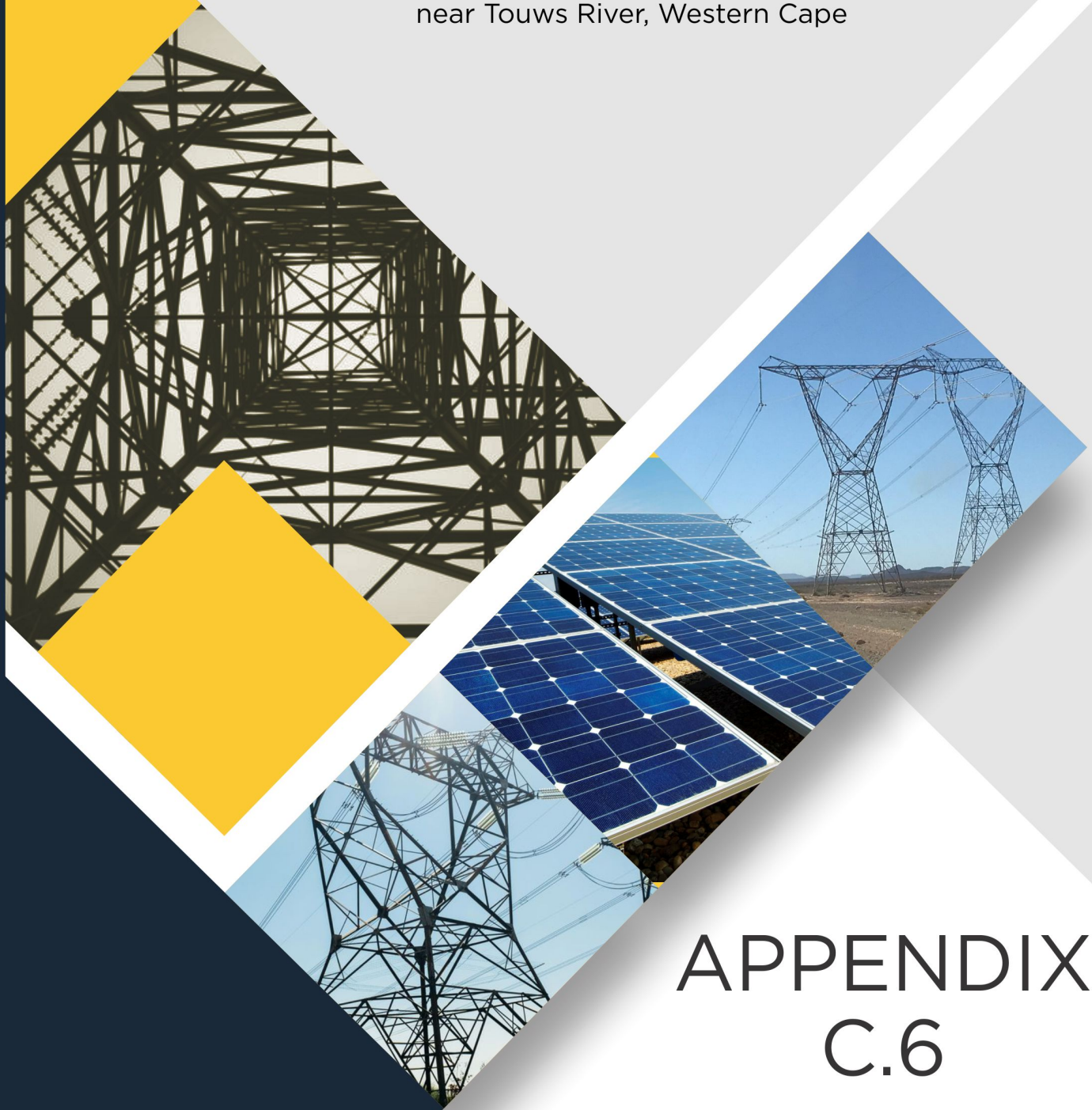
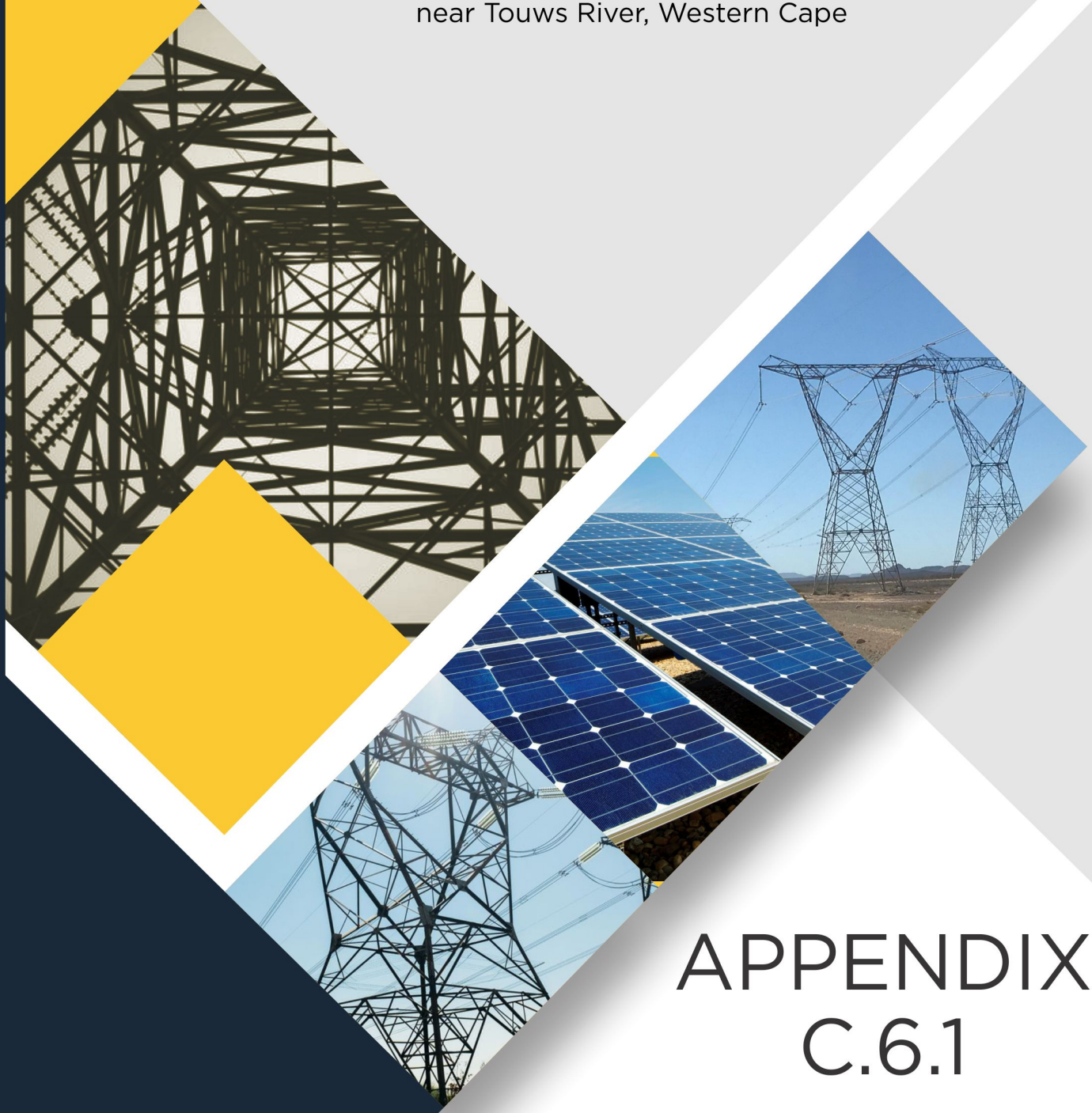
Basic Assessment for the Proposed Development of Electrical Grid Infrastructure to support the proposed nine 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape



APPENDIX C.6

Avifauna Assessment

Basic Assessment for the Proposed Development of Electrical Grid Infrastructure to support the proposed nine 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape



APPENDIX C.6.1

Avifauna Assessment for Witte Wall

AVIFAUNAL SPECIALIST ASSESSMENT

Basic Assessment for the Proposed Development of two 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure known as Witte Wall PV 1 and Witte Wall PV 2, near Touws River, Western Cape

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Report prepared for:	*Report prepared by:*
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October 2020

Executive Summary

The Project Developer, Veroniva (PTY) Ltd (hereinafter referred to as Veroniva), is proposing to design, construct and operate nine 175 MW Solar Photovoltaic (PV) power generation facilities, north-east of Ceres in the Western Cape Province. The proposed projects will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV facility will have a range of associated infrastructure, including an on-site substation and will connect to the Eskom Kappa Substation via a dedicated 132 kV power line. The facilities will be known as Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4. There are nine separate Project Applicants for the proposed projects.

This report serves as the Avifaunal Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed developments of Witte Wall PV 1 and Witte Wall PV 2, as the associated infrastructure and Electrical Grid Infrastructure.

It is estimated that a total of 100 bird species could potentially occur in the broader area. Of these, 41 species are classified as priority species, of which 17 is expected to occur regularly at the study area. The overall abundance of priority species at the study area was low, with an average of 0.83 birds/km recorded during transect counts. For all birds combined, the index of kilometric abundance (IKA) for transect counts was 8.45 birds/km, which is moderate. The low numbers are not surprising, given the general aridity of the habitat.

POTENTIAL IMPACTS

The following impacts have been identified in the Avifauna Specialist Assessment. Due to the similarity in habitat, the impacts are expected to be essentially identical for all the projects.

Construction Phase

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

Operational Phase

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections

Decommissioning Phase

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

Cumulative Impacts

- Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure
- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences

- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections
- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The table below indicates the overall impact significance for each phase before and after mitigation, as well as cumulative impacts.

Phase	**Overall Impact Significance (Pre Mitigation)**	**Overall Impact Significance (Post Mitigation)**
Construction	Moderate (3)	Low (4)
Operational	Moderate (3)	Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	Moderate (3)	Low (4)
Cumulative - Decommissioning	Moderate (3)	Low (4)

ENVIRONMENTAL SENSITIVITIES

Specialist Sensitivity Analysis and Verification

- **PV Solar**

The following environmental sensitivities (for the proposed PV facilities and associated infrastructure) were identified from an avifaunal perspective in the study area:

- **Very High sensitivity (No-Go): Surface water**

  Included are areas within 300m of water troughs, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped.

- **Very High sensitivity (No-Go): Drainage line woodland**

  Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival in this very arid climate. All major drainage lines should be classified as No-Go areas to prevent impact on the sensitive habitat.

- **Very High sensitivity (No-Go): Priority species nests**

  Nest of priority species, particularly those that occur naturally at naturally lower numbers such as raptors, should be protected by No-Go buffer zones to prevent displacement of the breeding birds due to disturbance associated with the construction activity.

- **Electricity grid infrastructure**

The following environmental sensitivities (for the proposed powerlines) were identified from an avifaunal perspective in the study area:

- **High sensitivity (Mitigation required): Surface water**

  Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Powerlines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. If a powerline has to be routed across a high sensitivity zone, mitigation in the form of Bird Flight Diverters will be required.

- **Medium sensitivity (Mitigation potentially required): Succulent Karoo**

  The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan.

MANAGEMENT ACTIONS

The following management actions have been proposed in this assessment:

Construction phase

- Activity should as far as possible be restricted to the footprint of the infrastructure.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.
- Access to the rest of the property must be restricted.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.

Operational phase

- The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.
- A 300m infrastructure-free buffer must be maintained around the water reservoirs (refer to the sensitivity map in Figure 12).
- No solar PV arrays must be constructed in drainage lines (refer to the sensitivity map).
- A single perimeter fence should be used.
- Use underground cabling for the internal reticulation network.
- The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.

De-commissioning phase

- Activity should as far as possible be restricted to the footprint of the infrastructure.
- Measures to control noise and dust should be applied according to current best practice in the industry.

- Maximum use should be made of existing access roads and the construction of new roads during the decommissioning phase should be kept to a minimum as far as practical.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.

STATEMENT AND REASONED OPINION

The expected impacts of the Witte Wall PV 1 and Witte Wall PV 2 solar PV facilities, associated infrastructure and the electrical grid infrastructure were rated to be Moderately negative pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (refer to the summary table above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the Environmental Management Programme (EMPr) (see Section 9) are strictly implemented.

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List of Abbreviations

BA	Basic Assessment
BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
DEFF	Department of Environment, Forestry and Fisheries
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
IBA	Important Bird Area
IKA	Index of Kilometric Abundance
IUCN	International Union for Conservation of Nature
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NPAES	National Protected Areas Expansion Strategy
PV	Photovoltaic
REDZs	Renewable Energy Development Zones
SABAP 1	South African Bird Atlas 1
SABAP 2	South African Bird Atlas 2
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa Protected Areas Database

Glossary

Definitions	
Study area	The area covered by the proposed application sites and the powerline corridor.
Broader area	A consolidated data set for a total of 12 pentads where the study area is located.
PV footprint	The actual development footprint containing the PV solar arrays and associated infrastructure.
Priority species	• South African Red Data species. • South African endemics and near-endemics. • Raptors • Waterbirds
Cumulative impact	Impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts.

The Project Developer, Veroniva (PTY) Ltd (hereinafter referred to as Veroniva), is proposing to design, construct and operate nine 175 MW Solar Photovoltaic (PV) power generation facilities, north-east of Ceres in the Western Cape Province. The proposed projects will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV facility will have a range of associated infrastructure, including an on-site substation and will connect to the Eskom Kappa Substation via a dedicated 132 kV power line. The facilities will be known as Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4. There are nine separate Project Applicants for the proposed projects.

The proposed PV facilities will be constructed on the following farm portions:

- Remainder of Grootfontein Farm 149;
- Portion 5 of Grootfontein Farm 149;
- Remainder of Witte Wall Farm 171; and
- Portion 1 of Hoek Doornen Farm 172.
- The power lines will traverse these aforementioned farm portions, as well as the Die Brak 241 and Platfontein 240.

This report serves as the Avifaunal Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed developments of the Witte Wall PV 1 and Witte Wall PV 2, as well as all associated infrastructure, including Electrical Grid Infrastructure.

1. Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The purpose of the report is to assess the potential impacts of the Witte Wall PV 1 and Witte Wall PV 2 facilities, as well as all associated infrastructure, including Electrical Grid Infrastructure, on avifauna, to provide a reasoned opinion on whether the projects should proceed or not from an avifaunal impact perspective, and to recommend measures for the mitigation of identified impacts, should the project proceed.

1.2 Details of Specialist

This specialist assessment has been undertaken by Chris van Rooyen and Albert Froneman of Chris van Rooyen Consulting. Chris van Rooyen works under the supervision of Albert Froneman who is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 400177/09 in the field of Zoology. Curriculum vitae are included in Appendix A of this specialist assessment.

In addition, a signed specialist statement of independence is included in Appendix B of this specialist assessment.

1.3 Terms of Reference

The terms of reference for the specialist study are as follows:

- Describe the affected environment from an avifaunal perspective.
- Map the sensitivity of the site in terms of avifaunal features such as habitat use, roosting, feeding and nesting / breeding.
- Discuss gaps in baseline data and other limitations.
- Adhere to the content requirements for specialist reports in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations 2014, as amended.
- Provide an overview of all applicable legislation.
- Provide an overview of assessment methodology used.

