PROPOSED SOLAR PHOTOVOLTAIC FACILITY, "RHINO" PV ON REMAINDER OF FARM RHENOSTERKOP 155 AND "SUNNYSIDE" PV ON FARM 400, BEAUFORT WEST, WESTERN CAPE PROVINCE

AVIFAUNAL IMPACT ASSESSMENT REPORT

25 January 2024

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EXECUTIVE SUMMARY

K2022578692 South Africa (Pty) Ltd, has appointed SiVEST SA (Pty) Ltd to undertake the required Basic Assessment (BA) process for the proposed development of a combined maximum output capacity of 500 megawatt alternating current (MWac) solar photovoltaic (PV) facilities and associated infrastructure. The proposed development sites, Rhenosterkop Farm 155 (Rhino PV) and Farm 400 Sunnyside (Sunnyside PV) are located approximately 20 kilometres (km) to the east and north-east, respectively, of Beaufort West in the Western Cape Province. The project is being developed either to supply the national grid under the REIPPPP or similar procurement programme.

The project will consist of one (1) Environmental Authorisation (EA); one (1) BA for the solar energy facility (SEF) including related infrastructure. Thus, the entire project will require one EA process. The proposed SEF and associated infrastructure are to be situated within a Renewable Energy Development Zone (REDZ), namely Zone 11 – Beaufort West.

Refer to the table below for the project overview, details of the project are developing.

Project	Description
SEF	• Approximate combined maximum capacity: 500 MWac; • Approximate properties affected/site extent: 498.09 hectares (ha); • Associated infrastructure, per cluster, include: o 6 to 8 metres (m) of access roads and 4 m internal roads; o Solar PV panels; o 132 kilovolt (kV) substation at a height of approximately 21 m; o One construction camp with temporary containers occupying approximately 1 ha. The 1 ha construction camp will become the operational site camp offices, workshop areas, operation, and maintenance (O&M) building, permanent parking area, storage area, etc.; o 2 ha temporary construction laydown/ staging areas within the development area; o Triple wire, electrical fencing of 3 m maximum height and 11.5 km length; o Up to 5 ha Battery Energy Storage Systems (BESS) area;

Avifauna

A review of the data from the Southern African Bird Atlas Project (SABAP2) determined that a total of 183 bird species could potentially occur within the broader area where the Project Area of Impact (PAOI) is located (the PAOI includes the land parcels of both Rhino PV and Sunnyside PV). Of the 183 species, 75 are classified as priority species for solar developments. Of the 75 solar priority species, 24 were recorded during the on-site surveys (Site Sensitivity Verification (SSV) site visit and pre-construction monitoring surveys), and 44 solar priority species have a medium to high likelihood of occurring regularly in the PAOI.

The following Red Data priority species were recorded during site surveys and could occur in the PAOI regularly:

- Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near-threatened)
- Secretarybird *Sagittarius serpentarius* (Regionally and Globally Endangered)
- Karoo Korhaan *Eupodotis vigorsii* (Regionally Near-threatened)
- Southern Black *Korhaan Afrotis afra* (Globally and Regionally Vulnerable)
- Ludwig's Bustard *Neotis ludwigii* (Regionally and Globally Endangered)
- Kori Bustard *Ardeotis kori* (Globally and Regionally Near Threatened)
- Martial Eagle *Polemaetus bellicosus* (Regionally and Globally Endangered)
- Verreaux's Eagle *Aquila verreauxii* (Regionally Vulnerable).

Potential Impacts

The following potential impacts relative to avifauna have been identified for Rhino PV:

Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV facility and associated infrastructure.

Operational Phase

- Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure.
- Collisions with the solar panels.
- Entanglement in perimeter fences.
- Electrocutions at the on-site substations and on the 33 kV overhead lines.
- Collisions with the 33 kV overhead lines.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV facility and associated infrastructure.

Below is a summary of the anticipated impacts of Rhino PV and its associated infrastructure pre- and post-mitigation:

Environmental Parameter	Impact	Significance Rating Pre-Mitigation	Significance Rating Post Mitigation
Avifauna	*Displacement of priority species due to disturbance associated with the construction of the PV facility and associated infrastructure.*	High -	Low -
	Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure	High -	Medium -
	Mortality of priority species due to collisions with solar panels	Medium -	Low -
	Entanglement of birds in the perimeter fence	Medium -	Low -
	Mortality of priority species due to electrocution at the on-site substations and on the 33 kV overhead lines	Medium -	Low -
	Displacement of priority species due to disturbance associated with the decommissioning of the PV facility and associated infrastructure.	Medium -	Low -

The following potential impacts relative to avifauna have been identified for Sunnyside PV:

Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV facility and associated infrastructure.

Operational Phase

- Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure.
- Collisions with the solar panels.
- Entanglement in perimeter fences.
- Electrocutions at the on-site substations and on the 33 kV overhead lines.
- Collisions with the 33 kV overhead lines.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV facility and associated infrastructure.

Below is a summary of the anticipated impacts of Sunnyside PV and its associated infrastructure pre- and post-mitigation:

Environmental Parameter	Impact	Significance Rating Pre-Mitigation	Significance Rating Post Mitigation
Avifauna	*Displacement of priority species due to disturbance associated with the construction of the PV facility and associated infrastructure.*	High -	Low -
	Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure	High -	Medium -
	Mortality of priority species due to collisions with solar panels	Medium -	Low -
	Entanglement of birds in the perimeter fence	Medium -	Low -
	Mortality of priority species due to electrocution at the on-site substations and on the 33 kV overhead lines	Medium -	Low -
	Displacement of priority species due to disturbance associated with the decommissioning of the PV facility and associated infrastructure.	Medium -	Low -

Environmental Sensitivities

According to the DFFE Screening Tool, the PAOI (the land parcels covered by Rhino PV and Sunnyside PV) and its immediate environment is classified as **Medium** and **High** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme (**Figure 3**). The High classification is attributed to the potential occurrence of Ludwig's Bustard (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Southern Black Korhaan (Globally and Regionally Vulnerable), Martial Eagle (Globally and Regionally Endangered), and Lanner Falcon (Regionally Vulnerable). The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (GN No. 1150 of 2020).

In 2022 an Environmental Site Establishment process was undertaken by the applicant to determine and understand site environmental sensitivities. This was, however, only specific to the Rhino PV development area. The occurrence of SCC was confirmed during the Site Sensitivity Verification site visits (26–29 September 2022) with observations of Martial Eagle, Verreaux's Eagle, Blue Crane (Globally Vulnerable and Regionally Near

Threatened), Karoo Korhaan (Regionally Near threatened), Ludwig's Bustard, and Secretarybird (Globally and Regionally Endangered) recorded.

During the pre-construction monitoring surveys of August and November 2023 for both proposed Rhino PV and Sunnyside PV facilities, Karoo Korhaan, Kori Bustard (Globally and Regionally Near Threatened), and Southern Black Korhaan were also recorded (Globally and Regionally Vulnerable).

Based on the results of the field investigations, a classification of **High** sensitivity for avifauna is suggested for the PAOI, which includes the Rhino PV and Sunnyside PV land parcels.

The following avifaunal sensitivities were identified at Rhino PV only:

- **Very High Sensitivity Zones: All Infrastructure Exclusion Zones**

Red Data Raptor Nests: An all-infrastructure exclusion zone should be implemented and maintained within 2.5km of the identified Martial Eagle nest, and within 1km of the identified Verreaux's Eagle nests, to avoid displacement due to disturbance. These buffer areas will also reduce the risk of injury due to collision with solar panels to juvenile birds when they start flying and practicing their hunting techniques near their nests **(see Figures i and ii).**

The following avifaunal sensitivities were identified at both Rhino PV and Sunnyside PV SEFs:

- **High Sensitivity Zones: Solar Panel Exclusion Zones**

Surface Water and Wetlands: A solar panel exclusion zone buffer is recommended around all surface water features such as dams and reservoirs (200 m), as well as non-perennial drainage lines and associated herbaceous wetlands (150 m) that can, when flowing, attract birds. Surface water areas are important congregation points for priority avifauna and many non-priority species. It is, therefore, important to leave open space with no solar panels for birds to access and leave the surface water area unhindered. Surface water is also an important area for some raptors to hunt other birds that tend to congregate around these micro-habitats. Raptors need enough space for fast aerial pursuit of prey. The buffer zones will also benefit species such as Blue Crane which prefer to breed close to water bodies.

Agricultural Fields: Agricultural fields attract many priority and non-priority species to the area in search of food, including Red Listed species such as Blue Crane, Kori Bustard, and Ludwig's Bustard. Agricultural fields should, therefore, be kept free of solar panels.

Refer to **Figures i and ii** for the avifaunal sensitivities identified for the Rhino PV (**Figure i**) and Sunnyside PV (**Figure ii**) SEFs, respectively.

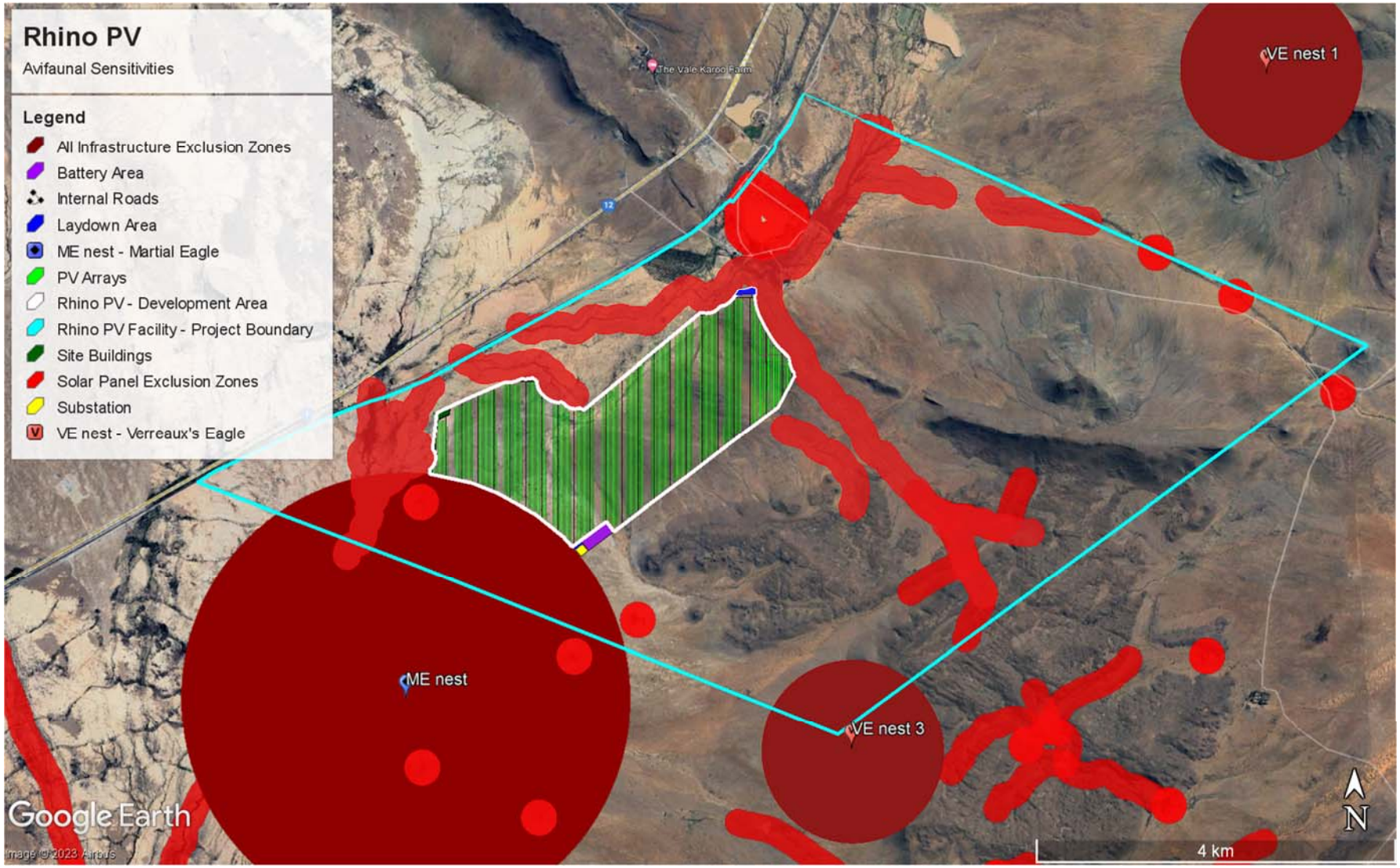

Figure i: Avifaunal sensitivities identified at Rhino PV.

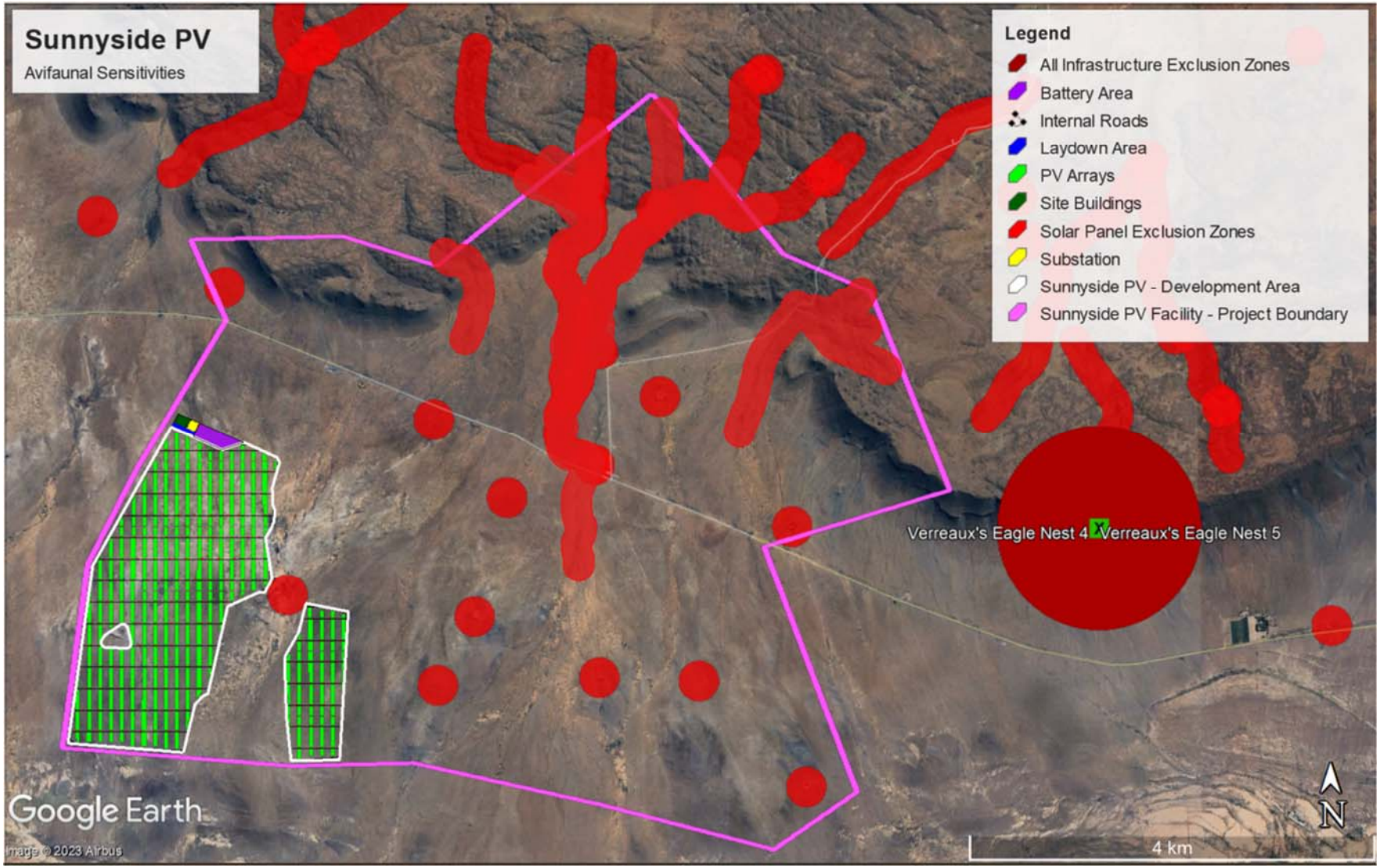

Figure ii: Avifaunal sensitivities identified at Sunnyside PV.

Management Actions

The following management actions are proposed for **both** SEF sites (Rhino PV and Sunnyside PV), unless stated otherwise:

Construction Phase

- An all-infrastructure exclusion zone should be implemented and maintained within 2.5 km of the identified Martial Eagle nest, and within 1 km of the identified Verreaux's Eagle nests, to avoid displacement due to disturbance.
- A solar panel exclusion zone buffer should be implemented and maintained around all surface water features such as dams and reservoirs (200 m), as well as non-perennial drainage lines and associated herbaceous wetlands (150 m).
- In addition, water troughs (if any) located within the PV footprints should be relocated outside the project area to ensure the continued availability of this water source to avifauna.
- Perimeter fences: Replace at least the top two barbed strands with smooth wire to reduce snagging risks, increasing the spacing between at least the top two wires (to a minimum of 30 cm), and ensuring they are correctly tensioned will reduce the snaring risks.
- Construction activity should, as far as possible, be restricted to the footprints of the infrastructure.
- Measures to control noise and dust should be applied according to current best industry practice.
- Maximum use of existing access roads should be made, and the construction of new roads should be kept to a minimum as far as is practical.
- Access to the rest of the property must be restricted.
- The recommendations of the Terrestrial Biodiversity (including Animal and Plant Species) Study must be strictly implemented, particularly as far as the limitation of the construction footprint is concerned.
- 33 kV cable networks: The cables must be placed underground as much as is practically possible. The final pole design must be developed in consultation with the avifaunal specialist to ensure that a bird-friendly design is employed. The avifaunal specialist must provide input and approve the final pole design.
- All internal medium voltage overhead lines must be marked with Eskom approved Bird Flight Diverters, according to the applicable Eskom Engineering Instruction.

Operational Phase

- An all-infrastructure exclusion zone should be implemented and maintained within 2.5 km of the identified Martial Eagle nest, and within 1 km of the identified Verreaux's Eagle nests, to avoid displacement due to disturbance and to reduce the risk of injury to juvenile birds due to collision with solar panels.
- A solar panel exclusion zone buffer should be implemented and maintained around all surface water features such as dams and reservoirs (200m), as well as non-perennial drainage lines and associated herbaceous wetlands (150 m).
- The recommendations of the Terrestrial Biodiversity (including Animal and Plant Species) Study must be strictly implemented, especially as far as site rehabilitation is concerned.
- Perimeter fences: Replace at least the top two barbed strands with smooth wire to reduce snagging risks, increasing the spacing between at least the top two wires (to a minimum of 30 cm), and ensuring they are correctly tensioned will reduce the snaring risks.
- Substations: Due to the complicated design of the substation hardware, pro-active mitigation is not a practical option. Instead, the situation must be monitored, and should electrocutions of priority species be recorded, reactive mitigation could be applied in the form of insulation of live components.
- All internal medium voltage overhead lines must be marked with Eskom approved Bird Flight Diverters, according to the applicable Eskom Engineering Instruction.

Decommissioning Phase

- Decommissioning activity should be restricted to the immediate footprints of the infrastructure.
- Access to the remainder of the sites should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current industry best practice.

Reasoned Opinion and Impact Statement

The PAOI (which includes the land parcels of both Rhino PV and Sunnyside PV)) and the immediate environment is classified as **Medium** and/or **High** sensitivity for terrestrial animals according to the DFFE Screening Tool Terrestrial Animal Species Theme. The High classification is linked to the potential occurrence of Ludwig's Bustard (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Southern Black Korhaan (Globally and Regionally Vulnerable), Martial Eagle (Globally and Regionally Endangered), and Lanner Falcon (Regionally Vulnerable). The PAOI contains confirmed habitat for SCC as defined in GN No. 1150 of 2020.

In 2022 an Environmental Site Establishment process was undertaken by the applicant to determine and understand site environmental sensitivities. This was, however, only specific to the Rhino PV development area. The occurrence of SCC was confirmed during the Site Sensitivity Verification site visits (26–29 September 2022) with observations of Martial Eagle, Verreaux's Eagle, Blue Crane (Globally Vulnerable and Regionally Near Threatened), Karoo Korhaan (Regionally Near threatened), Ludwig's Bustard, and Secretarybird (Globally and Regionally Endangered) recorded.

During the pre-construction monitoring surveys of August and November 2023 for both proposed Rhino PV and Sunnyside PV facilities, Karoo Korhaan, Kori Bustard (Globally and Regionally Near Threatened), and Southern Black Korhaan were also recorded (Globally and Regionally Vulnerable).

Based on the results of the field investigations, a classification of **High** sensitivity for avifauna is advocated for the PAOI, which consists of the Rhino and Sunnyside PV project sites (Land Parcels).

Despite the High Sensitivity rating for avifauna, there are no fatal flaws or unacceptable impacts associated with the proposed SEF project, provided the above-mentioned recommendations are strictly implemented and maintained. It is, therefore, recommended that the proposed Rhino PV and Sunnyside PV SEF be authorised, **on condition that the proposed mitigation measures as detailed in Sections 8 and 9 of this report and the EMPr (Appendix 6) are strictly implemented**.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL ANIMAL SPECIES (GOVERNMENT GAZETTE NO 43855, 30 OCTOBER 2020), GN No. 1150 of 2020

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL ANIMAL SPECIES	**Section of Report**
The Terrestrial Animal Species Specialist Assessment Report must include, as a minimum, the following information:	
• contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae;	**Appendix 1**
• a signed statement of independence by the specialist;	**Page iv**
• a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	**Section 6, Appendix 4**
• a description of the methodology used to undertake the SSV and impact assessment and site inspection, including equipment and modelling used where relevant;	**Section 2**
• a description of the mean density of observations/number of samples sites per unit area of site inspection observations;	**Section 5.3**
• a description of the assumptions made and any uncertainties or gaps in knowledge or data;	**Section 2.4**
• details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;	**Section 6**
• the online database name, hyperlink, and record accession numbers for disseminated evidence of SCC found within the study area;	**Section 5**
• the location of areas not suitable for development and to be avoided during construction where relevant;	**Section 6**
• a discussion on the cumulative impacts;	**Section 8.5**
• impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	**Sections 8 & 9, Appendix 6**
• a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to the specific theme considered, and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and	**Section 10**
• a motivation must be provided if there were any development footprints identified that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate.	**Section 6**
• A signed copy of the assessment must be appended to the BAR.	

forestry, fisheries
& the environment
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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE

Proposed Solar Photovoltaic
Facility, "Rhino" PV on Remainder of Farm
Rhenosterkop 155 And "Sunnyside" PV on Farm 400,
Beaufort West, Western Cape Province

Avifaunal Impact Assessment Report

Kindly note the following:

1. This form must always be used for assessment that is in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with '*the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Avifaunal Impact Assessment

Specialist Company Name	AfriAvian Environmental
Specialist Name	Albert Froneman
Specialist Identity Number	730814 5080081
Specialist Qualifications:	MSc Conservation Biology
Professional affiliation/registration:	SACNAP, Zoological Science, Reg. No. 400177
Physical address:	28 San Henrique, 2 Rosewood Road, Broadacres
Postal address:	Box 2676 Fourways, 2055
Cell phone	+27 (0)82 901 4016
E-mail	albert.froneman@gmail.com

DECLARATION BY THE SPECIALIST

I, Albert Froneman declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations, and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing –
  - any decision to be taken with respect to the application by the competent authority; and;
  - the objectivity of any report, plan, or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

AfriAvian Environmental

Name of Company:

26 Jan 2024

Date

UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Albert Froneman_____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

AfriAvian Environmental

Name of Company

26 January 2024

Date

See commissioned document below

Signature of the Commissioner of Oaths

See commissioned and dated document below

Date

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GLOSSARY OF TERMS

Definitions	
Broader Area	A consolidated data set for a total of six (6) pentads where the Rhino PV and Sunnyside PV Project Sites is located.
Project Area of Impact	The Project Area of Impact (PAOI) was defined as the area covered by the land parcels/farm portions where the Rhino PV and Sunnyside PV SEF are proposed to be located. These land parcels are the Remainder of Farm Rhenosterkop 155 (Rhino PV) and Remainder of Farm 400 (Sunnyside PV).
Solar Priority Species	Solar priority species which were defined as follows: • South African Red List species • South African endemics and near-endemics • Waterbirds; and • Raptors

LIST OF ABBREVIATIONS

BA	Basic Assessment
BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
DFFE	Department of Forestry, Fisheries and the Environment
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
HV	High voltage
IBA	Important Bird Area
IKA	Index of Kilometric Abundance
IUCN	International Union for Conservation of Nature
kV	Kilovolt
MV	Medium voltage
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
OHL	Overhead line
PAOI	Project Area of Impact
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
SABAP1	First Southern African Bird Atlas Project
SABAP2	Second Southern African Bird Atlas Project
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa Protected Areas Database

1. INTRODUCTION

K2022578692 South Africa (Pty) Ltd has appointed SiVEST SA (Pty) Ltd (hereinafter referred to as SiVEST) to undertake the required Basic Assessment (BA) process for the proposed development of the 500-megawatt alternating current (MWac) solar photovoltaic (PV) facility and associated infrastructure, to be located approximately 20 kilometres (km) to the east and north-east of Beaufort West in the Western Cape Province (**Figure 1-1**). The project is being developed either to supply the national grid under the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or similar procurement programme.

