines should be avoided. These areas are to be mapped;	Section 4, 6, Figure 6
In areas where existing operational wind energy generation facilities have been identified within a 30 km radius, a cumulative impact assessment must be undertaken which includes:	Section 5

Government Notice No. 320 in Government Gazette No. 43110 of 20 March 2020	Section of Report
The fatality rates for target species at the wind energy generation facilities within a 10 km radius;	N/A
The possible additional fatalities from the proposed wind energy generation facility for target species as well as general avifaunal species; and	Section 5
A discussion on the possible cumulative impact of the proposed facility on regional populations of target species;	Section 5
Where no existing operating wind energy generation facilities occur within the 10 km radius, the specialist must include a discussion on possible cumulative impacts on target species from the proposed facility; and	Section 5, 6
A plan for post construction monitoring (on both the preferred site as well as the control site) and reporting, which must include:	Section 5
Timeframes and intervals for monitoring;	Section 5
Number of turbines to be monitored, including any specific area for monitoring;	Section 5
Methodology for searcher efficiency and scavenger removal;	Section 5
Method for monitoring, i.e. transects or radial as well as extent of monitoring area;	Section 5
Results of monitoring compared against expected fatality rates per target species as well as general species;	Section 5
Reporting requirements, including organisations for submission of reports;	Section 5
Years and intervals for monitoring to occur; and	Section 5
All methods used to estimate bird numbers and movements during reconnaissance and pre-application monitoring, which should be applied in exactly the same order to ensure the comparability of these two data sets.	Section 4, 5

1 INTRODUCTION

Soyuz 3 (Pty) Ltd is considering the development of an up to 480 MW Wind Energy Facility (WEF) in the Northern Cape. The proposed WEF will form part of the Britstown WEF Cluster, which will comprise of a cluster of six WEF's. Arcus Consultancy Services South Africa (Pty) Ltd (an ERM Group Company) ('Arcus') was appointed to conduct the pre-construction avifaunal monitoring for the projects, the results of which have informed the final monitoring and specialist impact assessment process required for environmental authorisation in terms of the National Environmental Management Act, 1998 (Act 107 of 1998, as amended) (NEMA) and associated EIA regulations of 2014 as amended (EIA regulations). The final results and anticipated impacts for Soyuz 3 WEF are assessed in this report.

A pre-application avifaunal monitoring programme was conducted between July 2021 to May 2022 to document avifaunal activity in the area of interest and, based on this activity, assess the proposed WEF cluster with regards to potential impacts to avifauna and the risk to development consent. These data establish a pre-construction baseline of avifaunal species diversity and activity, and were used to inform the impact assessment. The monitoring data also assists in providing solutions to avoid and mitigate impacts by informing the final design, construction and operational management strategy of the WEF.

1.1 Project Description

The applicant Soyuz 3 (Pty) Ltd is proposing the development of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site located approximately 35 km South of Britstown within the Emthanjeni Local Municipality and the Pixley ka Seme District Municipality in the Northern Cape Province.

Five additional WEF's are concurrently being considered on the surrounding properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended). These projects are known as Soyuz 1 WEF, Soyuz 2 WEF, Soyuz 4 WEF, Soyuz 5 WEF and Soyuz 6 WEF.

A preferred project site with an extent of approximately 125 000 ha has been identified as a technically suitable area for the development of the six WEF projects. It is proposed that each WEF will comprise of up to 75 turbines with a contracted capacity of up to 480 MW. It is anticipated that each WEF will have an actual (permanent) footprint of up to 150 ha.

The Soyuz 3 WEF project site covers approximately 23 800 ha and comprises the following farm portions:

- Portion 4 of the Farm No. 143
- Remaining Extent of Portion 1 of the Farm No. 143
- Portion 9 of the Farm Combuisfontein No. 142.
- Portion 8 of the Farm Combuisfontein No. 142
- Portion 4 of the Farm Combuisfontein No. 142
- Portion 3 (a portion of Portion 1) of the Farm Combuisfontein No. 142
- Portion 6 (a portion of Portion 1 – Gemsbokdam) of the Farm Combuisfontein No. 142
- Portion 2 of the Farm Combuisfontein No. 142
- Portion 2 of the Farm No. 2
- Portion 0 of Farm No. 144.
- Portion 1 of the Farm No. 2
- Remaining Extent of the Farm No. 2
- Remaining Extent of Portion 13 of the Farm Welgedagt No. 3

The Soyuz 3 WEF project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 480 MW:

- Up to 75 wind turbines with a maximum hub height of up to 160 m and a rotor diameter of up to 200 m;
- A transformer at the base of each turbine;
- Concrete turbine foundations of up to 1 024 m^2 each;
- Permanent Crane hardstand / blade and tower laydown area / crane boom erection area with a combined maximum footprint 5 000 m^2 at each WTG;
- Temporary concrete batch plants to be located at the construction camp area and the satellite laydown areas;
- Battery Energy Storage System (with a footprint of up to 5 ha);
- Internal up to 132 kV overhead lines between substations. A 300 m wide corridor (150 m on either side of the proposed route) has been considered to allow for any technical and environmental sensitivity constraints identified during micro-siting prior to layout finalisation. Permanent service roads will be required for the construction and maintenance of the overhead lines. In areas where these overhead lines do not follow an existing or proposed road, additional roads of up to 3m in width will be required. Temporary construction areas beneath each overhead line tower position will also be required;
- Medium voltage (33 kV) cables/powerlines running from wind turbines to the facility substations. The routing will follow existing/proposed access roads and will be buried where possible. If the use of overhead lines is required, the Avifaunal Specialist will be consulted timeously to ensure that a raptor friendly pole design are used, and that appropriate mitigation is implemented pro-actively;
- Up to six permanent met masts;
- Three substations and operation and maintenance facilities (up to 4 ha each) as well as a laydown area (8 000 m^2) at each substation for the electrical contractor. Operation and maintenance facilities include a gate house, security building, control centre, offices, warehouses and workshops;
- Three temporary main construction camp areas (up to 12.25 ha each);
- Twelve temporary satellite laydown areas (5 000 m^2 each); and
- Access roads to the site and between project components inclusive of stormwater infrastructure. A 200 m road corridor is being applied for to allow for slight realignments pending technical and environmental sensitivity constraints identified during micro-siting prior to layout finalisation. The final road will have maximum width of 12 m (within the 200 m corridor).

2 TERMS OF REFERENCE

This report was compiled to align with Government Gazette 43110 (GN. 320) "*Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Avifaunal Species by Onshore Wind Energy Generation Facilities where the Electricity Output is 20 Megawatts or more*" dated 20 March 2020 ('The Protocol'), the Species Environmental Assessment Guideline[3], the Birds and Wind-Energy Best-Practice Guidelines[4] and the requirements prescribed therein. This report also considers the National Environment Management Act, 1998 (Act 107 0f 1998).

The aims of the study were to:

- Describe the study area and map avifaunal aspects identified during the site investigation;
- Describe and map (where relevant) the methodology used to undertake the site-specific pre-application avifauna monitoring programme;
- Present the outcomes of the site-specific pre-application avifaunal monitoring, including:

    - Bird abundance and movement within the preferred site;
    - Presence of target species and Species of Conservation Concern (SCC), their occurrence across the site and heights which could pose collision risks; and
    - Identification of preferential bird routes or corridors.
- Present an avifaunal sensitivity map of the preferred site indicating areas to be avoided;
- Assess, predict and discuss the expected impact and fatality risk for target and general avifaunal species of the proposed development on the preferred site;
- Provide recommended mitigation measures to reduce the potential impact on avifauna;
- Assess the cumulative impact of existing (or potential) renewable energy facilities within a 30 km radius of the preferred site;
- Provide a substantiated statement indicating the acceptability (or not) of the proposed development on the preferred site from an avifaunal perspective; and
- Provide details of the applicable post-construction monitoring programme.

2.1 Study Area Description

2.1.1 Regional Context

The proposed development site falls within the nama-Karoo biome in a transition zone between two broad vegetation types, where the southern extent of the Northern Upper Karoo meets the northern extent of the Eastern Upper Karoo (Figure 1). The proposed Soyuz 3 development site lies approximately 16 km west of the Platberg-Karoo Conservancy Important Bird Area (IBA, SA037). This is a large IBA that covers the entire districts of De Aar, Philipstown and Hanover, including suburban towns. The landscape consists of extensive flat to gently undulating plains broken by dolerite hills and flat-topped inselbergs. The land is used primarily for grazing and agriculture. Commercial livestock farming is mostly extensive wool and mutton production, with some cattle and game farming. This IBA contributes significantly to the conservation of large terrestrial birds and raptors. These include Blue Crane (*Anthropoides paradiseus*), Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*), Blue Korhaan (*Eupodotis caerulescens*), Black Stork (*Ciconia nigra*), Secretarybird (*Sagittarius serpentarius*), Martial Eagle (*Polemaetus bellicosus*), Verreaux's Eagle (*Aquila verreauxii*) and Tawny Eagle (*Aquila rapax*).

Congregatory species include Lesser Kestrel (*Falco naumanni*) and Amur Falcon (*Falco amurensis*). Lesser Kestrel have roosts throughout the area, including large roosts (5 000 – 10 000 individuals) in the towns of De Aar, Hanover and Philipstown; they are frequently seen foraging in the conservancy in summer, when close to 10% of the global population of Lesser Kestrels roost in this IBA. It is estimated that approximately 50,000 birds spend the southern spring and summer in South Africa, although numbers do vary from year to year. Amur Falcons are also abundant and forage and roost with Lesser Kestrels. This IBA is seasonally important for White Stork (*Ciconia Ciconia*) and Coordinated Avifaunal Road Counts (CARs) indicate high numbers of this species during outbreaks of brown locusts and armoured ground crickets.

2.1.2 Local Context

The majority of the proposed development site comprises relatively flat shrubland plains, with higher elevation areas found along the eastern border of the (Figure 2). These areas include Upper Karoo Hardeveld vegetation and provide higher levels of habitat complexity than the flatter areas below. The cliffs and outcrops associated with dolerite rings and intrusions are prominent features that potentially provide nesting and foraging habitat for Verreaux's Eagle, while the flatter areas may support cranes, bustards, korhaans, Secretarybird and Martial Eagle. Flat areas experience sheet runoff and some areas are

relatively barren or are 'washes' with low density vegetative cover. Only a few scattered areas are under cultivation (Figure 3).

The water bodies noted within the broader area are mostly man-made dams and may support certain red-listed species such as flamingos, large numbers of congregatory species, and potentially provide nocturnal roosting sites for Blue Crane.

One of the largest Lesser Kestrel roosts in the Karoo is found in De Aar, where an estimated 12 000 Lesser Kestrels have been counted by volunteers of the Migrating Kestrel Project. Lesser Kestrel breed in Europe and Asia, migrating to southern Africa over the northern winter, arriving in the Karoo in late October or early November and staying to late March.

3 METHODS

3.1 Pre-Application Avifaunal Monitoring Programme

A site-specific Pre-application Avifaunal Monitoring Programme (PAAMP, Appendix B) was developed to increase coverage of indicative WTG positions while considering the output of the Verreaux's Eagle Risk Assessment (VERA) tool and modelled sensitivities. The objective was to maximize time spent across the cluster during each monitoring survey. This was to increase the likelihood of recording less frequent events in the area (e.g. an influx of bustards or storks following weather systems), even if incidentally. It was therefore recommended that the monitoring programme be conducted across the whole WEF complex area of interest concurrently.

The resultant monitoring programme included the identification of 35 suitable Vantage Points (VPs) across the entire WEF cluster (Appendix C), with VPs 9, 10, 17, 18, 19, 20, 21 and 22 located on the Soyuz 3 site (Table 1), and three VPs at a suitable control site. VPs were selected based on consideration of viewshed coverage and accessibility. Five of the VPs were within risk areas identified by the VERA Tool (VPs 6, 18, 34, 25 and 28) and were therefore surveyed for 18 hours each per season to ensure that a minimum of 72 hours of monitoring per VP takes place, as prescribed by the VE guidelines. The remaining 30 VPs and control VPs were surveyed for 12 hours each per season. Each VP was surveyed by a pair of observers covering a 360 degree viewshed with a radius of approximately 2 km. These viewsheds were the focus of observation, however if target species were noted beyond these (or if a species being recorded flew out of the viewshed but was still visible), they would also be recorded. The flight paths of target species were recorded on a large-scale map along with data on the number/species of bird(s) and type of flight (e.g. soaring, foraging, commuting etc.), flight duration and flight height. Flight heights were recorded through five height bands: 1: 0 – 20 m; 2: 21 – 70 m; 3: 71 – 160 m; 4: 161 – 280 m and 5: >280 m. Height bands 2, 3 and 4 were considered to be within rotor-swept height (RSH), and flights within the RSH are considered to be at a higher risk of collision. The co-ordinates of the VPs on the Soyuz 3 site and total hours surveyed are provided in Table 1 below.