- Confirm the impact status, use of the land, and sensitivity of the site in comparison to the National Department of Environment, Forestry and Fisheries (DEFF) National Environmental Web-based Screening Tool (National Screening Tool) and associated protocols.
- Identify and assess the potential impacts of the proposed development on avifauna including cumulative impacts.
- Provide sufficient mitigation measures to include in the Environmental Management Programme (EMPr), as well as review of the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that need to be included.
- Conclude with an impact statement whether the PV facility is fatally flawed or may be authorised.

2. Approach and Methodology

The following approach was followed to conduct this study:

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the proposed development area is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 12 pentads where the study area is located, henceforth called the broader area. The SABAP2 data covers the period 2007 to 2020. The relevant pentads are 3250_1950, 3250_1955, 3250_2000, 3255_1950, 3255_1955, 3255_2000, 3300_1950, 3300_1955, 3300_2000, 3305_1950, 3305_1955, 3305_2000 (see Figure 1).
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map (2018) accessed via the South African National Biodiversity Institute (SANBI) Biodiversity Geographic Information System (BGIS) map viewer (SANBI 2020).
- 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, Lesotho and Swaziland (Taylor *et al*. 2015).
- The global threatened status of all priority species was determined by consulting the latest (2020.2) International Union for Conservation of Nature (IUCN) Red List of Threatened Species.
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- The SANBI BGIS map viewer was used to determine the locality of the study area relative to National Protected Areas and National Protected Areas Expansion Strategy (NPAES) focus areas.
- The DEFF National Screening Tool was used to determine the assigned avian sensitivity of the study area.
- Satellite imagery was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- A desktop investigation was conducted to source information on the impacts of solar facilities and Electrical Grid Infrastructure on avifauna.
- On-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2) according to the best practice guidelines for avifaunal impact studies for solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*. 2017). Monitoring was conducted in the following manner:
    - Eighteen walk transects were identified totalling 1km each in the study area and counted once per survey. One observer walking slowly recorded all birds on both sides of the transect. The observer stopped at regular intervals to listen to bird calls and to scan the environment with binoculars.
    - The following variables were recorded:
        - Species;
        - Number of birds;
        - Date;
        - Start time and end time;
        - Estimated distance from transect (m);
        - Wind direction;

- Wind strength (estimated Beaufort scale 1 - 7);
- 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.

- All incidental sightings of priority species were recorded.
- Three potential avifaunal focal points were also identified namely two water reservoirs and a small dam.

See Figure 1 below for the extent of the broader area.

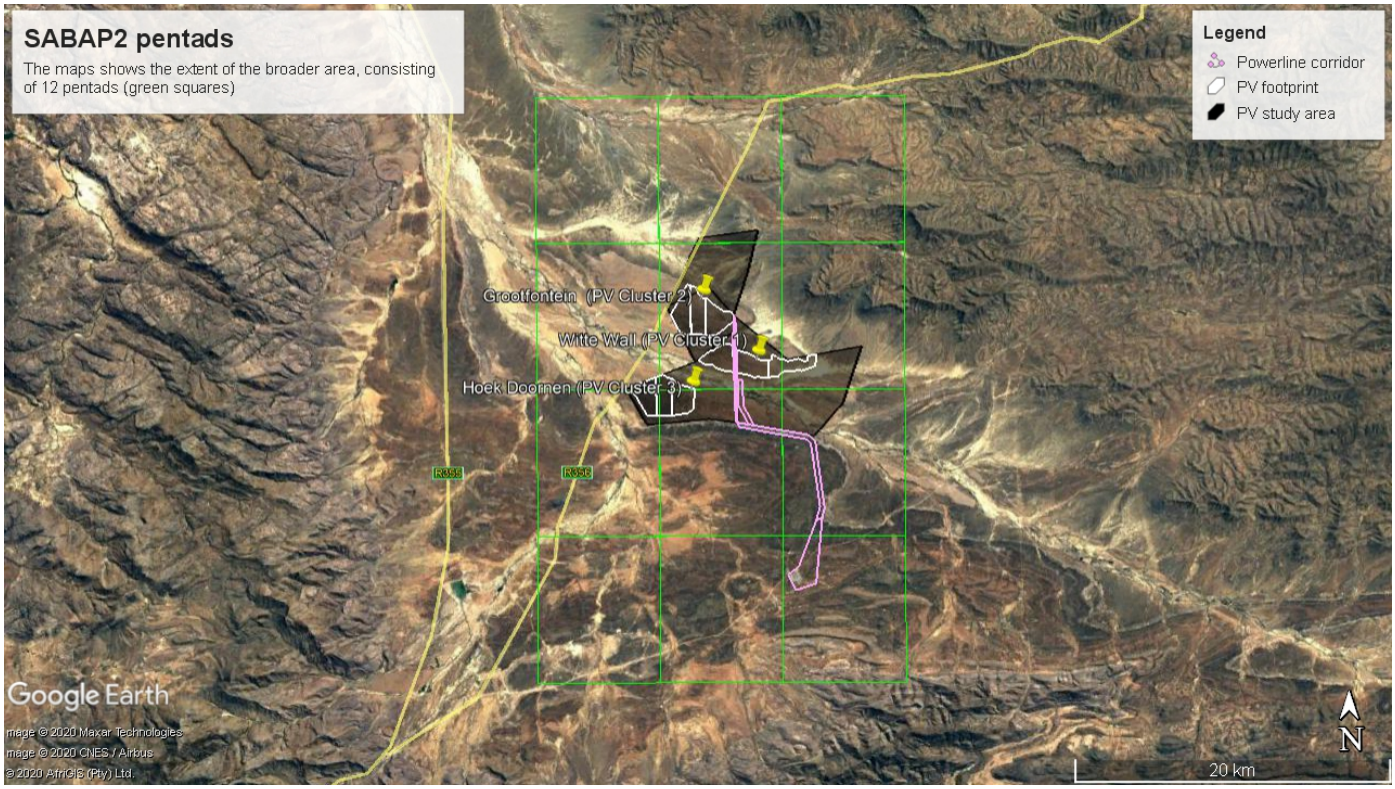

Figure 1: Area covered by the twelve SABAP 2 pentads (broader area = green squares).

See Figure 2 for the location of walk transects and focal points.

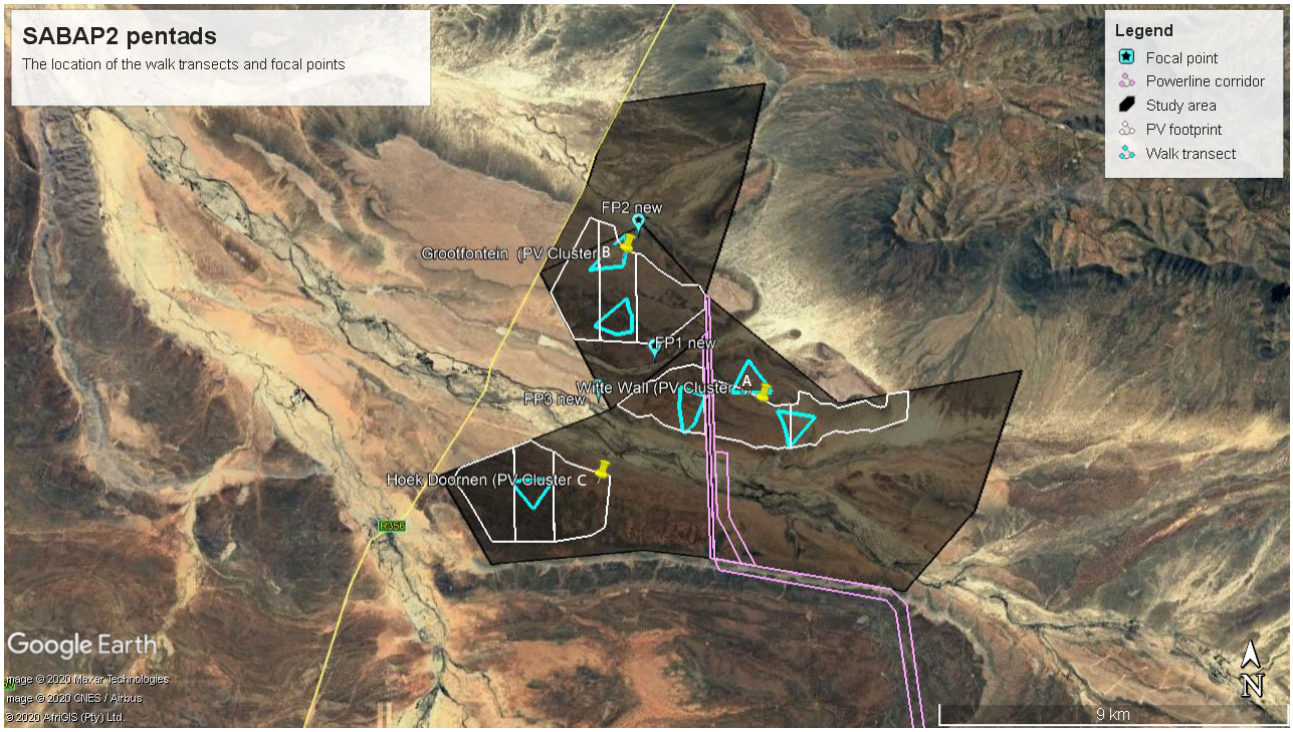

Figure 2: The location of the walk transects and focal points

2.1 Information Sources

The following data sources were used to compile this report:

Data / Information	Source	Date	Type	Description
South African Protected Areas Database (SAPAD)	Department of Environment, Forestry and Fisheries (DEFF)	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Atlas of Southern African Birds 1 (SABAP1)	University of Cape Town	1987-1991	Spatial, reference	SABAP1, which took place from 1987-1991.
South African Bird Atlas Project 2 (SABAP2)	University of Cape Town	October 2020	Spatial, database	SABAP2 is the follow-up project to the SABAP1. The second bird atlas project started on 1 July 2007 and is still growing. The project aims to map the distribution and relative abundance of birds in southern Africa.
National Vegetation Map	South African National Biodiversity Institute (SANBI) (BGIS)	2018	Spatial	The National Vegetation Map Project (VEGMAP) is a large collaborative project established to classify, map and sample the vegetation of South Africa, Lesotho and Swaziland.
Red Data Book of Birds of South Africa, Lesotho and Swaziland	BirdLife South Africa	2015	Reference	The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland is an updated and peer-reviewed conservation status assessment of the 854 bird species occurring in South Africa undertaken in collaboration between BirdLife South Africa, the Animal Demography Unit of the University of Cape Town, and the SANBI.
IUCN Red List of Threatened Species (2020.2)	IUCN	2020. 2	Online reference source	Established in 1964, the International Union for Conservation of Nature's Red List of Threatened Species is the world's most comprehensive information source on the global extinction risk status of animal, fungus and plant species.
Important Bird and Biodiversity Areas of South Africa	BirdLife South Africa	2015	Reference work	Important Bird and Biodiversity Areas (IBAs), as defined by BirdLife International, constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria.
National Protected Areas and National Protected Areas	DEFF	2016	Spatial	The goal of the NPAES is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets

Data / Information	Source	Date	Type	Description
Expansion Strategy (NPAES)				targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion.
Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa	Department of Environmental Affairs, 2015. Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa. CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.	2015	SEA	The SEA identifies areas where large scale wind and solar PV energy facilities can be developed in terms of Strategic Infrastructure Project (SIP) 8 and in a manner that limits significant negative impacts on the natural environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs).
DEFF National Screening Tool	Department of Environment and Forestry (DEFF)	2020	Online assessment tool	The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an application for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity.

2.2 Assumptions, Knowledge Gaps and Limitations

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

- A total of 70 SABAP2 full protocol lists had been completed for the broader area where the proposed project is located (i.e. bird listing surveys lasting a minimum of two hours each). In addition, 48 ad hoc protocol lists (i.e. bird listing surveys lasting less than two hours but still giving useful data) were also recorded. The SABAP2 data was therefore regarded as an adequate indicator of the avifauna which could occur at the study area, and it was further supplemented by data collected during the on-site surveys.
- The focus of the study was primarily on the potential impacts of the proposed solar PV facility and associated grid connection on priority species.
- Priority species were defined as follows:
  - South African Red Data species.
  - South African endemics and near-endemics.
  - Raptors
  - Waterbirds
- Only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser *et al.* 2018) currently exists. Some reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the 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 study area.
- Cumulative impacts include all renewable energy projects within a 30 km radius that have received an EA at the time of starting this BA (i.e. by August 2020). Cumulative impacts also included the consideration of approved (i.e. received EA at the start of this BA), existing and two proposed power line projects within the 30 km radius. The list of projects was provided by the CSIR, and it is assumed that the list is complete.
- Conclusions drawn in this study are based on experience of the specialist on the species found on site and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The broader area is defined as the area encompassed by the 12 pentads where the project is located (see Figure 1 above). The study area is defined as the area covered by the application sites and the powerline corridor. The PV footprint is the where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure.

2.3 Consultation Processes Undertaken

No specific consultative processes were undertaken during the compilation of this assessment.

3. Description of Project Aspects relevant to Avifauna

The following project components are relevant as far as avifauna is concerned:

- Solar Field, comprising Solar Arrays with a maximum height of 10 m and maximum footprint of 250 hectares.
- Building Infrastructure
  - Offices (maximum height 7 m and footprint of 1000 m^2);
  - Operational and maintenance control centre (maximum height 7 m and footprint 500 m^2);
  - Warehouse/workshop (maximum height 7 m and footprint 500 m^2);
  - Ablution facilities (maximum height 7 m and footprint 50 m^2);
  - Converter/inverter stations (height from 2.5 m to 7 m (maximum) and footprint 2500 m^2);
  - On-site substation and/or a switching substation (footprint 20 000 m^2); and
  - Guard Houses (height 3 m, footprint 40 m^2).

- Associated Infrastructure
  - 132 kV overhead power line to connect to the existing Eskom Kappa Substation with a length of 16 – 23km;
  - Internal 33 kV power lines/underground cables (either underground to maximum depth of 1.6 m or above ground with height of 9 m);
  - Battery storage for each Solar PV project. The proposed battery technology is a Lithium Ion Battery, that will cover an area of up to 8 hectares (within the laydown area) and a height of up to 5 – 10 m;
  - Access roads with width ranging between 4 - 8 m. Approximately 7 - 9 km for the Witte Wall PV 1 and Witte Wall PV 2 Projects;
  - Internal gravel roads and service road below the power line (width of 4 m);
  - Fencing (between 2 – 3 m high) around the PV Facilities - Access points will be managed and monitored by an appointed security service provider. The type of fencing will either be of palisade, mesh type or a fully electrified option;
  - Game fences will also be constructed around each PV facility on the farm Witte Wall;
  - Game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm, Hoekdoornen and Grootfontein.
  - Construction work area (i.e. laydown area of maximum 13 ha).

It must be noted that the specifications provided above apply to a single PV facility and are the same for Witte Wall PV 1 and Witte Wall PV 2, unless where specified.

4. Baseline Environmental Description

4.1 General Description

4.1.1 Important Bird Areas (IBAs)

The Cedarberg - Koue Bokkeveld Complex IBA SA101 is the closest IBA and is located approximately 16km west of the study area. The proposed development is not expected to have any impact on the avifauna in this IBA.