The project will consist of one Environmental Authorisation (EA), one BA for the solar energy facility (SEF) including related infrastructure. Thus, the entire project will require one EA process. The proposed SEF and associated infrastructure are situated within a Renewable Energy Development Zone (REDZ), namely Zone 11 – Beaufort West.

Refer to **Table 1-1** and **Figure 1-2** and **Figure** 1-3 for the project overview.

Table 1-1: Details of the SEF – Rhino and Sunnyside PV.

Project	Description
SEF	• Approximate combined capacity: 500 MWac; • Approximate properties affected/site extent: 498.09 hectares (ha); • Associated infrastructure, per cluster, include: o 6 to 8 metres (m) of access roads and 4 m internal roads; o Solar PV panels; o 132 kilovolt (kV) substation at a height of approximately 21 m; o One construction camp with temporary containers occupying o approximately 1 ha. The 1 ha construction camp will become the operational site camp offices, workshop areas, operation, and maintenance (O&M) building, permanent parking area, storage area, etc.; o 2 ha temporary construction laydown/ staging areas within the development area; o Triple wire, electrical fencing of 3 m maximum height and 11.5 km length; o Up to 5 ha Battery Energy Storage Systems (BESS) area;

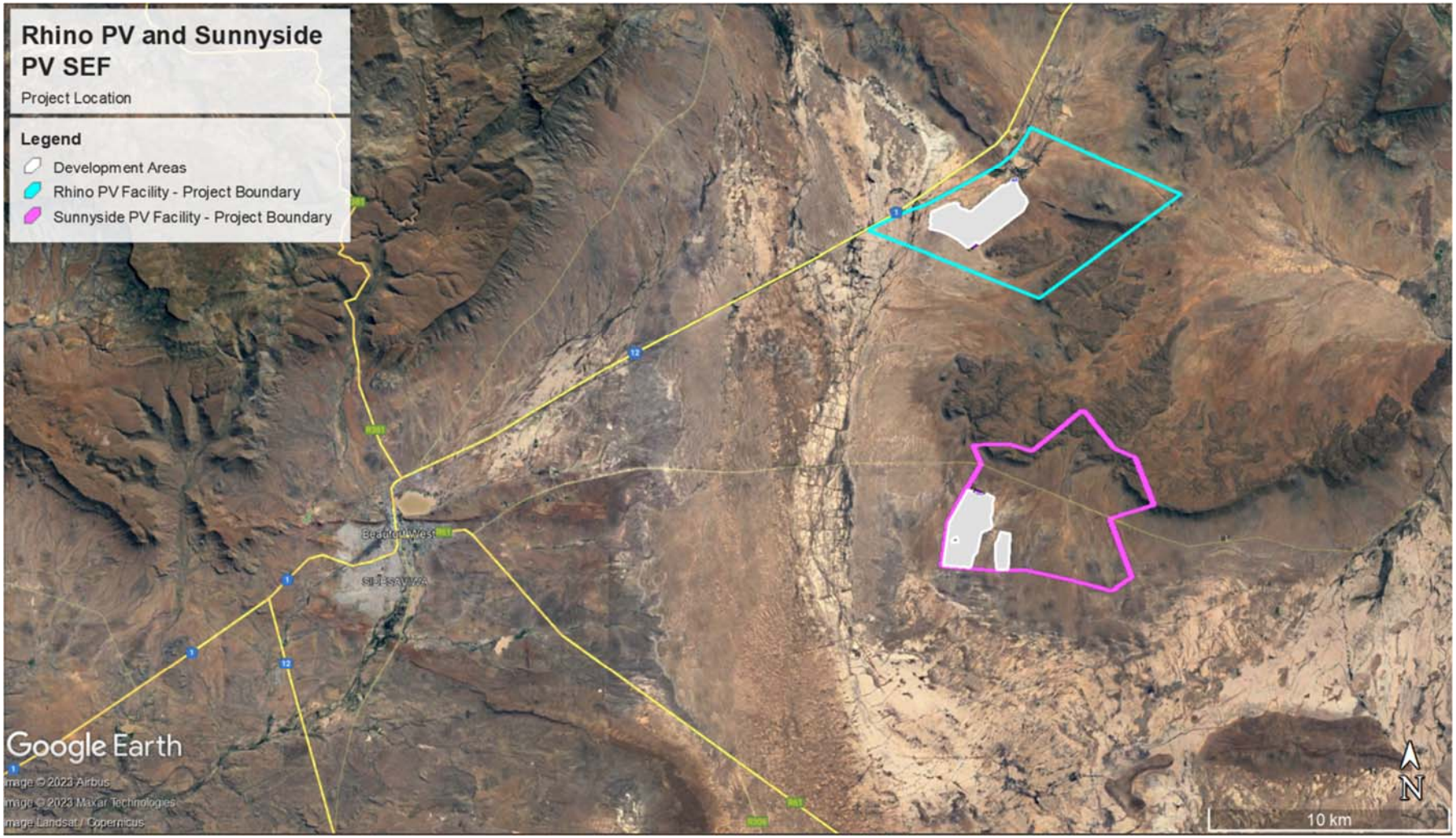

Figure 1-1**: Regional context of the proposed Rhino and Sunnyside SEF Project Boundaries and Development Areas (white polygons).**

Figure 1-2**: Project overview of the proposed Rhino PV Project Layout.**

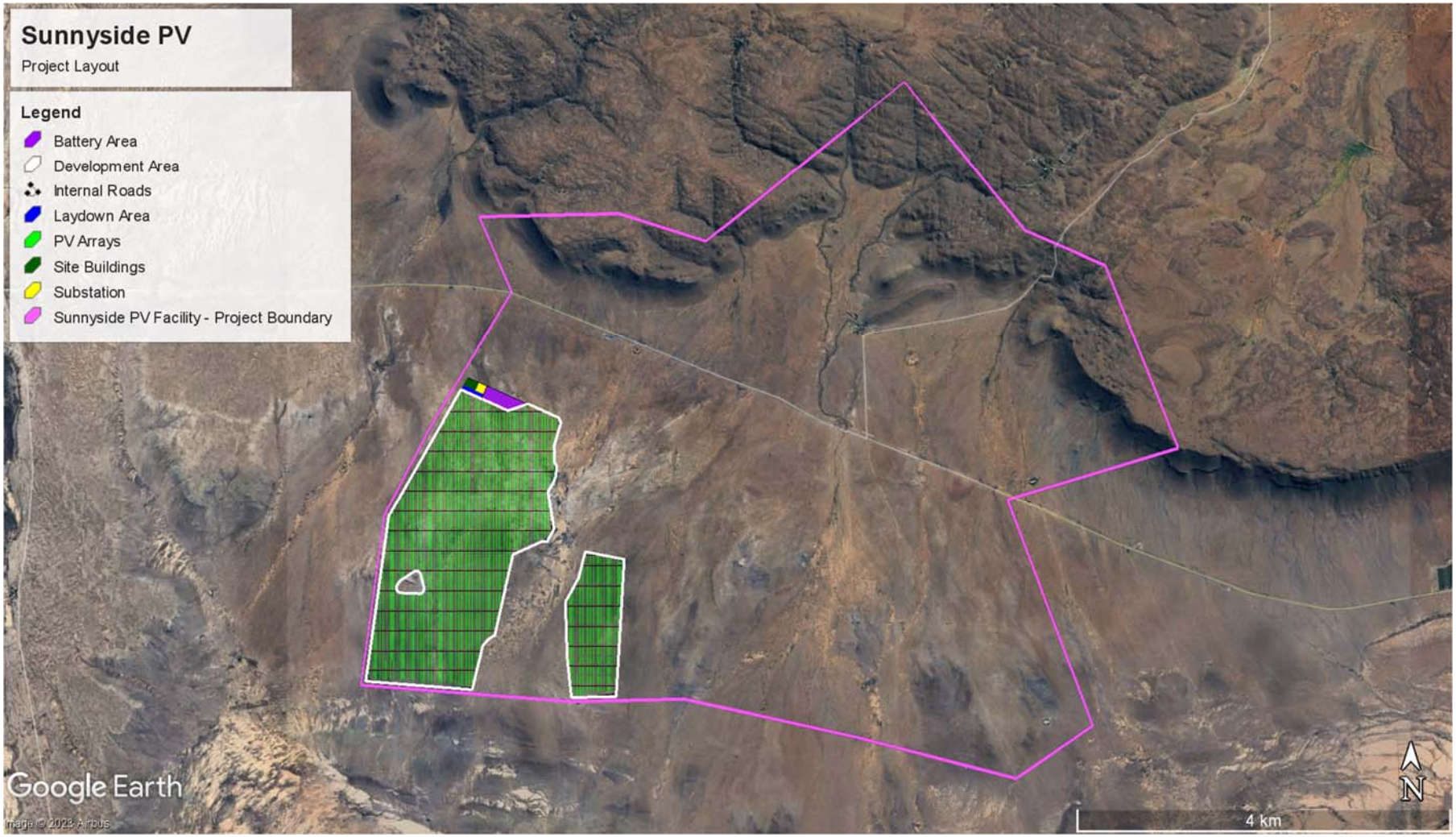

Figure 1-3: Project overview of the proposed Sunnyside PV Project Layout.

2. ASSESSMENT METHODOLOGY

2.1 Specialist Credentials

Please refer to **Appendix 1** for Specialist Curriculum Vitae (CVs).

2.2 Terms of Reference

The specialist study is required to follow the published Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species (Government Gazette No 43855, 30 October 2020), Government Notice No. 1150 of 2020 (GN No. 1150) enacted in terms of the National Environmental Management Act, 1998 (Act 107 of 1998), as amended (NEMA). The Protocols require determination of the level of sensitivity, which then determines the level of assessment required either a Compliance Statement or a Specialist Assessment.

Based on the findings of the site sensitivity verification (SSV), detailed in Section 6 of this report, it is suggested that a High Sensitivity rating would be more appropriate for the SEF sites. Therefore, a Specialist Assessment is applicable. The findings of the assessment must be written up in a Terrestrial Animal Species Specialist Assessment Report (this Report), and include as a minimum the following information (as outlined in the Protocol):

- contact details and relevant experience as well as the South African Council for Natural Scientific Professions (SACNASP) registration number of the specialist preparing the assessment including a CV (Appendix 1);
- a signed statement of independence by the specialist;
- a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
- a description of the methodology used to undertake the SSV and impact assessment and site inspection, including equipment and modelling used where relevant;
- a description of the mean density of observations/ number of samples sites per unit area of site inspection observations;
- a description of the assumptions made and any uncertainties or gaps in knowledge or data;
- details of all species of Conservation Concern (SCC) found or suspected to occur on site, ensuring sensitive species are appropriately reported;
- the online database name, hyperlink, and record accession numbers for disseminated evidence of SCC found within the study area;
- the location of areas not suitable for development and to be avoided during construction where relevant;
- a discussion on the cumulative impacts;
- impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);
- a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to the specific theme considered, and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and
- a motivation must be provided if there were any development footprints identified as per paragraph above that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate.
- A signed copy of the assessment must be appended to the Basic Assessment Report (BAR).

2.3 Approach

The following methods were used to compile the Site Sensitivity Verification Report (SSVR) (**Appendix 4**) and the Avifaunal Impact Assessment Report (this report):

- The **Project Area of Impact (PAOI)** was defined as the area covered by both SEF sites, i.e., the land parcels/ farm portions where both the Rhino and Sunnyside SEF are proposed to be located. These land parcels are the Remainder of Farm Rhenosterkop 155 (Rhino PV) and Remainder of Farm 400 (Sunnyside PV).
- Bird distribution data from the Second Southern African Bird Atlas Project (SABAP2) was obtained from the University of Cape Town (2023) to ascertain which species occur within the **Broader Area** i.e., within a block consisting of 12 pentads where the proposed SEF and associated infrastructure will be located (**Figure 2-1**). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 9 km. From 2007 to date, a total of 192 full protocol checklists (i.e., surveys lasting at least two hours each) have been completed for this area. In addition, 132 *ad hoc* protocol checklists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation and habitat was obtained from the First Southern African Bird Atlas Project (SABAP1) (Harrison et al. 1997) and the National Vegetation Map (2018) from the South African National Biodiversity Institute (SANBI) website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick et al. 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2023) was used to view the Broader Area and PAOI on a landscape level and to help identify sensitive bird habitat.
- Priority species were defined as follows:
    - South African Red Data species: High conservation significance
    - South African endemics and near-endemics: High conservation significance
    - Raptors: High conservation significance. Raptors are at the top of the food chain and play a key role in their ecosystems. When populations of birds of prey go down, then the numbers of their prey species go up, creating an imbalance in the ecosystem.
    - Waterbirds: Evidence indicates that waterbirds may be particularly susceptible to collisions with solar arrays due to the so-called lake effect, caused by the reflection of the sun on the smooth surface of solar panels.
- The SANBI BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The national Department of Forestry, Fisheries and the Environment National Web-Based Environmental Screening Tool (DFFE Screening Tool) was used to determine the assigned avian sensitivity of the PAOI.
- The BirdLife South Africa (BLSA) Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in Southern Africa. BirdLife South Africa by Jenkins *et al*. 2017 (Solar Guidelines) were consulted to determine the level of survey effort required.
- SSV site visits were undertaken from 26–29 September 2022.

- The main source of information on the avifaunal diversity and abundance at the Rhino and Sunnyside PV SEF sites is an integrated pre-construction monitoring programme that was implemented at the proposed Rhino and Sunnyside PV SEF development areas during August and November 2023. Surveys were conducted according to an adapted Regime 2 protocol as defined in the Best Practice Guidelines for Avifaunal Impact Studies at Solar Developments, compiled by BLSA (Jenkins et al. 2017); i.e., a minimum of two surveys conducted over 6 months, all necessary protocols and best practice guidelines were followed/ adhered to. Refer to **Appendix 3**.

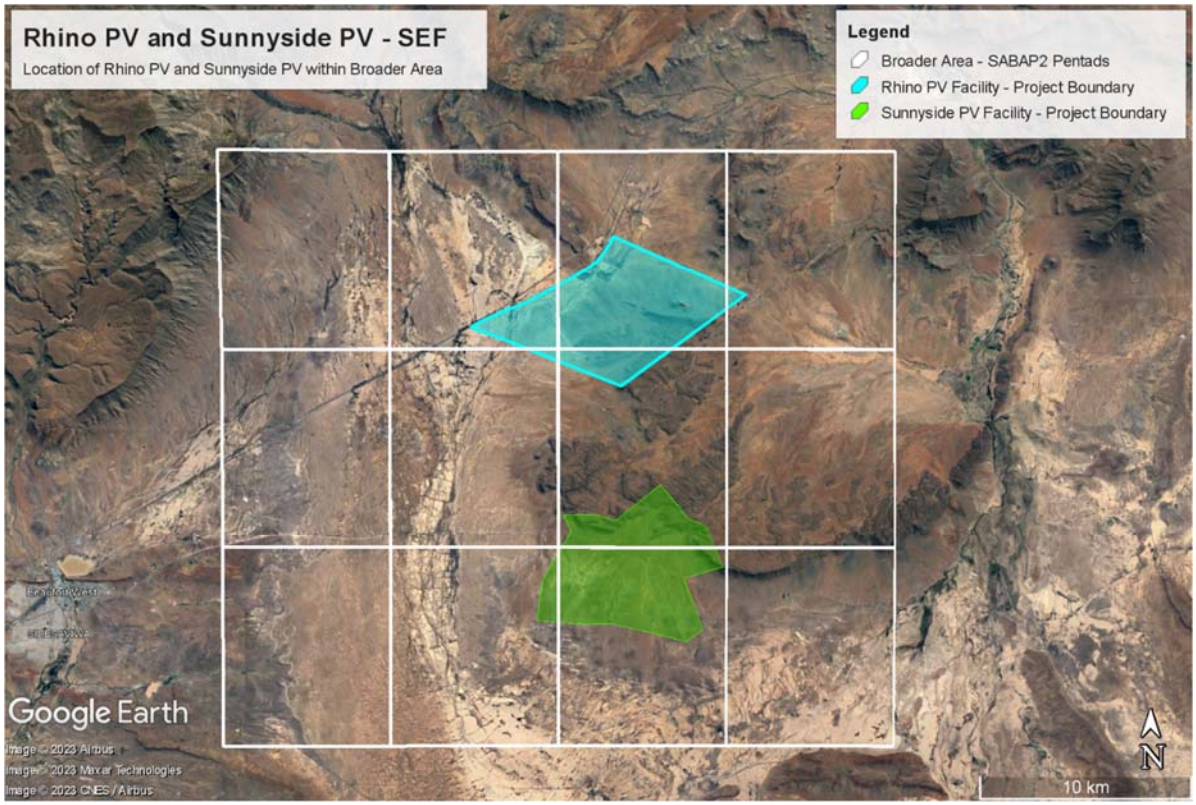

Figure 2-1: Location of Rhino PV (blue) and Sunnyside PV (green) Project Sites within the Broader Area of 12 pentads.

2.4 Assumptions and Limitations

This study assumed that the sources of information used in this report are reliable. In this respect, the following must be noted:

- It was assumed that the SABAP2 data is a reasonably accurate representation of the avifauna that is likely to occur in the Broader Area.
- The focus of the study was primarily on the potential impacts of the proposed SEF on priority species. Priority species were identified on the basis of (i) potential susceptibility to impacts caused by the SEF, and/or (ii) their conservation significance.
- The impact of solar installations on avifauna is a new field of study, with only two published scientific studies on the impact of SEFs on avifauna in South Africa (Rudman, Gauché, & Esler, 2017) (Visser, Perold, Ralston-Paton, Cardenal, & Ryan, 2019); and one related study on the impacts of concentrated solar power facilities on wildlife in South Africa (Jeal, Perolda, Seymour, Ralston-Paton, & Ryan, 2019). Strong reliance was, therefore, placed on expert opinion and data from existing monitoring programmes at solar facilities in

the United States of America (USA) where monitoring has been ongoing since 2013. The pre-cautionary principle was applied throughout as the full extent of impacts on avifauna at solar facilities is not presently known.

- The assessment of impacts is based on the baseline environment as it currently exists at the SEF Project Sites.
- Conclusions drawn in this study are based on experience of the specialist in relation to the species found on site and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that would be valid under all circumstances.
- The Broader Area is defined as the area encompassed by the 12 pentads where the proposed SEF Project Sites are located (**Figure 2-1**).

3. LEGAL REQUIREMENT AND GUIDELINES

There is no specific legislation relating to the impact of solar facilities and associated infrastructure on avifauna.

3.1 Agreements and Conventions

The table below lists agreements and conventions which South Africa is party to, and which are relevant to the conservation of avifauna.

Table 3-1: Agreements and conventions which South Africa is party to, and which are relevant to the conservation of avifauna.

Convention Name	Description	Geographic Scope
African-Eurasian Waterbird Agreement (AEWA)	The AEWA is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland, and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The CBD entered into force on 29 December 1993. It has three main objectives: • The conservation of biological diversity • The sustainable use of the components of biological diversity • The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
CMS, 1979	As an environmental treaty under the aegis of the UNEP, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

3.2 National Legislation

3.2.1 Constitution of the Republic of South Africa, 1996 (Act 108 of 1996), as amended

The Constitution of the Republic of South Africa, 1996 (Act 108 of 1996) as amended (the Constitution), provides in the Bill of Rights that: Everyone has the right:

- to an environment that is not harmful to their health or well-being; and
- to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
  - prevent pollution and ecological degradation;
  - promote conservation; and
  - secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

3.2.2 The National Environmental Management Act, 1998 (107 of 1998) as amended

The NEMA creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out several guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated. NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment or BA has been undertaken and EA has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes, Sections 24(5)(a) and (h) and 44, when applying for EA. The Protocol or GN No. 1150 is applicable in the case of solar PV developments.

3.2.3 The National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004) as amended, and the Threatened or Protected Species Regulations, February 2007

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004), as amended (NEMBA), read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 of the NEMBA sets out the objectives of the Act that are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources.

NEMBA also gives effect to CITES, the Ramsar Convention, and the Bonn CMS of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

3.3 Provincial Legislation

Provincial legislation applicable to the proposed Project is that of the Western Cape Nature Conservation Laws Amendment Act, 2000. This statute provides for the amendment of various laws on nature conservation to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board, which includes various regulations pertaining to wild animals, including avifauna.

4. PROJECT DESCRIPTION

4.1 Project Location

The Applicant intends to develop a SEF and associated infrastructure on Remainder of farm Rhenosterkop 155, and Farm 400. The SEF is located approximately 20 km east and north-east of Beaufort West in the Western Cape province. The SEF will have a combined maximum output capacity of up to 500 MWac. A total development footprint of approximately 489.09 ha is envisaged for the project (Error! Reference source not found.).

Details of each farm are provided in Table 4-1.

Table 4-1:Property details of the Project

Property Name	21-digit Surveyor General code	Extent
Remainder of farm Rhenosterkop 155	C00900000000015500000	4 247 ha, only 563 ha available for development
Farm 400	C00900000000040000000	4 035 ha, only 525.2 ha available for development

4.2 Project Components

The term PV describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the PV Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e., semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current).

The key components of the proposed project are described in **Table 4-2Error! Reference source not found.**.

Table 4-2: Summary of the key project components

Technical Details	
PV Panels	• Mono- or bifacial panels will be used, not thin film. • Panel width and height (TBC during detail design phase). • Expected panel dimensions: o Width: 1 – 1.3 m; o Height: 2 – 2.4 m.
Access Roads	• 6m – 8m access roads +15% • 4m internal roads
On-site Substation	• One 132 kV. • 21 m height. • Substation will step up voltage from 33 to 132 kV. • Various transformers will be located within the PV area. These will combine the power from multiple inverters and step up the supply voltage from 800 volts to 33 kV. The expected capacity of these transformers is in the range of 2.5 megavolt ampere each. • Note that the voltage levels are estimates and subject to confirmation/change during the detail design phase of the project.

Technical Details	
Construction Camp	• 1 per site. • Temporary containers: 1 ha per site.
Temporary construction laydown / staging area	• 2 ha within the development area – laydown.
O&M buildings	• 1 ha construction camps will become the operational site camp offices, workshop areas, O&M building, permanent parking area, storage area.
On-site Independent Power Producer Electrical infrastructure	• Medium voltage cabling will link the PV installation with the grid connection infrastructure at 33 kV. • The grid connection infrastructure will step up the voltage to 132 kV, high voltage.
Fencing	• Triple wire fence, electrical fencing: o Length – 11.5 km; o Maximum height 3 m.
Proximity to Grid Connection	• The facility is planned to connect to a new Main Transmission Substation (MTS) which will be established near the project site. The new MTS will tie in via loop-in-loop-out connection to the existing Droërivier/ Hydra 400 kV lines. • Alternatively, the project can tie into the existing Droërivier MTS via a 132 kV connection.
Site Access	• Rhino PV: Turn southward off from N1, 30 km outside Beaufort West, between Beaufort West and Three Sisters. This will lead to a Transnet service road used by the local population for access to farms and smallholdings. The site will be located immediately to the right at the T-junction of the road that connects the service road and the N1. • Sunnyside PV: Approximately 3.2 km outside Beaufort West on the R61, turn onto the Hopewell Road in an Eastern direction. After 24.1 km, turn right onto Farm 400 through the gate to the farm. This will be the main access point to the site.
Boreholes and Storage Tanks (if applicable)	• Existing boreholes will be tested. If no potential boreholes (existing), new boreholes will be required. • Water will be stored on site using JoJo tanks storing borehole or municipal water.
BESS	• Up to 5 ha. • The technology and capacity are still to be determined.

4.3 Alternatives

4.3.1 Activity alternatives

No other activity alternatives have been considered within the proposed SEF development footprints. However, the proposed SEF forms part of a larger proposed renewable energy (RE) development which potentially includes both solar and wind energy facilities.

4.3.2 Location Alternatives

Currently, there are two SEF clusters proposed, Rhino and Sunnyside.

An Environmental Site Establishment (ESE) process was undertaken from September 2022 to January 2023 to screen the greater project site from an environmental and social perspective. The ESE process included both desktop studies as well as on-site surveys by avifauna, bat, ecology, and heritage specialists. The aim of the ESE was to define the scope of the BA phase of the project.

The specialist constraints were considered in developing the proposed design and layout. This exercise also fed into the constraints mapping to identify the most suitable areas for the development of a solar PV facility which is envisaged to result in the least environmental and social impact. The design and layout of the proposed SEF was further refined on completion of SSV.

In considering the specialist limitations identified in the screening phase, three no-go areas have been identified and excluded from the proposed development. These are restricted areas and are not suitable for the installation of PV modules. Therefore, the final available land area covers an area of 498.09 ha.