Table 1: VP descriptions and hours surveyed on the Soyuz 3 site

VP	Longitude	Latitude	Survey Hours				Total
			S1	S2	S3	S4	
9	23°38'27.74"E	31° 0'4.92"S	12	12	12	12	48
10	23°36'16.48"E	30°57'24.38"S	12	12	12	12	48
17	23°33'4.44"E	30°56'18.20"S	12	12	12	12	48
18	23°34'50.79"E	30°54'23.12"S	18	18	18	18	72
19	23°31'43.16"E	30°53'27.35"S	12	12	12	12	48
20	23°31'14.40"E	30°51'39.14"S	12	12	12	12	48

VP	Longitude	Latitude	Survey Hours				Total
			S1	S2	S3	S4	
21	23°33'14.98"E	30°51'13.02"S	12	12	12	12	48
22	23°35'29.37"E	30°52'19.43"S	12	12	12	12	48

The diversity and abundance of smaller birds was determined using 17 WTs of 500 m each covering different vegetation and habitat types across the WEF cluster, with WTs 7, 9, 10, 11 and 12 located on the Soyuz 3 site (Table 2, Figure 1 and 2). Two observers walked between the start and end points of the transects and recorded all birds seen or heard up to 150 m on either side of the transect. Beyond 150 m, only priority species were noted and were recorded as incidental sightings. WTs were conducted twice per survey.

Table 2: WT locations and survey dates across the entire WEF cluster

WT No.	Start Coordinates		Finish Coordinates	
	Longitude	Latitude	Longitude	Latitude
7	30°51'38.27"S	23°31'17.26"E	30°51'25.76"S	23°31'29.46"E
9	30°54'23.19"S	23°34'51.90"E	30°54'25.74"S	23°35'10.51"E
10	30°55'56.80"S	23°33'8.92"E	30°56'13.02"S	23°33'6.29"
11	30°51'19.30"S	23°33'51.48"E	30°51'30.53"S	23°33'37.68"E
12	30°57'10.77"S	23°36'21.56"E	30°57'25.91"S	23°36'16.16"E

The abundances of large terrestrial birds and raptors across the WEF cluster were sampled along four (4) DT routes. Approximately 9 km of DT 1 (~18 km in total) and 1 km of DT 3 (~33.5 km in total) were located on the Soyuz 3 site (Figure 1 and 2). Target species were recorded by driving slowly (±25 km/h) with all windows open and stopping occasionally to listen and scan the surrounding environment. When a target species was located, a GPS co-ordinate was recorded, along with the distance and direction from the vehicle to the observed bird. Additional information, such as weather conditions and habitat type, were also noted. DTs were conducted twice per survey.

All other incidental sightings of priority species on the WEF cluster, control site and within the broader area were recorded and geo-referenced, along with additional relevant information such as weather and habitat type.

Four sampling trips were conducted to coincide with relevant expected climatic conditions over a 12-month period to account for potential seasonal variation in the site utilisation by avifauna. The first season of monitoring (winter) was conducted over 25 days from 21 July 2021 – 14 August 2021 to coincide with the peak of the dry season. The second monitoring survey (spring) was conducted over 26 days from 27 October 2021 – 21 November 2021 to coincide with the end of the dry season. The third season of monitoring (summer) was conducted over 26 days from 5 February 2022 – 4 March 2022 to coincide with the peak of the wet season. The fourth and final season of monitoring (autumn) was conducted over 25 days from 22 April 2022 – 18 May 2022 to coincide with the end of the wet season. All surveys were conducted by a team of six observers operating in three pairs of two observes each.

3.2 Avifaunal Sensitivity

3.2.1 Habitats

Prior to the analysis of pre-application avifaunal monitoring data, the relevant avifaunal aspects of the preferred site and Site Ecological Importance (SEI) were determined for each avifaunal SCC. This is done through a combination of various attributes (e.g. conservation importance) and consideration of site-specific factors (e.g. land-use) in combination with the nature of the potential impacts associated with the proposed development. The primary output of this exercise was the development of a map identifying the relative SEI of broader preferred habitats of relevant species across the preferred site (presented in the Scoping Report, June 2022). This was used in combination with pre-application monitoring data of species composition, abundance and site utilisation to determine avifaunal sensitivity.

3.2.2 Flight Activity

Observed flight sensitivity was determined by calculating a Grid Cell Sensitivity Score (GCSS), falling within either a Low, Medium, Medium-High or High classification for a 100 m x 100 m grid covering the preferred site. The GCSS was derived by analysing the following characteristics of all mapped priority species and raptors flight lines passing through each grid cell:

- Priority species score and the number of individuals associated with each flight line;
- Risk height factor, which considered if the flight was within RSH;
- The duration of the flight; and
- The length of the flight.

These factors were considered in the following equation to determine a Flight Section Sensitivity Score (FSSS), for each section of flight within a grid cell.

$$\mathbf{FSSS = PSS \times N \times (X/Y \times D) \times (P+1)}$$

Where:

- PSS is the Priority Species Score (Retief et al. 2011, updated 2014).
- N is the number of birds that are associated with the flight line.
- X is the length of the flight line section that is within a particular Grid Square.
- Y is the length of the whole flight line.
- D is the duration of the whole flight.
- P is the proportion of the flight line at Risk Height.

The GCSS is the sum of these flight sections within the grid cell, giving a sensitivity score specific to the cell.

The resultant GCSS scores were categorised as follows: Low (< 15 000); Medium (15 001 – 40 000); Medium – High (40 001 – 110 000); and High (> 110 000). Grid cells classified as Medium – High and High were considered to be preferential movement corridors in areas of elevated risk.

3.2.3 Avifaunal Sensitivity Mapping

The results of the avifaunal species diversity, abundance and activity recorded during the pre-application monitoring programme were used together with the initial SEI determinations presented in the Scoping Report to inform site utilisation by SCC and to map the avifaunal sensitivity across the site.

3.3 Impact Assessment Rating System

Significance ratings of the potential impacts were determined following the methods outlined in Appendix C. The impact assessment considers the results of the pre-application avifaunal monitoring programme in the context of the receiving environment, the conservation status of the species observed/expected, the susceptibility of species to the potential impacts and the species' utilisation of the proposed development site.

4 RESULTS

4.1 Assumptions and Limitations

Many areas of South Africa have not been well studied, with the result that the species lists derived for an area do not always adequately reflect the actual species present at a site. To address this potential limitation database searches were extended well beyond the proposed development site.

Nest locations for Verreaux's Eagle were provided to Arcus at the outset along with the output of the Verreaux's Eagle Risk Assessment (VERA) Tool. It was assumed that the nest survey was thorough (as this task was not conducted by Arcus) and it appeared to be based on the VERA output. It was assumed that higher sensitivity areas will be avoided for the placement of WTGs. Given the large area under consideration, it was impractical to survey the entire site and therefore monitoring efforts were focussed on indicative WTG positions supplied based on the assumption that these areas represent the focus areas for WTG development. The design of the layout was iterative in nature, with modifications being informed by the identification of sensitive areas and subsequent recommendations for avoidance following the precautionary principle (e.g. avoidance of identified Critical Biodiversity Areas and potentially sensitive avifaunal habitats). This limitation was not found to reduce the confidence in the impact assessment given the relatively uniform nature of the available habitats in the area. This, combined with the extensive monitoring coverage across these areas and prolonged period of time that observers spent monitoring or travelling across the site, allowed for the avifaunal community of the receiving environment to be well categorised and understood.

4.2 Avifaunal Baseline

4.2.1 Reconnaissance Study and Site Investigation

A list of Threatened, Near-Threatened, Endemic/Near-endemic and Priority Species was consolidated from the results of the desktop study and initial site investigation as potential impact receptors of the proposed WEF cluster development. The resultant list identified 35 Priority Species (including 16 SCC) to potentially occur in the area of relevance to the proposed development (Appendix B). The SEI was determined for 30 species considered most relevant to the potential impacts of the proposed WEF cluster. A total of 17 avifaunal SCCs were recorded across the WEF cluster during the pre-application avifaunal monitoring programme (including incidental sightings in the broader area), namely African Rock Pipit (*Anthus crenatus*, Near Threatened), Black Harrier (*Circus maurus*, Endangered), Black Stork (Vulnerable), Blue Crane (Vulnerable), Blue Korhaan (Near Threatened), Denham's Bustard (*Neotis denhami*, Vulnerable), Greater Flamingo (*Phoenicopterus roseus*, Near Threatened), Karoo Korhaan (*Eupodotis vigorsii*, Near Threatened), Kori Bustard (Near Threatened), Lanner Falcon (*Falco biarmicus*, Vulnerable), Lappet-faced Vulture (*Torgos tracheliotos*, Endangered), Ludwig's Bustard (Endangered), Maccoa Duck (*Oxyura maccoa*, Endangered), Martial Eagle (Endangered, Secretarybird (Endangered), Tawny Eagle (Endangered), and Verreaux's Eagle (Vulnerable).

4.2.2 Vantage Point Surveys

VP monitoring recorded a total of 18 positively identified target species at the proposed Soyuz 3 site over the pre-application monitoring period, during which 455 flight paths were recorded, comprising 803 birds (Table 3, Figure 4). This comprised 107, 97, 126, and 125 flights recorded during surveys 1 to 4, respectively. The majority of the flights recorded over the monitoring period were of Northern Black Korhaan (*Eupodotis afraoides*, 143), Blue Crane (88), and Ludwig's Bustard (76). Blue Crane flight records were often flocks of multiple individuals resulting in 266 birds recorded across the Soyuz 3 site (however, it must be noted that the same individuals may have been recorded on multiple separate occasions).

Table 3: Target Species Flight Activity recorded across the proposed Soyuz 3 development site during the full Pre-Application Avifaunal Monitoring period, showing the number of flights recorded per species per survey and the number of individuals in parentheses

Species	Survey flights (birds)				Total
	S1 (winter)	S2 (spring)	S3 (summer)	S4 (autumn)	
African Harrier-Hawk			1 (1)		**1 (1)**
Black-chested Snake Eagle			2 (2)		**2 (2)**
Black Harrier		1 (1)		1 (1)	**1 (1)**
Blue Crane	2 (7)	34 (65)	10 (51)	42 (143)	**88 (266)**
Blue Korhaan				2 (4)	**2 (4)**
Booted Eagle		1 (1)	4 (4)		**5 (5)**
Double-banded Courser		1 (1)			**1 (1)**
Greater Kestrel			9 (12)	4 (4)	**13 (16)**
Jackal Buzzard	3 (3)	5 (7)	3 (3)	10 (14)	**21 (27)**
Karoo Korhaan	8 (17)		3 (6)	2 (5)	**13 (28)**
Lesser Kestrel			11 (24)		**11 (24)**
Ludwig's Bustard	48 (119)	7 (13)	6 (8)	15 (19)	**76 (159)**
Northern Black Korhaan	18 (23)	38 (42)	61 (77)	26 (31)	**143 (173)**
Pale Chanting Goshawk	5 (6)	4 (4)	9 (9)	5 (6)	**23 (25)**
Rock Kestrel	17 (17)	3 (3)	2 (2)	15 (19)	**37 (41)**
Secretarybird	3 (9)	1 (1)	2 (3)	1 (2)	**7 (15)**
Tawny Eagle	1 (1)				**1 (1)**
Verreaux's Eagle	1 (1)	2 (3)		2 (4)	**5 (8)**
Unidentified Falcon			2 (3)		**2 (3)**
Unidentified Raptor	1 (1)		1 (1)		**2 (2)**
Total	**107 (204)**	**97 (141)**	**126 (206)**	**125 (252)**	**455 (803)**

The activity of target species across the Soyuz 3 site was relatively low in the specialist's experience of the area, with average passage rates ranging from 0.71 birds/hour at VP 17 to 5.27 birds/hour at VP 20 (Table 4). At a finer spatio-temporal scale, the maximum passage rate recorded was 8.17 birds/hour at VP 20 during Season 1, elevated by many sightings of Ludwig's Bustard. At the species level, Ludwig's Bustard averaged 0.44 birds/hour across the pre-application monitoring period, with the highest levels of activity recorded at VP 20 (1.48 birds/hour, Table 5), while Blue Crane averaged 0.74 birds/hour, with the highest level of activity at VP 20 (1.65 birds/hour).