4.1.2 Protected Areas

The study area does not form part of a formally protected area. The closest protected area is the Inverdoorn Private Nature Reserve which is located approximately 6 - 10km away at its closest point. The proposed development is not expected to have any impact on the avifauna in this nature reserve.

4.1.3 National Protected Areas Expansion Strategy

The study area is not included in the NPAES except for a small section of the powerline corridor which falls within the Tankwa-Cederberg-Roggeveld focus area, which should not result in a significant impact for the focus area.

4.1.4 The Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa

The study area falls within the Komsberg Renewable Energy Zone (REDZ) and is classified as Low Sensitivity from a solar PV perspective.

4.1.5 Climate, topography and habitat classes

The study area is located in the Succulent Karoo biome, in the Rainshadow Valley Karoo Bioregion (Mucina & Rutherford 2006). The topography is very flat. The Tankwa Karoo is one of the most arid sections of the

Karoo. Isohyets of mean annual rainfall (mm) for the Karoo indicate that the Tankwa-Karoo National Park, which is situated approximately 50km north of the study area in the same bioregion, falls into the 0-100mm range, with 75% of the mean annual precipitation in winter (https://www.sanparks.org/).

The mean July minimum temperature is 6°C (lowest measured -1°C), and the mean January maximum temperature is 38°C (highest measured 50°C). The highest average maximum temperatures occur from November to March with the hottest months being January and February. The highest wind speeds occur from October to March (https://www.sanparks.org/). The land use in the study area is primarily game farming.

The most important anthropogenic avifaunal-relevant habitat modifications currently present in the study area which could potentially influence the avifaunal community that were recorded in or close to the study area are earth dams, boreholes with water reservoirs and troughs, fences and transmission lines.

The habitat in the study area is discussed in more detail below. The priority species associated with each habitat class are listed in Table 1.

- **Succulent Karoo**

Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (Harrison *et al.* 1997). The dominant vegetation type in the study area is Tankwa Karoo (Mucina & Rutherford 2006), which occurs on the plains where study area is located. The plains are very sparsely vegetated with low succulent shrubland, and in extreme precipitation-poor years could appear almost barren (Mucina & Rutherford 2006). The study area is intersected by several drainage lines, supporting a mosaic of succulent shrublands and clumps of *Vachellia karroo* thickets (drainage line woodland). The stunted *Vachellia karoo* trees are used by a number of species for nesting including priority species such as Pale Chanting Goshawk and various smaller shrubland/woodland species.

Images of the typical vegetation structure in the study area is shown below in Figure 3 and Figure 4.

Figure 3: An example of the dominant Succulent Karoo habitat in the study area, consisting mostly of dwarf shrubs with open ground in between.

Figure 4: An example of a drainage line with shrubs and stunted trees.

See Table 1 for a list of priority species that could utilise the Succulent Karoo habitat associated with the study area.

- **Surface water**

Surface water is of specific importance to avifauna in this semi-arid environment. The study area contains a few earth dams located in ephemeral drainage lines, but these are generally dry for most of the year. The dams and drainage lines hold water after good rains, when it is attractive to various bird species, including large raptors, to drink and bath. It also serves as an attraction to waterbirds when it contains water during the winter season, although it must be noted that the study site is generally dry for most of the year. Pools of standing water form in the drainage lines after good rains, which can last for several weeks, depending on the level of precipitation. The study area also contains boreholes with water reservoirs, where surface water becomes available in the form of water troughs, which is an important source of permanent surface water. These water troughs are a big attractant for birds, as they often are the only source of permanent surface water in the area. The wind pumps at the boreholes are also used by a number of species for nesting, including priority species such as Greater Kestrel.

See Figures 5 and 6 for examples of surface water in the study area

Figure 5: An earth dam in the study area where water is pumped. The dams are dry for most of the year. Note that this dam is located on the Farm Kareekolk (outside of the footprint for the proposed PV plants and power lines).

Figure 6: A borehole and water trough in the study area

See Table 1 for a list of priority species that could utilise the surface water in the study area.

- **Transmission lines**

Transmission lines are an important breeding substrate for raptors in the Karoo, due to the lack of large trees (Jenkins *et al.* 2006, 2013). There are no transmission lines in the PV study area itself, but the powerline corridor is crossed by the 2 Droërivier Muldersvlei – Kappa 400kV transmission line. There is a nest originally built by Martial Eagles situated approximately 3.7km from the powerline corridor at its closest point on Tower 26 of the Kappa Muldersvlei 400kV transmission line. The pair of eagles have not bred there in the 2019 and 2020 breeding season, and the nest was used in both years by a pair of Lanner Falcons (see Figure 7).

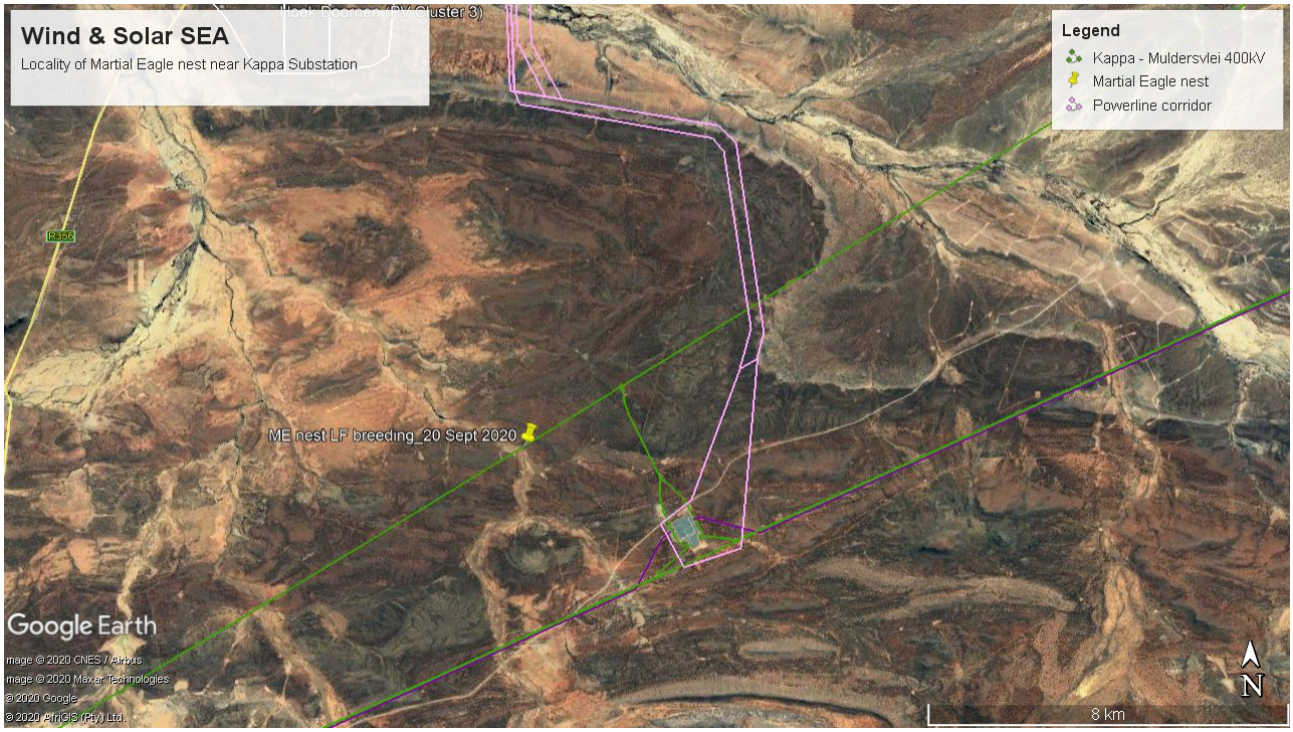

Figure 7: A pair of Lanner Falcons breeding on the Tower 26 of Kappa – Droërivier Muldersvlei 400kV transmission line. High voltage lines are represented by the green and dark purple lines.

See Table 1 for a list of priority species that could utilise the transmission lines near the study area.

- **Fences**

The study area contains a number of fences (see Figure 8 below). Farm fences provide important perching substrate for a wide range of birds in this virtually treeless environment where natural perches are scarce, as a staging post for territorial displays by small birds and also for perch hunting by raptors such as Greater Kestrel, Rock Kestrel, Jackal Buzzard and Pale Chanting Goshawk.

Table 1 lists the priority species which are associated with fences in the study area.

Figure 8: The study area contains many fences.

- **Agriculture**

The principal land-use in the study area is game farming, with the game subsisting on the natural vegetation. Crops are cultivated on a very limited scale and consist mostly of supplementary fodder, especially lucerne, which is usually located near drainage lines and irrigated through a system of boreholes. The agricultural lands attract certain priority species, e.g. Ludwig's Bustard, Spur-winged Goose, Black-headed Heron, Hadeda Ibis and Egyptian Goose.

Table 1 lists the priority species which are associated with cultivation in the study area.

4.1.6 Avifauna

- **Southern African Bird Atlas 2**

It is estimated that a total of 100 bird species could potentially occur in the broader area. Please refer to Appendix F which provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring so far. Of these, 41 species are classified as priority species, and 17 could occur regularly in the study area. The probability of a priority species occurring regularly in the study area is indicated in Table 1.

Table 1 below lists all the priority species and the possible impact on the respective species by the proposed PV facilities, power lines, and associated infrastructure.

- EN = Endangered
- VU = Vulnerable
- NT = Near threatened
- LC = least concern
- L= Low
- M = Medium
- H = High

Table 1: Priority species occurring in the broader area. The likelihood of regular occurrence in the study area is also indicated

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Drainage line woodland	Surface water	Agricultural lands	Transmission lines	Fences	PV panel collisions	Displacement - disturbance	Displacement - habitat loss	Entrapment in fences	Electrocution on 33kV OHL	Collision with the 132kV grid connection
African Spoonbill	*Platalea alba*	0.00	4.17	x					x	L				x									x
Black Harrier	*Circus maurus*	8.57	8.33	x	VU	EN	Near endemic	x		L		x					x	x	x	x		x	
Black-headed Canary	*Serinus alario*	14.29	4.17	x			Near endemic			H		x			x		x	x	x	x			
Black-headed Heron	*Ardea melanocephala*	2.86	0.00	x					x	L				x	x							x	
Booted Eagle	*Aquila pennatus*	8.57	4.17	x				x		M		x		x			x		x	x		x	
Cape Bulbul	*Pycnonotus capensis*	20.00	4.17	x			Endemic			H			x	x			x	x	x				
Cape Clapper Lark	*Mirafra apiata*	0.00	0.00	x			Endemic			L	x	x					x	x	x	x			
Cape Spurfowl	*Pternistis capensis*	2.86	0.00	x			Near endemic			L			x					x	x		x		
Cape Weaver	*Ploceus capensis*	17.14	4.17	x			Near endemic			H			x				x		x				
Egyptian Goose	*Alopochen aegyptiacus*	5.71	4.17	x					x	H	x			x	x	x		x				x	x
Fairy Flycatcher	*Stenostira scita*	17.14	0.00	x			Near endemic			H			x					x	x				
Great Crested Grebe	*Podiceps cristatus*	0.00	4.17	x					x	L				x				x					
Greater Kestrel	*Falco rupicoloides*	11.43	0.00	x				x		H	x	x				x	x	x	x	x		x	
Grey Tit	*Parus afer*	45.71	4.17	x			Near endemic			H	x	x	x					x	x	x			
Grey-winged Francolin	*Scleroptila africanus*	2.86	4.17	x			Endemic			L		x						x	x	x	x		
Hadeda Ibis	*Bostrychia hagedash*	14.29	0.00	x					x	H			x	x	x								
Jackal Buzzard	*Buteo rufofuscus*	8.57	0.00	x			Near endemic	x		M	x	x		x		x	x		x	x		x	
Karoo Eremomela	*Eremomela gregalis*	25.71	0.00	x			Near endemic			H	x	x	x					x	x	x			

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Drainage line woodland	Surface water	Agricultural lands	Transmission lines	Fences	PV panel collisions	Displacement - disturbance	Displacement - habitat loss	Entrapment in fences	Electrocution on 33kV OHL	Collision with the 132kV grid connection
Karoo Korhaan	*Eupodotis vigorsii*	14.29	0.00	x	LC	NT				H	x	x							x	x	x		x
Karoo Lark	*Calendulauda albescens*	0.00	0.00	x			Endemic			L	x	x						x	x	x			
Karoo Prinia	*Prinia maculosa*	54.29	16.67	x			Near endemic			H	x		x					x	x	x			
Lanner Falcon	*Falco biarmicus*	2.86	0.00	x	LC	VU		x		M		x	x	x	x	x	x	x	x	x		x	
Large-billed Lark	*Galerida magnirostris*	51.43	25.00	x			Near endemic			H	x	x					x	x	x	x			
Layard's Tit-babbler	*Parisoma layardi*	8.57	0.00	x			Near endemic			H			x					x	x	x			
Ludwig's Bustard	*Neotis ludwigii*	5.71	0.00	x	EN	EN				H	x	x			x				x	x	x		x
Martial Eagle	*Polemaetus bellicosus*	5.71	0.00	x	EN	EN		x		M	x	x	x	x	x	x			x	x		x	
Namaqua Warbler	*Phragmacia substriata*	14.29	4.17	x			Near endemic			H			x					x	x	x			
Pale Chanting Goshawk	*Melierax canorus*	68.57	45.83	x				x		H	x	x	x	x	x	x	x	x	x	x		x	
Pied Avocet	*Recurvirostra avosetta*	2.86	0.00	x					x	L	x			x				x					
Pied Starling	*Spreo bicolor*	8.57	0.00	x			Endemic			L	x	x	x	x			x	x	x	x			
Red-knobbed Coot	*Fulica cristata*	2.86	4.17	x					x	L				x				x					x
Rock Kestrel	*Falco rupicolus*	22.86	0.00	x				x		H		x					x		x	x		x	
Sickle-winged Chat	*Cercomela sinuata*	2.86	0.00	x			Near endemic			L	x	x	x				x	x	x	x			
South African Shelduck	*Tadorna cana*	14.29	0.00	x					x	M	x			x				x					x
Southern Black Korhaan	*Afrotis afra*	2.86	4.17	x	VU	VU	Endemic			L		x							x	x	x		x
Southern Double-collared Sunbird	*Cinnyris chalybeus*	0.00	0.00	x			Endemic			L	x		x					x	x				
Spotted Eagle-owl	*Bubo africanus*	8.57	0.00	x				x		M	x	x	x		x		x	x	x			x	
Spur-winged Goose	*Plectropterus gambensis*	2.86	0.00	x					x	L				x	x			x					x
Three-banded Plover	*Charadrius tricollaris*	17.14	12.50	x				x		L	x			x				x	x				
Verreaux's Eagle	*Aquila verreauxii*	11.43	12.50	x	LC	VU		x		L		x		x		x			x	x		x	

- **Pre-construction surveys**

As noted above, on-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2). Surveys were conducted according to a Regime 2 site (medium sensitivity) as defined in the best practice guidelines for avifaunal impact studies at solar developments, compiled by BLSA in 2017 (Jenkins *et al.* 2017).

The abundance of priority species (birds/km) recorded during the walk transects is displayed in Figure 9 below.