RE development in South Africa is highly desirable from a social, environmental and development point of view and a solar energy installation is more suitable for the site due to the high solar resource. These sites are preferred due to the suitable climate, conditions, and topography, including close proximity to the national grid. Based on the above site-specific attributes, the study area is considered highly preferred in terms of the development of solar and WEFs. As such, no further property/location alternatives have been considered.

4.3.2 Technology Alternatives

No other activity alternatives are being considered.

4.3.3 Layout Alternatives

Refer to “Location Alternatives” above. Additionally, layout alternatives were determined upon availability of all specialist sensitivities (SSV phase).

4.3.4 No-Go Alternative

The ‘no-go’ alternative is the option of not developing the proposed SEF project. Hence, if the ‘no-go’ option is implemented, there would be no development. This alternative, however, would result in no environmental impacts from the proposed project on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report.

5. BASELINE DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 Bird Species at the Project Site

A review of the data from the SABAP2 determined that a total of 183 bird species could potentially occur within the Broader Area where the PAOI is located. Of the 183 species, 75 are classified as priority species for solar developments. Of the 75 solar priority species, 24 were recorded during the on-site surveys (SSV site visit and pre-construction monitoring surveys), and 44 solar priority species have a medium to high likelihood of occurring regularly in the PAOI.

The following Red Data priority species were recorded during site surveys and could occur in the PAOI regularly:

- Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near-threatened)
- Secretarybird *Sagittarius serpentarius* (Regionally and Globally Endangered)
- Karoo Korhaan *Eupodotis vigorsii* (Regionally Near-threatened)
- Ludwig's Bustard *Neotis ludwigii* (Regionally and Globally Endangered)
- Martial Eagle *Polemaetus bellicosus* (Regionally and Globally Endangered)
- Verreaux's Eagle *Aquila verreauxii* (Regionally Vulnerable)

Table 5-1 lists all priority species and the possible impact on the respective species by the proposed SEF and the associated infrastructure. The legend for the table is provided below:

CR = Critically Endangered
VU = Vulnerable
LC = Least Concern
NT = Near Threatened

L= Low
M = Medium
H = High

Table 5-1: Solar priority species that could occur at the PAOI, their habitat preferences, and the possible impacts of the proposed Rhino and Sunnyside SEF on avifauna.

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Nama Karoo Grassland and Shrub	Drainage Woodland	Surface Water	Mesas, Ridges and Koppies	Agricultural Lands	Alien Trees	High Voltage Lines	Solar - Collisions with Solar Panels	Solar - Displacement: Disturbance (Breeding)	Solar - Displacement: Habitat Transformation	Solar - Entanglement in Fences	Power line - Electrocution MV	Power line - Collision
		Full Protocol	Ad Hoc Protocol																	
African Fish Eagle	*Haliaeetus vocifer*	0,52	0,00	-	-		L			x			x			x	x		x	
African Rock Pipit	*Anthus crenatus*	2,60	0,00	NT	NT		L	x			x				x	x				
African Sacred Ibis	*Threskiornis aethiopicus*	2,60	0,00	-	-		L			x		x	x		x				x	x
African Spoonbill	*Platalea alba*	10,94	3,03	-	-		H			x					x					x
Black Harrier	*Circus maurus*	0,52	0,00	EN	EN		L	x									x		x	
Black-eared Sparrow-Lark	*Eremopterix australis*	7,29	2,27	-	-	x	M	x							x	x				
Black-headed Canary	*Serinus alario*	27,08	3,79	-	-	x	H	x							x	x	x			
Black-headed Heron	*Ardea melanocephala*	0,52	0,00	-	-		L	x				x			x				x	x
Blacksmith Lapwing	*Vanellus armatus*	33,33	1,52	-	-	x	H	x		x		x			x					
Black-winged Kite	*Elanus caeruleus*	6,25	3,03	-	-		M	x	x			x	x	x		x			x	
Black-winged Stilt	*Himantopus himantopus*	4,17	0,00	-	-		M			x					x					
Blue Crane	*Grus paradisea*	23,96	2,27	VU	NT	x	H	x		x		x			x	x	x	x		x
Booted Eagle	*Hieraaetus pennatus*	15,10	1,52	-	-	x	H	x		x	x			x			x		x	
Burchell's Courser	*Cursorius rufus*	0,52	0,00	-	VU		L	x				x				x	x			

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Nama Karoo Grassland and Shrub	Drainage Woodland	Surface Water	Mesas, Ridges and Koppies	Agricultural Lands	Alien Trees	High Voltage Lines	Solar - Collisions with Solar Panels	Solar - Displacement: Disturbance (Breeding)	Solar - Displacement: Habitat Transformation	Solar - Entanglement in Fences	Power line - Electrocution MV	Power line - Collision
		Full Protocol	Ad Hoc Protocol																	
Cape Eagle-Owl	*Bubo capensis*	0,52	0,00	-	-		L	x	x		x		x			x			x	x
Cape Shoveler	*Spatula smithii*	2,08	0,76	-	-		L			x					x					x
Cape Teal	*Anas capensis*	0,52	0,00	-	-		L			x					x					x
Cape White-eye	*Zosterops virens*	39,58	0,76	-	-		H		x				x		x	x	x			
Common Buzzard	*Buteo buteo*	6,77	0,00	-	-		M	x	x	x		x	x	x					x	
Common Greenshank	*Tringa nebularia*	1,56	0,00	-	-		L			x					x					
Common Moorhen	*Gallinula chloropus*	0,52	0,00	-	-		L			x					x					
Egyptian Goose	*Alopochen aegyptiaca*	30,73	3,03	-	-	x	H			x		x	x	x	x				x	x
European Roller	*Coracias garrulus*	0,00	0,76	-	NT		L		x											
Fairy Flycatcher	*Stenostira scita*	51,04	3,03	-	-	x	H	x	x		x				x	x	x			
Fiscal Flycatcher	*Melaenornis silens*	51,04	1,52	-	-		H		x						x	x	x			
Gabar Goshawk	*Micronisus gabar*	1,56	0,00	-	-		L		x	x			x		x	x			x	
Great Egret	*Ardea alba*	0,52	0,00	-	-		L			x					x					x
Greater Kestrel	*Falco rupicoloides*	43,75	3,03	-	-	x	H	x					x	x		x			x	
Grey Heron	*Ardea cinerea*	5,73	0,00	-	-		M			x			x		x					x
Grey Tit	*Melaniparus afer*	4,17	0,00	-	-		M	x	x						x					

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Nama Karoo Grassland and Shrub	Drainage Woodland	Surface Water	Mesas, Ridges and Koppies	Agricultural Lands	Alien Trees	High Voltage Lines	Solar - Collisions with Solar Panels	Solar - Displacement: Disturbance (Breeding)	Solar - Displacement: Habitat Transformation	Solar - Entanglement in Fences	Power line - Electrocution MV	Power line - Collision
		Full Protocol	Ad Hoc Protocol																		
Grey-winged Francolin	*Scleroptila afra*	1,04	0,00	-	-		L	x				x				x	x			
Hamerkop	*Scopus umbretta*	1,04	0,00	-	-		L		x	x			x		x				x	x
Jackal Buzzard	*Buteo rufofuscus*	6,25	0,76	-	-		H	x		x	x		x	x		x	x		x	
Karoo Eremomela	*Eremomela gregalis*	1,56	0,00	-	-	x	M	x	x						x	x	x			
Karoo Korhaan	*Eupodotis vigorsii*	72,40	18,18	-	NT	x	H	x				x				x	x	x		x
Karoo Lark	*Calendulauda albescens*	4,17	0,00	-	-		M	x							x	x				
Karoo Prinia	*Prinia maculosa*	63,02	3,03	-	-	x	H	x							x	x	x			
Karoo Thrush	*Turdus smithi*	37,50	0,76	-	-		H		x				x		x	x	x			
Kittlitz's Plover	*Charadrius pecuarius*	1,56	0,00	-	-		L			x		x			x					
Kori Bustard	*Ardeotis kori*	9,38	0,76	NT	NT	x	M	x	x	x		x				x	x	x		x
Lanner Falcon	*Falco biarmicus*	16,67	3,79	-	VU		H	x	x	x	x	x	x	x	x	x			x	
Large-billed Lark	*Galerida magnirostris*	53,65	6,06	-	-	x	H	x				x			x	x				
Layard's Warbler	*Curruca layardi*	6,25	0,76	-	-	x	M	x	x						x	x	x			
Lesser Flamingo	*Phoeniconaias minor*	0,52	0,00	NT	NT		L			x					x					x
Lesser Kestrel	*Falco naumanni*	1,04	0,00	-	-		L	x			x		x	x	x	x			x	
Little Grebe	*Tachybaptus ruficollis*	2,08	0,00	-	-		L			x					x					x

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Nama Karoo Grassland and Shrub	Drainage Woodland	Surface Water	Mesas, Ridges and Koppies	Agricultural Lands	Alien Trees	High Voltage Lines	Solar - Collisions with Solar Panels	Solar - Displacement: Disturbance (Breeding)	Solar - Displacement: Habitat Transformation	Solar - Entanglement in Fences	Power line - Electrocution MV	Power line - Collision
		Full Protocol	Ad Hoc Protocol																	
Little Stint	*Calidris minuta*	0,52	0,00	-	-		L			x					x					
Ludwig's Bustard	*Neotis ludwigii*	40,10	7,58	EN	EN	x	H	x				x				x	x	x		x
Marsh Sandpiper	*Tringa stagnatilis*	0,52	0,00	-	-		L			x					x					
Martial Eagle	*Polemaetus bellicosus*	5,21	2,27	EN	EN	x	H	x	x	x	x	x	x	x		x	x		x	
Namaqua Warbler	*Phragmacia substriata*	20,31	0,00	-	-		H		x						x	x	x			
Pale Chanting Goshawk	*Melierax canorus*	59,38	15,15	-	-	x	H	x	x	x	x	x	x	x		x			x	
Pied Avocet	*Recurvirostra avosetta*	3,13	2,27	-	-	x	M			x					x					
Pied Starling	*Lamprotornis bicolor*	36,46	4,55	-	-	x	H	x		x		x	x		x	x				
Red-billed Teal	*Anas erythrorhyncha*	2,60	0,76	-	-		L			x					x					x
Red-knobbed Coot	*Fulica cristata*	1,56	0,00	-	-		L			x					x					x
Rock Kestrel	*Falco rupicolus*	36,98	6,82	-	-	x	H	x			x		x			x			x	
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0,52	0,00	-	-		L	x	x		x		x	x	x	x			x	
Sclater's Lark	*Spizocorys sclateri*	43,75	13,64	NT	NT		H	x							x	x				
Secretarybird	*Sagittarius serpentarius*	6,25	3,03	EN	VU	x	M	x		x		x	x			x	x	x		x
Sickle-winged Chat	*Emarginata sinuata*	26,56	3,03	-	-	x	H	x							x	x	x			
South African Shelduck	*Tadorna cana*	31,77	3,03	-	-		H			x					x					x

Species Name	Scientific Name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded During Monitoring	Likelihood Of Regular Occurrence	Nama Karoo Grassland and Shrub	Drainage Woodland	Surface Water	Mesas, Ridges and Koppies	Agricultural Lands	Alien Trees	High Voltage Lines	Solar - Collisions with Solar Panels	Solar - Displacement: Disturbance (Breeding)	Solar - Displacement: Habitat Transformation	Solar - Entanglement in Fences	Power line - Electrocution MV	Power line - Collision
		Full Protocol	Ad Hoc Protocol																		
Southern Black Korhaan	*Afrotis afra*	5,21	3,03	VU	VU	x	M	x				x			x	x	x	x		x
Southern Double-collared Sunbird	*Cinnyris chalybeus*	18,23	0,00	-	-		H		x						x	x	x			
Spotted Eagle-Owl	*Bubo africanus*	20,83	0,00	-	-		H	x	x	x			x		x	x		x	x	x
Spur-winged Goose	*Plectropterus gambensis*	4,69	0,00	-	-		M			x		x	x	x	x					x
Tawny Eagle	*Aquila rapax*	0,52	0,00	VU	EN		L	x				x	x	x		x	x		x	
Three-banded Plover	*Charadrius tricollaris*	35,94	0,00	-	-		H			x					x					
Verreaux's Eagle	*Aquila verreauxii*	3,65	0,76	-	VU	x	H	x		x	x		x	x		x	x		x	x
Western Barn Owl	*Tyto alba*	15,10	0,00	-	-		H	x	x	x		x	x						x	x
Western Cattle Egret	*Bubulcus ibis*	1,04	0,00	-	-		L	x		x		x	x		x				x	x
White Stork	*Ciconia ciconia*	0,00	1,52	-	-		L			x	x									x
White-breasted Cormorant	*Phalacrocorax lucidus*	0,52	0,00	-	-		L			x					x					x
Yellow-billed Duck	*Anas undulata*	2,60	0,76	-	-		L			x					x					x
Yellow-billed Kite	*Milvus aegyptius*	0,52	0,00	-	-		L	x		x		x	x	x					x	

5.2 Bird Habitat

The following bird habitat features were recorded at or near the Rhino PV and Sunnyside PV SEF. **The habitat features at Rhino and Sunnyside PV are similar in that both sites contain the avifaunal habitat features described in Section 5.2.1. None of the PV sites have a specific significant habitat feature that distinguishes one from the other.**

The PAOI was defined as the area covered by both SEF sites, i.e., the land parcels/farm portions where both the Rhino and Sunnyside SEF are proposed to be located. These land parcels are the Remainder of Farm Rhenosterkop 155 (Rhino PV) and Remainder of Farm 400 (Sunnyside PV).

5.2.1. Biomes and Vegetation Types

The landscape character of the PAOI is typical of the Great Karoo and comprises sections of plains and open valleys with dispersed drainage systems and rougher terrain including mesas (table type mountains/hills), koppies, rocky ridges, outcrops, and plateaus. The current land use in the PAOI is characterised by large agricultural holdings with mostly low-density livestock and game grazing being the main land use. Dry climatic conditions are such that agricultural activities are very limited and are restricted to valley bottoms often near or around farmsteads.

The PAOI comprises of flat plains and rugged mountains, with its centre approximately 28 km north-east of the town of Beaufort West in the Nama Karoo biome, in the Lower and Upper Karoo Bioregions (SANBI 2018). The habitat in the PAOI consists of extensive plains with low shrub and a prominent grass component (**Figure 5-1**), as well as and rougher terrain including rock-strewn mesas, koppies, rocky ridges, outcrops and plateaus covered with grass and low shrub. SANBI (2018) classifies the vegetation in the PAOI as Gamka Karoo on the plains, with Upper Karoo Hardeveld on the high lying ridges, koppies and mountains. Gamka Karoo consists of dwarf spiny shrubland dominated by Karoo dwarf shrubs (e.g., *Chrysocoma ciliata, Eriocephalus ericoides*) with rare low trees (e.g., *Euclea undulata*). Dense stands of drought-resistant grasses (*Stipagrostis, Aristida*) cover (especially after abundant rains) broad sandy bottomlands. Upper Karoo Hardeveld consists of sparse dwarf Karoo scrub with drought-tolerant grasses of genera such as *Aristida, Eragrostis and Stipagrostis* (SANBI 2018). There are no prominent rivers or drainage lines in the PAOI.

SABAP1 recognises six primary vegetation divisions (biomes) within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al.* 1997). The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. Using this classification system, the natural vegetation in the PAOI is classified as Nama Karoo (Harrison *et al.* 1997).

The Beaufort West area is semi-arid with extreme temperature ranges. Mean annual precipitation averages around 214 millimetres (mm) (meteoblue.com). The least amount of rainfall occurs in July with an average of 6mm. In February, the precipitation reaches its peak, with an average of 30mm. The temperatures are highest on average in January, at around 30 °C with hot days up to 36°C. At 15 °C daytime average, July is the coldest month of the year, with the temperature dropping as low as -13° at night (meteoblue.com).

5.2.2 Nama Karoo Grassy Shrubland

This habitat feature is described in Section 5.2.1. A habitat photo is provided in **Table 5-1** below.

Figure 5-1: Typical Nama Karoo habitat in the PAOI - A mixture of grass and shrubs on the plains in the PAOI.

Priority species that occur in the Broader Area and could utilise this habitat type in the PAOI include:

- Black-eared Sparrow-Lark
- Black-headed Canary
- Black-winged Kite
- Blue Crane
- Booted Eagle
- Common Buzzard
- Greater Kestrel
- Jackal Buzzard
- Karoo Korhaan
- Karoo Lark
- Karoo Prinia
- Kori Bustard
- Lanner Falcon
- Large-billed Lark
- Ludwig's Bustard
- Martial Eagle
- Pale Chanting Goshawk
- Pied Starling
- Rock Kestrel
- Sclater's Lark
- Secretarybird
- Sickle-winged Chat
- Southern Black Korhaan

- Spotted Eagle-Owl
- Verreaux's Eagle
- Western Barn Owl

5.2.3 Woodland

Trees and taller woody shrubs are mostly restricted to watercourses and include *Vachellia karroo, Diospyros lycioides, Grewia robusta, Searsia lancea,* and *Tamarix usneoides* (**Figure 5-2**). This habitat provides suitable foraging and nesting substrate for a number of woodland associated species, as well as some of the raptors.

Figure 5-2: Woodland habitat along a drainage line in the PAOI.

Priority species that occur in the Broader Area and could utilise this habitat type in the PAOI include:

- Black-winged Kite
- Cape White-eye
- Common Buzzard
- Fairy Flycatcher
- Fiscal Flycatcher
- Grey Tit
- Karoo Eremomela
- Karoo Thrush
- Kori Bustard
- Lanner Falcon
- Layard's Warbler
- Martial Eagle
- Namaqua Warbler
- Pale Chanting Goshawk
- Southern Double-collared Sunbird
- Spotted Eagle-Owl
- Western Barn Owl

5.2.4 Surface Water

Dams, ephemeral drainage lines and associated wetlands are sources of surface water in the PAOI and are important for most avifauna for drinking, bathing and in some instances foraging (**Figure 5-3**). During winter, flocks of Blue Crane roost at dams, arriving at dusk and departing before sunrise. Large raptors such as Martial Eagle, Tawny Eagle and Verreaux's Eagle use the dams and drainage lines for bathing and drinking. Boreholes with water troughs are also important as they often represent the only permanent source of water during dry periods.

Figure 5-3: A typical ground dam located just outside the PAOI (on Remainder of Farm 155 Rhenosterkop), but there are similar dams within the PAOI.

Priority species that occur in the Broader Area and could utilise this habitat type in the PAOI include:

- African Fish Eagle
- African Sacred Ibis
- African Spoonbill
- Blacksmith Lapwing
- Black-winged Stilt
- Blue Crane
- Booted Eagle
- Common Buzzard
- Egyptian Goose
- Grey Heron
- Hamerkop
- Jackal Buzzard
- Kori Bustard
- Lanner Falcon
- Martial Eagle
- Pale Chanting Goshawk
- Pied Avocet
- Pied Starling

- Secretarybird
- South African Shelduck
- Spotted Eagle-Owl
- Spur-winged Goose
- Three-banded Plover
- Verreaux's Eagle
- Western Barn Owl
- Yellow-billed Duck

5.2.5 Mesas, Ridges and Koppies

The PAOI contains many mesas, koppies, rocky ridges, outcrops, and plateaus (**Figure 5-4**). These landscape features are important for priority species as nesting and foraging areas including Verreaux's Eagle.

Figure 5-4: Rocky ridges in the PAOI.

Priority species that occur in the Broader Area and could utilise this habitat type in the PAOI include:

- Booted Eagle
- Jackal Buzzard
- Lanner Falcon
- Martial Eagle
- Pale Chanting Goshawk
- Rock Kestrel
- Verreaux's Eagle

5.2.6 Alien Trees

The PAOI is largely devoid of tall trees, except for alien trees which have been planted near homesteads (**Figure 5-5**). Although stands of *Eucalyptus* are strictly speaking invader species, they have become important refuges for some priority species which may use them for roosting and nesting.

Figure 5-5: Stands of alien trees are typically found near homesteads in the PAOI.

Priority species that occur in the Broader Area and could utilise this habitat type in the PAOI include:

- Black-winged Kite
- Cape White-eye
- Common Buzzard
- Egyptian Goose
- Greater Kestrel
- Grey Heron
- Hamerkop
- Jackal Buzzard
- Karoo Thrush
- Lanner Falcon
- Martial Eagle
- Pale Chanting Goshawk

- Pied Starling
- Rock Kestrel
- Secretarybird
- Spotted Eagle-Owl
- Spur-winged Goose
- Verreaux's Eagle
- Western Barn Owl

5.2.7 Agricultural Lands

Also relevant to the PAOI are agricultural areas. Cultivation is limited to a few irrigated agricultural lands within the PAOI. Arable or cultivated land represents a significant feeding area for many bird species in any landscape, but perhaps more so in arid environments. The opening up of the soil surface and land preparation makes many insects, seeds, bulbs, and other food sources accessible to birds and other predators. The crop or pasture plants are often eaten by birds or attract insects which are also eaten by birds. Agricultural areas are of specific importance to Blue Crane and Ludwig's Bustard (Shaw, 2013).

Priority species that occur in the Broader Area and could utilise this habitat type in the PAOI include:

- African Sacred Ibis
- Black-headed Heron
- Blacksmith Lapwing
- Black-winged Kite
- Blue Crane
- Common Buzzard
- Egyptian Goose
- Grey-winged Francolin
- Kittlitz's Plover
- Kori Bustard
- Lanner Falcon
- Ludwig's Bustard
- Martial Eagle
- Pale Chanting Goshawk
- Pied Starling
- Southern Black Korhaan
- Spur-winged Goose
- Tawny Eagle
- Western Barn Owl
- Western Cattle Egret
- Yellow-billed Kite

5.2.8 High Voltage Power Lines

There are several existing high voltage overhead power lines in the area (**Figure 5-6**). High voltage lines are an important breeding substrate for raptors in the Karoo due to the lack of large trees (Jenkins *et al.* 2013). Both Verreaux's Eagle and Martial Eagle have been recorded breeding on high voltage lines near the PAOI.

Figure 5-6: High voltage lines in and near the PAOI.

Priority species that occur in the Broader Area and could utilise this habitat type in the PAOI include:

- Black-winged Kite
- Booted Eagle
- Common Buzzard
- Egyptian Goose
- Greater Kestrel
- Jackal Buzzard
- Lanner Falcon
- Lesser Kestrel
- Martial Eagle
- Pale Chanting Goshawk
- Rufous-breasted Sparrowhawk
- Spur-winged Goose
- Tawny Eagle
- Verreaux's Eagle
- Yellow-billed Kite

5.3 Results of Pre-Construction Monitoring

SSV site visits were undertaken from 26–29 September 2022.

The main source of information on the avifaunal diversity and abundance at the Rhino and Sunnyside PV project sites is an integrated pre-construction monitoring programme which covered the development areas of both (i.e., Rhino PV and Sunnyside PV) proposed SEF sites. **The results of the monitoring are equally applicable to both development areas due to the similarity of the habitat**.

The pre-construction avifaunal monitoring programme followed an adapted Regime 2 protocol as defined in the Birds and Solar Energy Best Practice Guidelines (Jenkins, Smit-Robinson, & Ralston-Patton, 2017) which requires a minimum of two surveys over a six-month period.

On site surveys, transect counts were conducted from:

- 21–23 August 2023 and,
- 07-08 November 2023.

The abundance of solar priority species (Index of Kilometric Abundance i.e., birds/km = IKA) recorded during the transect counts, is displayed in **Figure 5-7**.