Table 4: Average Passage Rate (birds/hour) recorded per VP at the Soyuz 3 site during the full Pre-Application Avifaunal Monitoring period

VP	Average Passage Rate (birds/hour)				Total
	S1 (winter)	S2 (spring)	S3 (summer)	S4 (autumn)	
9	1.25	1.42	4.25	1.50	**2.10**
10	0.67	2.42	0.67	1.58	**1.33**
17	0.42	0.83	0.42	1.17	**0.71**
18	0.67	0.72	0.72	1.61	**0.93**
19	2.75	1.00	1.83	4.67	**2.56**
20	8.17	1.25	4.50	7.17	**5.27**
21	0.75	2.92	0.92	1.83	**1.60**
22	2.00	0.83	3.50	0.67	**1.75**

Table 5: Average Passage Rate (birds/hour) recorded per species at the proposed Soyuz 3 development site during the full Pre-Application Avifaunal Monitoring period

Species	Passage Rate (birds/hour)								Total
	VP9	VP10	VP17	VP18	VP19	VP20	VP21	VP22	
African Harrier-Hawk		0.02							**0.003**
Black-chested Snake Eagle				0.03					**0.006**
Black Harrier		0.02					0.02		**0.006**
Blue Crane	0.88	0.56	0.04	0.07	1.25	1.65	0.79	0.27	**0.739**
Blue Korhaan	0.08								**0.011**
Booted Eagle				0.06	0.02				**0.014**
Double-banded Courser						0.02			**0.003**
Greater Kestrel	0.08	0.06		0.01		0.17			**0.044**
Jackal Buzzard			0.42	0.07	0.04				**0.075**
Karoo Korhaan	0.40		0.08	0.03				0.06	**0.078**
Lesser Kestrel	0.04	0.06			0.02	0.38			**0.067**
Ludwig's Bustard	0.10	0.04	0.04	0.15	0.65	1.48	0.31	0.46	**0.442**
Northern Black Korhaan	0.33	0.42	0.04	0.17	0.29	1.10	0.27	0.90	**0.758**
Pale Chanting Goshawk	0.06	0.06	0.04	0.04	0.19	0.04	0.06		**0.069**
Rock Kestrel	0.06	0.06	0.04	0.21	0.02	0.19	0.10	0.06	**0.114**
Secretarybird	0.02				0.04	0.25			**0.042**
Tawny Eagle							0.02		**0.003**
Verreaux's Eagle		0.02		0.10					**0.022**

The overall proportion of risky flights for target species was relatively high as indicated by GCSS analyses (Figure 5).

4.2.3 Transect Surveys

A total of 47 species (547 birds) were recorded during WTs conducted across the full pre-application monitoring period (Table 6). WT 7 recorded the most observations (63) and the highest abundance (171), resulting in 42.75 birds/km, while WT 10 recorded the highest species diversity, with 23 species recorded at 37.5 birds/km. Target species recorded during WTs included Blue Crane, Ludwig's Bustard, Northern Black Korhaan, Rock Kestrel, Karoo Korhaan, and Jackal Buzzard (*Buteo rufofuscus*).

Table 6: Walk Transect Results across the proposed Soyuz 3 development site during the full Pre-Application Avifaunal Monitoring period

Transect	Total Observations (No. of Individual Birds)	Total Species Recorded	Priority Species (P), Red Data Species (Status), Raptors	Birds/km
WT7 (n=8)	63 (171)	22	Blue Crane (NT), Ludwig's Bustard (EN), Northern Black Korhaan (P), Rock Kestrel	42.75
WT9 (n=8)	32 (57)	15	Karoo Korhaan (NT), Ludwig's Bustard (EN)	14.25
WT10 (n=8)	62 (150)	23	Jackal Buzzard (P)	37.5
WT11 (n=8)	32 (71)	11	Northern Black Korhaan (P)	17.5
WT12 (n=8)	52 (98)	16	Blue Crane (NT), Karoo Korhaan (NT), Northern Black Korhaan (P)	24.5
Total	**240 (547)**	**47**		**27.35**

A total of 36 observations of 11 target species (comprising 214 birds) were recorded along DT 1. Northern Black Korhaan represented the highest number of records (12 observations/ 15 birds). Large flocks of Lesser Kestrel were observed, with six (6) records of 168 birds, indicating that Soyuz 3 likely represents an important area for foraging by Lesser Kestrel.

A total of 62 observations of 11 target species (comprising 101 birds) were recorded along DT 3. Northern Black Korhaan represented the highest number of records (26 observations/ 32 birds), followed by Ludwig's Bustard (8 observations/ 17 birds), Pale Chanting Goshawk (8 observations/ 9 birds) and Blue Crane (6 observations/ 16 birds).

4.2.4 Incidental Records

A total of 3 450 incidental records of 40 160 birds were made on and around the WEF cluster during the pre-application monitoring period (Appendix F), the majority of which were Blue Crane (509 observations/ 3 095 birds). Large numbers of the migratory Lesser Kestrel were also observed in the area during summer (436 observations/ 18 349 birds). Several incidental records of Lesser Kestrel were made on the Soyuz 3 WEF site, particularly along the southern border of the site, indicating that Soyuz 3 likely represents an important area for foraging by Lesser Kestrel. SCC recorded incidentally on the Soyuz 3 site included Black Harrier, Blue Crane, Blue Korhaan, Karoo Korhaan, Lanner Falcon, Ludwig's Bustard, Martial Eagle, Secretarybird, Tawny Eagle, and Verreaux's Eagle (Figure 4).

4.3 Avifaunal Sensitivity

An avifaunal sensitivity map was produced for the project site based on observed avifaunal activity, habitat quality/functionality, and nature of the impacts associated with the proposed development (Figure 6).

The site is generally of low to very low ecological importance for the majority of the species considered, however the site is of medium ecological importance for Ludwig's Bustard, Martial Eagle and Tawny Eagle as they are Endangered with relatively broad habitat availability across the proposed project site. Martial Eagle and Tawny Eagle are somewhat restricted in terms of available breeding locations in the karoo relying on transmission pylons and alien trees for nesting opportunities, however they do forage over a large area and mitigation measures are recommended to further reduce the potential risk of impacts to these species. The locations of two Tawny Eagle nests were obtained[5], these are positioned on the Hydra-Kronos-1 400 kV overhead power line beyond the northern boundary of the proposed development site. An area with a radius of 3 km around these

nests has been categorised as high sensitivity, however these buffers do not overlap with the proposed project boundary. The whole area is considered to be of elevated avifaunal sensitivity for Ludwig's Bustard with respect to overhead power lines and mitigation measures are to be implemented.

Verreaux's Eagle largely favour rocky cliffs and mountainous areas and are not expected to frequent areas outside of those identified by the VERA model. High and medium Verreaux's Eagle Sensitivity areas have been included in the sensitivity map as WTG No-Go areas. While all WTGs in the proposed layout avoid areas identified by the VERA model to be of High Verreaux's Eagle Sensitivity, it is recommended that the WTGs positioned near the edge of the Medium Verreaux's Eagle Sensitivity areas be adjusted so that the rotor-swept-area falls outside of those areas.

The site is positioned outside of the primary foraging habitat for Black Harrier, however migratory routes could occasionally result in this species traversing the site, albeit with a low frequency. Patches of preferred habitat across the project area have nevertheless been classified as Medium Sensitivity for this species along with Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). Flight paths that represented an elevated risk or preferred movement corridors are considered to be of High Avifaunal Sensitivity and should be avoided where possible (Figure 5 and 6). While WTGs are permitted within (including blade-tip) High or Medium Sensitivity areas not identified by the VERA model, it is recommended that additional mitigation measures such as blade painting or shut-down-on-demand be applied to such WTGs.

5 IMPACT ASSESSMENT

The following key potential impacts on avifauna, arising from the proposed development of the WEF (and associated infrastructure) have been identified for assessment, with assessed impact tables presented in Appendix A.

Construction Phase:

- Direct Habitat Destruction – modification, removal and clearing of vegetation for development of infrastructure such as temporary laydown areas, site buildings, WTG bases and access roads;
- Disturbance/Displacement – indirect habitat loss and/or reduced breeding success due to displacement by noise and activity associated with machinery and construction activity; and
- Direct Mortality – fatalities of avifauna due to vehicle collision, entrapment, entanglement or collision with temporary infrastructure (e.g. fencing), entrapment in uncovered excavations and increased predation pressure.

Operational Phase:

- Disturbance/Displacement – indirect habitat loss, reduced breeding success, obstruction of movement corridors due to displacement by infrastructure and noise/activity associated with ongoing, routine operational tasks/maintenance activity; and
- Direct Mortality – fatalities of avifauna due to WTG collision, collision or entrapment with perimeter fencing, collision with internal power lines, and electrocution from energised components.

Decommissioning Phase:

- As per construction phase.

Cumulative Phase:

- Cumulative – all of the above-mentioned impacts, and in particular operational phase impacts, may be intensified to some degree due to other developments in the area, particularly energy infrastructure development that includes overhead power lines.

5.1 Design Phase

Although impacts to birds are experienced during the construction and operational phases of the project, a key element to the success of preventing impacts to birds is realised during the earlier stages of the project. Mortality due to wind turbine collision (experienced during the operational phase) should be mitigated during the design phase already. Suitable mitigation would include the following:

- WTGs must not be placed within (or encroach within) any High or Medium Verreaux's Eagle Sensitivity areas as identified by the VERA model;
- WTGs are to be micro-sited to avoid blade tips from encroaching within these No-Go areas pending the specifics of final WTG dimensions;
- The footprint within Medium and High Sensitivity areas determined outside of VERA modelled areas must be minimized and avoided wherever possible;
- Laydown and other temporary infrastructure to be placed outside of Medium and High sensitivity areas, preferably within previously transformed areas, wherever possible;
- Additional mitigation must be implemented for WTGs placed within High and Medium sensitivity areas determined outside of VERA modelled areas;
- Shut down-on-demand or Blade Painting (contingent on approval by the Civil Aviation Authority) or similar technology must be implemented for all WTGs that are positioned within or encroach on High and Medium Sensitivity areas determined to be outside of VERA modelled areas;
- Internal power lines must be buried wherever technically feasible;
- Appropriate Bird Flight Diverters (BFDs) must be affixed to the entire length of novel overhead power lines (in all sensitivity categories);
- If double layers of fencing are required for security purposes, they should be positioned at least 2 m apart to reduce the probability of entrapment by larger bodied species that may find themselves between the two fences; and
- A site-specific Environmental Management Programme (EMPr) must be developed and implemented. The EMPr must give appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat (e.g. no open fires outside of designated areas).

5.2 Construction Phase

5.2.1 Impact 1: Direct Habitat Destruction

Direct habitat destruction associated with WEFs is generally low relative to the overall size of the project area. This impact is largely unavoidable, resulting in some birds being displaced from the project site. However, the habitats present in the proposed development site are not unique to the site and the land-use matrix is similar throughout the broader area.

The loss of habitat associated with clearing will not likely have a significant negative impact on the long-term viability or persistence of avifaunal species or populations in the area following the implementation of appropriate mitigation measures.

Impact 1: Direct Habitat Destruction		
	Before mitigation	**After mitigation**
Construction Phase	**Low Negative**	**Low Negative**

Mitigation Measures:

- WTGs must not be constructed within (or encroach within) any High or Medium Verreaux's Eagle Sensitivity areas identified by the VERA model;
- WTGs are to be micro-sited to avoid blade tips from encroaching within these No-Go areas pending the specifics of final WTG dimensions;
- The footprint within Medium and High Sensitivity areas not identified by the VERA model must be minimized and avoided wherever possible;
- Laydown and other temporary infrastructure to be placed outside of Medium and High sensitivity areas, preferably within previously transformed areas, wherever possible;
- Appropriate run-off and erosion control measures must be implemented where required;
- A site-specific Environmental Management Programme (EMPr) must be developed and implemented. The EMPr must give appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat (e.g. no open fires outside of designated areas);
- All contractors are to adhere to the EMPr and must apply good environmental practice during construction;
- All hazardous materials must be stored in the appropriate manner to prevent contamination of the site and downstream environments. Any accidental chemical, fuel and oil spills that occur at the site must be cleared as appropriate for the nature of the spill;
- Existing roads and farm tracks must be used where possible;
- The minimum footprint areas of infrastructure must be used wherever possible, including road widths and lengths;
- No off-road driving must be permitted in areas not identified for clearing;
- An Environmental Officer (EO) must form part of the on-site team to ensure that the EMPr is implemented and enforced and an Environmental Control Officer (ECO) must be appointed to oversee the implementation activities and monitor compliance for the duration of the construction phase; and
- Following construction, rehabilitation of areas disturbed by temporary laydown areas and facilities must be undertaken.