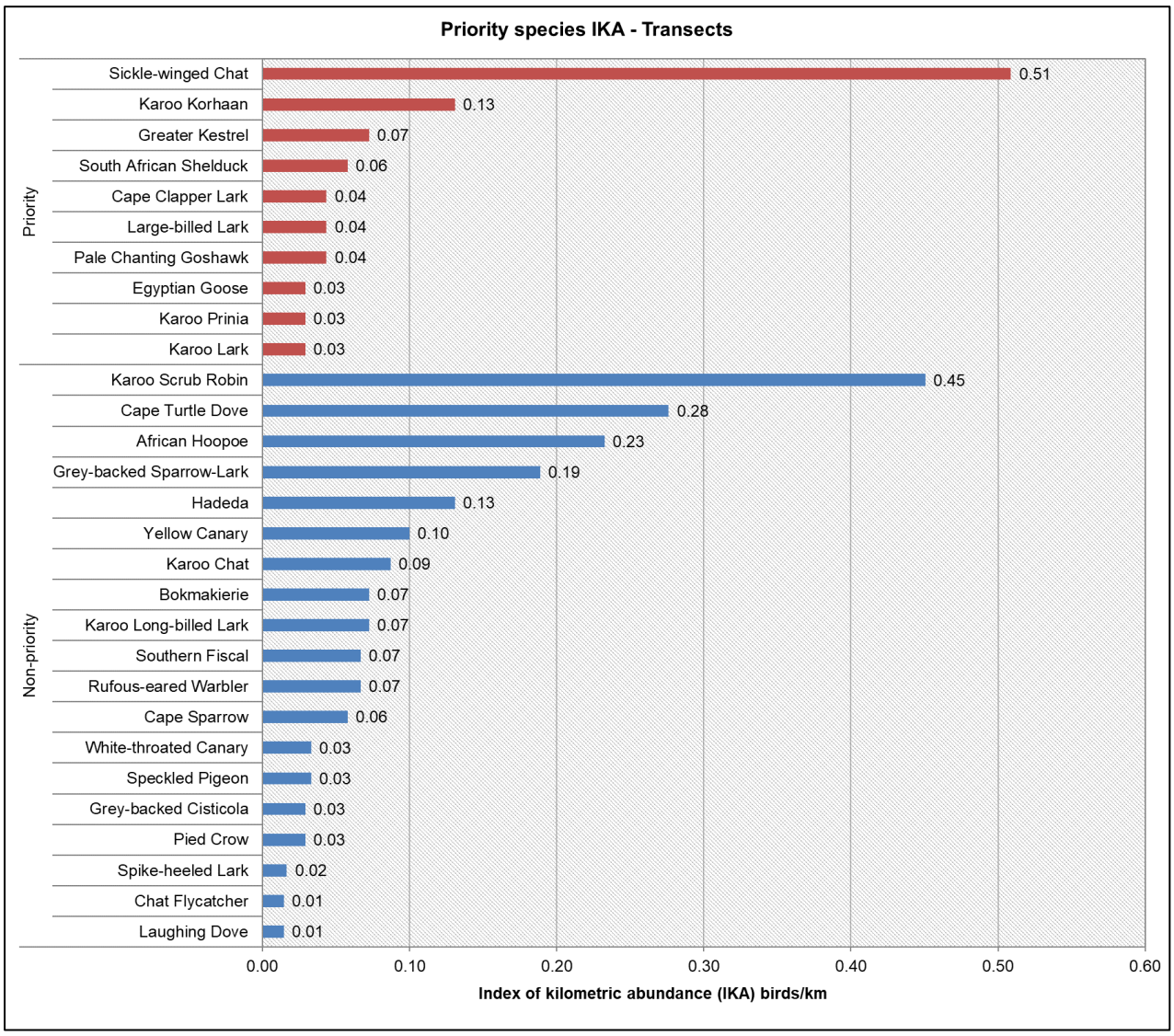

Figure 9: The abundance of priority species recorded during transect counts.

The species which were recorded at focal points are listed in Table 2 below.

Table 2: Species recorded at focal points. Priority species are shaded in red.

FP1	FP2	FP3
Karoo Chat	Karoo Korhaan	Brown-throated Martin
Speckled Pigeon	Karoo Chat	Pearl-breasted Swallow
Cape Sparrow	Cape Wagtail	Pied Avocet
Southern Fiscal	Egyptian Goose	South African Shelduck
Yellow Canary	Malachite Sunbird	Three-banded Plover
Karoo Lark	Yellow Canary	Yellow Canary
Bokmakierie	Pied Crow	
Cape Bunting	Cape Turtle Dove	
Malachite Sunbird		
Grey Tit		
Southern Double-collared Sunbird		
Lark-like Bunting		
White-throated Canary		

Table 3 lists the priority species which were recorded as incidental records.

Table 3: Priority species which were recorded as incidental records.

Species	Number
Karoo Korhaan	5
Karoo Lark	3
Ludwig's Bustard	3
Pale Chanting Goshawk	3
Pied Starling	3
Grey Heron	2
Karoo Prinia	2
South African Shelduck	2
Greater Kestrel	1
Jackal Buzzard	1
Karoo Eremomela	1
Large-billed Lark	1
Martial Eagle	1
Spotted Eagle-Owl	1

The overall abundance of priority species at the site was low, with an average of 0.83 birds/km recorded during transect counts. For all birds combined, the index of kilometric abundance (IKA) for transect counts was 8.45 birds/km, which is moderate. The low numbers are not surprising, given the general aridity of the habitat.

4.2 Project Specific Description

4.2.1 Witte Wall PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.2.2 Witte Wall PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.3. Identification of Environmental Sensitivities

4.3.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

The study area and immediate environment is classified as low sensitivity for avifauna from a PV perspective, except drainage lines (including the Groot River) and a few earth dams which are classified as high sensitivity. No reason is offered for the high classification, but surface water attracts avifauna and that could be the reason for attributing a high sensitivity rating. It should be noted that the Screening Tool did not identify any known nests or roosts.

The site investigation revealed that the study area is generally low sensitivity for avifauna from a PV perspective, with a few areas of high sensitivity namely water reservoirs (permanent surface water) and drainage lines (ephemeral water resource and drainage line woodland habitat) and one priority species nest, namely a Greater Kestrel. The earth dams are very small and basically dry for the majority of the year, therefore from a solar PV perspective, they constitute low sensitive habitat.

There is no specific powerline theme for avifauna in the DEFF Screening Tool, and the study area is classified as mostly medium sensitivity for Animal Species Theme, with small areas of low and high sensitivity. The medium sensitivity rating is linked to the presence of Ludwig's Bustard. The High and Low sensitivity ratings are not linked to avifauna.

See Appendix C for the Site Sensitivity Verification report and Figures 10 and 11 for maps of the sensitivities identified by the screening tool for PV solar (Avifauna) and powerlines (Animal Species Theme).

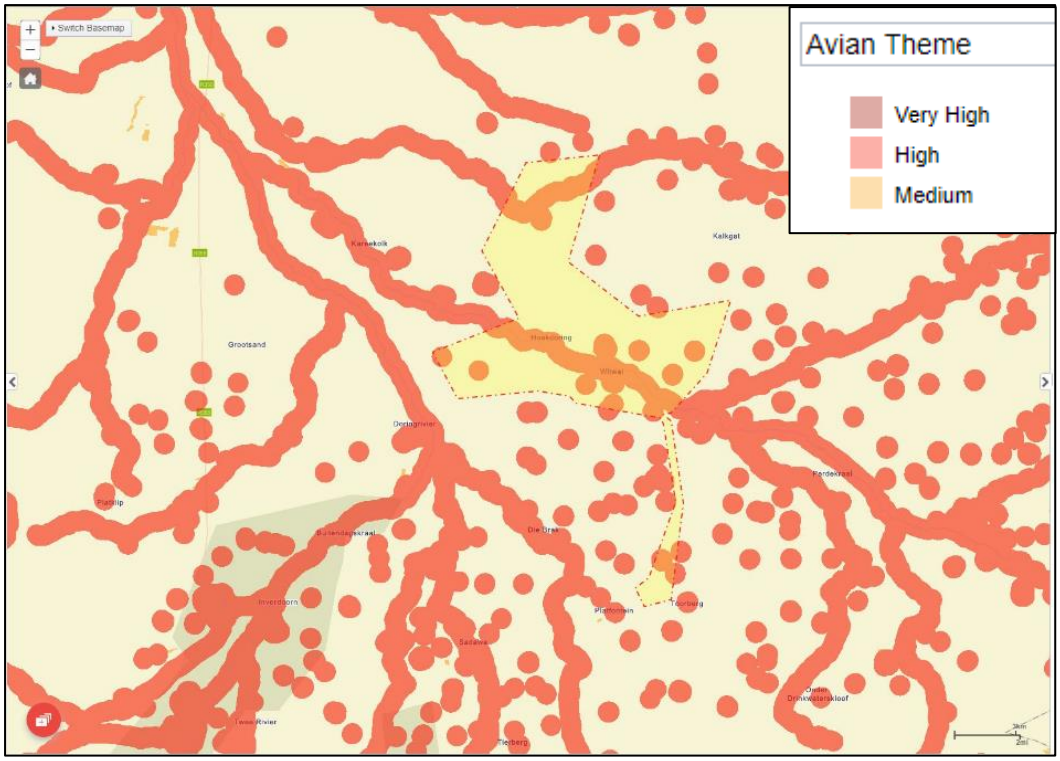

Figure 10: The National Web-Based Environmental Screening Tool map of the consolidated study area, indicating sensitivities for the solar PV avifaunal theme.

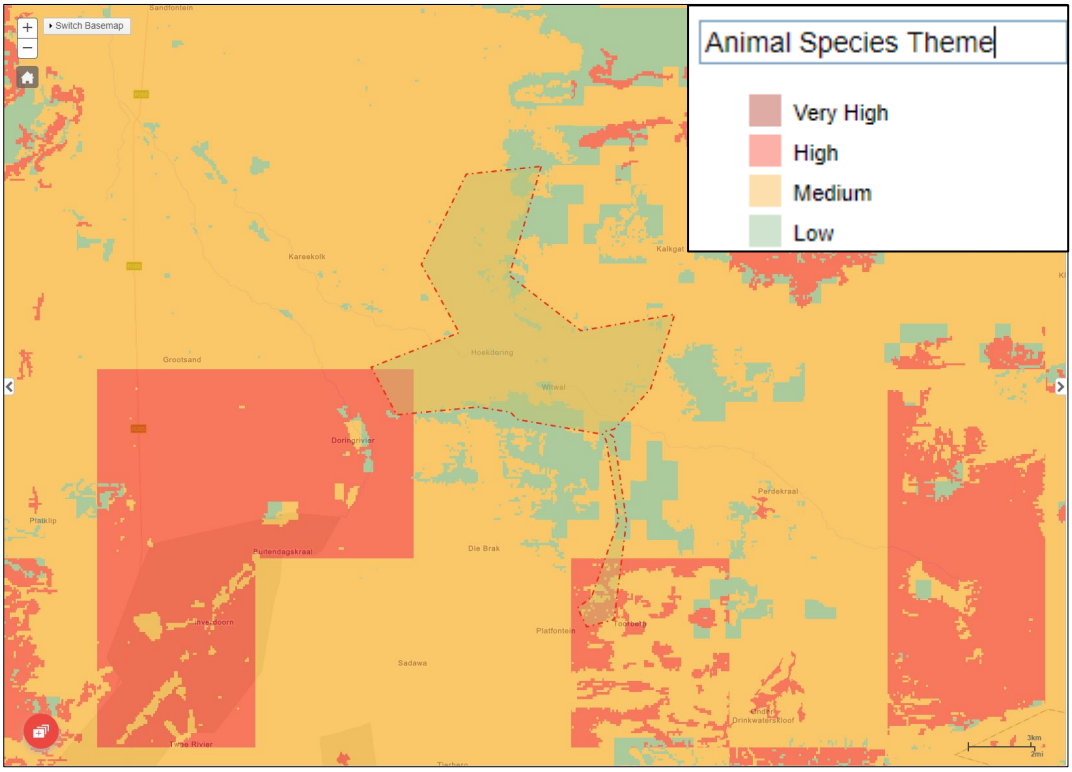

Figure 11: The National Web-Based Environmental Screening Tool map of the consolidated study area, indicating sensitivities for the powerline general animal species theme.

4.3.1.1 Witte Wall PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified largely as low sensitivity. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.1.2 Witte Wall PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified largely as low sensitivity. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.2 Specialist Sensitivity Analysis and Verification

- **PV Solar**

The following environmental sensitivities (for the proposed PV facilities and associated infrastructure) were identified from an avifaunal perspective in the study area:

- **Very High sensitivity (No-Go): Surface water**

  Included are areas within 300m of water troughs, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped.

- **Very High sensitivity (No-Go): Drainage line woodland**

  Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival in this very arid climate. All major drainage lines should be classified as No-Go areas to prevent impact on the sensitive habitat.

- **Very High sensitivity (No-Go): Priority species nests**

  Nest of priority species, particularly those that occur naturally at naturally lower numbers such as raptors, should be protected by No-Go buffer zones to prevent displacement of the breeding birds due to disturbance associated with the construction activity.

- **Electricity grid infrastructure**

The following environmental sensitivities (for the proposed powerlines) were identified from an avifaunal perspective in the study area:

- **High sensitivity (Mitigation required): Surface water**

  Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the

large pools that remain in the channel after the flow has stopped. Powerlines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. If a powerline has to be routed across a high sensitivity zone, mitigation in the form of Bird Flight Diverters will be required.

- **Medium sensitivity (Mitigation potentially required): Succulent Karoo**

The entire study area is rated medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan.

See Figures 12 and 13 for the avifaunal sensitivities identified from a PV solar and powerline perspective for the two Witte Wall PV facilities, electrical grid infrastructure and associated infrastructure.

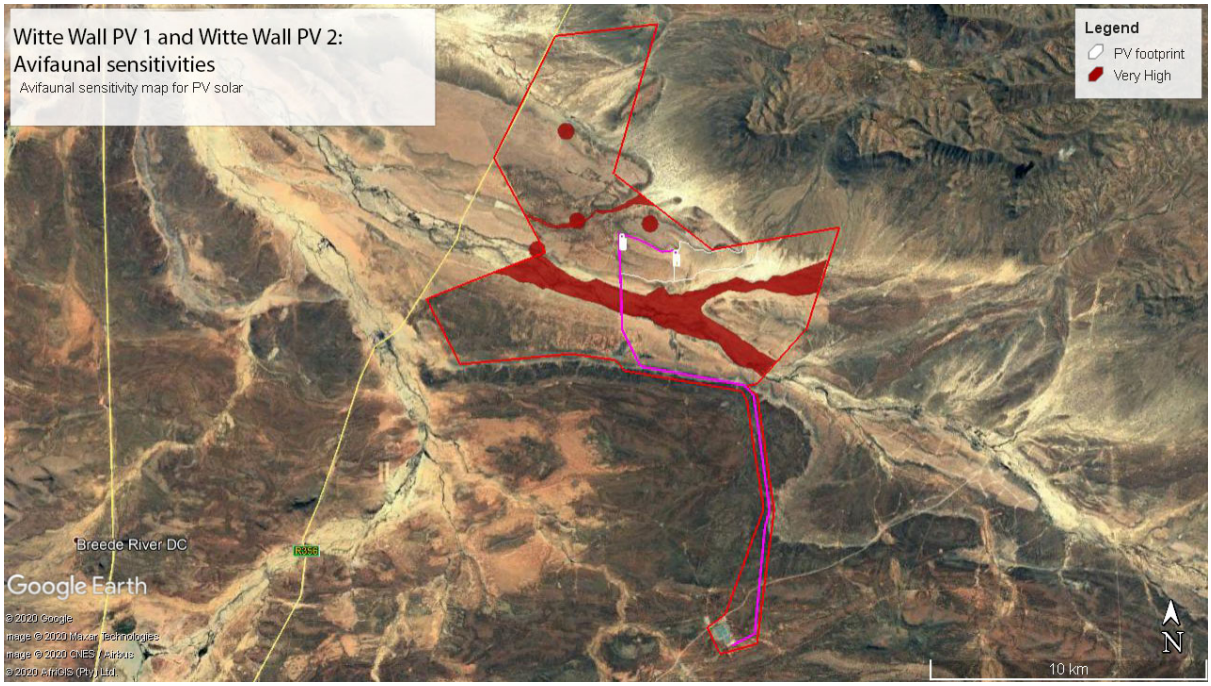

Figure 12: Avifaunal sensitivities (for the PV solar) at the two Witte Wall PV facilities and associated infrastructure.