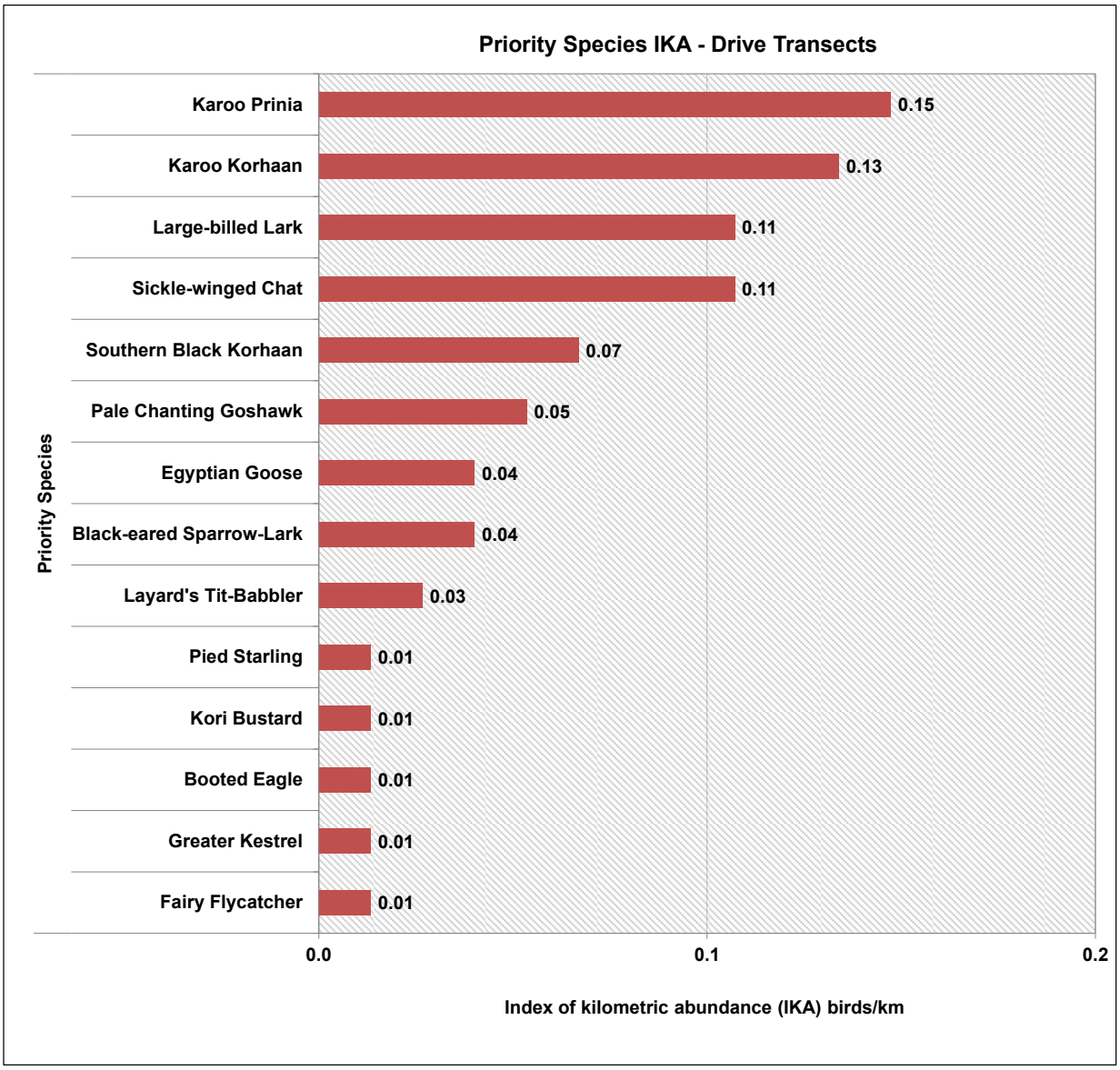

Figure 5-7: IKA of priority species recorded during drive transect counts (two surveys) at the Rhino PV and Sunnyside PV SEF sites.

The number of birds and number of different species (species composition) counted during the drive transects conducted during the two monitoring surveys, are presented in **Table 5-2** .

Table 5-2: Drive transect species and bird count and composition results for the development areas of the proposed Rhino PV and Sunnyside PV SEF sites.

Species Composition	
All Species	50
Priority Species	14 (28%)
Non-Priority Species	36
Total Count	
Drive Transect	827

Figures 5-8 and 5-9 below present the locations of priority species recorded during the two on-site surveys at the Rhino and Sunnyside PV SEF sites during drive transects counts and incidental sightings.

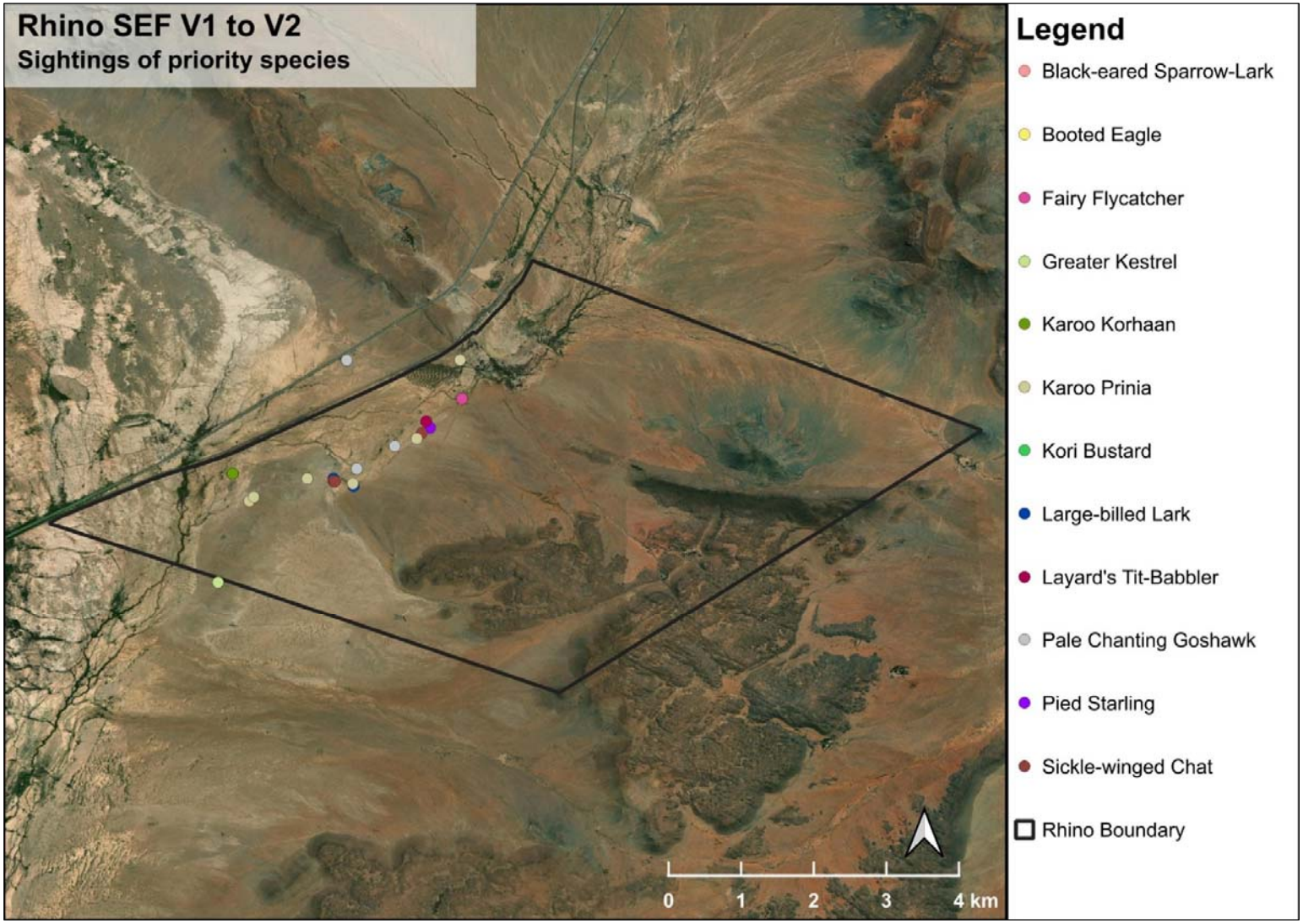

Figure 5-8: Priority species recorded during the pre-construction monitoring surveys at the proposed Rhino PV SEF.

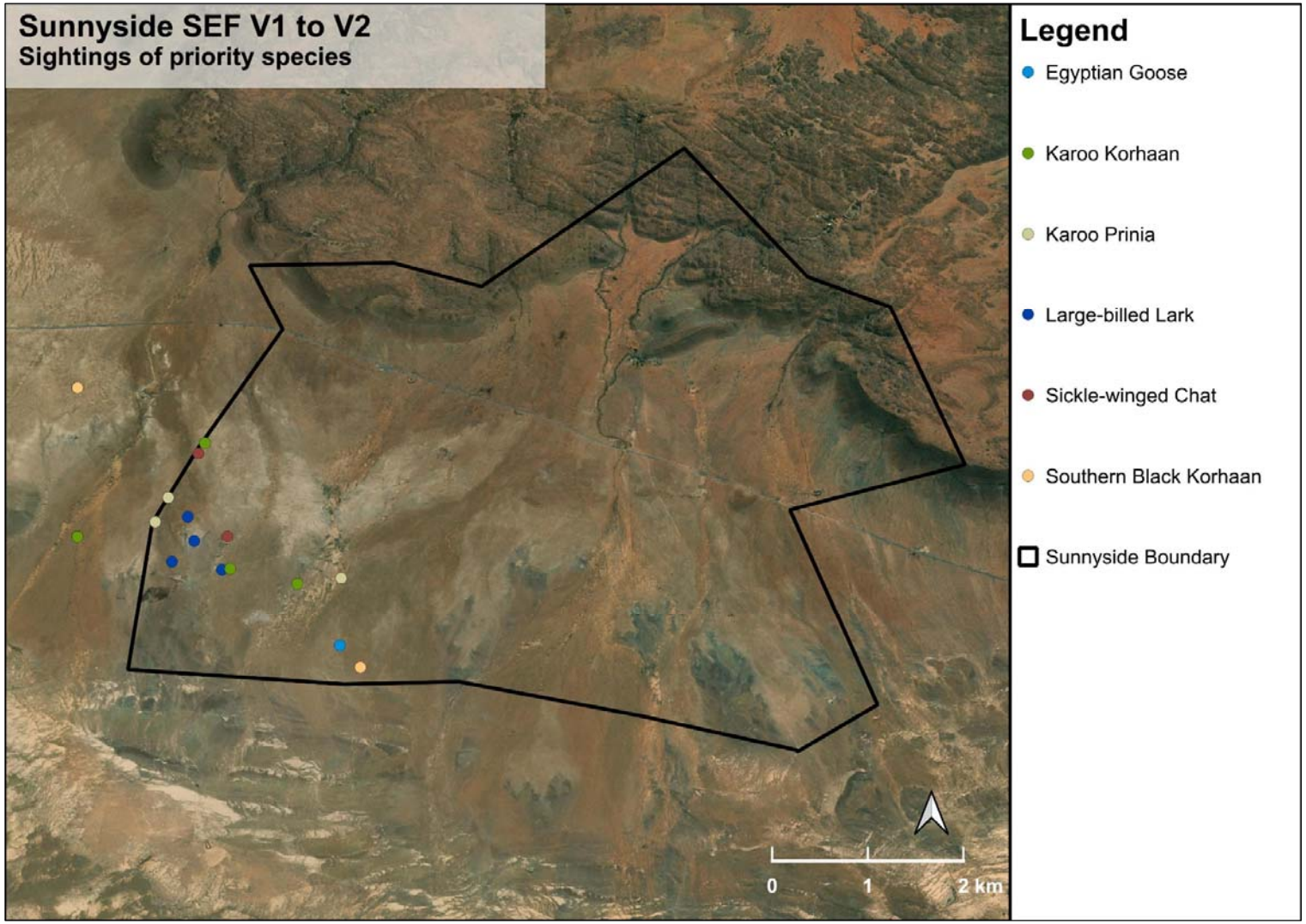

Figure 5-9: Priority species recorded during the pre-construction monitoring surveys at the proposed Sunnyside PV SEF.

6. SITE SENSITIVITY VERIFICATION

6.1 6.1Sensitivity Mapping

6.1.1 DFFE Screening Tool

According to the DFFE Screening Tool, the PAOI (which includes the land parcels of both Rhino PV and Sunnyside PV) and immediate environment is classified as **Medium** and **High** sensitivity for terrestrial animals under to the Terrestrial Animal Species Theme (**Figure 6-1**). The High classification is linked to the potential occurrence of Ludwig's Bustard (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Southern Black Korhaan (Globally and Regionally Vulnerable), Martial Eagle (Globally and Regionally Endangered) and Lanner Falcon (Regionally Vulnerable). The PAOI contains confirmed habitat for SCC as defined in the GN No. 1150 of 2020.

The occurrence of SCC was confirmed during the SSV site visits (26–29 September 2022) with observations of Martial Eagle, Verreaux's Eagle, Blue Crane (Globally Vulnerable and Regionally Near Threatened), Karoo Korhaan (Regionally Near threatened), Ludwig's Bustard and Secretarybird (Globally and Regionally Endangered) recorded, and during the pre-construction monitoring surveys of August 2023 and November 2023 with observations of Karoo Korhaan, Kori Bustard (Globally and Regionally Near Threatened), and Southern Black Korhaan were recorded (Globally and Regionally Vulnerable).

Based on the available SABAP2 data and the on-site surveys, the classification of **Medium and/or High** sensitivity for avifauna in the DFFE Screening Tool is supported for both PV SEF Project Sites including the smaller land parcel that forms part of Sunnyside SEF. **It is suggested that a High Sensitivity rating is appropriate (for both Rhino and Sunnyside SEF)**. None of the SEF Project Sites has a specific habitat feature that distinguishes it from the other SEF Project Site which would justify a lesser rating. Please refer to **Appendix 4** for the SSVR.

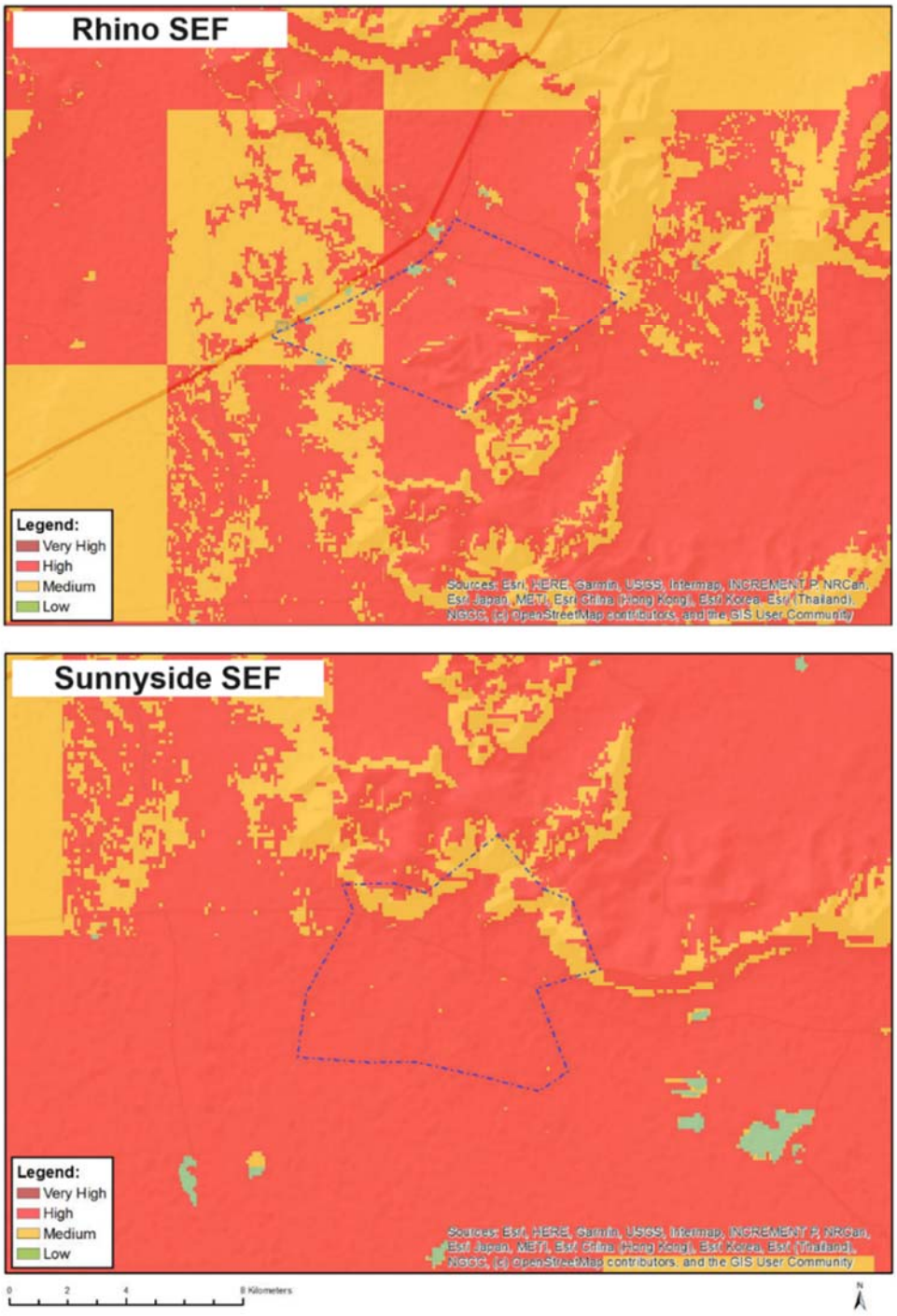

Figure 6-1: Map of Relative Animal Species Theme Sensitivity for Rhino SEF (top) and Sunnyside SEF (bottom). The High classification is linked to the potential occurrence of Ludwig's Bustard (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Southern Black Korhaan (Globally and Regionally Vulnerable), Martial Eagle (Globally and Regionally Endangered) and Lanner Falcon (Regionally Vulnerable).

6.1.2 Avifaunal Specialist Sensitivity Mapping

The following avifaunal sensitivities were identified at Rhino PV only:

- **Very High Sensitivity Zones: All Infrastructure Exclusion Zones**

Red Data Raptor Nests: An all-infrastructure exclusion zone should be implemented and maintained on Remainder of Farm 155 Rhenosterkop (Rhino PV) within 2.5 km of the identified Martial Eagle nest and within 1 km of the identified Verreaux's Eagle nests to avoid displacement due to disturbance. These buffer areas will also reduce the risk of injury to juvenile birds due to collision with solar panels, when they start flying and practicing their hunting techniques near their nests (see **Figure 6-2 and Figure 6-3**). No raptor nests were identified within or near the Sunnyside PV development area.

The following avifaunal sensitivities were identified at both Rhino PV and Sunnyside PV SEFs:

- **High Sensitivity Zones: Solar Panel Exclusion Zones**

Surface Water and Wetlands: A solar panel exclusion zone buffer should be implemented and maintained around all surface water features such as dams and reservoirs (200 m), as well as non-perennial drainage lines and associated herbaceous wetlands (150 m) which can, when flowing, attract birds. This is applicable for both the Rhino PV and Sunnyside PV SEF.

Surface water area are important congregation points for priority avifauna and many non-priority species. It is important to leave open space with no solar panels for birds to access and leave the surface water area unhindered. Surface water is also an important area for raptors to hunt other birds which tend to congregate around these micro-habitats. Raptors need enough space for fast aerial pursuit of prey. The buffer zones will also benefit species like Blue Crane which prefer to breed close to water bodies.

Agricultural Fields: Agricultural fields attract many priority and non-priority species to the area in search of food, including Red Listed species such as Blue Crane, Kori Bustard, and Ludwig's Bustard. Agricultural fields should, therefore, be kept free of solar panels.

Refer to **Figure 6-2** and **Figure** 6-3 for the avifaunal sensitivities identified for the Rhino and Sunnyside PV SEF.

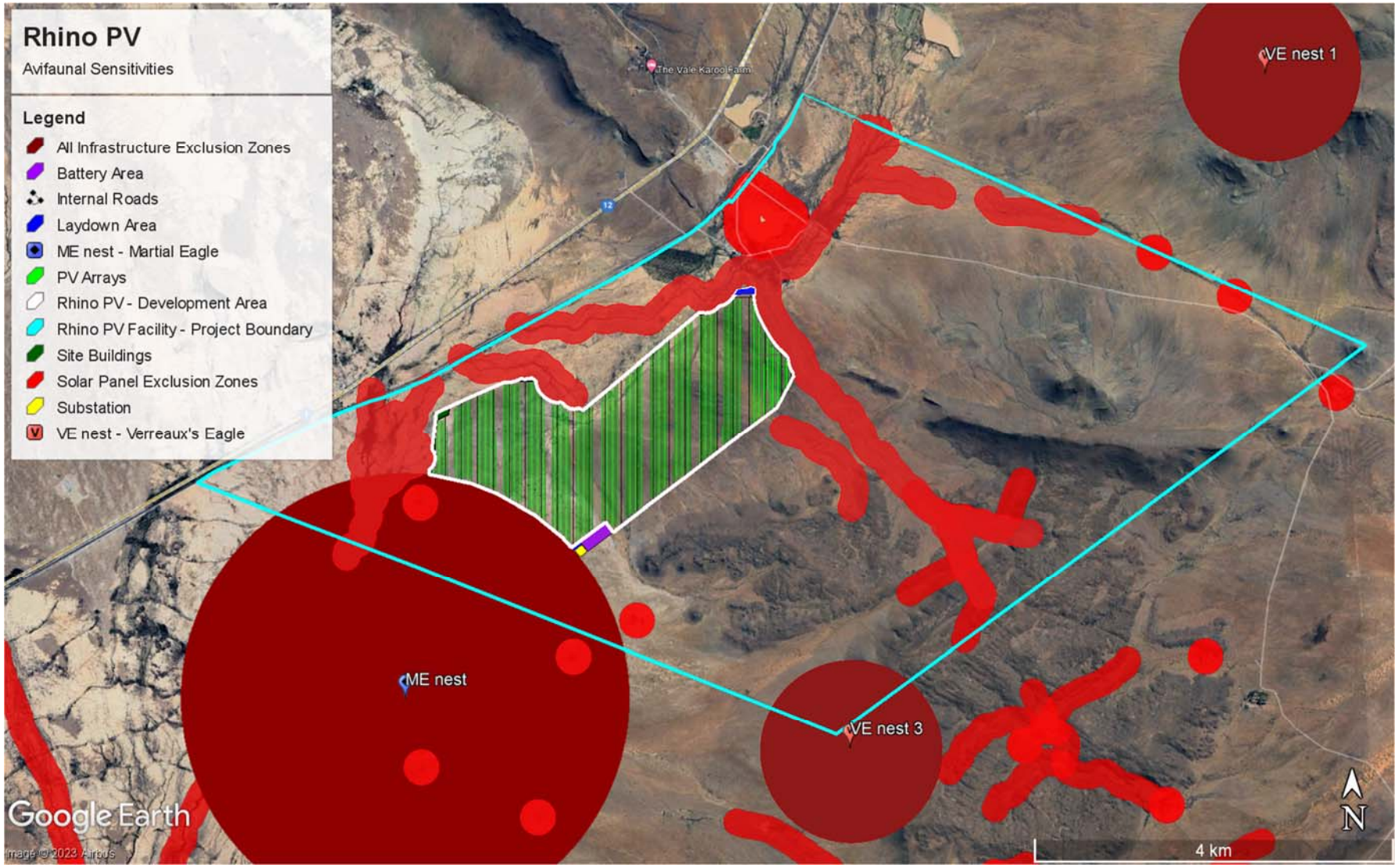

Figure 6-2: Avifaunal sensitivities identified at identified at Rhino PV.

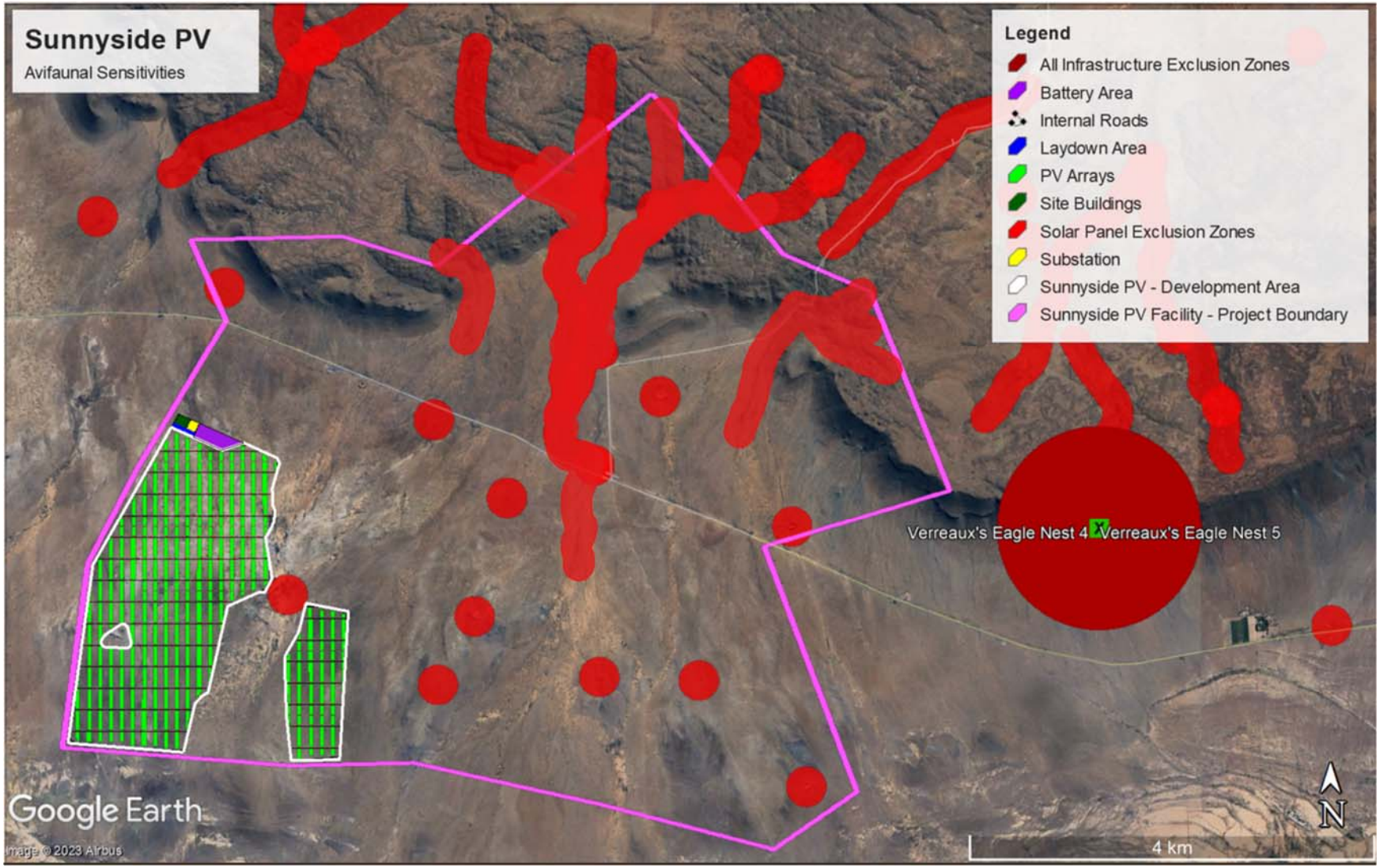

Figure 6-3: Avifaunal sensitivities identified at identified at Sunnyside PV.