5.2.2 Impact 2: Disturbance and Displacement

Indirect loss of habitat from disturbance during the construction phase is temporary in nature and is expected to result largely from the presence of heavy machinery and increased activity of construction personnel. The habitats present in vicinity of the proposed development are not unique to the site and are relatively widespread in the area so any displacement from the immediate vicinity that may occur will not likely incur a high energetic cost as suitable habitat is widely available nearby. The proximity of nearby suitable habitat makes it likely that species will return to areas that have not been physically altered by the proposed development once construction activity ceases.

There are no confirmed active nest locations in proximity to the proposed development site where breeding success is likely to be negatively impacted upon through disturbance or displacement during the construction phase.

Impact 2: Disturbance and Displacement		
	Before mitigation	**After mitigation**
Construction Phase	**Low Negative**	**Low Negative**

Mitigation Measures:

- A site specific EMPr must be developed and implemented. The EMPr must give appropriate and detailed description of how construction activities must be conducted;

- All contractors are to adhere to the EMPr and must apply good environmental practice during construction;
- The ECO must oversee activities and ensure that the site specific EMPr is implemented and enforced;
- Maximum use of existing access road and servitudes;
- Existing and novel access roads are to be suitably upgraded or constructed to prevent damage and erosion resulting from increased vehicular traffic and construction vehicles;
- No off-road driving in undesignated areas;
- Speed limits (50 km/h) must be strictly enforced on site to reduce unnecessary noise;
- Construction camps must be lit with as little light as practically possible, with the lights directed downwards where appropriate;
- The movement of construction personnel must be restricted to the construction areas on the project site;
- No dogs or cats other than those of the landowners must be allowed on site;
- The appointed ECO must be trained to identify the potential Red Data species, as well as the signs that indicate possible breeding by these species;
- The ECO must during audits/site visits make a concerted effort to look out for such breeding activities of SCCs (e.g. cranes, Secretarybird). Additional efforts must include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species; and
- If any avifaunal SCCs are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.

5.2.3 Impact 3: Direct Mortality

Fatalities of avifaunal species can occur through collision with vehicles as traffic in the area increases due to construction activity. Large-bodied and ground dwelling species (e.g. korhaans, cranes and bustards) are at increased risk, but this impact can be effectively mitigated against.

Temporary fencing can result in collisions, entrapment or entanglement if not suitably installed. Similarly ground dwelling avifauna (particularly chicks) can fall into uncovered excavations and become entrapped.

Impact 3: Direct Mortality		
	Before mitigation	**After mitigation**
Construction Phase	**Low Negative**	**Low Negative**

Mitigation Measures:

- A site specific EMPr must be developed and implemented. The EMPr must give appropriate and detailed description of how construction activities must be conducted;
- All contractors are to adhere to the EMPr and must apply good environmental practice during construction;
- The ECO must oversee activities and ensure that the site specific EMPr is implemented and enforced;
- Maximum use of existing access road and servitudes;
- Existing and novel access roads are to be suitably upgraded or constructed to prevent damage and erosion resulting from increased vehicular traffic and construction vehicles;
- No off-road driving in undesignated areas;

- Speed limits (50 km/h) must be strictly enforced on site to reduce unnecessary noise;
- Construction camps must be lit with as little light as practically possible, with the lights directed downwards where appropriate;
- The movement of construction personnel must be restricted to the construction areas on the project site;
- No dogs or cats other than those of the landowners must be allowed on site;
- The appointed ECO must be trained to identify the potential Red Data species, as well as the signs that indicate possible breeding by these species;
- The ECO must during audits/site visits make a concerted effort to look out for such breeding activities of SCCs (e.g. cranes, Secretarybird). Additional efforts must include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species; and
- If any avifaunal SCCs are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.

5.3 Operational Phase

5.3.1 Impact 4: Disturbance and Displacement

Disturbance and displacement by operational activities such as power line and turbine maintenance, fencing, and noise can lead to birds avoiding the area for feeding or breeding, and effectively leading to habitat loss and a potential reduction in breeding success.

It is expected that some species potentially occurring on the WEF site will be susceptible to disturbance and displacement, for example smaller passerines such as larks, warblers, flycatchers and chats, as well as large terrestrial Red Data species such as Karoo Korhaan and Ludwig's Bustard. Priority species nesting on the project site (including on new infrastructure e.g. powerline pylons) may be disturbed during routine maintenance.

Impact 4: Disturbance and Displacement		
	Before mitigation	**After mitigation**
Operational Phase	**Moderate Negative**	**Low Negative**

Mitigation Measures:

- A site specific operational EMPr must be developed and implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance;
- All contractors are to adhere to the EMPr and must apply good environmental practice during all operations;
- The ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational WEF, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction; and
- Operational phase bird monitoring (see Appendix H for a Post-construction Monitoring Programme), in line with the latest available guidelines, must be implemented.

5.3.2 Impact 5: Direct Mortality: Collisions with Infrastructure

WEFs can cause bird fatalities through the collision of birds with moving turbine blades. The most effective mitigation for collision impacts currently available is wind farm

placement, as well as specific turbine placement within a WEF to avoid elevated avifaunal SCC use areas[6].

Collisions with power lines are a well-documented threat to birds in southern Africa. Heavy-bodied birds such as bustards, cranes and waterbirds, with limited manoeuvrability, are more susceptible to this impact[7].

Impact 5: Direct Mortality: Collisions with Infrastructure		
	Before mitigation	**After mitigation**
Operational Phase	**High Negative**	**Moderate Negative**

Mitigation Measures:

- Additional mitigation (as detailed below) must be implemented for WTGs placed within High and Medium sensitivity areas determined outside of VERA modelled areas;
- Shut down-on-demand or Blade Painting (contingent on approval by the Civil Aviation Authority) or similar technology must be implemented for all WTGs that are positioned within or encroach on High and Medium Sensitivity areas;
- Internal power lines must be buried wherever technically feasible;
- Appropriate Bird Flight Diverters (BFDs) must be affixed to the entire length of novel overhead power lines (in all sensitivity categories);
- If one or more avifaunal SCC carcasses are located and determined likely to have resulted from collisions with infrastructure in any sensitivity area over the lifespan of the facility, the fatality is to be appropriately recorded and reported to an avifaunal specialist to determine the most appropriate action;
- If double layers of fencing are required for security purposes, they should be positioned at least 2 m apart to reduce the probability of entrapment by larger bodied species that may find themselves between the two fences;
- Develop and implement a carcass search and bird activity monitoring programme in-line with the latest applicable guidelines (see Appendix H);
- Regular reviews of operational phase monitoring data (activity and carcass) and results to be conducted by an avifaunal specialist;
- The above reviews should strive to identify sensitive locations including WTGs and areas of increased collisions that may require additional mitigation;
- An operational monitoring programme (see Appendix H) for any novel overhead power lines must be implemented to locate potential collision fatalities; and
- Any fatalities located must be reported to Birdlife South Africa (BLSA) and the Endangered Wildlife Trust (EWT).

5.3.3 Impact 6: Direct Mortality: Electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on energized structures and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components.

Overhead power line infrastructure with a capacity of 132 kV or more does not generally pose a risk of electrocution due to the large size of the clearances between the electrical infrastructure components. Electrocutions are therefore more likely for larger species whose wingspan is able to bridge the gap such as eagles or storks. A few large birds (such as Verreaux's Eagle), susceptible to electrocution (particularly in the absence of safe and mitigated structures) occur in the area. Electrocution is also possible on electrical infrastructure within the substation particularly for species such as crows and owls.

Impact 6: Direct Mortality: Electrocutions		
	Before mitigation	**After mitigation**
Construction Phase	**Low Negative**	**Low Negative**

Mitigation Measures:

- Internal power lines should be buried wherever possible;
- All new overhead power line pylons must be of a design that minimizes electrocution risk. This can be achieved by using adequately insulated 'bird friendly' structures, with sufficient clearances between live components; and
- An operational monitoring programme (see Appendix H) for the overhead power line route must be implemented to locate potential collision fatalities.

5.3.4 Impact 7: Cumulative Impact

At least 6 onshore wind facilities and onshore wind/solar PV combined facilities are being considered according to the DFFE Renewable Energy database (Q3 2022) within 50 km of the proposed development site, mostly towards the town of De Aar the north-east. In addition to these, the Britstown WEF Complex comprises 5 WEFs on the neighbouring properties.

Impact 7: Cumulative Impact		
	Before mitigation	**After mitigation**
Cumulative	**High Negative**	**Moderate Negative**

Mitigation Measures:

- All mitigation measures listed in the design, construction and operational phases should be implemented;
- The project should collaborate with other developments (current and proposed) in the broader project area. Companies in the area should share lessons learnt, align strategies and agree coordinated approaches to responding to environmental issues; and
- A data sharing agreement should be setup with other wind farm projects in the region to share operational monitoring data. Data should be shared with regulators and interested stakeholders to allow cumulative impacts to be documented and to inform adaptive operational management.

6 DISCUSSION

During the full avifaunal monitoring programme at Soyuz 3 WEF site, 10 out of the 16 SCC predicted to occur in the area were observed, namely Black Harrier, Blue Crane, Blue Korhaan, Karoo Korhaan, Lanner Falcon, Ludwig's Bustard, Martial Eagle, Secretarybird, Tawny Eagle and Verreaux's Eagle. Based on the precautionary principle, we assume that all predicted species will occur on site at some point within the proposed development's 25-year lifespan, despite some not being observed during site visits.

The primary potential impact associated with the proposed development relates to fatalities of avifauna resulting from collision with infrastructure including overhead power lines and WTGs. The avifaunal SCC differ in their susceptibility to collision impacts, with overhead power lines posing a proportionally higher risk to heavy-bodied, terrestrial species such as korhaans and bustards. The proposed development site largely represents medium site ecological importance for Ludwig's Bustard and the risk of collision with overhead power lines is to be mitigated against by burying internal connector power lines wherever practically possible.

All the large trigger species are highly susceptible to collisions with WTGs, as are large flocks of Lesser Kestrels. Areas corresponding to the output of the VERA model (High and Medium Verreaux's Eagle Sensitivity areas) are considered No-Go areas and should be avoided for the development of WTGs, including the rotor-swept-area. Flight paths that represented an elevated risk or preferred movement corridors were considered to be of

High Avifaunal Sensitivity and should be avoided for the placement of WTGs where possible. Areas of potentially suitable habitat for Black Harrier (e.g. CBAs, ESAs) are of medium sensitivity and should also be avoided as far as possible. Additional mitigation must be implemented for WTGs placed within or that encroach High and Medium sensitivity areas not identified by the VERA model, such as shut down-on-demand or blade painting (contingent on approval by the Civil Aviation Authority) or similar technology.

The avifaunal SCC of particular relevance to the proposed development in the area are generally large-bodied species that are easy to see and therefore even observer-based shut-down-on-demand in areas of elevated risk would probably be a very effective mitigation measure to reduce the likelihood of collisions. Mitigation measures such as affixing appropriate bird flight diverters on all spans of novel OHTLs will also reduce the likelihood of collisions with this infrastructure and avifaunal SCC are unlikely to utilise the transmission substations. That said, the main mitigation measure to protect avifauna is to adhere to the sensitivity map by avoiding VERA high risk areas. It is therefore recommended that the WTGs positioned near the edge of the medium sensitivity areas identified by the VERA model be adjusted so that the rotor-swept-area falls outside of those areas (i.e. WTGs 9, 10, 39, 44, 46 and 62). It is recommended that additional mitigation measures such as blade painting or shut-down-on-demand be applied to those WTGs positioned within (including blade-tip) Medium or High Sensitivity areas not identified by the VERA model (i.e. WTGs 8, 22, 23, 24, 26, 27, 28, 30, 32, 33, 34, 44, 53, 54 and 69).

Based on the information gathered to date from the full avifauna pre-construction monitoring campaign, it is the avifaunal specialist's informed opinion that the development of the proposed Soyuz 3 WEF and its associated infrastructure (including cumulative impacts) will not have a significant negative impact on the viability or persistence of avifaunal populations (particularly avifaunal SCC) in the area, provided that all mitigation measures are strictly adhered to. Once all project specifications have been finalised (i.e. WTG layouts and dimensions), an avifaunal specialist site walk-through is required to take place, prior to construction, to confirm the final layout (including proposed WTG dimensions and positions) in terms of sensitivities and impacts to birds.

7

CONCLUSION

It is the specialist's opinion, based on the information contained in this report, that the proposed development can be approved from an avifaunal perspective provided the recommended mitigation measures are implemented.