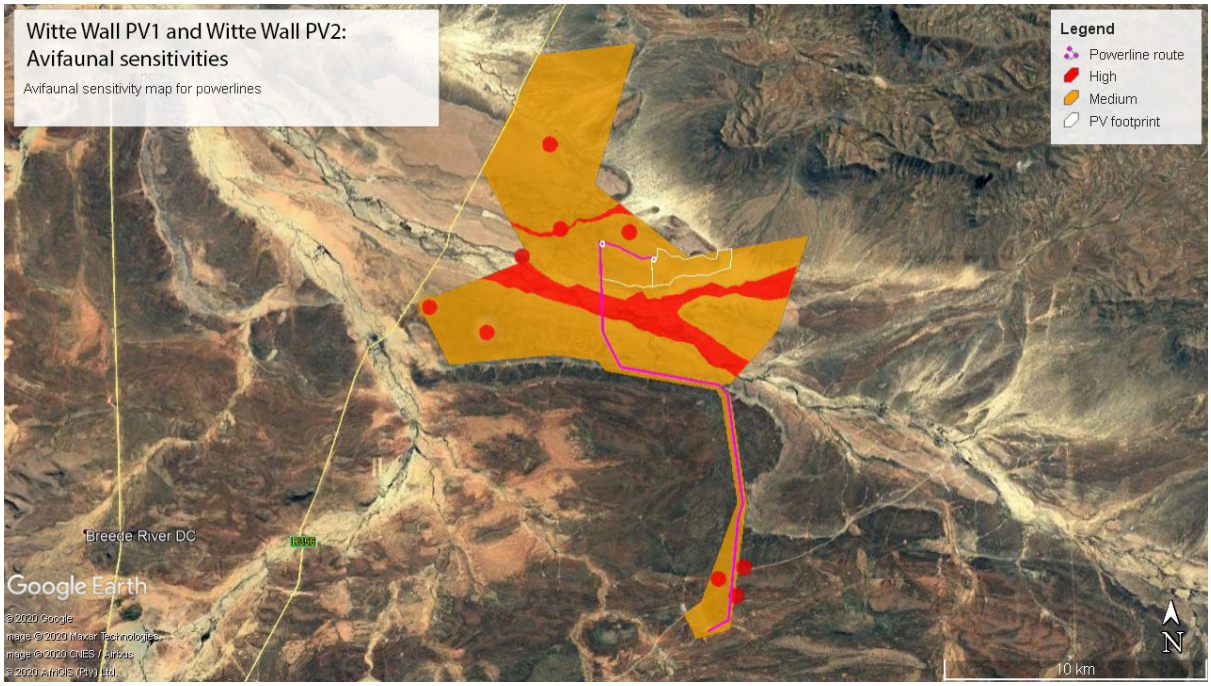

Figure 13: Avifaunal sensitivities (for the powerlines) at the two Witte Wall PV facilities and associated electrical grid infrastructure.

4.3.2.1 Witte Wall PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.2.2 Witte Wall PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.3 Sensitivity Analysis Summary Statement

- PV solar: Avifaunal theme

The site investigation revealed that the study area is generally low sensitivity with a few **very highly** sensitive areas namely water reservoirs, drainage lines and priority species nests (see Figure 12). The sensitivity ratings in the DEFF screening tool are therefore partially confirmed as far as the low sensitivity areas are concerned. However, a few very highly sensitive areas were identified which do not appear in the screening tool

- Powerline: Animal Species theme

The site investigation revealed that the sensitivity rating of medium sensitivity is accurate for avifauna, but there are also areas of high sensitivity, namely water reservoirs, drainage lines and earth dams which do not appear in the screening tool (see Figure 13).

See Appendix C for the site verification reports.

5 Issues, Risks and Impacts

5.1 Identification of Potential Impacts/Risks

The potential impacts identified in the course of the study are:

5.1.1 Construction Phase

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

5.1.2 Operational Phase

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections

5.1.3 Decommissioning Phase

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

5.1.4 Cumulative Impacts

- Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure
- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections
- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

6 Impact Assessment

6.1 Introduction

Increasingly, human-induced climate change is recognized as a fundamental driver of biological processes and patterns. Historic climate change is known to have caused shifts in the geographic ranges of many plants and animals, and future climate change is expected to result in even greater redistributions of species (National Audubon Society 2015). In 2006, the World Wide Fund for Nature (WWF) Australia produced a report on the envisaged impact of climate change on birds worldwide (Wormworth & Mallon, 2006). The report found that:

- Climate change now affects bird species' behaviour, ranges and population dynamics;
- Some bird species are already experiencing strong negative impacts from climate change; and

- In future, subject to greenhouse gas emissions levels and climatic response, climate change will put large numbers 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, loss occurs without accompanying range expansion.
- For 188 species, 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 10 developing countries required to significantly reduce their carbon emissions (Seymore *et al.* 2014), and the introduction of low-carbon technologies into the country's compliment of power generation will greatly assist with achieving this important objective (Walwyn & Brent 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri 2009; Munzhedi & Sebitosi 2009), it is clear that solar power generation should feature prominently in future efforts to convert to a more sustainable energy mix in order to combat climate change, also from an avifaunal impact perspective. However, while the expansion of solar power generation is undoubtedly a positive development for avifauna in the longer term in that it will help reduce the effect of climate change and thus habitat transformation, it must also be acknowledged that renewable energy facilities, including solar PV facilities, in themselves have some potential for negative impacts on avifauna.

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 source 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-west United States. In South Africa, only one published scientific study has been completed on the impacts of PV plants in a South African context (Visser *et al.* 2019).

6.2 Impacts associated with PV plants and associated infrastructure

6.2.1 Impact trauma (collisions)

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 photovoltaic 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.

Weekly mortality searches at 20% coverage were conducted at the 250MW, 1300ha 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 550MW, 1 600ha Desert Sunlight PV plant in California. 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 96MW 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

[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.

and 30km east of Postmasburg in the Northern Cape Province (Visser *et al.* 2019). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 hectares with the capacity to deliver 180 000 MWh 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 the 14th of September 2015 until the 6th of December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per hectare 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/yr (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 solar energy facilities across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser *et al.* 2019).

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 facility 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, and possibly raptors which prey on them.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.2 Entrapment in perimeter fences

Visser *et al.* (2019) recorded a fence-line fatality (Orange River Francolin *Scleroptila gutturalis*) resulting from the bird being trapped between the inner and outer perimeter fence of the facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (e.g. Red-crested Korhaan *Lophotis ruficrista*) (Visser *et al.* 2019). 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.

It is not foreseen that entrapment in perimeter fences will be a significant impact. The priority species which could potentially be affected by this impact are most likely medium to large terrestrial species.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.3 Displacement due to disturbance and habitat transformation associated with the construction and operation of the solar PV facilities

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 solar energy facilities, 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).

Solar energy facilities 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 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 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 vs 46), supporting the view that solar development is 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.* (2019) gathered bird transect data at the 180 hectares, 96MW 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*. (2019) 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 specialists species 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 Witte Wall PV 1 and Witte Wall PV 2 projects, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities.

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 Witte Wall PV 1 and Witte Wall PV 2 facilities. In addition, raptors and large terrestrial species could also be impacted.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.4 Electrocutions

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, on the internal 33kV powerlines within the footprint of the PV facilities, should the decision be to not go underground with the reticulation network. This is especially a major problem for the larger Red Listed species, e.g. Martial Eagle, as it is envisaged that they will frequently perch on the power poles.

See Table 1 for list of species which could potentially be affected by this impact.

6.3 Impacts associated with electricity grid infrastructure

Negative impacts on birds by electricity infrastructure generally take two principal forms, namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins *et al.* 2010). In this instance, the major potential impact with the 132kV grid connections is powerline collisions.

6.3.1 Collisions with the 132kV grid connections

Collisions are probably the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004; Shaw 2013). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. 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 power lines (van Rooyen 2004; Shaw 2013).

In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with power lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini *et al*. 2005, Jenkins *et al*. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the low-resolution and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin *et al*. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown *et al.* 1987, Henderson *et al.* 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown *et al*. 1987, APLIC 1994).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins *et al.* 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown *et al.* 1987, Faanes 1987, Bevanger 1994)."

As mentioned by Shaw (2013) in the extract above, several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is essential to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin *&* Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes and White Storks. In all species

the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35° respectively are sufficient to render the birds blind in the direction of travel; in storks head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (*Accipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes and are also known to be vulnerable to power line collisions.

Thus visual field topographies which have evolved primarily to meet visual challenges associated with foraging may render certain bird species particularly vulnerable to collisions with human artefacts, such as power lines and wind turbines that extend into the otherwise open airspace above their preferred habitats. For these species placing devices upon power lines to render them more visible may have limited success since no matter what the device the birds may not see them. It may be that in certain situations it may be necessary to distract birds away from the obstacles, or encourage them to land nearby (for example by the use of decoy models of conspecifics, or the provision of sites attractive for roosting) since increased marking of the obstacle cannot be guaranteed to render it visible if the visual field configuration prevents it being detected. Perhaps most importantly, the results indicate that collision mitigation may need to vary substantially for different collision prone species, taking account of species specific behaviours, habitat and foraging preferences, since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all (Martin & Shaw 2010).

Despite evidence that line marking might be ineffective for some species due to differences in visual fields and behaviour, or have only a small reduction in mortality in certain situations for certain species, particularly bustards (Martin & Shaw 2010; Barrientos *et al.* 2012; Shaw 2013), it is generally accepted that marking a line with PVC spiral type Bird Flight Diverters can reduce the collision mortality rates (Sporer *et al.* 2013; Barrientos *et al.* 2012, Alonso & Alonso 1999; Koops & De Jong 1982). Regardless of statistical significance, a slight mortality reduction may be very biologically relevant in areas, species or populations of high conservation concern (e.g. Ludwig's Bustard) (Barrientos *et al.* 2012). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. A study reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease in bird collisions. At unmarked lines, there were 0.21 deaths/1000 birds (n = 339,830) that flew among lines or over lines. At marked lines, the mortality rate was 78% lower (n = 1,060,746) (Barrientos *et al.* 2011). Koops and De Jong (1982) found that the spacing of the Bird Flight Diverters were critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5 metres, whereas using the same devices at 10 metre intervals only reduces the mortality by 57%. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important, as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (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).

Quantifying the collision impact in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from incidental record keeping by the EWT, it is possible to give a measure of what species are susceptible to powerline collisions (see Figure 14). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

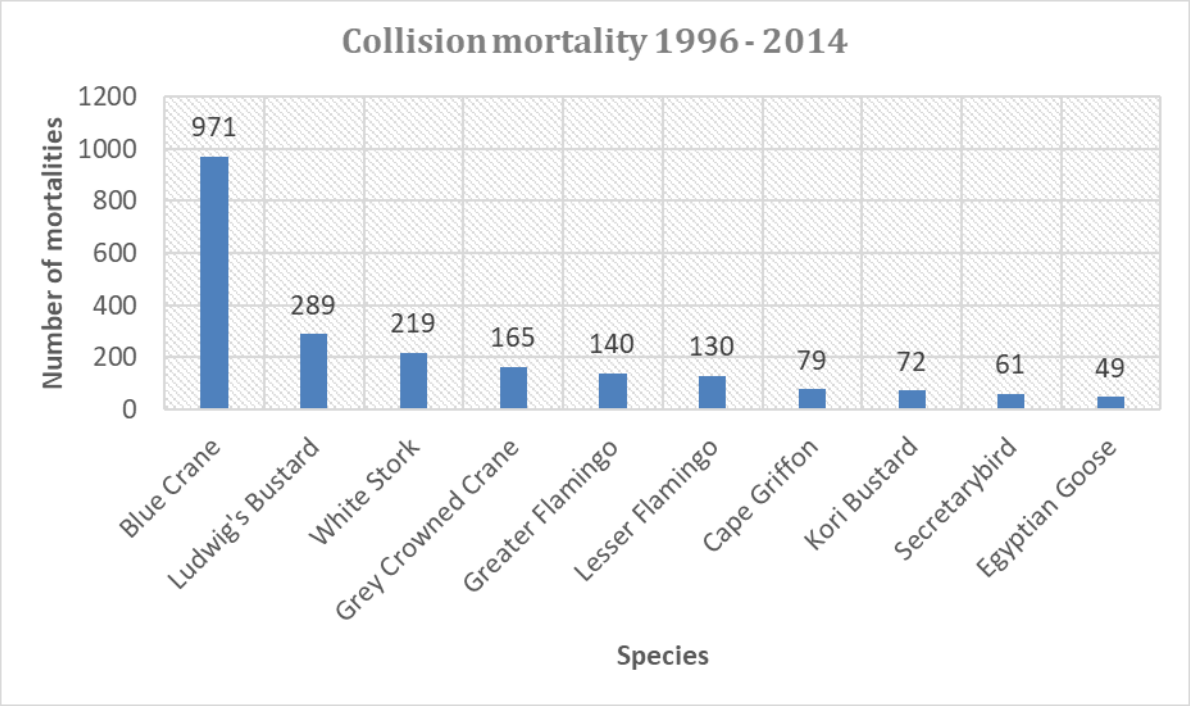

Figure 14: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data 2014).

Species potentially at risk of collisions with the 132kV grid connection are listed in Table 1.

6.4 Cumulative impacts

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy developments that have received an Environmental Authorisation within at least a 30km radius of the proposed site, as well as the nine proposed Veroniva Ceres PV developments and associated grid connections (i.e. total of nine power lines). There are currently 11 renewable energy projects authorised within a 30km radius around the proposed nine Veroniva Ceres PV projects. Of these, only two are solar PV projects, and one is a hybrid wind and solar PV project. The locality of renewable projects (land parcels) which are authorised are displayed in Figure 15 and listed in Appendix G.