7. IMPACT ASSESSMENT

7.1 Introduction

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants are a relatively recent phenomenon. The main sources of information for these types of impacts are from compliance reports and a few government-sponsored studies relating to recently constructed solar plants in the south-western United States. In South Africa, only two published scientific studies have been conducted on the environmental impacts of PV plants in a South African context (Rudman *et al.*, 2017; Visser *et al.*, 2019). A related scientific study has also been conducted upon the effects of concentrated solar power facilities on wildlife in South Africa (Jeal *et al.*, 2019).

In summary, the main impacts of PV solar plants on avifauna which have emerged so far include the following:

- Displacement of priority species due to disturbance associated with the construction and decommissioning of the PV plants and associated infrastructure.
- Displacement of priority species due to habitat transformation associated with the PV plant and associated infrastructure during the construction and operational phases.
- Collisions with the solar panels during the operational phase.
- Mortality of priority species due to electrocution on the medium voltage internal reticulation network during the operational phase.
- Mortality of priority species due to collisions with the medium voltage internal reticulation network during the operational phase.
- Mortality of priority species due to entanglement with fencing wire during the operational phase.
- Displacement of priority species due to disturbance associated with decommissioning of the PV plant and associated infrastructure during the decommissioning phase.

Anthropogenic climate change poses a global conservation concern and is predicted to drive rapid redistribution of plant and animal species (National Audubon Society, 2015). Such redistribution events include large-scale population displacements alongside species range reductions and fragmentation, alongside population displacements (Ehrlén & Morris, 2015; Pecl *et al.*, 2017), and changes to the timing interactions (Kharouba *et al.*, 2018). Collectively, these anthropogenically-induced changes pose the risk of extinction event occurring at unprecedented rates compared to natural long-term climate (Urban, 2015) – which is itself a fundamental driver behind species distributions. In 2006, World Wildlife Fund Australia produced a report on the envisaged impact of climate change on birds worldwide (Wormworth & Mallon, 2006). The report found that:

- Anthropogenic Climate change now affects bird species' behaviour, ranges, and population dynamics;
- Some bird species are already experiencing strong negative impacts from climate change;
- In future, subject to greenhouse gas emissions levels and climatic response, climate change will put large numbers of bird species at risk of extinction, with estimates of extinction rates varying from 2% to 72%, depending on the region, climate scenario, and potential for birds to shift to new habitat.

Using statistical models based on the North American Breeding Bird Survey and Audubon Christmas Bird Count datasets, the National Audubon Society assessed geographic range shifts through the end of the century for 588 North American bird species during both the summer and winter seasons under a range of future climate change scenarios (National Audubon Society, 2015). Their analysis showed the following:

- 314 of 588 species modelled (53%) lose more than half of their current geographic range in all three modelled scenarios.
- For 126 species, range loss is predicted to occur without accompanying range expansion.

- For 188 species, predicted range loss is coupled with the potential to colonize new areas.

Climate sensitivity is an important piece of information to incorporate into conservation planning and adaptive management strategies. The persistence of many birds will depend on their ability to colonize climatically suitable areas outside of current ranges and management actions that target climate change adaptation.

South Africa is among the world's top ten developing countries required to significantly reduce their carbon emissions (Seymore *et al.*, 2014). The introduction of low carbon-emitting technologies into the country's compliment of power generation will greatly facilitate achieving this important objective (Walwyn & Brent, 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri, 2009; Munzhedzi & Sebitosi, 2009), it is clear that solar power generation should feature prominently in future national efforts to convert to a more sustainable energy suite of energy productions to combat human-induced climate change.

From an avifaunal perspective, solar power generation undoubtedly presents a long-term benefit to species viability, given that solar power generation is anticipated to mitigate the environmental threats posed by anthropogenic climate change (i.e., rapid species redistribution and broad-scale habitat transformation). However, renewable energy facilities – including solar PV facilities – themselves can impede the viability of bird species populations. The environmental risks associated with solar PV facilities need to be recognised and addressed to minimise the negative impacts such facilities may have on bird species populations.

7.2 Impacts Associated with PV Plants and Associated Infrastructure

7.2.1 Impact Trauma - Collisions with Solar Panels

This impact refers to collision-related fatality, i.e., fatality resulting from the direct contact of the bird with a project structure(s). This type of fatality has been occasionally documented at solar projects of all technology types (McCrary *et al.* 1986; Hernandez *et al.* 2014; Kagan *et al.* 2014). In some instances, the bird is not killed outright by the collision impact, but succumbs to predation later, as it cannot avoid predators due to its injured state.

Sheet glass used in commercial and residential buildings has been well established as a hazard for birds. When the sky is reflected in the sheet glass, birds fail to see the building as an obstacle and attempt to fly through the glass, mistaking it for empty space (Loss *et al.* 2014). Although very few cases have been reported it is possible that the reflective surfaces of solar panels could constitute a similar risk to avifauna.

An extremely rare but potentially related problem is the so-called "lake effect", i.e., it seems possible that reflections from solar facilities' infrastructure, particularly large sheets of dark blue PV panels, may attract birds in flight across the open desert, who mistake the broad reflective surfaces for water (Kagan *et al.* 2014)[1]. The unusually high percentage of waterbird mortalities at the Desert Sunlight PV facility in California (44%) may support the "lake effect" hypothesis (West, 2014). Although in the case of Desert Sunlight, the proximity of evaporation ponds may act as an additional risk increasing factor, in that birds are both attracted to the water feature and habituated to the presence of an accessible aquatic environment in the area. This may translate into the misinterpretation of diffusely reflected sky or horizontal polarised light source as a body of water. However, due to limited data it would be premature to make any general conclusions about the influence of the lake effect or other factors that contribute to fatality of water-dependent birds. The activity and abundance of water-dependent species near solar facilities may depend on other site-specific or regional factors, such as the surrounding landscape (Walston *et al.* 2015). However, until such time that enough scientific evidence has been collected to discount the "lake effect" hypothesis, it must be considered as a potential source of impacts.

[1] This could either result in birds colliding directly with the solar panels or getting stranded and unable to take off again because many aquatic bird species find it very difficult and sometimes impossible to take off from dry land e.g. grebes and cormorants. This exposes them to predation, even if they do not get injured through direct collisions with the panels.

Weekly mortality searches at 20% coverage were conducted at the 250 MW, 1 300 ha California Valley Solar Ranch PV site (Harvey & Associates 2014a and 2014b). According to the information that could be sourced from the internet (two quarterly reports), 152 avian mortalities were reported for the period 16 November 2013 – 15 February 2014, and 54 for the period 16 February 2014 – 15 May 2014, of which approximately 90% were based on feather spots which precluded a finding on the cause of death. These figures give an estimated unadjusted 1 030 mortalities per year, which is obviously an underestimate as it does not include adjustments for carcasses removed by scavengers and missed by searchers. The authors stated clearly that these quarterly reports do not include the results of searcher efficiency trials, carcass removal trials, or data analyses, nor does it include detailed discussions.

In a report by the National Fish and Wildlife Forensic Laboratory (Kagan *et al.* 2014), the cause of avian mortalities was estimated based on opportunistic avian carcass collections at several solar facilities, including the 550 MW, 1 600 ha Desert Sunlight PV plant. Impact trauma emerged as the highest identifiable cause of avian mortality, but most mortality could not be traced to an identifiable cause.

Walston *et al.* (2015) conducted a comprehensive review of avian fatality data from large scale solar facilities (all technology types) in the USA. Collision as cause of death (19 birds) ranked second at Desert Sunlight PV plant and California Valley Solar Ranch (CVSR) PV plant, after unknown causes. Cause of death could not be determined for over 50% of the fatality observations and many carcasses included in these analyses consisted only of feather spots (feathers concentrated together in a small area) or partial carcasses, thus making determination of cause of death difficult. It is anticipated that some unknown fatalities were caused by predation or some other factor unrelated to the solar project. However, they found that the lack of systematic data collection and standardization was a major impediment in establishing the actual extent and causes of fatalities across all projects.

The only scientific investigation of potential avifaunal impacts that has been performed at a South African PV facility was completed in 2016 at the 96 MW Jasper PV Solar Facility (28°17′53″S, 23°21′56″E) which is located on the Humansrus Farm, approximately 4 km south-east of Groenwater and 30 km east of Postmasburg in the Northern Cape Province (Visser *et al.* 2018). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 ha with the capacity to deliver 180 000 MWh (megawatt-hour) of renewable electricity annually. The solar panels face north at a fixed 20° angle, reaching a height of approximately 1.86 m relative to ground level with a distance of 3.11 m between successive rows of panels. Mortality surveys were conducted from 14 September 2015 until 06 December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per ha surveyed per month. All fatalities were inferred from feather spots. Extrapolated bird mortality within the solar field at the Jasper PV facility was 435 birds/year (95% CI 133 - 805). The broad confidence intervals result from the small number of birds detected. The mortality estimate is likely conservative because detection probabilities were based on intact birds, and probably decrease for older carcasses and feather spots. The study concluded *inter alia* that the short study period and lack of comparable results from other sources made it difficult to provide a meaningful assessment of avian mortality at PV facilities. It further stated that despite these limitations, the few bird fatalities that were recorded might suggest that there is no significant collision-related mortality at the study site. The conclusion was that to fully understand the risk of solar energy development on birds, further collation, and analysis of data from SEFs across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser *et al.* 2018).

The results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. However, it is clear from this limited literature survey that the lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely speculative and based on professional opinion.

Based on the lack of evidence to the contrary, **it is not foreseen that collisions with the solar panels at the PV facilities will be a significant impact**. The priority species which would most likely be potentially affected by this impact are mostly small birds which forage between the solar panels, raptors which prey on them, and a variety of waterbirds which may be at risk due to the "lake effect."

Priority species which could potentially be impacted due to collisions with the solar panels are the following (applicable to both PV facilities): African Rock Pipit, African Sacred Ibis, African Spoonbill, Black-eared Sparrow-Lark, Black-headed Canary, Black-headed Heron, Blacksmith Lapwing, Black-winged Stilt, Blue Crane, Cape Shoveler, Cape Teal, Cape White-eye, Common Greenshank, Common Moorhen, Egyptian Goose, Fairy Flycatcher, Fiscal Flycatcher, Gabar Goshawk, Great Egret, Grey Heron, Grey Tit, Hamerkop, Karoo Eremomela, Karoo Lark, Karoo Prinia, Karoo Thrush, Kittlitz's Plover, Lanner Falcon, Large-billed Lark, Layard's Warbler, Lesser Flamingo, Lesser Kestrel, Little Grebe, Little Stint, Marsh Sandpiper, Namaqua Warbler, Pied Avocet, Pied Starling, Red-billed Teal, Red-knobbed Coot, Rufous-breasted Sparrowhawk, Sclater's Lark, Sickle-winged Chat, South African Shelduck, Southern Black Korhaan, Southern Double-collared Sunbird, Spotted Eagle-Owl, Spur-winged Goose, Three-banded Plover, Western Cattle Egret, White-breasted Cormorant, and Yellow-billed Duck.

7.2.2 Entrapment / Entanglement in Perimeter Fences

Visser *et al.* (2019) recorded a fence-line fatality of an Orange River Francolin *Scleroptila gutturalis* being trapped between the inner and outer perimeter fence of the facility; additionally, three Red-crested Korhaans were claimed to be unable to escape between these two fences without intervention from facility personnel. Considering that one would expect the birds to be able to take off in the lengthwise direction (parallel to the fences), it seems possible that the birds panicked when they were approached by observers and thus flew into the fence. Potentially, a too-close parallel configuration of double-fenced perimeters can cause fatalities, particularly of larger terrestrial birds, by way of entrapment, and especially if disturbed by people. This risk remains low, however, with Visser *et al.* (2019) tentatively presenting a fatality rate of 0.002 birds per km per month from this risk factor, although qualifying that the single documented fatality was inadequate for robust extrapolations. Owls are also prone to getting entangled in barbed wire fences (personal observation).

It is not foreseen that entrapment of solar priority species in perimeter fences will be a significant impact at the PV facilities. However, a single perimeter fence is recommended to reduce the risks of entrapment. To reduce the risks of entanglement, it is recommended that at least the top two barbed strands should be replaced with smooth wire and the spacing between at least the top two wires should be increased (to a minimum of 30 cm). Ensuring that the wires are correctly tensioned will also reduce the entanglement risks (Retief, 2021). The solar priority species which could potentially be affected by this impact are most likely medium to large terrestrial species, and large owls.

Priority species which could be impacted due to entanglement are the following: Blue Crane, Karoo Korhaan, Kori Bustard, Ludwig's Bustard, Secretarybird, Southern Black Korhaan, and Spotted Eagle-Owl. This is applicable to both solar PV facilities.

7.2.3 Displacement due to Disturbance and Habitat Transformation Associated with the Construction and Operation of the Solar PV Facilities and associated infrastructure, including BESS.

Ground-disturbing activities affect a variety of processes in arid areas, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the semi-desert landscape, including the construction and decommissioning of utility-scale SEFs, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011).

SEFs require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality in arid areas. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns (Lovich & Ennen, 2011).

The activities listed below are *typically* associated with the construction and operation of solar facilities and could have direct impacts on avifauna (County of Merced, 2014):

- Preparation of solar panel areas for installation, including vegetation clearing, grading, cut and fill;
- Excavation/trenching for water pipelines, cables, fibre-optic lines, and the septic system;
- Construction of piers and building foundations;
- Construction of new dirt or gravel roads and improvement of existing roads;
- Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes;
- Soil compaction, dust, and water runoff from construction sites;
- Increased vehicle traffic;
- Short-term construction-related noise (from equipment) and visual disturbance;
- Degradation of water quality in drainages and other water bodies resulting from project/development site runoff;
- Maintenance of fire breaks and roads; and
- Weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.

These activities could have an impact on birds breeding, foraging, and roosting in or in close proximity to the site through disturbance and transformation of habitat, which could result in temporary or permanent displacement.

In a study comparing the avifaunal habitat use in PV arrays with adjoining managed grassland at airports in the USA, DeVault *et al.* (2014) found that species diversity in PV arrays was reduced compared to the grasslands (37 species versus 46 species), supporting the view that solar developments are generally detrimental to wildlife on a local scale.

In order to identify functional and structural changes in bird communities in and around the development footprint, Visser *et al.* (2018) gathered bird transect data at the 180 ha, 96 MW Jasper PV solar facility in the Northern Cape, representing the solar development, boundary, and untransformed landscape. The study found both bird density and diversity per unit area was higher in the boundary and untransformed landscape, however, the extent therefore was not considered to be statistically significant. This indicates that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. The most significant finding of Visser *et al*. (2018) was that the distribution of birds in the landscape changed, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. These changes in resource availability patterns were detrimental to some bird species and beneficial to others. Shrubland habitat specialists appeared to be negatively affected by the presence of the PV facility. In contrast, open country/grassland, and generalist species, were favoured by its development (Visser *et al.* 2019).

As far as **disturbance** is concerned, it is likely that all the avifauna, including all the priority species, will be temporarily displaced in the footprint area of the proposed project, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities.

*Priority species which could be impacted due to **disturbance** are the following (applicable to both solar PV facilities): African Fish Eagle, African Rock Pipit, Black-eared Sparrow-Lark, Black-headed Canary, Black-winged Kite, Blue Crane, Burchell's Courser, Cape Eagle-Owl, Cape White-eye, Fairy Flycatcher, Fiscal Flycatcher, Gabar Goshawk, Greater Kestrel, Grey-winged Francolin, Jackal Buzzard, Karoo Eremomela, Karoo Korhaan, Karoo Lark, Karoo Prinia, Karoo Thrush, Kori Bustard, Lanner Falcon, Large-billed Lark, Layard's Warbler, Lesser Kestrel, Ludwig's Bustard, Martial Eagle, Namaqua Warbler, Pale Chanting Goshawk Pied Starling, Rock Kestrel, Rufous-breasted Sparrowhawk, Sclater's Lark, Secretarybird, Sickle-winged Chat, Southern Black Korhaan, Southern Double-collared Sunbird, Spotted Eagle-Owl, Tawny Eagle, and Verreaux's Eagle.*

As far as **displacement**, either completely or partially (reduced densities) due to **habitat loss** and transformation is concerned, it is highly likely that the same pattern of reduced avifaunal densities for shrubland species, as explained above, will manifest itself at the proposed projects. In addition, raptors and terrestrial species could also be impacted.

*Priority species which could be impacted due to **habitat loss** are the following (applicable to both solar PV facilities): African Fish Eagle, Black Harrier, Black-headed Canary, Blue Crane, Booted Eagle, Burchell's Courser, Cape White-eye, Fairy Flycatcher, Fiscal Flycatcher, Grey-winged Francolin, Jackal Buzzard, Karoo Eremomela, Karoo Korhaan, Karoo Prinia, Karoo Thrush, Kori Bustard, Layard's Warbler, Ludwig's Bustard, Martial Eagle, Namaqua Warbler, Secretarybird, Sickle-winged Chat, Southern Black Korhaan, Southern Double-collared Sunbird, Tawny Eagle, and Verreaux's Eagle.*

7.2.4 Electrocutions on the Internal Medium Voltage Reticulation Network

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen, 2004). The electrocution risk is largely determined by the design of the electrical hardware. There could be an electrocution risk to certain species, mostly raptors, but also some waterbirds, in the on-site substations, but it is unlikely to be a regular occurrence for any of the priority species. Depending on the pole design, the 33 kV overhead lines could also pose an electrocution risk to certain priority species, particularly raptors, which is a more significant risk than the substations.

While the intention is to place most of the medium voltage reticulation network underground at the PV facilities, there are areas where the lines could run above ground. Priority species which could be at risk of electrocution on the medium voltage power lines are the following (applicable to both PV facilities): African Fish Eagle, African Sacred Ibis, Black Harrier, Black-headed Heron, Black-winged Kite, Booted Eagle, Cape Eagle-Owl, Common Buzzard, Egyptian Goose, Gabar Goshawk, Greater Kestrel, Hamerkop, Jackal Buzzard, Lanner Falcon, Lesser Kestrel, Martial Eagle, Pale Chanting Goshawk, Rock Kestrel, Rufous-breasted Sparrowhawk, Spotted Eagle-Owl, Tawny Eagle, Verreaux's Eagle, Western Barn Owl, Western Cattle Egret, Yellow-billed Kite.

7.2.5 Collisions with the Internal Medium Voltage Overhead Lines

Collisions are the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen, 2004). Most heavily impacted upon are bustards, storks, cranes, and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001).

From incidental record keeping by the Endangered Wildlife Trust (EWT), it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa (**Figure 7-1**).

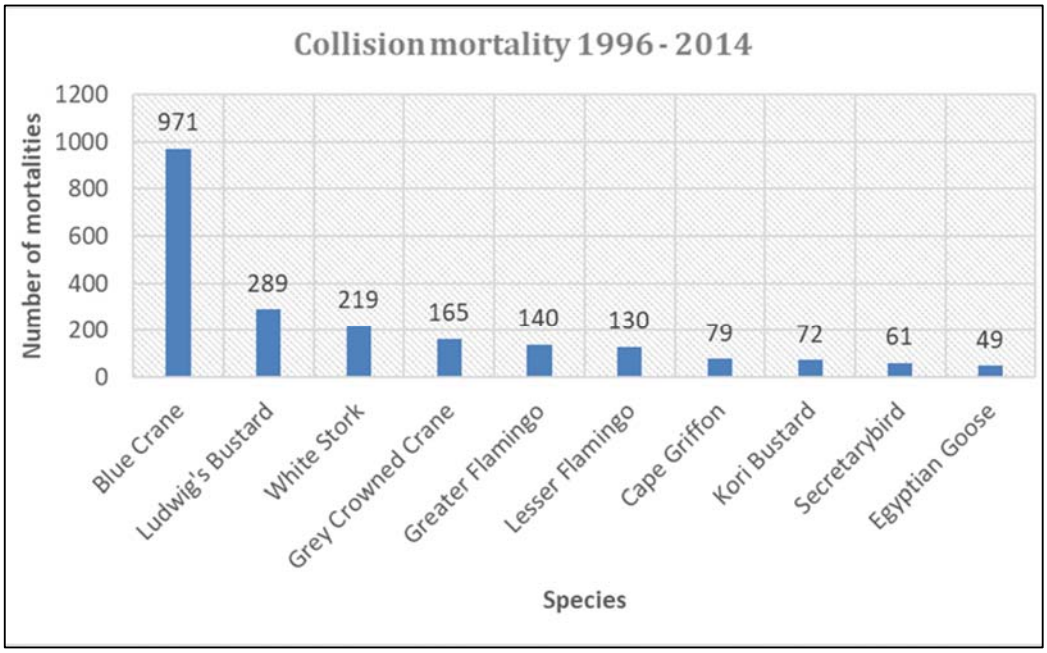

Figure 7-1: The top ten collision prone bird species in South Africa in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2014 (EWT, unpublished data).

Power line collisions are generally accepted as a key threat to bustards (Raab *et al*. 2009; Raab *et al*. 2010; Jenkins & Smallie 2009; Barrientos *et al*. 2012, Shaw 2013). In one study, carcass surveys were performed under high voltage transmission lines in the Karoo for two years, and low voltage distribution lines for one year (Shaw, 2013). Ludwig's Bustard was the most common collision victim (69% of carcasses), with bustards generally comprising 87% of mortalities recovered. Total annual mortality was estimated at 41% of the Ludwig's Bustard population, with Kori Bustards *Ardeotis kori* also dying in large numbers (at least 14% of the South African population killed in the Karoo alone). Karoo Korhaan was also recorded, but to a much lesser extent than Ludwig's Bustard. The reasons for the relatively low collision risk of this species probably include their smaller size (and hence greater agility in flight) as well as their more sedentary lifestyles, as local birds are familiar with their territory and are less likely to collide with power lines (Shaw, 2013).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the EWT and Eskom tested the effectiveness of two types of line markers in reducing power line collision mortalities of large birds on three 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, with a 92% reduction in mortality, and large birds in general with a 56% reduction in mortality, but not for bustards, including the endangered Ludwig's Bustard. The two different marking devices were approximately equally effective, namely spirals and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw *et al*. 2017).

While the intention is to place most of the medium voltage reticulation network underground at the PV facilities, there are areas where the lines could run above ground. Priority species which are most at risk of collisions with the medium voltage power lines are the following (applicable to both solar PV facilities): African Sacred Ibis, African Spoonbill, Black-headed Heron, Blue Crane, Cape Eagle-Owl, Cape Shoveler, Cape Teal, Egyptian Goose, Great Egret, Grey Heron, Hamerkop, Karoo Korhaan, Kori Bustard, Lesser Flamingo, Little Grebe, Ludwig's Bustard, Red-billed Teal, Red-knobbed Coot, Secretarybird, South African Shelduck, Southern Black Korhaan, Spotted Eagle-Owl, Spur-winged Goose, Verreaux's Eagle, Western Barn Owl, Western Cattle Egret, White Stork, White-breasted Cormorant, and Yellow-billed Duck.

8. IMPACT ASSESSMENT RATINGS

The tables below summarise the potential impacts on avifauna of the proposed Rhino PV and Sunnyside PV SEF.

The impact ratings and recommended mitigation measures below are applicable to both PV sites (Rhino PV and Sunnyside PV SEF), unless stated otherwise.

Please refer to **Appendix 5** for the Impact Rating Methodology.

8.1 Construction Phase

During the construction phase, the proposed SEF will impact on avifauna as a result of the displacement of priority species due to disturbance associated with construction of the PV plants and associated infrastructure (Error! Not a valid bookmark self-reference.).

Table 8-1: Rating of Impacts: Construction Phase.

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
CONSTRUCTION PHASE																				
Avifauna	Displacement of priority species due to disturbance associated with construction of the PV plants and associated infrastructure.	2	4	3	3	3	3	45	-	High	1) An all-infrastructure exclusion zone should be implemented and maintained within 2.5 km of the identified Martial Eagle nest and within 1 km of the identified Verreaux's Eagle nests to avoid displacement due to disturbance. 2) A solar panel exclusion zone buffer should be implemented and maintained around all surface water features such as dams and reservoirs (200 m), as well as non-perennial drainage lines and associated herbaceous wetlands (150 m). 3) Activity should, as far as possible, be restricted to the footprint of the infrastructure. 4) Measures to control noise and dust should be applied according to current best practice in the industry.	1	4	2	3	1	2	22	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
CONSTRUCTION PHASE																				
											5) The construction of new roads should be kept to a minimum as far as practical and maximum use should be made of existing access roads. 6) Access to the rest of the property must be restricted. 7) The recommendations of the Terrestrial Ecology specialist study must be strictly implemented, especially as far as limitation of the construction footprint is concerned.									