FIGURES

APPENDIX A: IMPACT ASSESSMENT TABLES

Table A.1: Full Impact Table Summary

Phase	Impact	Nature	Type	Consequence	Extent	Duration	Probability	Significance without Mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance with Mitigation
Construction	Impact 1: Direct Habitat Destruction	Negative	Direct	Slight	Study Area	Long Term	Definite	**Low Negative**	Reversible	Resource will not be lost	Achievable	**Low Negative**
	Impact 2: Disturbance and Displacement	Negative	Direct	Slight	Study Area	Short Term	Probable	**Low Negative**	Reversible	Resource will not be lost	Achievable	**Low Negative**
Operational	Impact 3: Direct Mortality	Negative	Direct	Moderate	Study Area	Short Term	Probable	**Low Negative**	Irreversible	Resource will not be lost	Achievable	**Low Negative**
	Impact 4: Disturbance and Displacement	Negative	Direct	Moderate	Study Area	Long Term	Probable	**Moderate Negative**	Reversible	Resource will not be lost	Achievable	**Low Negative**
	Impact 5: Direct Mortality – Collision with Infrastructure	Negative	Direct	Severe	Regional	Long Term	Probable	**High Negative**	Irreversible	Resource may be partly lost	Difficult	**Moderate Negative**
	Impact 6: Direct Mortality - Electrocution	Negative	Direct	Slight	Study Area	Long Term	Probable	**Low Negative**	Reversible	Resource will not be lost	Achievable	**Low Negative**
Cumulative	Impact 7: Cumulative Impacts on avifaunal habitat, displacement and direct mortality	Negative	Indirect	Severe	National	Long Term	Probable	**High Negative**	Reversible	Resource may be partly lost	Achievable	**Moderate Negative**

Table A.2: Assessment of destruction of habitat during construction

Potential issue	Alt	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Construction Phase														
Direct Habitat Destruction	Preferred	Direct habitat destruction associated with WEFs is generally low relative to the overall size of the project area. This impact is largely unavoidable, resulting in some birds being displaced from the project site.	Negative	Direct	Slight	Study Area	Long Term	Definite	Reversible	Resource will not be lost	Achievable	**Low Negative**	*The footprint within Medium and High Sensitivity areas must be minimized and avoided wherever possible;* *Laydown and other temporary infrastructure to be placed outside of Medium and High sensitivity areas, preferably within previously transformed areas, wherever possible;* *Appropriate run-off and erosion control measures must be implemented where required;* *A site-specific Environmental Management Programme (EMPr) must be developed and implemented. The EMPr must give appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat (e.g. no open fires outside of designated areas);* *All contractors are to adhere to the EMPr and must apply good environmental practice during construction;* *All hazardous materials must be stored in the appropriate manner to prevent contamination of the site and downstream environments. Any accidental chemical, fuel and oil spills that occur at the site must be cleared as appropriate for the nature of the spill;* *Existing roads and farm tracks must be used where possible;* *The minimum footprint areas of infrastructure must be used wherever possible, including road widths and lengths;* *No off-road driving must be permitted in areas not identified for clearing;* *An Environmental Officer (EO) must form part of the on-site team to ensure that the EMPr is implemented and enforced and an Environmental Control Officer (ECO) must be appointed to oversee the implementation activities and monitor compliance for the duration of the construction phase; and* *Following construction, rehabilitation of areas disturbed by temporary laydown areas and facilities must be undertaken.*	**Low Negative**

Table A.3: Assessment of disturbance and displacement of birds during construction

Potential issue	Alt	Description / Source Of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Construction Phase														
Disturbance and Displacement	Preferred	Indirect loss of habitat from disturbance during the construction phase is temporary in nature and is expected to result largely from the presence of heavy machinery and increased activity of construction personnel.	Negative	Direct	Slight	Study Area	Short Term	Probable	Reversible	Resource will not be lost	Achievable	**Low Negative**	*A site specific EMPr must be developed and implemented. The EMPr must give appropriate and detailed description of how construction activities must be conducted;* *All contractors are to adhere to the EMPr and must apply good environmental practice during construction;* *The ECO must oversee activities and ensure that the site specific EMPr is implemented and enforced;* *Maximum use of existing access road and servitudes;* *Existing and novel access roads are to be suitably upgraded or constructed to prevent damage and erosion resulting from increased vehicular traffic and construction vehicles;* *No off-road driving in undesignated areas;* *Speed limits (50 km/h) must be strictly enforced on site to reduce unnecessary noise;* *Construction camps must be lit with as little light as practically possible, with the lights directed downwards where appropriate;* *The movement of construction personnel must be restricted to the construction areas on the project site;* *No dogs or cats other than those of the landowners must be allowed on site;* *The appointed ECO must be trained to identify the potential Red Data species, as well as the signs that indicate possible breeding by these species;* *The ECO must during audits/site visits make a concerted effort to look out for such breeding activities of SCCs (e.g. cranes, Secretarybird). Additional efforts must include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species; and* *If any avifaunal SCCs are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.*	**Low Negative**

Table A.4: Assessment of direct mortality of birds during construction

Potential issue	Alt	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Construction Phase														
Direct Mortality	Preferred	Fatalities of avifaunal species can occur through collision with vehicles as traffic in the area increases due to construction activity. Large-bodied and ground dwelling species (e.g. korhaans, cranes and bustards) are at increased risk, but this impact can be effectively mitigated against. Temporary fencing can result in collisions, entrapment or entanglement if not suitably installed. Similarly ground dwelling avifauna (particularly chicks) can fall into uncovered excavations and become entrapped.	Negative	Direct	Moderate	Study Area	Short Term	Probable	Irreversible	Resource will not be lost	Achievable	**Low Negative**	*Maximum use of existing access road and servitudes;* *No off-road driving in undesignated areas;* *Speed limits (50 km/h) must be strictly enforced on site to reduce probability of vehicle collisions;* *The movement of construction personnel must be restricted to the construction areas on the project site;* *No dogs or cats other than those of the landowners must be allowed on site;* *Any holes dug e.g. for foundations of pylons must not be left open for extended periods of time to prevent entrapment by ground dwelling avifauna or their young and only be dug when required and filled in soon thereafter;* *Temporary fencing must be suitably constructed, e.g. if double layers of fencing are required for security purposes, they must be positioned at least 2 m apart to reduce the probability of entrapment by larger bodied species that may find themselves between the two fences; and* *Roadkill must be reported to the ECO and removed as soon as possible to reduce attracting crows to the area.*	**Low Negative**

Table A.5: Assessment of disturbance and displacement of birds during the operational phase.

Potential issue	Alt	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Operational Phase														
Disturbance and Displacement	Preferred	Disturbance and displacement by operational activities such as power line and turbine maintenance, fencing, and noise can lead to birds avoiding the area for feeding or breeding, and effectively leading to habitat loss and a potential reduction in breeding success.	Negative	Direct	Moderate	Study Area	Long Term	Probable	Reversible	Resource will not be lost	Achievable	**Moderate Negative**	*A site specific operational EMPr must be developed and implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance;* *All contractors are to adhere to the EMPr and must apply good environmental practice during all operations;* *The ECO must be trained by an avifaunal specialist to identify the potential priority species and Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on the operational WEF, the nest/breeding site must not be disturbed and an avifaunal specialist must be contacted for further instruction; and* *Operational phase bird monitoring, in line with the latest available guidelines, must be implemented.*	**Low Negative**

Table A.6: Assessment of bird collision with infrastructure during operational phase.

Potential issue	Alt	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Operational Phase														
Direct Mortality – Collision with Infrastructure	Preferred	WEFs can cause bird fatalities through the collision of birds with moving turbine blades.	Negative	Direct	Severe	Regional	Long Term	Probable	Irreversible	Resource may be partly lost	Difficult	**High Negative**	*WTGs must not be constructed within (or encroach within) any High or Medium Sensitivity areas identified by the VERA model;* *WTGs are to be micro-sited to avoid blade tips from encroaching within these areas pending the specifics of final WTG dimensions;* *Additional mitigation (as detailed below) must be implemented for WTGs placed within High and Medium sensitivity areas determined outside of VERA modelled areas;* *Shut down-on-demand or Blade Painting (contingent on approval by the Civil Aviation Authority) or similar technology must be implemented for all WTGs that are positioned within or encroach on High and Medium Sensitivity areas;* *Internal power lines must be buried wherever technically feasible;* *Appropriate (approved) Bird Flight Diverters (BFDs) must be affixed to the entire length of novel overhead power lines (in all sensitivity categories);* *If one or more avifaunal SCC carcasses are located and determined likely to have resulted from collisions with infrastructure in any sensitivity area over the lifespan of the facility, the fatality is to be appropriately recorded and reported to an avifaunal specialist to determine the most appropriate action;* *If double layers of fencing are required for security purposes, they should be positioned at least 2 m apart to reduce the probability of entrapment by larger bodied species that may find themselves between the two fences;* *Develop and implement a carcass search and bird activity monitoring programme in-line with the latest applicable guidelines;* *Regular reviews of operational phase monitoring data (activity and carcass) and results to be conducted by an avifaunal specialist;* *The above reviews should strive to identify sensitive locations including WTGs and areas of increased collisions that may require additional mitigation;* *An operational monitoring programme for any novel overhead power lines must be implemented to locate potential collision fatalities; and* *Any fatalities located must be reported to Birdlife South Africa (BLSA) and the Endangered Wildlife Trust (EWT).*	**Moderate Negative**

Table A.7: Assessment of bird electrocution on overhead lines during operational phase.

Potential issue	Alt	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Operational Phase														
Direct Mortality - Electrocution	Preferred	Electrocution refers to the scenario where a bird is perched or attempts to perch on energized structures and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. Overhead power line infrastructure with a capacity of 132 kV or more does not generally pose a risk of electrocution due to the large size of the clearances between the electrical infrastructure components. Electrocutions are therefore more likely for larger species whose wingspan is able to bridge the gap such as eagles or storks. A few large birds (such as Verreaux's Eagle), susceptible to electrocution (particularly in the absence of safe and mitigated structures) occur in the area. Electrocution is also possible on electrical infrastructure within the substation particularly for species such as crows and owls.	Negative	Direct	Slight	Study Area	Long Term	Probable	Reversible	Resource will not be lost	Achievable	**Low Negative**	*Internal power lines should be buried wherever possible;* *All new overhead power line pylons must be of a design that minimizes electrocution risk. This can be achieved by using adequately insulated 'bird friendly' structures, with sufficient clearances between live components; and* *An operational monitoring programme for the overhead power line route must be implemented to locate potential collision fatalities.*	**Low Negative**

Table A.8: Assessment of cumulative impacts.

Potential issue	Alt	Description / Source of Impact	Nature	Type	Consequence	Extent	Duration	Probability	Reversibility	Irreplaceable Loss	Mitigation Potential	Significance without Mitigation	Mitigation Measures	Significance with Mitigation
Cumulative Impact														
Cumulative Impacts on avifaunal habitat, displacement and direct mortality	Preferred	At least 6 onshore wind facilities and onshore wind/solar PV combined facilities are being considered according to the DFFE Renewable Energy database (Q3 2022) within 50 km of the proposed development site, mostly towards the town of De Aar the north-east. In addition to these, the Britstown WEF Complex comprises 5 WEFs on the neighbouring properties.	Negative	Indirect	Severe	National	Long Term	Probable	Reversible	Resource may be partly lost	Achievable	**High Negative**	*All appropriate mitigation measures listed above should be implemented;* *The project should collaborate with other developments (current and proposed) in the broader project area. Companies in the area should share lessons learnt, align strategies and agree coordinated approaches to responding to environmental issues; and* *A data sharing agreement should be setup with other wind farm projects in the region to share operational monitoring data. Data should be shared with regulators and interested stakeholders to allow cumulative impacts to be documented and to inform adaptive operational management.*	**Moderate Negative**

APPENDIX B: RECONNAISSANCE STUDY AND PRE-APPLICATION AVIFAUNAL MONITORING PLAN

Reconnaissance Study

Desktop Study

The desktop study included data obtained from the following sources:

- Broad vegetation types present on the project site were obtained from the updated National Vegetation Map 2018 (NVM 2018) database[8] and the vegetation descriptions were obtained from Mucina & Rutherford (2006)[9];
- Bird distribution data of the Southern African Bird Atlas Project 2 (SABAP2) obtained from the Avian Demography Unit of the University of Cape Town[10];
- Co-ordinated Avifaunal Road Count (CAR) project[11];
- Co-ordinated Water-bird Count (CWAC) project[12];
- The Important Bird Areas of southern Africa (IBA) project[13];
- Output from the National Web-based Screening Tool[14] ('Screening Tool');
- Habitat suitability maps compiled by BirdLife South Africa ('BLSA');
- Publicly available satellite imagery;
- The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland[15]; and
- Verreaux's Eagle Risk Assessment (VERA) modelling.