The total affected land parcel area taken up by authorised renewable energy projects and their grid connections within the 30km radius is approximately 44 578 ha. The total affected land parcel area of the nine Veroniva Ceres PV projects and grid connections comprises approximately 18 232ha. If one assumes that all nine Veroniva projects will be authorised, the combined land parcel area affected by renewable energy developments within the 30km radius around the Veroniva projects will equal 62 810 ha. The total area within the 30km radius around the proposed projects equates to about 502 776ha of similar habitat. The total combined size of the land parcels affected by renewable energy projects and their grid connections will thus equate to 12.4% of the available habitat in the 30km radius. However, the actual physical footprint of the renewable energy facilities will be much smaller than the land parcel areas themselves, for example in the case of wind energy, the physical footprint comprises less than 5% of the project area. Furthermore, each of these projects must still be subject to a competitive bidding process where only the most competitive projects will win a power purchase agreement required for the project to proceed to construction. The cumulative impact of the Witte Wall PV 1 and Witte Wall PV 2 solar PV projects is thus anticipated to be **low** after mitigation.

The proposed grid connections of the 9 Veroniva Ceres PV projects equates to about 184km. However, approximately 135km of line will be routed parallel in one “highway”, which means that as far as bird collision impacts are concerned, the additional length of powerline effectively equates to about 64km. There are approximately 221km of existing and 83km (total = 304km) of planned transmission lines within the 30km radius around the Veroniva Ceres PV projects. These projects will thus increase the total number of planned and existing high voltage lines by 21%. The cumulative impact of the planned grid connections is therefore considered to be **moderate** from a potential bird collision perspective after mitigation.

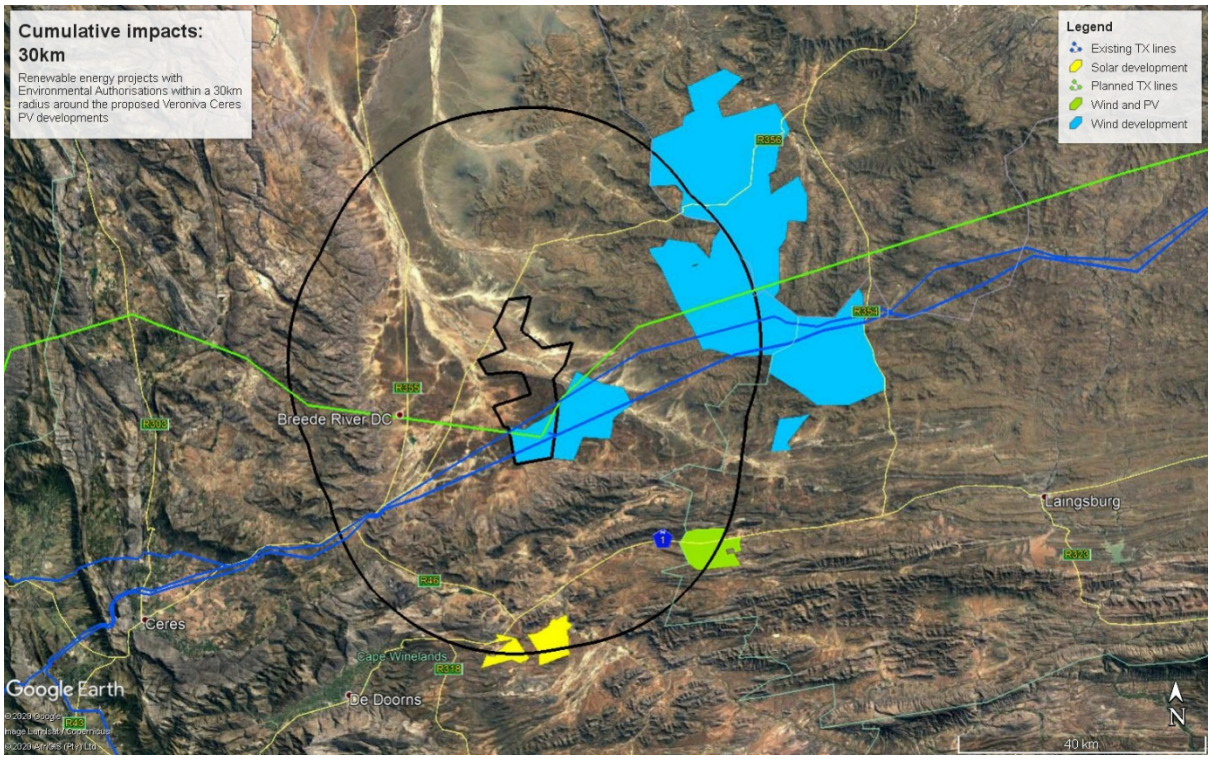

Figure 15: Map showing location of land parcels with authorised renewable energy projects within a 30km radius around the study area. This map also shows proposed and existing power lines within the 30km radius.

6.5 No-go option

The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained, which will be to the advantage of the avifauna. No fatal flaws were discovered in the course of the investigations.

6.6. Witte Wall PV 1 and Witte Wall PV 2 – PV Facilities, Electrical Grid Infrastructure and Associated Infrastructure[2]

This section includes a description of the assessment of the potential impacts identified for avifauna for the proposed Witte Wall PV 1, Witte Wall PV 2 and all associated infrastructure, including the power lines. No indirect impacts have been identified for the proposed project from an avifaunal perspective.

6.6.1. Potential Impacts during the Construction Phase

The following impacts have been identified for the construction phase.

6.6.1.1. Impact 1: Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure

The noise and movement associated with the construction activities at the proposed PV footprints for Witte Wall PV 1 and Witte Wall PV 2 will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site-specific spatial extent and a short term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.1.2 below.

[2] Due to the similarity in habitat, the impacts are expected to be essentially identical for all the projects

6.6.1.2. **Impact Summary Tables: Construction Phase**

The rating of the impacts identified for the construction phase is discussed in this section.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Impact 1: Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility* *Irreplaceability*	*Negative* *Site specific* *Short term* *Substantial* *Very likely* *High* *Low*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.* ▪ *Access to the rest of the property must be restricted.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.*	*Low (4)*	*High*

6.6.2. Potential Impacts during the Operational Phase

The following impacts have been identified for the operational phase.

6.6.2.1. **Impact 1**: Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.

This impact relates to the total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure. This impact is rated as negative, with a site-specific spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and very likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.2.6 below.

6.6.2.2. **Impact 2:** Mortality through collisions with the solar panels.

This impact relates to the bird kills and injury as a result of potential collisions with the solar panels. This impact is rated as negative, with a site-specific spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a slight consequence and unlikely probability, which will render the impact significance as very low. As detailed in Section 6.6.2.6 below, no mitigation is required due to the very low impact significance.

6.6.2.3. **Impact 3:** Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.

This impact pertains to the entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality. This impact is rated as negative, with a site-specific spatial extent and a long term duration due to the long timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is rated with a moderate consequence and likely probability, which will result in a low impact significance, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to very low. The recommended mitigation measure includes using a single perimeter fence around the PV Facility.

6.6.2.4. **Impact 4:** Electrocution of priority species on the internal 33kV powerlines.

This impact deals with the potential electrocution of priority species on the internal 33kV powerlines at the Witte Wall PV 1 and Witte Wall PV 2 facilities. This impact is rated as negative, with a local spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will result in an impact significance of high, without the implementation of mitigation measures. With the implementation of mitigation measures (i.e. use underground cabling), the significance of the impact is reduced to very low.

6.6.2.5. **Impact 5:** Collisions with the 132kV grid connections

This impact deals with potential collisions with the 132kV grid connections. This impact is rated as negative, with a local spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.2.6 below.

6.6.2.6. **Impact Summary Tables: Operational Phase**

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.	*Status*	*Negative*	*High (2)*	▪ *The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.* ▪ *A 300m infrastructure-free buffer must be maintained around the water reservoirs (see sensitivity map Figure 12).* ▪ *No solar PV arrays must be constructed in drainage lines (see sensitivity map Figure 12).*	*Moderate (3)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Mortality through collisions with the solar panels.	*Status*	*Negative*	*Very low (5)*	*No mitigation is required due to the very low significance*	*Very low (5)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Slight*				
	Probability	*Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	*Status*	*Negative*	*Low (4)*	*A single perimeter fence should be used.*	*Very low (5)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Electrocution of priority species on the internal 33kV powerlines.	*Status*	*Negative*	*High (2)*	*Use underground cabling*	*Very Low (5)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Collision mortality of priority species due to the 132kV grid connections.	*Status*	*Negative*	*High (2)*	*The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.*	*Moderate (3)*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.3. Potential Impacts during the Decommissioning Phase

The following impacts have been identified for the decommissioning phase.

6.6.3.1. **Impact 1:** Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure.

The noise and movement associated with the potential decommissioning activities will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.3.2 below.

6.6.3.2. **Impact Summary Tables: Decommissioning Phase**

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the study area will be a source of disturbance which would lead to the displacement of avifauna from the area.	*Status*	*Negative*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned*	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.4. Cumulative Impacts

The following cumulative impacts have been identified.

6.6.4.1. **Impact 1: Construction Phase -** Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure

The noise and movement associated with the construction activities of similar projects within the 30 km radius will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site-specific spatial extent and a short-term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.5 below.

6.6.4.2. **Impact 2**: **Operational Phase** - Habitat transformation, collisions with the solar panels, entrapment in fences and electrocution on internal reticulation lines

This impact deals with the following during the operational phase with regards to other similar projects in the 30 km radius:

- Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure;
- Bird mortality and injury as a result of collisions with the solar panels;
- Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality;
- Electrocution of priority species on the internal 33kV powerlines

This impact is rated as negative, with a regional spatial extent and a long-term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.5 below.

6.6.4.3. **Impact 3: Operational Phase -** Collisions with the 132kV grid connections

This impact deals with potential collisions with the 132kV grid connections during the operational phase with regards to other similar projects in the 30 km radius. This impact is rated as negative, with a local spatial extent and a long-term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.4.5 below.

6.6.4.4. **Impact 4: Decommissioning Phase -** Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The noise and movement associated with the potential decommissioning activities (in terms of other similar projects in the 30 km radius) will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site-specific spatial extent and a short-term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.5 below.

6.6.4.5. **Impact Summary Tables: Cumulative Impacts**

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility* *Irreplaceability*	*Negative* *Site specific* *Short term* *Substantial* *Very likely* *High* *Low*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.* ▪ *Access to the rest of the property must be restricted.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.*	*Low (4)*	*High*
OPERATIONAL PHASE						
Habitat transformation, collisions with the solar panels, entrapment in fences, and electrocution on internal reticulation lines	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility* *Irreplaceability*	*Negative* *Regional* *Long term* *Substantial* *Likely* *High* *Low*	*Moderate (3)*	▪ *The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.* ▪ *Infrastructure-free buffers must be maintained around the water reservoirs*	*Low (4)*	*Medium*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
				▪ No solar PV arrays must be constructed in drainage lines ▪ A single perimeter fence should be used. ▪ Use underground cabling		
Collisions with the 132kV grid connection	Status	Negative	High (2)	▪ The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.	Moderate (3)	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Severe				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	Low				
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the study area will be a source of disturbance which would lead to the	Probability	Negative	Moderate (3)	▪ Activity should as far as possible be restricted to the footprint of the infrastructure. ▪ Measures to control noise and dust should be applied according to current best practice in the industry.	Low (4)	Medium
	Reversibility	Site specific				
	Irreplaceability	Short term				
	Consequence	Substantial				
	Probability	Very likely				
	Reversibility	High				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
displacement of avifauna from the area	*Irreplaceability*	*Low*		▪ *Maximum use should be made of existing access roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned*		

7 Impact Assessment Summary

The overall impact significance is provided in this section, in terms of pre- and post-mitigation.

Table 4: Overall Impact Significance (Pre- and Post Mitigation)

Phase	Overall Impact Significance (Pre-Mitigation)	Overall Impact Significance (Post Mitigation)
Construction	Moderate (3)	Low (4)
Operational	Moderate (3)	Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	Moderate (3)	Low (4)
Cumulative - Decommissioning	Moderate (3)	Low (4)

8 Legislative and Permit Requirements

8.1 Legislative Framework

There is no legislation pertaining specifically to the impact of solar facilities and associated electrical grid infrastructure on avifauna. There are best practice guidelines available which were compiled under the auspices of BLSA i.e. Jenkins, A.R., Ralston-Patton, Smit- Robinson, A.H. 2017. *Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa*. This guideline has been considered in this assessment.

8.1.1 Agreements and conventions

International agreements and conventions are described in this section.

Table 5: International agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of 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 Convention on Biological Diversity (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; and • The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global

Convention name	Description	Geographic scope
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 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

8.1.2 National legislation

8.1.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

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

8.1.2.2 The National Environmental Management Act (Act 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 a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) 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 (via the promulgation of the EIA Regulations (2014, as amended), which may significantly affect the environment, may be performed only after an EIA or BA has been undertaken and environmental authorisation has been

obtained from the relevant competent 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.

8.1.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 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 (Act 10 of 2004, as amended) read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they 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. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals (as noted in Table 5 above). The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

8.1.2.4 Provincial legislation

8.1.2.4.1 Western Cape Nature Conservation Laws Amendment Act, 2000

This statute provides for the amendment of various laws on nature conservation in order 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.

9 Environmental Management Programme Inputs

Please see a description of the key mitigation and monitoring recommendations for each applicable mitigation measure identified for all phases of the project below.

9.1 Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Entrapment					
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Prevent mortality of avifauna	1. A single perimeter fence should be used[3].	Design the facility with a single perimeter fence.	Once-off during the planning phase.	Project Developer
Avifauna: Displacement					
Displacement of avifauna due to habitat loss in the development footprint.	Prevent displacement of avifauna	1. A 300m infrastructure-free buffer must be maintained at waterpoints in terms of the sensitivities determined for the power lines. 2. No solar panels to be constructed in drainage lines	Design the facility with 300m buffers around boreholes and with no solar panels in drainage lines.	Once-off during the planning phase.	Project Developer
Avifauna: Electrocution					
Electrocution of raptors on the internal 33kV poles	Prevent electrocutions	1. Use underground cabling	Design the facility with underground cabling	Once-off during the planning phase.	Project Developer

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

9.2. 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 botanical 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. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO
Avifauna: Mortality due to collisions with the 132kV grid connection					
Bird collisions with the earthwire of the proposed 132kV grid connection.	Prevention of collision mortality on the powerline.	Pro-active marking of identified high risk spans with Bird Flight Diverters (BFDs), based on walk-through by the avifaunal specialist.	1. Walk-through by avifaunal specialist prior to implementation to identify high risk spans. 2. Implementation of appropriate measures e.g. marking of the earthwire with BFDs on high risk spans.	1. Once-off during the construction phase. 2. Once-off during the construction phase.	1. Project Developer 2. Facility operational manager

9.3 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) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. 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
Avifauna: Mortality due to collisions with the 132kV grid connection					
Bird collisions with the earthwire of the proposed 132kV grid connections.	Prevention of collision mortality on the powerlines.	Reactive marking of identified high risk spans with Bird Flight Diverters (BFDs), based on regular powerline inspections by the avifaunal specialist.	1. Powerline inspections by avifaunal specialist to look for carcasses. 2. Implementation of appropriate measures e.g. marking of the earthwire with BFDs on high risk spans.	1. Monthly 2. Monthly	1. Facility Environmental Manager 2. Facility Operational Manager

9.4 Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to disturbance					
The noise and movement associated with the activities at the PV footprints 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 Decommissioning EMPr.	A site-specific Decommissioning EMPr (DEMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the DEMPr and should apply good environmental practice during decommissioning. The DEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical; 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 botanical specialist report pertaining to the limitation of the footprint.	1. Implementation of the DEMPr. Oversee activities to ensure that the DEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that decommissioning personnel are made aware of the impacts relating to off-road driving. 3. 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 decommissioning area is demarcated clearly and that personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

10 Final Specialist Statement and Authorisation Recommendation

10.1 Statement and Reasoned Opinion

The expected impacts of the Witte Wall PV 1 and Witte Wall PV 2 solar PV facilities, electrical grid infrastructure and associated infrastructure were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (see Table 4 above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the EMPr (Section 9) are strictly implemented.