8.2 Operational Phase

The following impacts are identified and assessed as a result of the proposed SEF during the operational phase:

- Displacement of priority species due to habitat transformation associated with the presence of the PV plants and associated infrastructure.
- Mortality of priority species due to collisions with the solar panels.
- Entanglement/entrapment of birds in the perimeter fence.
- Mortality due to electrocutions on the overhead sections of the internal 33kV cables.
- Mortality due to collisions with the overhead sections of the internal 33kV cables.

Table 8-2: Rating of Impacts: Operational Phase.

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
OPERATIONAL PHASE																				
Avifauna	Displacement of priority species due to habitat transformation associated with the presence of the PV plants and associated infrastructure.	2	4	3	3	3	3	45	-	High	1) An all-infrastructure exclusion zone should be implemented and maintained within 2.5 km of the identified Martial Eagle nest and within 1 km of the identified Verreaux's Eagle nests. 2) A solar panel exclusion zone buffer should be implemented and maintained around all surface water features such as dams and reservoirs (200 m), as well as non-perennial drainage lines and	1	4	2	3	1	3	33	-	Medium

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
OPERATIONAL PHASE																				
											associated herbaceous wetlands (150 m). 3) Access to the rest of the property must be restricted during maintenance activities. 4) The recommendations of the Terrestrial Biodiversity and Botanical Specialist Study must be strictly implemented, especially as far as site rehabilitation is concerned.									
Avifauna	Mortality of priority species due to collisions with the solar panels.	1	4	1	2	1	2	18	-	Low	No mitigation is required due to the low significance of this impact	1	3	1	2	1	2	16	-	Low
Avifauna	Entanglement/entrapment of birds in the perimeter fence.	1	4	2	3	1	3	33	-	Medium	1) Replace at least the top two barbed strands with smooth wire to eliminate the risk of entanglement. 2) Increasing the spacing between at least the top two wires (to a minimum of 30 cm) and ensuring they are correctly tensioned will also reduce the entanglement risk. 3) A single (instead of double) perimeter fence should be used if possible.	1	3	1	2	1	2	16	-	Low
Avifauna	Electrocution of priority species on the 33 kV power line network and in the on-site substations.	2	3	1	3	3	2	24	-	Medium	1) The cables must be placed underground as much as practically possible. The final pole design must be developed in consultation	2	2	1	2	3	1	10	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
OPERATIONAL PHASE																				
											with the avifaunal specialist to ensure that a bird friendly design is employed. The avifaunal specialist should provide input and approve on the final pole design. 2) Due to the complicated design of the substation hardware, pro-active mitigation is not a practical option. Instead, the situation must be monitored, and should electrocutions of priority species be recorded, reactive mitigation could be applied in the form of insulation of live components.									
Avifauna	Mortality due to collisions with the overhead sections of the internal 33kV cables.	2	3	2	3	3	2	26		Medium	1) Bird flight diverters should be installed on all the overhead line sections for the full span length according to the applicable Eskom standard at the time. 2) The final pole design must be developed in consultation with the avifaunal specialist to ensure that a bird friendly design is employed.	2	1	1	2	3	1	9		Low

8.3 Decommissioning Phase

During the decommissioning phase, it is likely that the activities will result in the displacement of priority species due to disturbance associated with decommissioning of the PV facilities and associated infrastructure.

Table 8-3: Rating of Impacts: Decommissioning Phase.

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
DECOMMISSIONING PHASE																				
Avifauna	Displacement of priority species due to disturbance associated with decommissioning of the PV facilities and associated infrastructure.	1	4	2	3	1	3	33	-	Medium	1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. 2) Measures to control noise and dust should be applied according to current best practice in the industry.	1	4	2	3	1	2	22	-	Low

A summary of the impacts for pre-and post-mitigation for all phases are shown in **Table 8-4**.

Table 8-4: Summary of impacts on environmental parameters pre- and post-mitigation- this is applicable for each of the solar PV projects (Rhino PV and Sunnyside PV) addressed in this report.

Environmental Parameter	Impact	Significance Rating Pre-Mitigation	Significance Rating Post Mitigation
	Construction Phase		
Avifauna	*Displacement of priority species due to disturbance associated with construction of the PV facility and associated infrastructure.*	High -	Low -
	Operation Phase		
	Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure	High -	Medium -
	Mortality of priority species due to collisions with solar panels	Low -	Low -
	Entanglement/entrapment of birds in the perimeter fence	Medium -	Low -
	Electrocution of priority species on the 33 kV power line network and in the on-site substations.	Medium -	Low -
	Mortality due to collisions with the overhead sections of the internal 33kV cables.	Medium -	Low -
	Decommissioning Phase		
	Displacement of priority species due to disturbance associated with decommissioning of the PV facility and associated infrastructure.	Medium -	Low -

8.4 No-Go Impact Assessment

The no-go option will result in no additional impacts on avifauna, due to this project. This will result in the ecological status quo being maintained, which will be to the advantage of the avifauna. However, no fatal flaws were identified during the study as the SEF layouts (**Figure 6-2 and Figure 6-3**) have considered and avoided sensitive habitat that would likely support SCC.

8.5 Cumulative Impact Assessment

In relation to an activity, cumulative impact means "*the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*" (Environmental Impact Assessment Regulations, 2014 as amended, enacted under the NEMA).

According to the South African Renewable Energy EIA Application Database (REEA) ("REEA_OR_2023_Q2") there are several other authorised Renewable Energy Projects within a 35 km radius (**Table 8-5** below) of the Rhino PV and Sunnyside PV SEF. The cumulative impact assessed for Rhino PV and Sunnyside PV is thus the collective impact of both PV facilities and all the other authorised Renewable Energy Projects (**Figure 8-1** below). There is also an authorised dolerite mining project (Ref: WC 30/5/1/3/2/10319MP) which has been approved on a portion of the remaining Portion of the Farm Rhenosterkop no.155.

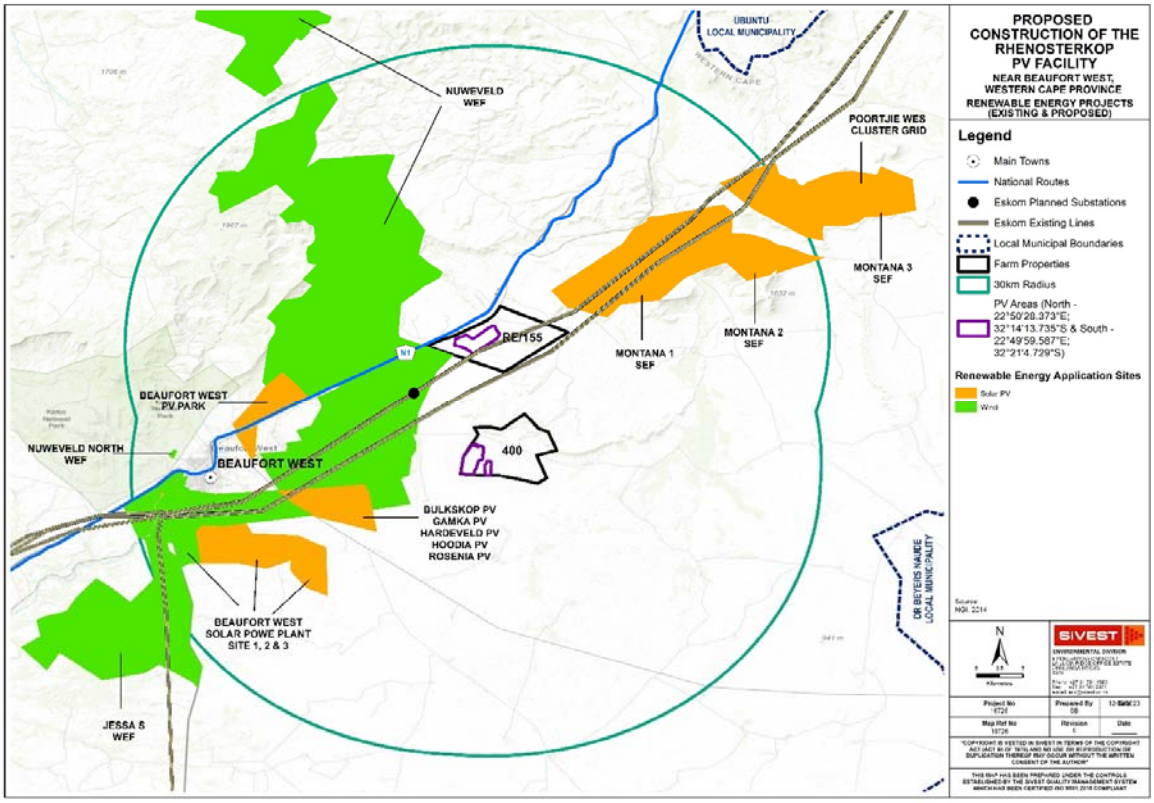

Figure 8-1: Proposed Renewable Energy Projects within 35 km radius of the proposed Rhino PV and Sunnyside PV SEF.

The total affected land parcel area taken up by planned and authorised Renewable Energy Projects within the 35 km radius is approximately 3 154 km² (315 421 ha), which includes Rhino PV and Sunnyside PV SEFs in addition to the 13 other authorised Renewable Energy Projects. There is also an additional area of 5 ha authorised for a dolerite mining project (Ref: WC 30/5/1/3/2/10319MP).

The total area within the 35 km radius around the proposed SEF Project (Rhino PV and Sunnyside PV) equates to approximately 5 837 km² (583 746 ha) of similar habitat. Therefore, the total combined size of the land parcels potentially affected by renewable energy projects will equate to approximately 50% of the available untransformed habitat in the 35 km radius.

The cumulative impact considers the loss of habitat, habitat fragmentation, the disturbance factors linked to the various projects, and potential bird mortalities due to collisions and/or electrocutions within the above explained 35 km radius of similar habitat.

Assuming that all the projects are constructed, the cumulative impact of all the planned and authorised renewable energy projects is estimated to be **high**. It should be noted that the actual physical footprint of the renewable energy facilities will be smaller than the land parcel areas themselves. If all mitigation measures for all projects are strictly implemented the cumulative impact could be reduced to **medium.**

Table 8-5: Other Renewable Energy Projects within 35 km of Rhino and Sunnyside PV SEF.

DEA_REF	PROJECT	PROVINCE	TECH.	CAPACITY (MW)	LOCAL MUNICIPALITY	STATUS
14/12/16/3/3/1/2517	The construction of a 120 MW PV solar energy facility (known as the Bulkskop PV) located on the remaining extent (Portion 0) of Farm 423 approximately 12 km South-East of Beaufort West in the Beaufort West Local Municipality, Western Cape Province	Western Cape	PV	120	Beaufort West Local Municipality	Approved
14/12/16/3/3/1/2518	The construction of a 120 MW PV solar energy facility (known as the Gamka PV) located on the remaining extent (Portion 0) of Farm 423 approximately 12 km South-East of Beaufort west in the Beaufort West Local Municipality, Western Cape Province	Western Cape	PV	120	Beaufort West Local Municipality	Approved
14/12/16/3/3/1/2519	The construction of 120 MW photovoltaic (PV) solar energy facility (known as the Hardeveld PV) located on the remaining extent (Portion 0) of Farm 423, Western Cape Province	Western Cape	PV	120	Beaufort West Local Municipality	Approved
14/12/16/3/3/1/2520	The construction of a 120MW PV solar energy facility (known as Hoodia PV) in the Beaufort West Local Municipality, Western Cape Province	Western Cape	PV	120	Beaufort West Local Municipality	Approved
14/12/16/3/3/1/2521	The construction of a 120 MW photovoltaic (PV) solar energy facility (known as the Rosenia PV), Western Cape Province	Western Cape	PV	120	Beaufort West Local Municipality	Approved
12/12/20/2133	Proposed Construction of 19MW Photovoltaic Solar Facility Proposed by Lurama 214 Pty Ltd on Portion 1 of the Farm Steenrotsfontein 168, Beaufort West, Western Cape Province	Western Cape	PV	19	Beaufort West Local Municipality	Approved
12/12/20/2133/A1	Proposed Construction of 19MW Photovoltaic Solar Facility Proposed by Lurama 214 Pty Ltd on Portion 1 Of the Farm Steenrotsfontein 168, Beaufort West, Western Cape Province	Western Cape	PV	0	Beaufort West Local Municipality	Approved
12/12/20/2133/AM3	Proposed Construction of 19MW Photovoltaic Solar Facility Proposed by Lurama 214 Pty Ltd on Portion 1 of the Farm Steenrotsfontein 168, Beaufort West, Western Cape Province	Western Cape	PV	0	Beaufort West Local Municipality	Approved
12/12/20/2133/AM4	Proposed Construction of 19MW Photovoltaic Solar Facility Proposed by Lurama 214 (Pty) Ltd on Portion 1 of the Farm Steenrotsfontein 168, Beaufort West, Western Cape Province	Western Cape	PV	0	Beaufort West Local Municipality	Approved
12/12/20/2133/AM5	Proposed Construction of 19MW Photovoltaic Solar Facility Proposed by Lurama 214 (Pty) Ltd on Portion 1 of the Farm Steenrotsfontein 168, Beaufort West, Western Cape Province	Western Cape	PV	0	Beaufort West Local Municipality	Approved
12/12/20/2286	The Proposed Beaufort West Photovoltaic Park on Portion 9 of the Farm 161 Kuilspoort in the Western Cape Province	Western Cape	PV	85	Beaufort West Local Municipality	Approved
12/12/20/2286/AM4	The Proposed Beaufort West Photovoltaic Park on Portion 9 of the Farm 161 Kuilspoort in the Western Cape Province	Western Cape	PV	0	Beaufort West Local Municipality	Approved
14/12/16/3/3/1/2332	Proposed 75MW Beaufort West Photovoltaic (PV) Project, Western Cape Province	Western Cape	PV	75	Beaufort West Local Municipality	Approved

DEA_REF	PROJECT	PROVINCE	TECH.	CAPACITY (MW)	LOCAL MUNICIPALITY	STATUS
14/12/16/3/3/2/772	Proposed establishment of the Beaufort West Solar Power Plant Site 1, Western Cape Province	Western Cape	PV	90	Beaufort West Local Municipality	Approved
14/12/16/3/3/2/773	Proposed Establishment of the Beaufort West Solar Power Plant Site 2, Western Cape Province	Western Cape	PV	90	Beaufort West Local Municipality	Approved
14/12/16/3/3/2/774	Proposed Beaufort West Solar power plant site 3 near Beaufort West, Western Cape Province	Western Cape	PV	90	Beaufort West Local Municipality	Approved
14/12/16/3/3/1/2494	The proposed 220MW Jessa M wind energy facility (WEF) and associated infrastructure near Beaufort west in the Western Cape Province	Western Cape	Wind	220	Beaufort West Local Municipality	Approved
14/12/16/3/3/1/2496	The proposed 220MW Jessa Z wind energy facility (WEF) and associated infrastructure, near Beaufort West in the Western Cape Province	Western Cape	Wind	220	Beaufort West Local Municipality	Approved
240/160/ 80/ 72	N1 Wind Farm, Beaufort West	Western Cape	Wind			Approved
12/12/20/1784/1	Proposed Development of the 140 MW Beaufort West Wind Farm in the Prince Albert Local Municipality, Western Cape Province.	Western Cape	Wind	140		Approved
12-12-20-1784-1-AM3	140 MW Beaufort West Wind Farm	Western Cape	Wind	140		Approved
14-12-16-3-3-2-925-2	Genelania 132/400 kV Main Transmission Substation and 400 kV Overhead Line associated with Beaufort West Wind Farm	Western Cape	-	-	Beaufort West Local Municipality	Approved
14/12/16/3/3/1/2464/AM2	33/132 kV Independent Power Producer (Varsfontein) substation associated with Beaufort West Wind Farm	Western Cape	-	-	Beaufort West Local Municipality	Approved
14-12-16-3-3-2-925-1	132/400 kV Main Transmission Substation and 400 kV Overhead Line associated with Beaufort West Wind Farm	Western Cape	-	-	Beaufort West Local Municipality	Approved
16/3/3/1/C3/2/0032/22	Proposed Development of a Radio Mast, approximately 90 metres in height on Portion 1 of the Farm No. 15 of Trakaskuilen Located on the Beaufort West Cluster of Wind Farm Developments, near the town of Beaufort West in the Western Cape Province	Western Cape	-	-	Beaufort West Local Municipality	Approved

9. MITIGATION AND EMPR REQUIREMENTS

The following management actions are proposed for **both** SEF sites (**Rhino PV and Sunnyside PV**), unless stated otherwise. Please refer to **Appendix 6** for the Avifaunal Inputs to the EMPr:

9.1 Construction Phase

- An all-infrastructure exclusion zone should be implemented and maintained within 2.5 km of the identified Martial Eagle nest and within 1 km of the identified Verreaux's Eagle nests to avoid displacement due to disturbance.
- A solar panel exclusion zone buffer should be implemented and maintained around all surface water features such as dams and reservoirs (200 m), as well as non-perennial drainage lines and associated herbaceous wetlands (150 m).
- In addition, water troughs (if any) located within the PV footprints should be relocated outside the project area to ensure the continued availability of this water source to avifauna.
- Perimeter fences: Replace at least the top two barbed strands with smooth wire to reduce snagging risks, increasing the spacing between at least the top two wires (to a minimum of 30 cm), and ensuring they are correctly tensioned will reduce the snaring risk.
- Construction activity should as far as possible be restricted to the footprints of the infrastructure.
- Measures to control noise and dust should be applied according to current best industry practice.
- The construction of new roads should be kept to a minimum as far as practical and maximum use of existing access roads.
- Access to the rest of the property must be restricted.
- The recommendations of the Terrestrial Biodiversity Specialist Study must be strictly implemented, especially as far as the limitation of the construction footprint is concerned.
- 33 kV networks: The cables must be placed underground as much as practically possible. The final pole design must be developed in consultation with the avifaunal specialist to ensure that a bird-friendly design is employed. The avifaunal specialist must sign off on the final pole design.
- All internal medium voltage overhead lines must be marked with Eskom approved Bird Flight Diverters, according to the applicable Eskom Engineering Instruction.

9.2 Operational Phase

- An all-infrastructure exclusion zone should be implemented and maintained within 2.5 km of the identified Martial Eagle nest and within 1 km of the identified Verreaux's Eagle nests to avoid displacement due to disturbance and to reduce the risk of injury to juvenile birds due to collision with solar panels.
- A solar panel exclusion zone buffer should be implemented and maintained around all surface water features such as dams and reservoirs (200 m), as well as non-perennial drainage lines and associated herbaceous wetlands (150 m).
- The recommendations of the Terrestrial Biodiversity Specialist Study must be strictly implemented, especially as far as site rehabilitation is concerned.
- Perimeter fences: Replace at least the top two barbed strands with smooth wire to reduce snagging risks, increasing the spacing between at least the top two wires (to a minimum of 30 cm), and ensuring they are correctly tensioned will reduce the snaring risk.

- Substations: Due to the complicated design of the substation hardware, pro-active mitigation is not a practical option. Instead, the situation must be monitored, and should electrocutions of priority species be recorded, reactive mitigation could be applied in the form of insulation of live components.
- All internal medium voltage overhead lines must be marked with Eskom approved Bird Flight Diverters, according to the applicable Eskom Engineering Instruction.

9.3 Decommissioning Phase

- Decommissioning activity should be restricted to the immediate footprints of the infrastructure.
- Access to the remainder of the sites should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current industry best practice.

10. CONCLUSION AND SUMMARY

10.1 Summary of Findings

A review of the data from the SABAP2 determined that a total of 183 bird species could potentially occur within the Broader Area (**Appendix 2**) where the PAOI is located. Of the 183 species, 75 are classified as priority species for solar developments. Of the 75 solar priority species, 24 were recorded during the on-site surveys (SSV site visit and pre-construction monitoring surveys), and 44 solar priority species have a medium to high likelihood of occurring regularly in the PAOI.

The following Red Data priority species were recorded during site surveys (2022 and 2023) and could occur in the PAOI regularly:

- Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near-threatened)
- Secretarybird *Sagittarius serpentarius* (Regionally and Globally Endangered)
- Karoo Korhaan *Eupodotis vigorsii* (Regionally Near-threatened)
- Southern Black *Korhaan Afrotis afra* (Globally and Regionally Vulnerable)
- Ludwig's Bustard *Neotis ludwigii* (Regionally and Globally Endangered)
- Kori Bustard *Ardeotis kori* (Globally and Regionally Near Threatened)
- Martial Eagle *Polemaetus bellicosus* (Regionally and Globally Endangered)
- Verreaux's Eagle *Aquila verreauxii* (Regionally Vulnerable)

10.2 Potential Impacts

The following potential impacts relative to avifauna have been identified for Rhino PV:

Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV facility and associated infrastructure.

Operational Phase

- Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure.
- Collisions with the solar panels.
- Entanglement in perimeter fences.
- Electrocutions at the on-site substations and on the 33 kV overhead lines.
- Collisions with the 33 kV overhead lines.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV facility and associated infrastructure.

The following potential impacts relative to avifauna have been identified for Sunnyside PV:

Construction Phase

- Displacement due to disturbance associated with the construction of the solar PV facility and associated infrastructure.

Operational Phase

- Displacement due to habitat transformation associated with the presence of the solar PV facility and associated infrastructure.
- Collisions with the solar panels.
- Entanglement in perimeter fences.
- Electrocutions at the on-site substations and on the 33 kV overhead lines.
- Collisions with the 33 kV overhead lines.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the solar PV facility and associated infrastructure.

7.3 Conclusion and Impact Statement

The PAOI (which includes the land parcels of both Rhino PV and Sunnyside PV) and immediate environment is classified as **Medium** and **High** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme. The High classification is linked to the potential occurrence of Ludwig's Bustard (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Southern Black Korhaan (Globally and Regionally Vulnerable), Martial Eagle (Globally and Regionally Endangered) and Lanner Falcon (Regionally Vulnerable). The PAOI contains confirmed habitat for SCC as defined in GN No. 1150 of 2020.

The occurrence of SCC was confirmed during the on-site surveys, i.e., Martial Eagle, Verreaux's Eagle, Blue Crane (Globally Vulnerable and Regionally Near Threatened), Karoo Korhaan (Regionally Near threatened), Ludwig's Bustard and Secretarybird (Globally and Regionally Endangered) were recorded. Based on the results of the field investigations, a classification of **High** sensitivity for avifauna is advocated for the PAOI, which consists of the Rhino PV and Sunnyside PV project sites (land parcels).

Despite the High Sensitivity rating for avifauna, there are no fatal flaws or unacceptable impacts associated with the proposed SEF project, provided the above-mentioned recommendations are strictly implemented and maintained.

The impacts identified are acceptably mitigated to Low (negative) impact with the exception of the displacement of avifauna due to habitat transformation as a result of the proposed development. This impact is mitigated to Medium (negative) impact. However, this is not considered to be a fatal flaw. The mitigation measures in this report, and input into the EMPr are considered satisfactory and as best practise for a SEF as proposed by the Applicant.