Site Visit

- Date: 2021-07-12 to 2021-07-20
- Duration: 8 days.
- Season: July.
- Season Relevance: The timing of the site inspection coincided with the early breeding season of Verreaux's Eagle (May – July) when flight activity is usually increased and was sufficient to determine the current land-use in the area as well as the identification of suitable VPs for the avifaunal pre-application monitoring programme.

Results

Site Description

Regional Context

The proposed development site falls within the nama-Karoo biome in a transition zone between two broad vegetation types, where the southern extent of the Northern Upper Karoo meets the northern extent of the Eastern Upper Karoo (Figure B.1). The proposed development site lies to the west of the Platberg-Karoo Conservancy Important Bird Area (IBA SA037). This is a large IBA that covers the entire districts of De Aar, Philipstown and Hanover, including suburban towns. The landscape consists of extensive flat to gently undulating plains that are broken by dolerite hills and flat-topped inselbergs. The land is used primarily for grazing and agriculture. Commercial livestock farming is mostly extensive wool and mutton production, with some cattle and game farming. This IBA contributes significantly to the conservation of large terrestrial birds and raptors. These include Blue Crane, Ludwig's Bustard, Kori Bustard, Blue Korhaan, Black Stork, Secretarybird, Martial Eagle, Verreaux's Eagle, and Tawny Eagle.

Local Context

The majority of the proposed development site comprises relatively flat shrubland plains, with higher elevation areas found along the eastern border of the site and scattered in the north (Figure B.1). These areas include Upper Karoo Hardeveld vegetation and provide higher levels of habitat complexity than the flatter areas below. The cliffs and outcrops associated with dolerite rings and intrusions are prominent features that potentially provide

nesting and foraging habitat for Verreaux's Eagle while the flatter areas may support cranes, bustards, korhaans, Secretarybird and Martial Eagle. Flat areas experience sheet runoff and some areas are relatively barren or are 'washes' with low density vegetative cover. Only a few scattered areas are under cultivation (Figure 2).

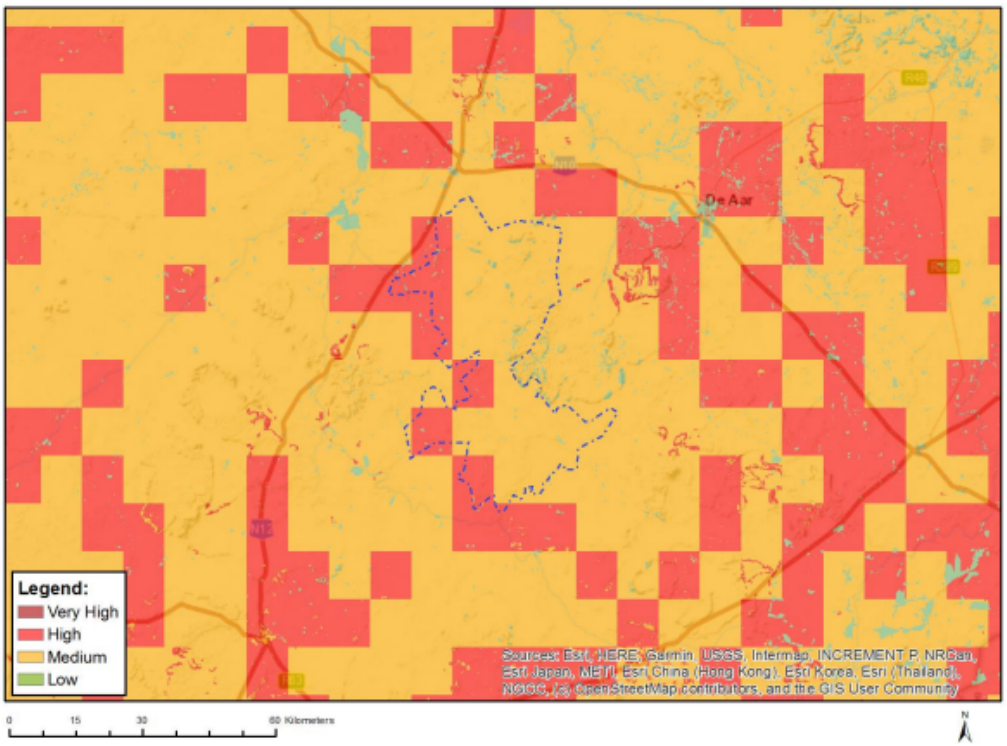
The water bodies noted within the broader area are mostly man-made dams and may support certain red-listed species such as flamingos, large numbers of congregatory species, and potentially provide nocturnal roosting sites for Blue Cranes.

Screening Tool

In terms of avifauna, the output from the Screening Tool (updated 2022-05-03) identified the site to be of High Sensitivity in the Relative Animal Species Theme due to the presence of Ludwig's Bustard and Medium Sensitivity due to the potential presence of Verreaux's Eagle (Figure B.1).

It must be noted that the avian species theme output produce by the screening tool indicates that the proposed development site is outside of avifaunal sensitivities and is of low avian sensitivity. The avian species theme however currently only provides avian sensitivities within Renewable Energy Development Zones (REDZ). Therefore, the animal species theme was used in this instance.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Mammalia-Felis nigripes
High	Aves-Neotis ludwigii
Low	Low sensitivity
Medium	Aves-Neotis ludwigii
Medium	Aves-Aquila verreauxii
Medium	Mammalia-Bunolagus monticularis

Figure B.1: The output from the National Web-based Screening Tool

South African Bird Atlas Project 2 (SABAP2)

SABAP2 data were examined for 32 pentads (which are approximately 8 km x 8 km squares) in and around the PAOI (Figure B.1). Adjacent pentads were included to ensure that all species potentially occurring within the PAOI, whether resident, nomadic, or migratory, are identified. A total of 145 species were recorded during full protocol SABAP2. This included 19 Priority Species, 8 species classified as *Endangered*, *Near Threatened* or *Vulnerable* and 17 endemic or near-endemic species (Appendix A). Due to the relatively few full protocol surveys conducted in some of the pentads this list cannot be considered to be complete.

Co-ordinated Avifaunal Roadcounts Project (CAR)

There are 10 CAR routes (NK033, NK201, NK202, NK203, NK321, NK322, NK323, NK451, NK452, and NK453) that run through the proposed development area. Blue Crane, Karoo Korhaan, Northern-black Korhaan, Ludwig's Bustard, and Secretarybird have been recorded along these routes (Figure 1).

Co-ordinated Waterbird Counts Project (CWAC)

Four CWAC sites (Nuwejaarsfontein Farm Dam, Nuwejaarsfontein House Dam, De Aar Sewage Works and Wortelfontein Dam) are located near the proposed development area, between 22 and 31 km in an easterly direction. Priority Species that have been recorded at these sites include Black Stork, African Fish Eagle, Greater Flamingo and Maccoa Duck (Figure 1).

Important Bird Area (IBA)

The proposed development area is located adjacent the Platberg–Karoo Conservancy (SA037) IBA, with its closest point less than 2 km away (Figure 1). The IBA was established specifically due to the presence of several globally and regionally threatened species of large terrestrial birds and raptors, certain biome-restricted passerines, and congregatory species. Globally threatened bird species include Blue Crane, Ludwig's Bustard, Kori Bustard, Secretarybird, Martial Eagle, Blue Korhaan, Black Harrier and Denham's Bustard. Regionally threatened species include Black Stork, Lanner Falcon, Tawny Eagle, Karoo Korhaan and Verreaux's Eagle. Biome-restricted species include Karoo Lark, Karoo Long-billed Lark, Karoo Chat, Tractrac Chat, Sickle-winged Chat, Namaqua Warbler, Layard's Tit-Babbler, Pale-winged Starling, and Black-headed Canary. Besides the presence of large resident raptors, congregatory species such as Amur Falcon and Lesser Kestrel also occur here, with almost 10% of the global population of Lesser Kestrels roosting in this conservancy during summer. The IBA is also seasonally important for White Stork during insect outbreaks.

Verreaux's Eagle Risk Assessment Tool (VERA)

The applicant provided Arcus with the results of the VERA tool that included several previously identified Verreaux's Eagle nest locations on the Kombuisfonteinberg and Waterval se Berge in the central-eastern portion of the site as well as on the dolerite intrusions on Perdepoort and Twyfelhoek. The output of the VERA tool was used in conjunction with the Verreaux's Eagle habitat suitability model to determine areas likely to be utilised by the species.

Expected Species

The species predicted to occur on the project site was determined by the desktop study results (Table 1). The desktop study revealed 29 potential Priority or Avifaunal SCC that are known to occur in and around the study area, including the Endangered Ludwig's Bustard and Martial Eagle, as well as the Vulnerable Secretarybird and Verreaux's Eagle. In addition to these red-listed species, Priority Species such as Northern Black Korhaan, Blue Korhaan, and Jackal Buzzard have been recorded in the area and likely occur in the broader impact zone in good numbers. Long-term data on waterbird numbers reveal that most red-listed water-dependant species appear to occur infrequently at low densities in the area, but include the Vulnerable Black Stork, as well as the Near-Threatened Maccoa Duck and Greater Flamingo.

Table B.1: List of priority species and SCC to potentially occur in the proposed Soyuz 3 site.

Species	Scientific Name	Regional Status	Global Status	Endemic or Near-endemic	Priority Score	SABAP2	IBA	CWAC	CAR
African Fish Eagle	*Haliaeetus vocifer*	Least Concern	Least Concern		290	x		x	
African Harrier-hawk	*Polyboroides typus*	Least Concern	Least Concern		190	x			
African Rock Pipit	*Anthus crenatus*	Near Threatened A2c+3c; C1; E	Near Threatened C1	X	200	x			
Amur Falcon	*Falco amurensis*	Least Concern	Least Concern		210		x		
Black Harrier	*Circus maurus*	Endangered C1+2a(ii)	Endangered C2a(ii)	X	345		x		
Black Stork	*Ciconia nigra*	Vulnerable A2c; D1	Least Concern		330		x	x	
Blue Crane	*Anthropoides paradiseus*	Near Threatened A2acde	Vulnerable A 3cde+4cde		320	x	x		x
Blue Korhaan	*Eupodotis caerulescens*	Least Concern	Near Threatened A3c; C1		270		x		
Booted Eagle	*Hieraaetus pennatus*	Least Concern	Least Concern		230	x			
Cape Eagle-owl	*Bubo capensis*	Least Concern	Least Concern		250				
Denham's Bustard	*Neotis denhami*	Vulnerable A2bcd+3bcd +4bcd; C1	Near Threatened A2bcd+3bcd +4bcd		300		x		
Greater Flamingo	*Phoenicopterus roseus*	Near Threatened A2bd	Least Concern		290			x	
Greater Kestrel	*Falco rupicoloides*	Least Concern	Least Concern		174	x			
Grey-winged Francolin	*Scleroptila afra*	Least Concern	Least Concern	X	190	x			
Jackal Buzzard	*Buteo rufofuscus*	Least Concern	Least Concern	X		x			
Karoo Korhaan	*Eupodotis vigorsii*	Near Threatened A2c	Least Concern		240	x	x		x
Kori Bustard	*Ardeotis kori*	Near Threatened A2bcd+3bcd +4bcd	Near Threatened A2bcd+3bcd +4bcd		260	x	x		
Lanner Falcon	*Falco biarmicus*	Vulnerable A2bc; C1	Least Concern		300	x	x		
Lesser Kestrel	*Falco naumanni*	Least Concern	Least Concern		214	x	x		
Ludwig's Bustard	*Neotis ludwigii*	Endangered A4cd	Endangered A4cd		320	x	x		x
Martial Eagle	*Polemaetus bellicosus*	Endangered A2cde ; C1	Endangered A2acde+3cde+4acde		350		x		
Maccoa Duck	*Oxyura maccoa*	Near Threatened C1	Endangered A2acde					x	

Species	Scientific Name	Regional Status	Global Status	Endemic or Near-endemic	Priority Score	SABAP2	IBA	CWAC	CAR
Northern Black Korhaan	*Afrotis afraoides*	Least Concern	Least Concern		180	x			x
Secretarybird	*Sagittarius serpentarius*	Vulnerable A4acd; C1	Endangered A2acde+3cde+4acde		320	x	x		x
Spotted Eagle-owl	*Bubo africanus*	Least Concern	Least Concern		170	x			
Tawny Eagle	*Aquila rapax*	Endangered A2bc+3bc; C1	Vulnerable A2ace+3ce+4ace		290		x		
Verreaux's Eagle	*Aquila verreauxii*	Vulnerable A2c; C1	Least Concern		360		x		
Verreaux's Eagle-owl	*Bubo lacteus*	Least Concern	Least Concern		210	x			
White Stork	*Ciconia ciconia*	Least Concern	Least Concern		220	x	x		

The shrubland plains habitat usually supports a relatively low diversity of bird species comprising both small passerines and non-passerines. The passerine species assemblage of the site is expected to be typical of similar areas in the Nama Karoo Biome, with the most commonly encountered species expected to be African Rock Pipit (*Near-Threatened*), Eastern Clapper Lark, Spike-heeled Lark, African Pipit, Rufous-eared Warbler, and Large-billed Lark. We therefore predict to find many endemic and near-endemic passerine species throughout the study site. Many of the red-listed non-passerines usually occur in shrubland plains and therefore it is highly likely for them to occur in the study site. It is also predicted that raptors use the ridges on a regular basis in addition to the plains.