10.2 EA Condition Recommendations

The proposed mitigation measures are detailed in Section 9 above.

11 References

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Appendices

Appendix A: Specialist Expertise

Appendix B: Specialist statement of independence

Appendix C: Site sensitivity verification

Appendix D: Impact Assessment methodology

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Appendix F: Species List

Appendix G: List of renewable energy projects within 30km radius

Appendix A - Specialist Expertise

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	22 years

Key Experience

Chris van Rooyen has twenty-two years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Key Project Experience

Bird Impact Assessment Studies and avifaunal monitoring for wind-powered generation facilities:

1. Eskom Klipheuwel Experimental Wind Power Facility, Western Cape
2. Mainstream Wind Facility Jeffreys Bay, Eastern Cape (EIA and monitoring)
3. Biotherm, Swellendam, (Excelsior), Western Cape (EIA and monitoring)
4. Biotherm, Napier, (Matjieskloof), Western Cape (pre-feasibility)
5. Windcurrent SA, Jeffreys Bay, Eastern Cape (2 sites) (EIA and monitoring)
6. Caledon Wind, Caledon, Western Cape (EIA)
7. Innowind (4 sites), Western Cape (EIA)
8. Renewable Energy Systems (RES) Oyster Bay, Eastern Cape (EIA and monitoring)
9. Oelsner Group (Kerriefontein), Western Cape (EIA)
10. Oelsner Group (Langefontein), Western Cape (EIA)
11. InCa Energy, Vredendal Wind Energy Facility Western Cape (EIA)
12. Mainstream Loeriesfontein Wind Energy Facility (EIA and monitoring)
13. Mainstream Noupoort Wind Energy Facility (EIA and monitoring)
14. Biotherm Port Nolloth Wind Energy Facility (Monitoring)
15. Biotherm Laingsburg Wind Energy Facility (EIA and monitoring)
16. Langhoogte Wind Energy Facility (EIA)
17. Vleesbaai Wind Energy Facility (EIA and monitoring)
18. St. Helena Bay Wind Energy Facility (EIA and monitoring)
19. Electrawind, St Helena Bay Wind Energy Facility (EIA and monitoring)
20. Electrawind, Vredendal Wind Energy Facility (EIA)
21. SAGIT, Langhoogte and Wolseley Wind Energy facilities
22. Renosterberg Wind Energy Project – 12-month preconstruction avifaunal monitoring project
23. De Aar – North (Mulilo) Wind Energy Project – 12-month preconstruction avifaunal monitoring project
24. De Aar – South (Mulilo) Wind Energy Project – 12-month bird monitoring
25. Namies – Aggenys Wind Energy Project – 12-month bird monitoring
26. Pofadder - Wind Energy Project – 12-month bird monitoring
27. Dwarsrug Loeriesfontein - Wind Energy Project – 12-month bird monitoring
28. Waaihoek – Utrecht Wind Energy Project – 12-month bird monitoring

29. Amathole – Butterworth Utrecht Wind Energy Project – 12-month bird monitoring & EIA specialist
30. Phezukomoya and San Kraal Wind Energy Projects 12-month bird monitoring & EIA specialist study (Innowind)
31. Beaufort West Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
32. Leeuwdraai Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
33. Sutherland Wind Energy Facility 12-month bird monitoring (Mainstream)
34. Maralla Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
35. Esizayo Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
36. Humansdorp Wind Energy Facility 12-month bird monitoring & EIA specialist study (Cennergi)
37. Aletta Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
38. Eureka Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
39. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
40. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
41. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
42. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
43. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
44. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
45. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
46. Dassieklip Wind Energy Facility 3 years post-construction monitoring (Biotherm)
47. Loeriesfontein 2 Wind Energy Facility 2 years post-construction monitoring (Mainstream)
48. Khobab Wind Energy Facility 2 years post-construction monitoring (Mainstream)
49. Excelsior Wind Energy Facility 18 months construction phase monitoring (Biotherm)
50. Boesmansberg Wind Energy Facility 12-months pre-construction bird monitoring (juwi)
51. Mañhica Wind Energy Facility, Mozambique, 12-months pre-construction monitoring (Windlab)
52. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
53. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO).
54. Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
55. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
56. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
57. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
58. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
59. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
60. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
61. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
62. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
63. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
64. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
65. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
66. Pofadder Wind Energy Facility, Northren Cape, Screening Report (Atlantic Energy)
67. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
68. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
69. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment Studies for Solar Energy Plants:

1. Concentrated Solar Power Plant, Upington, Northern Cape.
2. Globeleq De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos PV project, Copperton, Northern Cape

4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena PV Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla PV Project, Aggeneys, Northern Cape
8. Biotherm Sendawo PV Project, Vryburg, North-West
9. Biotherm Tlisitseng PV Project, Lichtenburg, North-West
10. JUWI Hotazel Solar Park Project, Hotazel, Northern Cape
11. Namakwa Solar Project, Aggeneys, Northern Cape
12. Brypaal Solar Power Project, Kakamas, Northern Cape
13. ABO Vryburg 1,2,3 Solar PV Project, Vryburg, North-West
14. Scatec Solar Kenhardt PV 4, PV 5 and PV6 Projects, Kenhardt, Northern Cape
15. NamPower CSP Facility near Arandis, Namibia
16. Dayson Klip PV Facility near Upington, Northern Cape
17. Geelkop PV Facility near Upington, Northern Cape
18. Oya PV Facility, Ceres, Western Cape
19. Vrede and Rondawel PV Facilities, Free State
20. Kolkies & Sadawa PV Facilities, Western Cape
21. Leeudoringstad PV Facility, North-West

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV
14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation

37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV

94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
118. Matla-Glockner 400kV
119. Delmas North 44kV
120. Houwhoek 11kV Refurbishment
121. Clau-Clau 132kV
122. Ngwedi-Silwerkrans 134kV
123. Nieuwehoop 400kV walk-through
124. Booysendal 132kV Switching Station
125. Tarlton 132kV
126. Medupi - Witkop 400kV walk-through
127. Germiston Industries Substation
128. Sekgame 132kV
129. Botswana – South Africa 400kV Transfrontier Interconnector
130. Syferkuil – Rampheri 132kV
131. Queens Substation and associated 132kV powerlines
132. Oranjemond 400kV Transmission line
133. Aries – Helios – Juno walk-down
134. Kuruman Phase 1 and 2 Wind Energy facilities 132kV Grid connection
135. Transnet Thaba 132kV

Bird Impact Assessment Studies for the following residential and industrial developments:

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Somerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm Blesbokfontein)
8. N17 Section: Springs To Leandra – “Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek 314 Ir)
9. South African Police Services Gauteng Radio Communication System: Portion 136 Of The Farm 528 Jq, Lindley.
10. Report for the proposed upgrade and extension of the Zeekoegat Wastewater Treatment Works,

Gauteng.

11. Bird Impact Assessment for Portion 265 (a portion of Portion 163) of the farm Rietfontein 189-JR, Gauteng.
12. Bird Impact Assessment Study for Portions 54 and 55 of the Farm Zwartkop 525 JQ, Gauteng.
13. Bird Impact Assessment Study Portions 8 and 36 of the Farm Nooitgedacht 534 JQ, Gauteng.
14. Shumba's Rest Bird Impact Assessment Study
15. Randfontein Golf Estate Bird Impact Assessment Study
16. Zilkaatsnek Wildlife Estate
17. Regenstein Communications Tower (Namibia)
18. Avifaunal Input into Richards Bay Comparative Risk Assessment Study
19. Maquasa West Open Cast Coal Mine
20. Glen Erasmia Residential Development, Kempton Park, Gauteng
21. Bird Impact Assessment Study, Weltevreden Mine, Mpumalanga
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Mpumalanga
24. Lindley Estate, Lanseria, Gauteng
25. Proposed open cast iron ore mine on the farm Lylyveld 545, Northern Cape
26. Avifaunal monitoring for the Sishen Mine in the Northern Cape as part of the EMPr requirements
27. Steelpoort CNC Bird Impact Assessment Study

Professional affiliations

I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	20 years

Key Qualifications

Albert Froneman **(**Pr.Sci.Nat) has more than 18 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. Oysterbay 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 Faclity (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 Kolkies & 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 Assesment 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 Powerline 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 Origstad 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 Tswane – 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 Powerline 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 powerlines – GIS Specialist & Mapping
45. ESKOM Magopela- Pitsong 132kV line and new substation – GIS Specialist & Mapping

Professional affiliations

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

Appendix B - Specialist Statement of Independence

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

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)

PROJECT TITLE

Basic Assessments for the Proposed Development of two 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Witte Wall 1 and Witte Wall 2), near Touws River, Western Cape

Kindly note the following:

1. This form must always be used for 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 01 September 2018. 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.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Afrimage Photography (Pty) Ltd t/a Chris van Rooyen Consulting			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 4	Percentage Procurement recognition	
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.			
Physical address:	6 Pladda Drive Plettenberg Bay			
Postal address:	P.O Box 2676, Fourways			
Postal code:	2055			
Telephone:	0824549570			
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Chris van Rooyen declare that –

- I act as the independent specialist in this application;
- 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 Act.

Signature of the Specialist

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company:

1 November 2020

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Chris van Rooyen, 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

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company

1 November 2020

Date

Signature of the Commissioner of Oaths

2020-11-01

Date

SOUTH AFRICAN POLICE SERVICE
PLETTENBERG BAY
2020 -11- 01
PLETTENBERGBAAI
SOUTH AFRICAN POLICE SERVICE

Appendix C: Site Sensitivity Verification

Prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification was 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).

The details of the site sensitivity verification are noted below:

Date of Site Visit	25-27 August 2020 and 16 – 19 September 2020
Specialist Name	Chris van Rooyen
Professional Registration Number	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.
Specialist Affiliation / Company	Chris van Rooyen Consulting

1 Methodology

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the study area is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 12 pentads where the study area is located, henceforth called the broader area. The SABAP2 data covers the period 2007 to 2020. The relevant pentads are 3250_1950, 3250_1955, 3250_2000, 3255_1950, 3255_1955, 3255_2000, 3300_1950, 3300_1955, 3300_2000, 3305_1950, 3305_1955, 3305_2000.
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map (2018) accessed via the South African National Biodiversity BGIS map viewer (SANBI 2020).
- Satellite imagery was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- On-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2) according to the best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*. 2017).

2 Results

The study area and immediate environment is classified as low sensitivity for avifauna from a PV perspective, except drainage lines (including the Groot River) and a few earth dams which are classified as high sensitivity. No reason is offered for the high classification, but surface water attracts avifauna and that could be the reason for attributing a high sensitivity rating. It should be noted that the screening tool did not identify any known nests or roosts.

The site investigation revealed that the study area is generally low sensitivity for avifauna from a PV perspective, with a few areas of very high sensitivity namely water reservoirs (permanent surface water) and drainage lines (ephemeral water resource and drainage line woodland habitat) and one priority species nest, namely a Greater Kestrel. The earth dams are very small and basically dry for the majority of the year, therefore from a solar PV perspective, they constitute low sensitive habitat (see Figures 12-13).

There is no specific powerline theme for avifauna in the DEFF screening tool, and the study area is classified as mostly medium sensitivity for Animal Species Theme, with small areas of low and high sensitivity (see Figures 10-11). The medium sensitivity rating is linked to the presence of Ludwig's Bustard. The High and Low sensitivity ratings are not linked to avifauna.

3 Concluding statement

The expected impacts of the Witte Wall PV 1 and Witte Wall PV 2 solar PV facilities, electrical grid infrastructure and associated infrastructure were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (see Table 4). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the EMPr (Section 9) are strictly implemented.

Appendix D: Impact Assessment Methodology

The following impact assessment was used in this study.

The impact assessment includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFF Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D1).

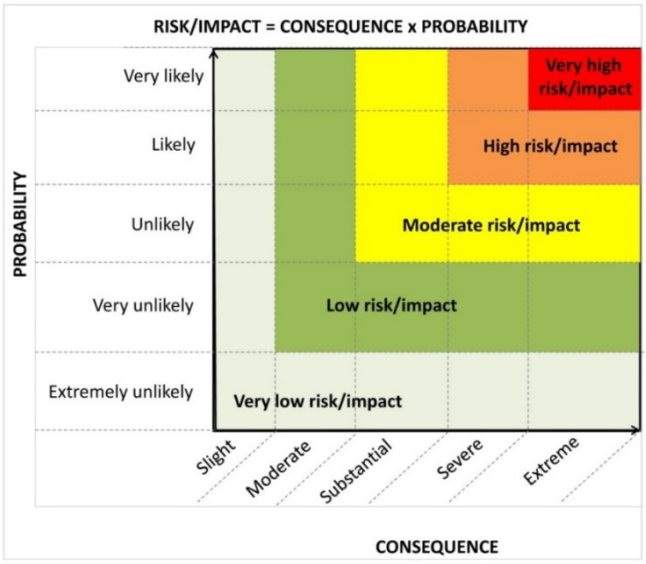


Figure D1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	***Section where this has been addressed in the Specialist Report***
1. (1) A specialist report prepared in terms of these Regulations must contain - *a) details of -* *i. the specialist who prepared the report; and* *ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;*	*Appendix A*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Appendix B*
c) an indication of the scope of, and the purpose for which, the report was prepared;	*Section 1*
(cA) an indication of the quality and age of base data used for the specialist report;	*Section 2*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*Section 4 and Section 6*
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*Section 4*
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	*Section 2 and Section 4*
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	*Section 4 and Section 5*
g) an identification of any areas to be avoided, including buffers;	*Section 4*
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	*Section 4*
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Section 2 (i.e. Section 2.2)*
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	*Section 6 and Section 10*
k) any mitigation measures for inclusion in the EMPr;	*Section 6 and Section 9*
l) any conditions for inclusion in the environmental authorisation;	*Section 9*
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*Section 9*
n) a reasoned opinion- *i. whether the proposed activity, activities or portions thereof should be authorised;* *(iA) regarding the acceptability of the proposed activity or activities; and* *ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;*	*Section 10*
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	*Not Applicable*
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*Not Applicable. Refer to the BA Report for additional information.*
q) any other information requested by the competent authority.	*Not Applicable. Refer to the BA Report for additional information.*
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	*Appendix C (i.e. Part A of the Assessment Protocols published in GN 320 on 20*

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	*Section where this has been addressed in the Specialist Report*
	March 2020 (i.e. Site sensitivity verification requirements where a specialist assessment is required but no specific assessment protocol has been prescribed)).