It is recommended that the proposed Rhino PV and Sunnyside PV SEF are authorised, ***on condition that the proposed mitigation measures as detailed in Sections 8 and 9 of this report and the EMPr (Appendix 6) are strictly implemented.***

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APPENDIX 1: SPECIALIST CVs

Curriculum Vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	25 years

Key Qualifications

Albert Froneman **(**Pr.Sci.Nat) has more than 25 years' experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee and has presented various papers at international conferences and workshops. At present he is consulting to ACSA with wildlife hazard management on all their airports. He also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies. He has co-authored many avifaunal specialist studies and pre-construction monitoring reports for proposed renewable energy developments across South Africa. He also has vast experience in using Geographic Information Systems to analyse and interpret avifaunal data spatially and derive meaningful conclusions. Since 2009 Albert has been a registered Professional Natural Scientist (reg. nr 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

Key Project Experience

Renewable Energy Facilities –avifaunal monitoring projects in association with Chris van Rooyen Consulting

1. Jeffrey's Bay Wind Farm – 12-months preconstruction avifaunal monitoring project
2. Oyster Bay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
3. Ubuntu Wind Energy Project near Jeffrey's Bay – 12-months preconstruction avifaunal monitoring project
4. Bana-ba-Pifu Wind Energy Project near Humansdorp – 12-months preconstruction avifaunal monitoring project
5. Excelsior Wind Energy Project near Caledon – 12-months preconstruction avifaunal monitoring project
6. Laingsburg Spitskopvlakte Wind Energy Project – 12-months preconstruction avifaunal monitoring project
7. Loeriesfontein Wind Energy Project Phase 1, 2 & 3 – 12-months preconstruction avifaunal monitoring project
8. Noupoort Wind Energy Project – 12-months preconstruction avifaunal monitoring project
9. Vleesbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
10. Port Nolloth Wind Energy Project – 12-months preconstruction avifaunal monitoring project
11. Langhoogte Caledon Wind Energy Project – 12-months preconstruction avifaunal monitoring project
12. Lunsklip – Stilbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
13. Indwe Wind Energy Project – 12-months preconstruction avifaunal monitoring project
14. Zeeland St Helena bay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
15. Wolseley Wind Energy Project – 12-months preconstruction avifaunal monitoring project
16. Renosterberg Wind Energy Project – 12-months preconstruction avifaunal monitoring project
17. De Aar – North (Mulilo) Wind Energy Project – 12-months preconstruction avifaunal monitoring project (2014)
18. De Aar – South (Mulilo) Wind Energy Project – 12-months bird monitoring
19. Namies – Aggenys Wind Energy Project – 12-months bird monitoring

20. Pofadder - Wind Energy Project – 12-months bird monitoring
21. Dwarsrug Loeriesfontein - Wind Energy Project – 12-months bird monitoring
22. Waaihoek – Utrecht Wind Energy Project – 12-months bird monitoring
23. Amathole – Butterworth Utrecht Wind Energy Project – 12-months bird monitoring & EIA specialist study
24. De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
25. Makambako Wind Energy Facility (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
26. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
27. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
28. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
29. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
30. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
31. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
32. Mañhica Wind Energy Facility 12-month bird monitoring & EIA specialist study (Windlab)
33. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
34. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO). Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
35. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
36. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
37. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
38. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
39. Mainstream Damlaagte & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
40. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
41. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
42. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
43. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
44. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
45. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
46. Pofadder Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
47. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
48. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
49. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment studies and / or GIS analysis:

1. Aviation Bird Hazard Assessment Study for the proposed Madiba Bay Leisure Park adjacent to Port Elizabeth Airport.
2. Extension of Runway and Provision of Parallel Taxiway at Sir Seretse Khama Airport, Botswana Bird / Wildlife Hazard Management Specialist Study
3. Maun Airport Improvements Bird / Wildlife Hazard Management Specialist Study
4. Bird Impact Assessment Study - Bird Helicopter Interaction – The Bitou River, Western Cape Province South Africa
5. Proposed La Mercy Airport – Bird Aircraft interaction specialists study using bird detection radar to assess swallow flocking behaviour
6. KwaZulu Natal Power Line Vulture Mitigation Project – GIS analysis
7. Perseus-Zeus Power line EIA – GIS Analysis

8. Southern Region Pro-active GIS Blue Crane Collision Project.
9. Specialist advisor ~ Implementation of a bird detection radar system and development of an airport wildlife hazard management and operational environmental management plan for the King Shaka International Airport
10. Matsapha International Airport – bird hazard assessment study with management recommendations
11. Evaluation of aviation bird strike risk at candidate solid waste disposal sites in the Ekurhuleni Metropolitan Municipality
12. Gateway Airport Authority Limited – Gateway International Airport, Polokwane: Bird hazard assessment; Compile a bird hazard management plan for the airport
13. Bird Specialist Study - Evaluation of aviation bird strike risk at the Mwakirunge Landfill site near Mombasa Kenya
14. Bird Impact Assessment Study - Proposed Weltevreden Open Cast Coal Mine Belfast, Mpumalanga
15. Avian biodiversity assessment for the Mafube Colliery Coal mine near Middelburg Mpumalanga
16. Avifaunal Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
17. Avifaunal Impact Assessment Study (with specific reference to African Grass Owls and other Red List species) Stone Rivers Arch
18. Airport bird and wildlife hazard management plan and training to Swaziland Civil Aviation Authority (SWACAA) for Matsapha and Sikhupe International Airports
19. Avifaunal Impact Scoping & EIA Study - Renosterberg Wind Farm and Solar PV site
20. Bird Impact Assessment Study - Proposed 60-year Ash Disposal Facility near to the Kusile Power Station
21. Avifaunal pre-feasibility assessment for the proposed Montrose dam, Mpumalanga
22. Bird Impact Assessment Study – Proposed ESKOM Phantom Substation near Knysna, Western Cape
23. Habitat sensitivity map for Denham's Bustard, Blue Crane, and White-bellied Korhaan in the Kouga Municipal area of the Eastern Cape Province
24. Swaziland Civil Aviation Authority – Sikhuphe International Airport – Bird hazard management assessment
25. Avifaunal monitoring – extension of Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
26. Avifaunal Specialist Study – Rooikat Hydro Electric Dam – Hope Town, Northern Cape
27. The Stewards Pan Reclamation Project – Bird Impact Assessment study
28. Airports Company South Africa – Avifaunal Specialist Consultant – Airport Bird and Wildlife Hazard Mitigation

Geographic Information System analysis & maps

1. ESKOM Power line Makgalakwena EIA – GIS specialist & map production
2. ESKOM Power line Benficosa EIA – GIS specialist & map production
3. ESKOM Power line Riversong EIA – GIS specialist & map production
4. ESKOM Power line Waterberg NDP EIA – GIS specialist & map production
5. ESKOM Power line Bulge Toulon EIA – GIS specialist & map production
6. ESKOM Power line Bulge DORSET EIA – GIS specialist & map production
7. ESKOM Power lines Marblehall EIA – GIS specialist & map production
8. ESKOM Power line Grootpan Lesedi EIA – GIS specialist & map production
9. ESKOM Power line Tanga EIA – GIS specialist & map production
10. ESKOM Power line Bokmakierie EIA – GIS specialist & map production
11. ESKOM Power line Rietfontein EIA – GIS specialist & map production
12. Power line Anglo Coal EIA – GIS specialist & map production
13. ESKOM Power line Camcoll Jericho EIA – GIS specialist & map production
14. Hartbeespoort Residential Development – GIS specialist & map production
15. ESKOM Power line Mantsole EIA – GIS specialist & map production
16. ESKOM Power line Nokeng Flourspar EIA – GIS specialist & map production
17. ESKOM Power line Greenview EIA – GIS specialist & map production

18. Derdepoort Residential Development – GIS specialist & map production
19. ESKOM Power line Boynton EIA – GIS specialist & map production
20. ESKOM Power line United EIA – GIS specialist & map production
21. ESKOM Power line Gutshwa & Malelane EIA – GIS specialist & map production
22. ESKOM Power line Ohrigstad EIA – GIS specialist & map production
23. Zilkaatsnek Development Public Participation –map production
24. Belfast – Paarde Power line - GIS specialist & map production
25. Solar Park Solar Park Integration Project Bird Impact Assessment Study – avifaunal GIS analysis.
26. Kappa-Omega-Aurora 765kV Bird Impact Assessment Report – Avifaunal GIS analysis.
27. Gamma – Kappa 2nd 765kV – Bird Impact Assessment Report – Avifaunal GIS analysis.
28. ESKOM Power line Kudu-Dorstfontein Amendment EIA – GIS specialist & map production.
29. Proposed Heilbron filling station EIA – GIS specialist & map production
30. ESKOM Lebatlhane EIA – GIS specialist & map production
31. ESKOM Pienaars River CNC EIA – GIS specialist & map production
32. ESKOM Lemara Phiring Ohrigstad EIA – GIS specialist & map production
33. ESKOM Pelly-Warmbad EIA – GIS specialist & map production
34. ESKOM Rosco-Bracken EIA – GIS specialist & map production
35. ESKOM Ermelo-Uitkoms EIA – GIS specialist & map production
36. ESKOM Wisani bridge EIA – GIS specialist & map production
37. City of Tshwane – New bulkfeeder pipeline projects x3 Map production
38. ESKOM Lebohang Substation and 132kV Distribution Power Line Project Amendment GIS specialist & map production
39. ESKOM Geluk Rural Power line GIS & Mapping
40. Eskom Kimberley Strengthening Phase 4 Project GIS & Mapping
41. ESKOM Kwaggafontein - Amandla Amendment Project GIS & Mapping
42. ESKOM Lephalale CNC – GIS Specialist & Mapping
43. ESKOM Marken CNC – GIS Specialist & Mapping
44. ESKOM Lethabong substation and power lines – GIS Specialist & Mapping
45. ESKOM Magopela- Pitsong 132kV line and new substation – GIS Specialist & Mapping

Professional registrations and industrial affiliations

South African Council for Natural Scientific Professions (SACNASP) registered Professional Natural Scientist (reg. nr 400177/09) – specialist field: Zoological Science. Registered since 2009.

- **Member** of the Zoological Society of Southern Africa (ZSSA)

Curriculum Vitae: **Megan Loftie-Eaton**

Profession/Specialization	:	Avifaunal Specialist
Highest Qualification	:	PhD Biological Sciences
Nationality	:	South African
Years of Experience	:	10 years

Key Qualifications

Megan Loftie-Eaton **(**Pr. Sci.Nat) holds a PhD in Biological sciences from the Avian Demography Unit, University of Cape Town, and has more than 10 years' experience conducting bird research, atlasing, mapping and environmental assessment consulting. Megan was an assistant researcher on the African Penguin EarthWatch Research Team, conducting population surveys on penguins and other seabirds, sustainable agriculture research, biodiversity surveys and ecological monitoring. She has acted as coordinator, Social media manager and communications officer for various programmes including The Biodiversity and Development Institute (OdonataMAP, Citizen Science Projects), LepiMAP, BirdMAP, ADU and Hoedspruit Hub. She is on the Expert Panel for a virtual museum covering several vertebrate taxa. Megan is also very active with the bird atlasing project; she presented and assessed several atlasing workshops in Africa and Europe. She facilitated an assessed Ecology courses and provided training materials for it. She has been involved in Environmental and specifically Avian assessments since 2020 by conducting fieldwork, completing assessments, and acting as an environmental assessment practitioner. She has several additional qualifications, including a FGASA Level 1 Nature guide qualification, a First aid level one qualification, snake and scorpion training courses and a course in humane trapping methods. She completed online global environmental management course, and a NQF level 5 outcomes-based assessment course. Megan is an author or co-author on several scientific papers and currently operates as an Avifaunal specialist working with AfriAvian Environmental.

Key Project Experience

Renewable Energy Facilities – avifaunal monitoring projects in association with Chris van Rooyen Consulting

1. Philipstown Kudu Solar Energy Facilities and associated infrastructure
2. Umsobomvu Solar Energy Facilities and associated infrastructure
3. Ezelsjacht Wind Energy Facility and associated infrastructure
4. Heuweltjies en Kraaltjies Wind Energy Facilities and associated infrastructure
5. Mercury Solar Energy Facilities and associated infrastructure
6. Perdekraal East Wind Energy Facility and associated infrastructure
7. Skilpad Solar Energy Facility and associated infrastructure

Other Avifaunal Projects

1. Blue Stone Quarry Wall Restoration, Robben Island, Western Cape, South Africa – Avifaunal Impact Assessment

Professional registrations and industrial affiliations

- **Professional Natural Scientist in Ecology (Member #135161)** registered with the South African Council for Natural Scientific Professions (SACNASP)
- **Environmental Assessment Practitioner (Number 2021/3690)** registered with the Environmental Assessment Practitioners Association of South Africa (EAPASA)
- **Member** of the Zoological Society of Southern Africa (ZSSA)

APPENDIX 2: BIRD SPECIES LIST FOR BROADER AREA

Species Name	Scientific Name	SABAP2 Reporting Rate %	
		Full Protocol	Ad Hoc Protocol
Acacia Pied Barbet	*Tricholaema leucomelas*	72,40	4,55
African Black Swift	*Apus barbatus*	3,13	0,00
African Fish Eagle	*Haliaeetus vocifer*	0,52	0,00
African Hoopoe	*Upupa africana*	25,52	0,00
African Pipit	*Anthus cinnamomeus*	51,56	3,79
African Red-eyed Bulbul	*Pycnonotus nigricans*	57,29	2,27
African Reed Warbler	*Acrocephalus baeticatus*	5,73	0,00
African Rock Pipit	*Anthus crenatus*	2,60	0,00
African Sacred Ibis	*Threskiornis aethiopicus*	2,60	0,00
African Spoonbill	*Platalea alba*	10,94	3,03
Alpine Swift	*Tachymarptis melba*	17,71	1,52
Ant-eating Chat	*Myrmecocichla formicivora*	58,33	8,33
Barn Swallow	*Hirundo rustica*	26,56	3,03
Black Harrier	*Circus maurus*	0,52	0,00
Black-eared Sparrow-Lark	*Eremopterix australis*	7,29	2,27
Black-headed Canary	*Serinus alario*	27,08	3,79
Black-headed Heron	*Ardea melanocephala*	0,52	0,00
Blacksmith Lapwing	*Vanellus armatus*	33,33	1,52
Black-throated Canary	*Crithagra atrogularis*	33,85	2,27
Black-winged Kite	*Elanus caeruleus*	6,25	3,03
Black-winged Stilt	*Himantopus himantopus*	4,17	0,00
Blue Crane	*Grus paradisea*	23,96	2,27
Bokmakierie	*Telophorus zeylonus*	53,13	1,52
Booted Eagle	*Hieraaetus pennatus*	15,10	1,52
Brown-hooded Kingfisher	*Halcyon albiventris*	4,69	0,00
Brown-throated Martin	*Riparia paludicola*	1,04	0,00
Buffy Pipit	*Anthus vaalensis*	0,52	0,00
Burchell's Courser	*Cursorius rufus*	0,52	0,00
Cape Bunting	*Emberiza capensis*	54,17	2,27
Cape Canary	*Serinus canicollis*	1,04	0,00
Cape Crow	*Corvus capensis*	52,60	13,64
Cape Eagle-Owl	*Bubo capensis*	0,52	0,00
Cape Penduline Tit	*Anthoscopus minutus*	4,69	0,76
Cape Robin-Chat	*Cossypha caffra*	42,19	2,27
Cape Shoveler	*Spatula smithii*	2,08	0,76
Cape Sparrow	*Passer melanurus*	90,63	9,09
Cape Teal	*Anas capensis*	0,52	0,00
Cape Turtle Dove	*Streptopelia capicola*	76,04	6,06
Cape Wagtail	*Motacilla capensis*	54,17	2,27
Cape White-eye	*Zosterops virens*	39,58	0,76
Capped Wheatear	*Oenanthe pileata*	34,90	3,03
Cardinal Woodpecker	*Dendropicos fuscescens*	14,06	0,00
Chat Flycatcher	*Melaenornis infuscatus*	48,96	6,82
Chestnut-vented Warbler	*Curruca subcoerulea*	61,98	1,52
Cinnamon-breasted Bunting	*Emberiza tahapisi*	1,56	0,00
Common Buzzard	*Buteo buteo*	6,77	0,00
Common Greenshank	*Tringa nebularia*	1,56	0,00

Species Name	Scientific Name	SABAP2 Reporting Rate %	
		Full Protocol	Ad Hoc Protocol
Common Moorhen	*Gallinula chloropus*	0,52	0,00
Common Ostrich	*Struthio camelus*	29,17	1,52
Common Quail	*Coturnix coturnix*	3,65	0,00
Common Starling	*Sturnus vulgaris*	1,04	0,00
Common Swift	*Apus apus*	4,17	0,00
Common Waxbill	*Estrilda astrild*	14,06	0,76
Crowned Lapwing	*Vanellus coronatus*	22,92	0,00
Desert Cisticola	*Cisticola aridulus*	7,81	0,76
Diederik Cuckoo	*Chrysococcyx caprius*	1,56	0,00
Double-banded Courser	*Rhinoptilus africanus*	32,29	4,55jess
Dusky Sunbird	*Cinnyris fuscus*	22,92	2,27
Eastern Clapper Lark	*Mirafra fasciolata*	18,75	3,79
Egyptian Goose	*Alopochen aegyptiaca*	30,73	3,03
European Bee-eater	*Merops apiaster*	7,29	0,00
European Roller	*Coracias garrulus*	0,00	0,76
Fairy Flycatcher	*Stenostira scita*	51,04	3,03
Familiar Chat	*Oenanthe familiaris*	61,46	2,27
Fiscal Flycatcher	*Melaenornis silens*	51,04	1,52
Fork-tailed Drongo	*Dicrurus adsimilis*	2,60	0,00
Gabar Goshawk	*Micronisus gabar*	1,56	0,00
Great Egret	*Ardea alba*	0,52	0,00
Greater Kestrel	*Falco rupicoloides*	43,75	3,03
Greater Striped Swallow	*Cecropis cucullata*	36,98	0,76
Grey Heron	*Ardea cinerea*	5,73	0,00
Grey Tit	*Melaniparus afer*	4,17	0,00
Grey-backed Cisticola	*Cisticola subruficapilla*	23,44	0,00
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	46,88	8,33
Grey-winged Francolin	*Scleroptila afra*	1,04	0,00
Hadada Ibis	*Bostrychia hagedash*	28,65	0,00
Hamerkop	*Scopus umbretta*	1,04	0,00
Helmeted Guineafowl	*Numida meleagris*	28,65	5,30
House Sparrow	*Passer domesticus*	56,77	1,52
Jackal Buzzard	*Buteo rufofuscus*	6,25	0,76
Jacobin Cuckoo	*Clamator jacobinus*	0,52	0,00
Karoo Chat	*Emarginata schlegelii*	70,83	6,82
Karoo Eremomela	*Eremomela gregalis*	1,56	0,00
Karoo Korhaan	*Eupodotis vigorsii*	72,40	18,18
Karoo Lark	*Calendulauda albescens*	4,17	0,00
Karoo Long-billed Lark	*Certhilauda subcoronata*	73,44	6,82
Karoo Prinia	*Prinia maculosa*	63,02	3,03
Karoo Scrub Robin	*Cercotrichas coryphoeus*	72,92	9,85
Karoo Thrush	*Turdus smithi*	37,50	0,76
Kittlitz's Plover	*Charadrius pecuarius*	1,56	0,00
Kori Bustard	*Ardeotis kori*	9,38	0,76
Lanner Falcon	*Falco biarmicus*	16,67	3,79
Large-billed Lark	*Galerida magnirostris*	53,65	6,06
Lark-like Bunting	*Emberiza impetuani*	73,96	12,12
Laughing Dove	*Spilopelia senegalensis*	53,65	3,79
Layard's Warbler	*Curruca layardi*	6,25	0,76

Species Name	Scientific Name	SABAP2 Reporting Rate %	
		Full Protocol	Ad Hoc Protocol
Lesser Flamingo	*Phoeniconaias minor*	0,52	0,00
Lesser Grey Shrike	*Lanius minor*	0,52	0,00
Lesser Honeyguide	*Indicator minor*	1,04	0,00
Lesser Kestrel	*Falco naumanni*	1,04	0,00
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	0,52	0,00
Little Grebe	*Tachybaptus ruficollis*	2,08	0,00
Little Stint	*Calidris minuta*	0,52	0,00
Little Swift	*Apus affinis*	29,17	1,52
Long-billed Crombec	*Sylvietta rufescens*	30,21	0,76
Long-billed Pipit	*Anthus similis*	0,00	0,76
Ludwig's Bustard	*Neotis ludwigii*	40,10	7,58
Malachite Sunbird	*Nectarinia famosa*	20,83	1,52
Marsh Sandpiper	*Tringa stagnatilis*	0,52	0,00
Martial Eagle	*Polemaetus bellicosus*	5,21	2,27
Mountain Wheatear	*Myrmecocichla monticola*	28,13	3,03
Namaqua Dove	*Oena capensis*	50,52	6,06
Namaqua Sandgrouse	*Pterocles namaqua*	42,71	3,03
Namaqua Warbler	*Phragmacia substriata*	20,31	0,00
Neddicky	*Cisticola fulvicapilla*	3,65	1,52
Nicholson's Pipit	*Anthus nicholsoni*	13,02	3,79
Pale Chanting Goshawk	*Melierax canorus*	59,38	15,15
Pale-winged Starling	*Onychognathus nabouroup*	12,50	2,27
Pearl-breasted Swallow	*Hirundo dimidiata*	4,17	0,00
Pied Avocet	*Recurvirostra avosetta*	3,13	2,27
Pied Crow	*Corvus albus*	82,81	34,85
Pied Starling	*Lamprotornis bicolor*	36,46	4,55
Pink-billed Lark	*Spizocorys conirostris*	5,21	0,76
Pin-tailed Whydah	*Vidua macroura*	10,94	0,76
Plain-backed Pipit	*Anthus leucophrys*	19,27	0,76
Pririt Batis	*Batis pririt*	45,31	0,00
Quailfinch	*Ortygospiza atricollis*	5,21	0,00
Red-backed Shrike	*Lanius collurio*	2,60	0,00
Red-billed Firefinch	*Lagonosticta senegala*	22,40	0,00
Red-billed Quelea	*Quelea quelea*	23,96	1,52
Red-billed Teal	*Anas erythrorhyncha*	2,60	0,76
Red-capped Lark	*Calandrella cinerea*	45,83	4,55
Red-eyed Dove	*Streptopelia semitorquata*	3,65	0,76
Red-faced Mousebird	*Urocolius indicus*	39,06	1,52
Red-headed Finch	*Amadina erythrocephala*	48,96	6,06
Red-knobbed Coot	*Fulica cristata*	1,56	0,00
Red-winged Starling	*Onychognathus morio*	20,31	0,76
Rock Kestrel	*Falco rupicolus*	36,98	6,82
Rock Martin	*Ptyonoprogne fuligula*	54,17	4,55
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0,52	0,00
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	11,98	0,00
Rufous-eared Warbler	*Malcorus pectoralis*	87,50	11,36
Sabota Lark	*Calendulauda sabota*	46,35	8,33
Scaly-feathered Weaver	*Sporopipes squamifrons*	29,17	0,00
Sclater's Lark	*Spizocorys sclateri*	43,75	13,64

Species Name	Scientific Name	SABAP2 Reporting Rate %	
		Full Protocol	Ad Hoc Protocol
Secretarybird	*Sagittarius serpentarius*	6,25	3,03
Short-toed Rock Thrush	*Monticola brevipes*	2,08	0,76
Sickle-winged Chat	*Emarginata sinuata*	26,56	3,03
South African Shelduck	*Tadorna cana*	31,77	3,03
Southern Black Korhaan	*Afrotis afra*	5,21	3,03
Southern Double-collared Sunbird	*Cinnyris chalybeus*	18,23	0,00
Southern Fiscal	*Lanius collaris*	70,31	6,82
Southern Grey-headed Sparrow	*Passer diffusus*	36,46	1,52
Southern Masked Weaver	*Ploceus velatus*	66,67	4,55
Southern Red Bishop	*Euplectes orix*	21,88	0,00
Speckled Pigeon	*Columba guinea*	56,77	5,30
Spike-heeled Lark	*Chersomanes albofasciata*	73,96	9,85
Spotted Eagle-Owl	*Bubo africanus*	20,83	0,00
Spotted Flycatcher	*Muscicapa striata*	1,56	0,00
Spotted Thick-knee	*Burhinus capensis*	31,77	3,79
Spur-winged Goose	*Plectropterus gambensis*	4,69	0,00
Tawny Eagle	*Aquila rapax*	0,52	0,00
Temminck's Courser	*Cursorius temminckii*	0,52	0,00
Three-banded Plover	*Charadrius tricollaris*	35,94	0,00
Tractrac Chat	*Emarginata tractrac*	52,60	8,33
Verreaux's Eagle	*Aquila verreauxii*	3,65	0,76
Village Indigobird	*Vidua chalybeata*	0,52	0,00
Wattled Starling	*Creatophora cinerea*	7,29	3,03
Western Barn Owl	*Tyto alba*	15,10	0,00
Western Cattle Egret	*Bubulcus ibis*	1,04	0,00
White Stork	*Ciconia ciconia*	0,00	1,52
White-backed Mousebird	*Colius colius*	45,31	2,27
White-breasted Cormorant	*Phalacrocorax lucidus*	0,52	0,00
White-necked Raven	*Corvus albicollis*	34,38	3,79
White-rumped Swift	*Apus caffer*	23,96	3,79
White-throated Canary	*Crithagra albogularis*	57,81	1,52
White-throated Swallow	*Hirundo albigularis*	19,79	0,00
Willow Warbler	*Phylloscopus trochilus*	1,04	0,00
Yellow Canary	*Crithagra flaviventris*	18,75	3,03
Yellow-bellied Eremomela	*Eremomela icteropygialis*	33,85	1,52
Yellow-billed Duck	*Anas undulata*	2,60	0,76
Yellow-billed Kite	*Milvus aegyptius*	0,52	0,00
Zitting Cisticola	*Cisticola juncidis*	1,04	0,00

APPENDIX 3: PRE-CONSTRUCTION MONITORING PROTOCOL

Pre-construction avifaunal surveys were undertaken at the Rhino PV and Sunnyside PV SEF sites during the following time envelopes:

- 21–23 August 2023 (Survey 1)
- 07–08 November 2023 (Survey 2)

Surveys were conducted according to an adapted Regime 2 site as defined in the Solar Guidelines (Jenkins *et al.* 2017) i.e., a minimum of two (2) surveys conducted over 6 months.