Pre-Application Avifaunal Monitoring Plan (PAAMP)

Survey Design

The survey design and methodology will follow the Birds and Wind Energy Best-Practice Guidelines[16] ('standard' guidelines), and the Verreaux's Eagle Guidelines[17] ('VE' guidelines). It is determined that the optimum strategy is to monitor the whole WEF cluster concurrently to maximise the length of time that observers will spend across the site per monitoring survey. This will increase the likelihood of recording less frequent events in the area (e.g. an influx of bustards or storks following weather systems), even if incidentally.

It is estimated that six (6) observers operating in three (3) pairs could conduct monitoring surveys over approximately 25 days. Given that this is a long time to be in the field it is recommended that teams be rotated where practical.

Vantage Points

A total of 35 VPs will be positioned across the proposed project area (Figure 1). VP positions are designed to include a minimum of 75% coverage of the indicative WTG positions provided. Additional VPs will be placed in areas identified by the VERA tool to be of elevated risk to Verreaux's Eagle and areas suspected to be utilised by species such as Secretarybird, bustards and korhaans. As large portions of the proposed project site are located on flat terrain comprising typical karroid scrubland, away from cliffs, and rocky outcrops, most of the area is unlikely to represent potentially important Verreaux's Eagle habitat and therefore the 'standard' guidelines are considered appropriate for these areas. These guidelines recommend 12 hours of monitoring per VP per season (48 hours per VP over a

12-month period). For VPs positioned in areas that are likely to include Verreaux's Eagle habitat or territories, the VE guidelines are considered appropriate. These guidelines recommend additional survey effort to be conducted including 18 hours of monitoring per VP per season (72 hours per VP over a 12-month period where areas associated with high/risky flight activity are avoided). Given the overall length of the surveys required to monitor this number of VPs, it is recommended that four surveys be conducted over the 12-month period to include potential seasonal variation in site utilisation by avifauna.

These considerations result in 30 VPs across the proposed project site requiring 12 hours of monitoring per survey and five (5) VPs requiring 18 hours of monitoring per survey, totalling 48 hours per VP and 72 hours per VP respectively depending on the predicted level of Verreaux's Eagle flight activity in those areas. Three control VPs are to be surveyed for 12 hours each per survey.

VPs are to be conducted in pairs of bird observers recording bird flight activity, abundance, flight paths, flight height, species, age, and sex where possible as well as other relevant information such as date, time, and weather characteristics. VPs will be monitored in sessions of a maximum of four (4) hours per session to reduce fatigue as travel time across the project site can be long given the availability and condition of the roads. Each VP will be monitored over more than a single day per survey, i.e. the same VP will not be monitored for more than a single session per day by a pair of observers. Observer pairs are to monitor 360 degrees over an approximate radius of 2 km surrounding the VP.

Walk Transects

The diversity and abundance of smaller birds will be determined using 17 WTs of 500 m each covering different vegetation and habitat types across the WEF cluster. Observer pairs will walk between the start and end points of the transects and record all birds seen or heard up to 150 m on either side of the transect. Beyond 150 m, only priority species will be noted and recorded as incidental sightings.

Drive Transects

Four (4) DTs are to be conducted on and around the project site where vehicles are to be driven slowly (<25 km/h) along predetermined routes, stopping approximately every 250 m to scan the landscape. Any target species located must be recorded with a GPS position, age and sex where possible.

Incidental Records

Incidental records are to be made of target species when they are located outside of other monitoring activities including the species, GPS position, number, age, and sex where possible.

APPENDIX C: IMPACT ASSESSMENT SCORING METHODOLOGY

CES has developed the following impact rating methodology which has been developed in line with the Terrestrial Biodiversity Protocol, as well as the content requirements of Appendix 6 and the impact ratings required in Appendix 1 and 3 of the EIA Regulations (2014, as amended). This scale takes into consideration the following variables:

- **Nature**: negative or positive impact on the environment.
- **Type**: direct, indirect and/or cumulative effect of impact on the environment.
- **Significance**: The criteria in Table C.1 are used to determine the overall significance of an activity. The impact effect (which includes duration; extent; consequence and probability) and the reversibility/mitigation of the impact are then read off the significance matrix in order to determine the overall significance of the issue. The overall significance is either negative or positive and will be classified as low, moderate or high (Table C.1).
- **Consequence:** the consequence scale is used in order to objectively evaluate how severe a number of negative impacts might be on the issue under consideration, or how beneficial a number of positive impacts might be on the issue under consideration.
- **Extent:** the spatial scale defines the physical extent of the impact.
- **Duration:** the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
- **Probability:** the likelihood of impacts taking place as a result of project actions arising from the various alternatives. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development and alternatives. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.
- **Reversibility:** The degree to which an environment can be returned to its original/partially original state.
- **Irreplaceable loss:** The degree of irreplaceable loss which an impact may cause, e.g. loss of non-regenerative vegetation or removal of rocky habitat or destruction of wetland.
- **Mitigation potential:** The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table 2.3 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Table C.1: Impact Rating Criteria

Criteria	Categories	Description
Overall nature	**Negative**	Beneficial/positive impact.
	Positive	Detrimental/negative impact.
Type	**Direct**	Direct interaction of an activity with the environment.
	Indirect	Impacts on the environment that are not a direct result of the project or activity.
	Cumulative	Impacts which may result from a combination of impacts of this project and similar related projects.
Duration	**Short term**	Less than 5 years.
	Medium term	Between 5-20 years.
	Long term	More than 20 years.
	Permanent	Over 40 years or resulting in a permanent and lasting change that will always be there.
Extent	**Localised**	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
	Study area	The proposed site and its immediate environments.
	Municipal	Impacts affect the municipality, or any towns within the municipality.
	Regional	Impacts affect the wider district municipality or the Eastern Cape Province as a whole.

Criteria	Categories		Description
	National		Impacts affect the entire country.
Consequence	**Slight**		Slight impacts or benefits on the affected system(s) or party(ies).
	Moderate		Moderate impacts or benefits on the affected system(s) or party(ies).
	Severe/Beneficial		Severe impacts or benefits on the affected system(s) or party(ies).
Probability	**Definite**		More than 90% sure of a particular fact. Should have substantial supportive data.
	Probable		Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
	Possible		Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
	Unsure		Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.
Reversibility	**Reversible**		The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.
	Irreversible		The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.
Irreplaceable Loss	**Resource will not be lost**		The resource will not be lost/destroyed provided mitigation measures are implemented.
	Resource may be partly lost		The resource will be partially destroyed even though mitigation measures are implemented.
	Resource will be lost		The resource will be lost despite the implementation of mitigation measures.
Mitigation Potential	**Easily achievable**		The impact can be easily, effectively and cost effectively mitigated/reversed.
	Achievable		The impact can be effectively mitigated/reversed without much difficulty or cost.
	Difficult		The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.
	Very Difficult		The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.
Impact Significance	**Low Negative**	**Low Positive**	Largely of HIGH mitigation potential, after considering the other criteria.
	Moderate Negative	**Moderate Positive**	Largely of MODERATE or partial mitigation potential after considering the other criteria.
	High Negative	**High Positive**	Largely of LOW mitigation potential after considering the other criteria.

APPENDIX D: VP DESCRIPTIONS AND HOURS SURVEYED ACROSS THE ENTIRE WEF CLUSTER.

VP	Longitude	Latitude	Survey Hours				Total
			S1	S2	S3	S4	
1	23°36'53.04"E	31° 8'30.91"S	12	12	12	12	48
2	23°37'49.39"E	31° 5'48.75"S	12	12	12	12	48
3	23°33'45.77"E	31° 7'18.82"S	12	12	12	12	48
4	23°34'55.78"E	31° 5'25.80"S	12	12	12	12	48
5	23°37'44.51"E	31° 3'57.51"S	12	12	12	12	48
6	23°40'29.64"E	31° 3'0.30"S	18	18	18	18	72
7	23°43'1.40"E	31° 1'39.18"S	12	12	12	12	48
8	23°47'25.80"E	31° 2'25.98"S	12	12	12	12	48
9	23°38'27.74"E	31° 0'4.92"S	12	12	12	12	48
10	23°36'16.48"E	30°57'24.38"S	12	12	12	12	48
11	23°25'37.79"E	31° 3'27.38"S	12	12	12	12	48
12	23°26'49.59"E	31° 1'8.11"S	12	12	12	12	48
13	23°29'43.37"E	31° 2'17.86"S	12	12	12	12	48
14	23°31'3.29"E	31° 0'21.67"S	12	12	12	12	48
15	23°33'29.22"E	31° 1'24.90"S	12	12	12	12	48
16	23°33'4.76"E	30°59'6.10"S	12	12	12	12	48
17	23°33'4.44"E	30°56'18.20"S	12	12	12	12	48
18	23°34'50.79"E	30°54'23.12"S	18	18	18	18	72
19	23°31'43.16"E	30°53'27.35"S	12	12	12	12	48
20	23°31'14.40"E	30°51'39.14"S	12	12	12	12	48
21	23°33'14.98"E	30°51'13.02"S	12	12	12	12	48
22	23°35'29.37"E	30°52'19.43"S	12	12	12	12	48
23	23°35'5.37"E	30°50'12.62"S	12	12	12	12	48
24	23°37'10.47"E	30°49'59.98"S	18	18	18	18	72
25	23°39'3.46"E	30°48'27.47"S	18	18	18	18	72
26	23°38'53.15"E	30°46'34.89"S	12	12	12	12	48
27	23°42'20.39"E	30°45'47.78"S	12	12	12	12	48
28	23°38'38.27"E	30°44'21.86"S	18	18	18	18	72
29	23°31'56.60"E	30°48'21.28"S	12	12	12	12	48
30	23°34'13.07"E	30°46'4.04"S	12	12	12	12	48
31	23°28'18.76"E	30°48'4.24"S	12	12	12	12	48
32	23°23'45.33"E	30°47'16.28"S	12	12	12	12	48
33	23°26'12.32"E	30°46'8.88"S	12	12	12	12	48
34	23°31'15.27"E	30°42'25.24"S	12	12	12	12	48
35	23°36'20.64"E	30°48'7.25"S	12	12	12	12	48
CVP1	23°57'22.40"E	30°50'52.06"S	12	12	12	12	48
CVP2	23°32'30.67"E	31°17'10.84"S	12	12	12	12	48

VP	Longitude	Latitude	Survey Hours				Total
			S1	S2	S3	S4	
CVP3	23°14'10.14"E	30°55'6.97"S	12	12	12	12	48

APPENDIX E: WT LOCATIONS AND SURVEY DATES ACROSS THE ENTIRE WEF CLUSTER.

WT No.	Start Coordinates		Finish Coordinates	
	Longitude	Latitude	Longitude	Latitude
1	30°42'27.57"S	23°31'27.71"E	30°42'12.23"S	23°31'33.53"E
2	30°46'8.89"S	23°26'12.19"	30°46'24.55"S	23°26'7.57"E
3	30°47'17.60"S	23°25'17.89"E	30°47'33.49"S	23°25'21.62"E
4	30°48'5.15"S	23°28'21.67"E	30°47'57.85"S	23°28'4.85"E
5	30°46'24.64"S	23°38'38.72"E	30°46'35.07"S	23°38'53.23"E
6	30°47'53.20"S	23°36'27.73"E	30°48'1.34"S	23°36'12.16"E
7	30°51'38.27"S	23°31'17.26"E	30°51'25.76"S	23°31'29.46"E
8	30°49'50.78"S	23°36'50.87"E	30°49'58.02"S	23°37'7.60"E
9	30°54'23.19"S	23°34'51.90"E	30°54'25.74"S	23°35'10.51"E
10	30°55'56.80"S	23°33'8.92"E	30°56'13.02"S	23°33'6.29"
11	30°51'19.30"S	23°33'51.48"E	30°51'30.53"S	23°33'37.68"E
12	30°57'10.77"S	23°36'21.56"E	30°57'25.91"S	23°36'16.16"E
13	31° 0'57.33"S	23°26'59.62"E	31° 1'8.02"S	23°26'49.06"E
14	31° 3'43.73"S	23°25'41.25"E	31° 3'27.74"S	23°25'37.84"E
15	31° 8'30.02"S	23°36'53.14"E	31° 8'22.22"S	23°36'38.16"E
16	31° 2'22.61"S	23°48'18.94"E	31° 2'7.58"S	23°48'23.41"E
17	31° 1'39.04"S	23°43'2.34"E	31° 1'23.23"S	23°43'4.30"E
CWT1	30°50'52.62"S	23°57'21.82"E	30°51'8.95"S	23°57'24.03"E
CWT2	31°17'7.08"S	23°32'29.55"E	31°17'22.72"S	23°32'33.75"E
CWT3	30°55'5.33"S	23°14'9.48"E	30°54'49.61"S	23°14'14.80"E

APPENDIX F: DT LOCATIONS ACROSS THE ENTIRE WEF CLUSTER.