Monitoring at the Rhino PV and Sunnyside PV SEF sites was conducted in the following manner:

- Two (2) drive transects of 5.8 km (Rhino PV) and 6.7 km (Sunnyside PV) respectively, were identified within the Rhino PV and Sunnyside PV SEF Development Areas.
- One (1) monitor travelling slowly (± 10km/h) in a vehicle, or on foot, recorded all birds on both sides of the transects. The observer stopped at regular intervals (every 500m) to scan the environment with binoculars. Drive transects were counted four times per sampling session. All birds were recorded during the surveys.
- The following variables were recorded:
    - Species
    - Number of birds
    - Date
    - Start time and end time
    - Estimated distance from transect
    - Wind direction
    - Wind strength (estimated Beaufort scale)
    - Weather (sunny; cloudy; partly cloudy; rain; mist)
    - Temperature (cold; mild; warm; hot)
    - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground) and

Figure 1 below indicates the location of the drive transects where monitoring was conducted.

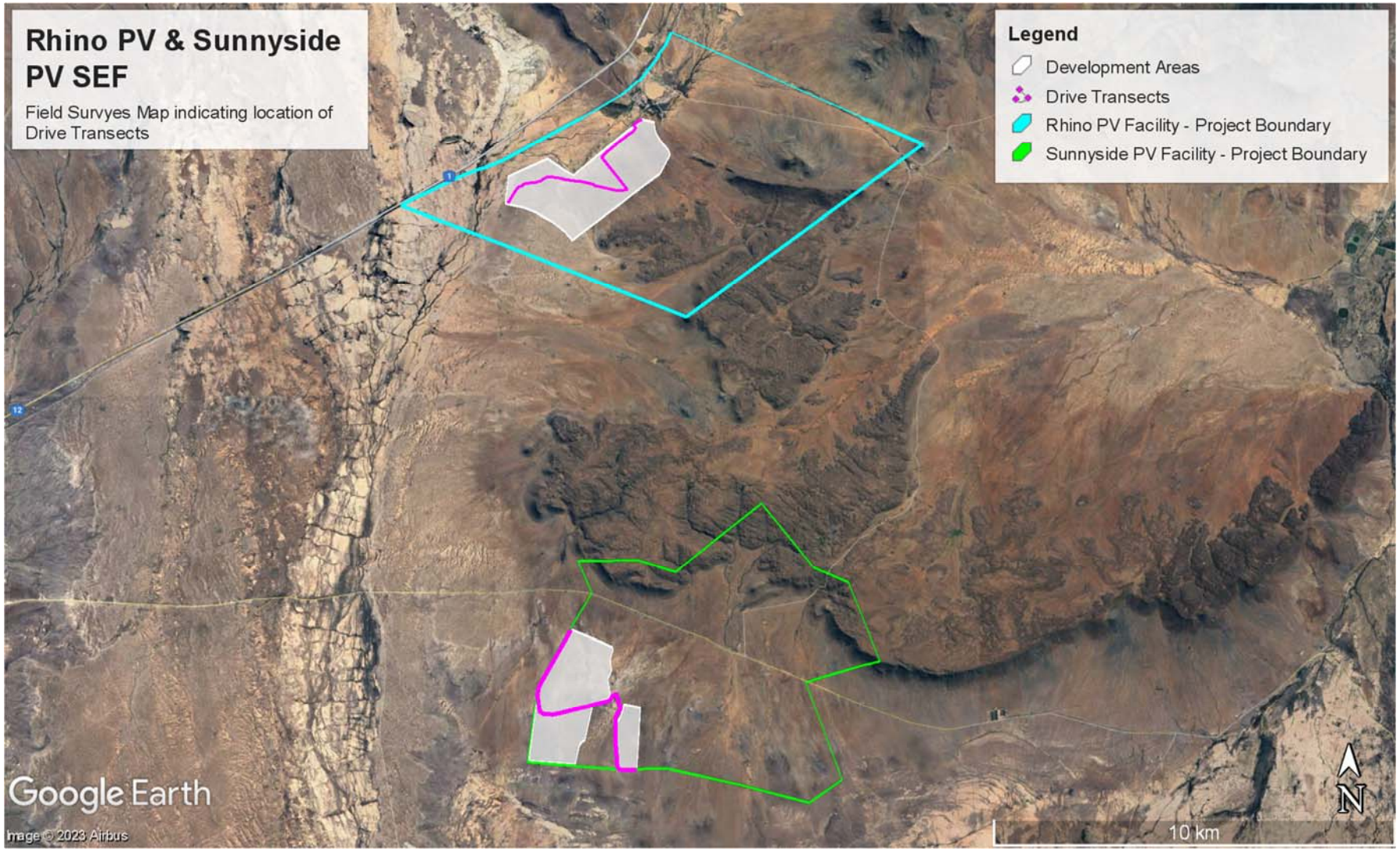

Figure 1: Location of drive transects (pink lines) where pre-construction monitoring was conducted.

APPENDIX 4: SITE SENSITIVITY VERIFICATION

INTRODUCTION

In accordance with Government Notice (GN) 320 and 1150 of 2020 enacted in terms of Section 24(5)(a) and (h) including 44 of the National Environmental Management Act, 1998 (Act 107 of 1998) as amended (NEMA), a reconnaissance visit has been undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

Site Sensitivity Verification

The following methods and sources were used to compile this report:

- The **Project Area of Impact (PAOI)** was defined as the area covered by both SEFs, i.e., the land parcels/farm portions where both the Rhino and Sunnyside Solar Energy Facilities (SEFs) are proposed to be located. These land parcels are the Remainder of Farm Rhenosterkop 155 (Rhino SEF) and Remainder of Farm 400 (Sunnyside SEF).
- Bird distribution data from the Second Southern African Bird Atlas Project (SABAP2) was obtained from the University of Cape Town (2023), to ascertain which species occur within the **Broader Area** i.e., within a block consisting of 12 pentads where the proposed SEFs and associated infrastructure will be located (**Figure 1**). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 9 km. From 2007 to date, a total of 192 full protocol checklists (i.e., surveys lasting at least two hours each) have been completed for this area. In addition, 132 *ad hoc* protocol checklists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of avifauna was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The BirdLife South Africa (BLSA) Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa by Jenkins et al. 2017 (hereafter referred to as the Solar Guidelines) were consulted to determine the level of survey effort required.
- Solar priority species were defined as follows:
    - South African Red Data species: High conservation significance.
    - South African endemics and near-endemics: High conservation significance.
    - Raptors: High conservation significance. Raptors are at the top of the food chain and play a key role in their ecosystems. When populations of birds of prey go down, then the numbers of their prey species go up, creating an imbalance in the ecosystem.
    - Waterbirds: Evidence indicate that waterbirds may be particularly susceptible to collisions with solar arrays due to the so-called lake effect, caused by the reflection of the sun of the smooth surface of solar panels.
- The global threatened status of avifauna was determined by consulting the (2022-2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation was obtained from the First Southern African Bird Atlas Project (SABAP1) (Harrison *et al.* 1997) and the National Vegetation Map (2018) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).

- Satellite imagery (Google Earth ©2023) was used in order to view the Broader Area and PAOI on a landscape level and to help identify sensitive bird habitat.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The Screening Tool was used to determine the assigned avian sensitivity of the PAOI.
- Site Sensitivity Verification site visits were undertaken from 26–29 September 2022
- The main source of information on the avifaunal diversity and abundance at the Rhino PV and Sunnyside PV SEF sites is an integrated pre-construction monitoring programme that was implemented at the proposed Rhino PV and Sunnyside PV SEF development areas during August 2023 and November 2023. Surveys were conducted according to an adapted Regime 2 protocol as defined in the Best Practice Guidelines for Avifaunal Impact Studies at Solar Developments, compiled by BirdLife South Africa (BLSA) (Jenkins *et al*. 2017); i.e., a minimum of two surveys conducted over 6 months, all necessary protocols and best practice guidelines were followed/adhered to.

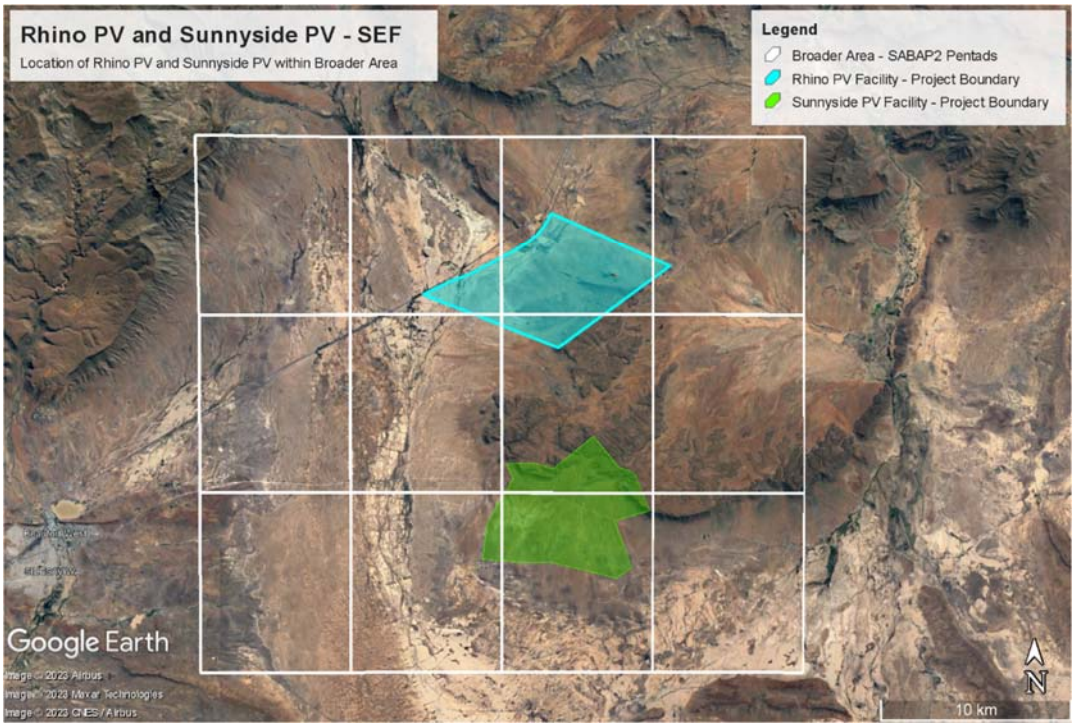

Figure 1: Location of Rhino SEF (blue) and Sunnyside SEF (green) Project Sites within the Broader Area of 12 pentads.

Outcome of Site Sensitivity Verification

The Project Area of Impact (PAOI) was defined as the area covered by both SEFs, i.e., the land parcels/farm portions where both the Rhino and Sunnyside Solar Energy Facilities (SEFs) are proposed to be located. These land parcels are the Remainder of Farm Rhenosterkop 155 (Rhino PV) and Remainder of Farm 400 (Sunnyside PV).

The habitat features and avifauna present within the PAOI (i.e., which incorporates both Rhino PV and Sunnyside PV SEF sites) are similar. From an avifaunal perspective, there is no habitat feature that distinguishes the Rhino SEF site from the Sunnyside SEF site.

The habitat and avifauna descriptions below are applicable to both Rhino SEF and Sunnyside SEF:

- **Habitat**

The landscape character of the PAOI is typical of the Great Karoo and comprises sections of plains and open valleys with dispersed drainage systems and rougher terrain including mesas (table type mountains/hills), koppies, rocky ridges, outcrops, and plateaus. The current land use in the PAOI is characterised by large agricultural holdings with mostly low-density livestock and game grazing being the main land use. Dry climatic conditions are such that agricultural activities are very limited and is restricted to valley bottoms often near or around farmsteads.

The Beaufort West area is semi-arid with extreme temperature ranges. Mean annual precipitation averages around 214mm (meteoblue.com). The least amount of rainfall occurs in July with an average of 6mm. In February, the precipitation reaches its peak, with an average of 30mm. The temperatures are highest on average in January, at around 30 °C with hot days up to 36°C. At 15 °C daytime average, July is the coldest month of the year, with the temperature dropping as low as -13° at night (meteoblue.com).

The PAOI comprises of flat plains and rugged mountains, with its centre approximately 28 km north-east of the town of Beaufort West in the Nama Karoo biome, in the Lower and Upper Karoo Bioregions (SANBI 2018). The habitat in the PAOI consists of extensive plains with low shrub and a prominent grass component (**Figure 2**), as well as rougher terrain including rock-strewn mesas (table type mountains/hills), koppies, rocky ridges, outcrops and plateaus covered with grass and low shrub (**Figure 3**). SANBI (2018) classifies the vegetation in the PAOI as Gamka Karoo on the plains, with Upper Karoo Hardeveld on the high lying ridges, koppies and mountains. Gamka Karoo consist of dwarf spiny shrubland dominated by Karoo dwarf shrubs (e.g., *Chrysocoma ciliata, Eriocephalus ericoides*) with rare low trees (e.g., *Euclea undulata*). Dense stands of drought-resistant grasses (*Stipagrostis, Aristida*) cover (especially after abundant rains) broad sandy bottomlands. Upper Karoo Hardeveld consists sparse dwarf Karoo scrub with drought-tolerant grasses of genera such as *Aristida, Eragrostis and Stipagrostis* (SANBI 2018). There are no prominent rivers or drainage lines in the PAOI.

Figure 2: Typical Nama Karoo habitat in the PAOI - A mixture of grass and shrubs on the plains in the PAOI.

SABAP1 recognises six primary vegetation divisions (biomes) within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al.* 1997). The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. Using this classification system, the natural vegetation in the PAOI is classified as Nama Karoo (Harrison *et al.* 1997).

Trees and taller woody shrubs are mostly restricted to watercourses and include *Vachellia karroo, Diospyros lycioides, Grewia robusta, Searsia lancea,* and *Tamarix usneoides* (**Figure 3**). This habitat provides suitable foraging and nesting substrate for a number of woodland associated species, as well as some of the raptors.

Figure 3: Woodland habitat along a drainage line in the PAOI.

Dams, ephemeral drainage lines and associated wetlands are sources of surface water in the PAOI and are important for most avifauna for drinking, bathing and in some instances foraging (**Figure 4**). During winter, flocks of Blue Crane roost at dams, arriving at dusk and departing before sunrise. Large raptors such as Martial Eagle, Tawny Eagle and Verreaux's Eagle use the dams and drainage lines for bathing and drinking. Boreholes with water troughs are also important as they often represent the only permanent source of water during dry periods.

Figure 3: A typical ground dam located just outside the PAOI, but there are similar dams within the PAOI.

The PAOI is largely devoid of tall trees, except for alien trees which have been planted near homesteads (**Figure 5**). Although stands of *Eucalyptus* are strictly speaking invader species, they have become important refuges for some priority species which may use them for roosting and nesting.

Figure 4: Stands of alien trees are typically found near homesteads in the PAOI.

There are several existing high voltage overhead power lines in the area (**Figure 6**). High voltage lines are an important breeding substrate for raptors in the Karoo, due to the lack of large trees (Jenkins *et al.* 2013). Both Verreaux's Eagle and Martial Eagle have been recorded breeding on high voltage lines near the PAOI.

Figure 5: High voltage lines in and near the PAOI.

The PAOI contains many mesas, koppies, rocky ridges, outcrops, and plateaus. These landscape features are important for priority species as nesting and foraging areas including Verreaux's Eagle.

Also relevant to the PAOI are agricultural areas. Cultivation is limited to a few irrigated agricultural lands within the PAOI. Arable or cultivated land represents a significant feeding area for many bird species in any landscape, but perhaps more so in arid environments. The opening up of the soil surface, and land preparation makes many insects, seeds, bulbs, and other food sources accessible to birds and other predators. The crop or pasture plants are often eaten by birds or attract insects which are also eaten by birds. Agricultural areas are of specific importance to Blue Crane and Ludwig's Bustard (Shaw 2013).

- **Avifauna**

A total of 183 species could potentially occur within the Broader Area (**Figure 1**) where the PAOI is located. Of the 183 species, 75 are classified as priority species for solar developments. Of the 75 solar priority species, 24 were recorded during the on-site surveys (SSV site visit and pre-construction monitoring survyes), and 44 solar priority species have a medium to high likelihood of occurring regularly in the PAOI.

The following Red Data priority species could regularly occur in the PAOI:

- Blue Crane *Grus paradisea* (Globally Vulnerable and Regionally Near-threatened)
- Secretarybird *Sagittarius serpentarius* (Regionally and Globally Endangered)
- Karoo Korhaan *Eupodotis vigorsii* (Regionally Near-threatened)
- Ludwig's Bustard *Neotis ludwigii* (Regionally and Globally Endangered)
- Martial Eagle *Polemaetus bellicosus* (Regionally and Globally Endangered)
- Verreaux's Eagle *Aquila verreauxii* (Regionally Vulnerable)

Screening Tool

The Project Area of Impact (PAOI) was defined as the area covered by both SEFs, i.e., the land parcels/farm portions where both the Rhino and Sunnyside Solar Energy Facilities (SEFs) are proposed to be located. These land parcels are the Remainder of Farm Rhenosterkop 155 (Rhino SEF) and Remainder of Farm 400 (Sunnyside SEF).

The habitat features and avifauna present within the PAOI (i.e., which incorporates both Rhino and Sunnyside SEF sites) are similar. From an avifaunal perspective, there is no habitat feature that distinguishes the Rhino SEF site from the Sunnyside SEF site.

The Screening Tool Outcome discussed below is applicable to both Rhino SEF and Sunnyside SEF:

According to the screening tool, the PAOI (which includes the land parcels of both Rhino PV and Sunnyside PV) and immediate environment is classified as **Medium** and **High** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme (**Figure 7**). The High classification is linked to the potential occurrence of Ludwig's Bustard (Globally and Regionally Endangered), Verreaux's Eagle (Regionally Vulnerable), Southern Black Korhaan (Globally and Regionally Vulnerable), Martial Eagle (Globally and Regionally Endangered) and Lanner Falcon (Regionally Vulnerable). The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020).

The occurrence of SCC was confirmed during the on-site surveys i.e., Martial Eagle, Verreaux's Eagle, Blue Crane (Globally Vulnerable and Regionally Near Threatened), Karoo Korhaan (Regionally Near threatened), Ludwig's Bustard and Secretarybird (Globally and Regionally Endangered) were recorded.

Based on the results of the field investigations, a classification of **High** sensitivity for avifauna is suggested for the PAOI, which consists of Rhino PV and Sunnyside PV SEF project sites.

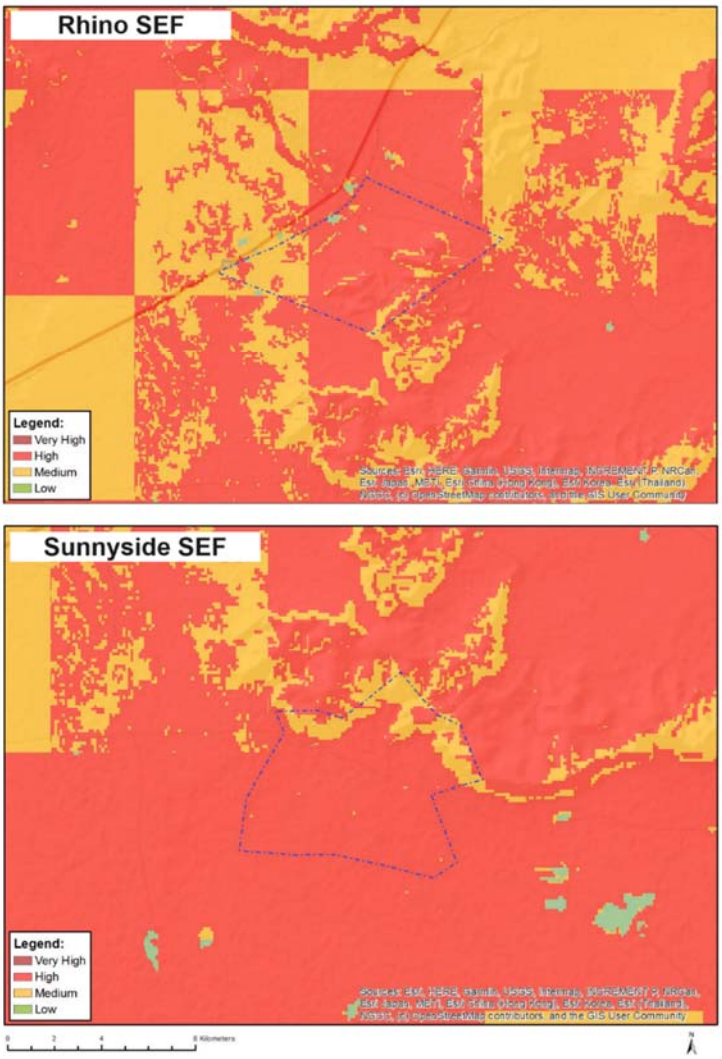

Figure 6: The National Web-Based Environmental Screening Tool map of the PAOI (Rhino and Sunnyside SEF), indicating sensitivities for the Terrestrial Animal Species Theme. The High sensitivity classification is linked to Ludwig's Bustard Neotis ludwigii, Verreaux's Eagle Aquila verreauxii, Martial Eagle Polemaetus bellicosus, Southern Black Korhaan Afrotis afra, and Lanner Falcon Falco biarmicus.

Conclusion

Based on the available evidence; SABAP2 data, the DFFE Screening Tool and the on-site surveys (conducted in August 2023), the proposed classification of **High Sensitivity** is confirmed for the whole PAOI (which consists of Rhino PV and Sunnyside PV SEF project sites).

APPENDIX 5: IMPACT RATING METHODOLOGY

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining the significance of an environmental impact on an environmental parameter is assessed through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e., site, local, national, or global), whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 1**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

The impact assessment must take account of the nature, scale, and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue, the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).
EXTENT (E)
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact has different scales and as such bracketing ranges are often required. This is often useful during the

detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).

2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.**		

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

APPENDIX 6: ENVIRONMENTAL MANAGEMENT PLAN – SEF

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: ENTRAPMENT/ENTANGLEMENT IN FENCES					
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Prevent mortality of avifauna	• A single perimeter fence should be used[2]. • Replace at least the top two barbed strands with smooth wire to reduce entanglement risks, increasing the spacing between at least the top two wires (to a minimum of 30cm), and ensuring they are correctly tensioned will also reduce the entanglement risks.	Design the Facility with a single perimeter fence.	Once-off during the planning phase.	Project Developer
AVIFAUNA: DISPLACEMENT					
Displacement of avifauna due to disturbance and habitat transformation during construction activities.	Prevent displacement of avifauna	An all-infrastructure exclusion zone should be implemented and maintained within 2.5km of the identified Martial Eagle nest and within 1km of the identified Verreaux's Eagle nests to avoid displacement due to disturbance	Design the Facility with recommended buffer zone around the nest sites.	Once-off during the planning phase.	Project Developer
		A solar panel exclusion zone buffer should be implemented and maintained around all surface water features such as dams and reservoirs (200m), as well as non-	Design the Facility with solar panel free buffer zones around surface water features.		

[2] If a fence is used consisting of an outer diamond mesh fence and inner electric fence with a separation distance of approximately 100 mm or less, it should not pose any risk of entrapment for large terrestrial species and can be considered a single fence.

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		perennial drainage lines and associated herbaceous wetlands (150m). The recommendations of the Terrestrial Ecology specialist studies must be strictly implemented, especially as far as limitations of the construction footprints are concerned.			
AVIFAUNA: MORTALITY DUE TO ELECTROCUTIONS ON THE INTERNAL 33KV NETWORK AND/OR SUBSTATION YARD					
Electrocution of priority species on the 33kV networks and substations.	Prevention of electrocution mortality	Design the facilities with underground cables as much as possible. A raptor -friendly pole design must be used, and the pole design must be approved by the avifaunal specialist. Due to the complicated design of the substation hardware, pro-active mitigation is not a practical option. Instead, the situation must be monitored, and should electrocutions of priority species be recorded, reactive mitigation could be applied in the form of insulation of live components	Design the Facility with underground cabling and where impractical, use a bird friendly pole design approved by the avifaunal specialist.	Once-off during the planning phase.	Project Developer

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: DISTURBANCE					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the ecology specialist report pertaining to the limitation of the footprint.	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. Monthly 2. Monthly 3. Monthly 4. Monthly 5. Monthly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: MORTALITY DUE TO COLLISIONS ON THE INTERNAL 33KV NETWORK					
Mortality of priority species due to collisions with the medium voltage internal reticulation networks	Prevention of power line collision mortality	Eskom approved bird flight diverters should be installed on the full span length of all 33kV overhead lines according to the applicable Eskom Engineering Instruction. These devices must be installed as soon as the conductors are strung.	Bird Flight Diverters must be installed as soon as the conductors are strung.	1. Once-off	1. Contractor and ECO

Management Plan for the Operational Phase

Impact	**Mitigation/Management Objectives and Outcomes**	**Mitigation/Management Actions**	**Monitoring**		
			Methodology	***Frequency***	***Responsibility***
AVIFAUNA : DISPLACEMENT DUE TO HABITAT TRANSFORMATION					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plants and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	1. Develop a Habitat Restoration Plan (HRP). 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. 3. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop HRP. 2. Site inspections to monitor progress of HRP. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year 3. As and when required	1. Project Developer 2. Facility Environmental Manager 3. Project Developer and Facility Operational Manager