DT	Start Coordinates		Finish Coordinates	
	Longitude	Latitude	Longitude	Latitude
1	31° 3'22.41"S	23°42'50.26"E	30°57'28.48"S	23°36'14.99"E
2	31° 0'53.22"S	23°33'25.97"	31° 1'16.96"S	23°26'34.44"E
3	30°47'17.83"S	23°23'46.24"E	30°49'24.68"S	23°38'28.71"E
4	30°44'26.90"S	23°38'36.64"E	30°45'48.20"S	23°42'39.68"E
CDT1	30°55'9.07"S	23°14'9.63"E	30°50'3.37"S	23°19'27.55"E
CDT2	31°13'29.56"S	23°29'44.63"E	31°17'5.67"S	23°32'29.24"E

APPENDIX G: INCIDENTAL OBSERVATIONS OF TARGET BIRD SPECIES ON OR NEAR THE PROPOSED DEVELOPMENT SITE.

Species	Regional Red Data Status	Priority Species Score	Total Observations (No. Individual Birds)
African Harrier-Hawk	Least Concern	190	4 (4)
African Rock Pipit	Near Threatened	200	4 (4)
Amur Falcon	Least Concern	210	75 (271)
Black Harrier	Endangered	345	5 (5)
Black Kite	Least Concern	220	1 (1)
Black Stork	Vulnerable	330	3 (5)
Black-winged Kite	Least Concern	174	1 (1)
Blue Crane	Near Threatened	320	509 (3095)
Blue Korhaan	Least Concern	270	2 (8)
Booted Eagle	Least Concern	230	12 (14)
Common (Steppe) Buzzard	Least Concern	210	21 (22)
Double-banded Courser	Least Concern	204	15 (19)
Gabar Goshawk	Least Concern	-	4 (4)
Greater Kestrel	Least Concern	174	91 (118)
Grey-winged Francolin	Least Concern	190	7 (19)
Jackal Buzzard	Least Concern	250	197 (223)
Karoo Korhaan	Near Threatened	240	113 (234)
Kori Bustard	Near Threatened	260	5 (6)
Lanner Falcon	Vulnerable	260	35 (46)
Lappet-faced Vulture	Endangered	300	1 (2)
Lesser Kestrel	Least Concern	214	436 (18 349)
Ludwig's Bustard	Endangered	320	225 (526)
Martial Eagle	Endangered	350	3 (3)
Northern Black Korhaan	Least Concern	180	830 (1 115)
Pale Chanting Goshawk	Least Concern	200	513 (593)
Rock Kestrel	Least Concern	-	103 (136)
Secretarybird	Vulnerable	320	25 (37)
Spotted Eagle-Owl	Least Concern	170	19 (23)
Tawny Eagle	Endangered	290	11 (11)
Verreaux's Eagle	Vulnerable	360	44 (60)
Verreaux's Eagle-Owl	Least Concern	210	1 (1)
Western Barn Owl	Least Concern	-	2 (2)
White Stork	Least Concern	220	82 (15 126)

Species	Regional Red Data Status	Priority Species Score	Total Observations (No. Individual Birds)
White-backed Vulture	Critically Endangered	300	1 (5)
Yellow-billed Kite	Least Concern	-	3 (3)
Unidentified	-	-	31 (32)
Unidentified Buzzard	-	-	1 (1)
Unidentified Falcon	-	-	1 (1)
Unidentified Owl	-	-	1 (1)
Unidentified Raptor	-	-	5 (6)
		Total	3 450 (160)

APPENDIX H: POST-CONSTRUCTION MONITORING PROGRAMME

Avifaunal Abundance and Flight Activity Monitoring

As a minimum, survey protocols used in the pre-application monitoring should be repeated during the first two years of operation and should be combined with monitoring of fatalities. Requirements of the latest available guidelines should be included wherever necessary. The need for further monitoring of bird abundance and movements should be reviewed at the end this of period to determine if it is necessary to continue with some, or all, components of the monitoring.

Any observed changes in bird numbers and movements at a WEF could be linked to changes in the available habitat (e.g. agricultural expansion, mining, alien vegetation clearing as well as changes in weather conditions, rainfall, etc.). The avifaunal habitats available on both the development and reference sites should therefore be mapped at least once a year (at the same time every year).

Fatality Monitoring

In addition to avifaunal abundance, flight activity monitoring and habitat mapping, the post-construction monitoring programme must include fatality monitoring that incorporates carcass searches, as well as scavenger removal (carcass persistence) and searcher efficiency trials.

The aims of fatality estimates are to:

- Estimate the number and rate of fatalities at a WEF;
- Describe the species composition of fatalities (as well as the age and sex where possible);
- Record and document the circumstances and site characteristics associated with avian fatalities at turbines and ancillary infrastructure of the WEF (this could aid in understanding the cause of fatalities, and hence possible mitigation measures); and
- Mitigate impacts by informing final operational planning and ongoing management.

There are normally three separate components to estimating fatalities:

- Regular searches for collision casualties;
- Experimental assessment of search efficiency and scavenging rates of bird carcasses on the site; and
- Estimating fatality rates based on these data.

Carcass Searching

The search schedule will ultimately be dependent on the number of WTGs developed and their location. No fewer than 30 % of the total number of WTGs constructed should be surveyed using intensive sampling methods. WTGs should be selected randomly, or through stratified random sampling where habitat variation is pronounced. The same turbines are searched at regular intervals and once the subset of turbines has been selected, these should be fixed for the rest of the monitoring period, unless there is good reason to change this.

As a minimum, the radius of the search area should be equal to 75 % of the turbine height (ground to vertical blade-tip). The size of the search area should remain the same throughout the study. The area around each turbine should be searched using transects located no more than 10 m apart; this width should be reduced where thick groundcover hampers visibility. Transects should be walked slowly, and the target area searched carefully and methodically for any sign of a bird-collision incident (carcasses, dismembered body parts, scattered feathers, injured birds).

It may be acceptable to search only a subset of the search area if the habitat is such that surveying the entire area is not possible, although such circumstances should be carefully documented. All guyed masts and sample sections of any new lengths of power line associated with the development should also be surveyed for collision and/or electrocution victims and included in the search schedule.

The search interval must be adjusted to ensure that WTG search intervals are shorter than scavenger removal rates.

All physical evidence associated with located carcasses should be photographed, referenced (including accurately geo-referenced using a GPS), checked for age and sex (where possible). Carcasses should be collected, bagged and carefully labelled (label inside and outside the bag(s) – if double-bagged, put one label inside the outer bag), and refrigerated or frozen to await further examination.

If an injured bird is recovered, it should be contained in a suitably sized cardboard box. The local conservation authority should be notified that the bird will be transported to the nearest veterinary clinic or wild-animal/bird rehabilitation centre. In such cases, the immediate area of the recovery should be searched for evidence of impact with the turbine blades, and any such evidence should be fully documented (as above).

Maintenance staff should be required to report bird mortalities through a formalised reporting system throughout the lifespan of the facility. This should be additional to post-construction monitoring and does not replace formal carcass searches. All information should be recorded as far as possible.

Where there are incidental carcass finds at turbines that are being formally monitored, the carcass should be left in place where they may be detected during formal searches.

Details of carcasses found incidentally must be included in post-construction monitoring reports. Where bird carcasses are found in years where there is no formal monitoring, carcasses should be labelled, bagged and frozen. Fatalities should be reported annually to BirdLife South Africa, EWT, the Department of Environmental Affairs/SANBI and any relevant species specialists (more often if significant incidents occur).

An avifaunal specialist is to be notified of any significant (e.g. avifaunal SCCs) carcasses located as soon as possible to consider the most appropriate course of action.

Searcher Efficiency and Scavenger Trials

Scavenger removal trials must occur prior to the spinning of any WTG to determine the appropriate, initial search interval.

Fresh carcasses of birds of similar size and colour to a variety of the priority species should be placed randomly at sites around the search area and the location of each carcass recorded. As far as possible, carcasses used in trials should mimic the species characteristics and state of carcasses from WTG collisions.

Care should be taken to avoid tainting carcasses with human scent and the total number of carcasses set out should not be less than 20, but not so plentiful as to saturate the food-supply for the local scavengers.

These sites should be checked daily for the first week to record any changes in the presence, location and condition of each carcass. After the first week, the search interval can be increased and searches should continue for up to a month.

Scavenge and decomposition rates should therefore be measured at least twice over a monitoring year, once in winter and once in summer. Scavenger removal rates may also differ according to ground-cover and proximity to modified habitats and agricultural activity

(e.g. from farm cats) and scavenger removal rate trials must be stratified to account for this.

To estimate the probability of an observer detecting a carcass, a sample of suitable bird carcasses should be obtained and distributed randomly around the search area. The number and location of the paced carcasses should be recorded, and these carcasses should be of similar size and colour to the priority species. The proportion of the carcasses located in surveys will indicate the relative efficiency of the survey method. These trials should be done under the supervision of the avifaunal specialist during the scheduled carcass searches, without the knowledge of the field teams. Separate trials should be conducted for each individual searcher or search team. The location of all carcasses not detected by the survey team should be checked subsequently to discriminate between error due to search efficiency (those carcasses still in place which were missed) and scavenge rate (those immediately removed from the area).

Observed mortality rates need to be adjusted to account for searcher efficiency, scavenger removal and the probability that some carcasses may be outside the search area. It is recommended that the GenEst model is used when estimating fatality rates.

The need for further monitoring of fatalities should also be reviewed after the first two years, and then again on an annual basis. Carcass searches must always be repeated in the fifth year of operation, and again every five years thereafter.

Reporting

Quarterly monitoring reports should be completed for each site, presenting the results of the previous three months monitoring. Quarterly reports must include the details of carcasses found, including the species, date found, carcass condition (e.g. fresh, decomposed, feathers only), age class and sex (if possible), nearest turbine number, GPS location and proximity to relevant impact receptors (e.g. nests).

A post-construction monitoring report analysing the results of monitoring should be completed at the end of each year of monitoring. These reports must be submitted to the competent authority and relevant stakeholders

Post-construction monitoring reports must also be made available to environmental assessment practitioners, specialists and scientists for the purposes of environmental audits, environmental impacts assessments, cumulative impact assessments and scientific research.

The annual report is to investigate the following:

- Has the habitat available to birds in and around the facility changed?
- Has the abundance of birds and/or species composition changed?
- Have the distributions and/or movements of priority species changed?
- Where the answer is yes to any of the above four questions, what is the nature of the observed changes? (Compare these changes before (during) and after construction).
- What is the nature, and likely drivers, of any changes observed?
- What is the likely demographic and ecological significance of any observed changes in bird populations at the site (including consideration of the magnitude and direction of change) at both the local and broader population scale?
- What are the collision rates and the total number of bird fatalities at the facility? (Collision rates should be reported per MW (nameplate capacity) and per turbine for different size classes of birds. Data should be reported in both raw and corrected formats, and the GPS locations of carcasses must be included).
- What is the species and, as far as possible, age and sex composition of fatalities?
- What proportion of fatalities is likely to be due to collisions with wind turbines?

- Are there any factors (e.g. site characteristics and proximity to wind turbines) that may contribute to these fatalities?
- Is additional monitoring and/or mitigation necessary and if so, what needs to be done?

The outcomes of the post-construction monitoring, including data and specialist's reports, must be uploaded onto the national bird monitoring database, to be accessed at https://www.environment.gov.za/birddatabase, once operational.

APPENDIX I: SPECIALIST DECLARATION, CV AND PROFESSIONAL REGISTRATION

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