Appendix F: Species Lists

Species recorded by SABAP2 in the broader area

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
Acacia Pied Barbet	*Tricholaema leucomelas*	14.29	0.00				
African Black Swift	*Apus barbatus*	2.86	0.00				
African Pipit	*Anthus cinnamomeus*	0.00	4.17				
African Reed-warbler	*Acrocephalus baeticatus*	2.86	0.00				
African Spoonbill	*Platalea alba*	0.00	4.17	x			
Alpine Swift	*Tachymarptis melba*	11.43	4.17				
Anteating Chat	*Myrmecocichla formicivora*	5.71	0.00				
Barn Swallow	*Hirundo rustica*	11.43	4.17				
Black Harrier	*Circus maurus*	8.57	8.33	x	VU	EN	Near endemic
Black-headed Canary	*Serinus alario*	14.29	4.17	x			Near endemic
Black-headed Heron	*Ardea melanocephala*	2.86	0.00	x			
Bokmakierie	*Telophorus zeylonus*	54.29	4.17				
Booted Eagle	*Aquila pennatus*	8.57	4.17	x			
Brown-throated Martin	*Riparia paludicola*	20.00	0.00				
Cape Bulbul	*Pycnonotus capensis*	20.00	4.17	x			Endemic
Cape Bunting	*Emberiza capensis*	57.14	29.17				
Cape Penduline-tit	*Anthoscopus minutus*	8.57	0.00				
Cape Robin-chat	*Cossypha caffra*	5.71	0.00				
Cape Sparrow	*Passer melanurus*	77.14	20.83				
Cape Spurfowl	*Pternistis capensis*	2.86	0.00	x			Near endemic
Cape Turtle-dove	*Streptopelia capicola*	28.57	0.00				
Cape Wagtail	*Motacilla capensis*	40.00	12.50				
Cape Weaver	*Ploceus capensis*	17.14	4.17	x			Near endemic
Capped Wheatear	*Oenanthe pileata*	0.00	4.17				
Cardinal Woodpecker	*Dendropicos fuscescens*	2.86	0.00				
Chestnut-vented Tit-babbler	*Parisoma subcaeruleum*	28.57	8.33				
Common Fiscal	*Lanius collaris*	57.14	16.67				
Common Ostrich	*Struthio camelus*	11.43	0.00				
Common Quail	*Coturnix coturnix*	2.86	0.00				
Common Waxbill	*Estrilda astrild*	17.14	4.17				
Dusky Sunbird	*Cinnyris fuscus*	5.71	4.17				
Egyptian Goose	*Alopochen aegyptiacus*	5.71	4.17	x			
European Bee-eater	*Merops apiaster*	14.29	4.17				
Fairy Flycatcher	*Stenostira scita*	17.14	0.00	x			Near endemic
Familiar Chat	*Cercomela familiaris*	45.71	0.00				
Great Crested Grebe	*Podiceps cristatus*	0.00	4.17	x			
Greater Kestrel	*Falco rupicoloides*	11.43	0.00	x			
Greater Striped Swallow	*Hirundo cucullata*	8.57	8.33				
Grey Tit	*Parus afer*	45.71	4.17	x			Near endemic
Grey-backed Cisticola	*Cisticola subruficapilla*	62.86	12.50				
Grey-backed Sparrowlark	*Eremopterix verticalis*	5.71	0.00				
Grey-winged Francolin	*Scleroptila africanus*	2.86	4.17	x			Endemic (SA, Lesotho, Swaziland)
Hadeda Ibis	*Bostrychia hagedash*	14.29	0.00	x			
Helmeted Guineafowl	*Numida meleagris*	0.00	4.17				
House Sparrow	*Passer domesticus*	14.29	0.00				

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
Jackal Buzzard	*Buteo rufofuscus*	8.57	0.00	x			Near endemic
Karoo Chat	*Cercomela schlegelii*	100.00	41.67				
Karoo Eremomela	*Eremomela gregalis*	25.71	0.00	x			Near endemic
Karoo Korhaan	*Eupodotis vigorsii*	14.29	0.00	x	LC	NT	
Karoo Lark	*Calendulauda albescens*	74.29	33.33				Near endemic
Karoo Long-billed Lark	*Certhilauda subcoronata*	25.71	4.17				
Karoo Prinia	*Prinia maculosa*	54.29	16.67	x			Near endemic
Karoo Scrub-robin	*Cercotrichas coryphoeus*	62.86	12.50				
Kittlitz's Plover	*Charadrius pecuarius*	2.86	0.00				
Lanner Falcon	*Falco biarmicus*	2.86	0.00	x	LC	VU	
Large-billed Lark	*Galerida magnirostris*	51.43	25.00	x			Near endemic
Lark-like Bunting	*Emberiza impetuani*	14.29	0.00				
Laughing Dove	*Streptopelia senegalensis*	2.86	0.00				
Layard's Tit-babbler	*Parisoma layardi*	8.57	0.00	x			Near endemic
Little Swift	*Apus affinis*	17.14	0.00				
Long-billed Crombec	*Sylvietta rufescens*	17.14	0.00				
Ludwig's Bustard	*Neotis ludwigii*	5.71	0.00	x	EN	EN	
Malachite Sunbird	*Nectarinia famosa*	31.43	12.50				
Martial Eagle	*Polemaetus bellicosus*	5.71	0.00	x	EN	EN	
Mountain Wheatear	*Oenanthe monticola*	2.86	16.67				
Namaqua Dove	*Oena capensis*	14.29	12.50				
Namaqua Sandgrouse	*Pterocles namaqua*	17.14	0.00				
Namaqua Warbler	*Phragmacia substriata*	14.29	4.17	x			Near endemic
Neddicky	*Cisticola fulvicapilla*	2.86	0.00				
Pied Avocet	*Recurvirostra avosetta*	2.86	0.00	x			
Pied Crow	*Corvus albus*	51.43	16.67				
Pied Starling	*Spreo bicolor*	8.57	0.00	x			Endemic (SA, Lesotho, Swaziland)
Pin-tailed Whydah	*Vidua macroura*	0.00	4.17				
Pririt Batis	*Batis pririt*	20.00	0.00				
Red-capped Lark	*Calandrella cinerea*	2.86	4.17				
Red-faced Mousebird	*Urocolius indicus*	8.57	0.00				
Red-knobbed Coot	*Fulica cristata*	2.86	4.17	x			
Rock Kestrel	*Falco rupicolus*	22.86	0.00	x			
Rock Martin	*Hirundo fuligula*	62.86	25.00				
Rufous-eared Warbler	*Malcorus pectoralis*	68.57	25.00				
Sickle-winged Chat	*Cercomela sinuata*	2.86	0.00	x			Near endemic
South African Shelduck	*Tadorna cana*	14.29	0.00	x			
Southern Black Korhaan	*Afrotis afra*	2.86	4.17	x	VU	VU	Endemic
Southern Double-collared Sunbird	*Cinnyris chalybeus*	42.86	4.17				Near endemic
Southern Masked-weaver	*Ploceus velatus*	22.86	0.00				
Southern Pale Chanting Goshawk	*Melierax canorus*	68.57	45.83	x			
Speckled Pigeon	*Columba guinea*	34.29	16.67				
Spike-heeled Lark	*Chersomanes albofasciata*	45.71	4.17				
Spotted Eagle-owl	*Bubo africanus*	8.57	0.00	x			
Spur-winged Goose	*Plectropterus gambensis*	2.86	0.00	x			
Three-banded Plover	*Charadrius tricollaris*	17.14	12.50	x			
Tractrac Chat	*Cercomela tractrac*	22.86	0.00				
Verreaux's Eagle	*Aquila verreauxii*	11.43	12.50	x	LC	VU	
White-backed Mousebird	*Colius colius*	34.29	4.17				

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
White-breasted Cormorant	*Phalacrocorax carbo*	0.00	4.17	x			
White-necked Raven	*Corvus albicollis*	20.00	4.17				
White-rumped Swift	*Apus caffer*	14.29	0.00				
White-throated Canary	*Crithagra albogularis*	57.14	12.50				
Willow Warbler	*Phylloscopus trochilus*	2.86	0.00				
Yellow Canary	*Crithagra flaviventris*	85.71	37.50				
Yellow-bellied Eremomela	*Eremomela icteropygialis*	8.57	8.33				

Species recorded during the pre-construction monitoring

Priority Species		**Transects**	**Focal point**	**Incidental**
Cape Clapper Lark	*Mirafra apiata*	*		
Egyptian Goose	*Alopochen aegyptiaca*	*	*	
Greater Kestrel	*Falco rupicoloides*	*		*
Grey Heron	*Ardea cinerea*			*
Grey Tit	*Melaniparus afer*		*	
Jackal Buzzard	*Buteo rufofuscus*			*
Karoo Eremomela	*Eremomela gregalis*			*
Karoo Korhaan	*Eupodotis vigorsii*	*	*	*
Karoo Lark	*Calendulauda albescens*	*	*	*
Karoo Prinia	*Prinia maculosa*	*		*
Large-billed Lark	*Galerida magnirostris*	*		*
Ludwig's Bustard	*Neotis ludwigii*			*
Martial Eagle	*Polemaetus bellicosus*			*
Pale Chanting Goshawk	*Melierax canorus*	*		*
Pied Avocet	*Recurvirostra avosetta*		*	
Pied Starling	*Lamprotornis bicolor*			*
Sickle-winged Chat	*Emarginata sinuata*	*		
South African Shelduck	*Tadorna cana*	*	*	*
Southern Double-collared Sunbird	*Cinnyris chalybeus*		*	
Spotted Eagle-Owl	*Bubo africanus*			*
Three-banded Plover	*Charadrius tricollaris*		*	
Yellow-billed Kite	*Milvus aegyptius*			*
22	*Priority Species sub-total:*	10	8	15
Non-Priority Species		**Transects**	**Focal point**	
African Hoopoe	*Upupa africana*	*		
Bokmakierie	*Telophorus zeylonus*	*	*	
Brown-throated Martin	*Riparia paludicola*		*	
Cape Bunting	*Emberiza capensis*		*	
Cape Sparrow	*Passer melanurus*	*	*	

Species recorded during the pre-construction monitoring				
Cape Turtle Dove	*Streptopelia capicola*	*	*	
Non-Priority Species		**Transects**	**Focal point**	
Cape Wagtail	*Motacilla capensis*		*	
Chat Flycatcher	*Melaenornis infuscatus*	*		
Grey-backed Cisticola	*Cisticola subruficapilla*	*		
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	*		
Hadeda	*Bostrychia hagedash*	*		
Karoo Chat	*Emarginata schlegelii*	*	*	
Karoo Long-billed Lark	*Certhilauda subcoronata*	*		
Karoo Scrub Robin	*Cercotrichas coryphoeus*	*		
Lark-like Bunting	*Emberiza impetuani*		*	
Laughing Dove	*Spilopelia senegalensis*	*		
Malachite Sunbird	*Nectarinia famosa*		*	
Pearl-breasted Swallow	*Hirundo dimidiata*		*	
Pied Crow	*Corvus albus*	*	*	
Rufous-eared Warbler	*Malcorus pectoralis*	*		
Southern Fiscal	*Lanius collaris*	*	*	
Speckled Pigeon	*Columba guinea*	*	*	
Spike-heeled Lark	*Chersomanes albofasciata*	*		
White-throated Canary	*Crithagra albogularis*	*	*	
Yellow Canary	*Crithagra flaviventris*	*	*	
25	*Non-priority Species sub-total:*	19	15	
	Grand total:	**29**	**23**	

Appendix G: List of renewable energy projects within 30km radius

Renewable Energy Projects - Source: DEA REEA, 2020 Q2 (2020-08-31)

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
14/12/16/3/3/1/1976	DEA/EIA/0001017/2018	2014	BAR	Proposed development of the 325MW Kudusberg Wind Energy Facility and associated infrastructure in Western and Northern Cape Provinces	2018-11-13	Kudusberg Wind Farm (Pty) Ltd	CSIR	Karoo Hoogland Local Municipality	Namakwa District Municipality	Northern Cape	Onshore Wind	325	Approved
								Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape			
12/12/20/1783/1	DEAT/EIA/12233/2011	2010	Scoping and EIA	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2012-12-01	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	150	Approved
12/12/20/1783/2	DEAT/EIA/12233/2011	2010	Scoping and EIA	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 2	2012-12-01	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	150	Approved
12/12/20/1783/2/AM1	DEA/EIA/AMEND/000468/2014	2010	Amendment	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2014-10-03	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technology	0	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
12/12/20/1783/2/AM3	To Review	2014	Amend ment	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2017-09-20	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1783/2/AM4	To Review	2014	Amend ment	Proposed development of a WEF at the Perdekraal Site 2, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1783/2/AM4	To Review	2014	Amend ment	Proposed development of a WEF at the Perdekraal Site 2, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	150	Approved
12/12/20/1783/2/AM5	To Review	2014	Amend ment	Proposed development of a Wind Energy Facility at Perdekraal, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1787	DEAT/EIA/12346/ 2011	2010	Scoping and EIA	Proposed Renewable Energy Facility at Konstabel	2010-01-29	South Africa Mainstream Renewable Power Developmen ts (Pty) Ltd	Environmental Resource Management (Pty) Ltd	Laingsburg Local Municipality	Central Karoo District Municipality	Western Cape	Onshore Wind and Solar PV	170	Approved
12/12/20/1956	DEAT/EIA/12205/ 2011	2010	Scoping and EIA	Proposed Touwsrivier Solar Energy Facility	2010-06-07	CPV Power Plant No.1 Pty Ltd	University of Cape Town Environmental Evaluation	Breede Valley Local Municipality	Cape Winelands District Municipality	Western Cape	Solar PV	36	Approved
12/12/20/1988	DEAT/EIA/12460/ 2011	2010	Scoping and EIA	Proposed Construction of the 750 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality of	2012-11-16	G7 Renewable Energies Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Namakwa District Municipality	Western Cape	Onshore Wind	750	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
				the Northern Cape Province and within the Laingsburg Local Municipality of the Western Cape Province									
12/12/20/1988/1/AM1	DEA/EIA/AMEND/0000529/2015	2010	Amendment	Proposed Construction of the 750 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality of the Northern Cape Province and within the Laingsburg Local Municipality of the Western Cape Province	2014-12-05	G7 Renewable Energies Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Namakwa District Municipality	Western Cape	Onshore Wind	0	Approved
14/12/16/3/3/2/899	DEA/EIA/000258/2016	2014	Scoping and EIA	140 MW Rietkloof WE, near Sutherland, Northern Cape and Western Cape	2016-01-19	Rietkloof Wind Farm (Pty) Ltd	EOH Coastal and Environmental Services (Pty) Ltd	Laingsburg Local Municipality	Central Karoo District Municipality	Western Cape	Onshore Wind	36	Approved
14/12/16/3/3/2/810	To Review	2014	Scoping and EIA	75 MW Montague Road Solar PV SEF on Vredefort No. 34 Near Touws River within the Breede Valley Local Municipality in the Western Cape Province	2015-05-29	Montague Road Energy (Pty) Ltd	Sharples Environmental Services cc	Breede Valley Local Municipality	Cape Winelands District Municipality	Western Cape	Solar PV	75	Approved
14/12/16/3/3/2/900	DEA/EIA/0000259/2016	2014	Scoping and EIA	147 MW Brandvalley Wind Energy Facility north of the town of Matjiesfontein within Karoo Hoogland Local Municipality	2016-01-19	Brandvalley Wind Farm (Pty) Ltd.	EOH Coastal and Environmental Services	!Kheis Local Municipality	Z F Mgcawu District Municipality	Western Cape	Onshore Wind	147	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
14/12/16/3/3/1/1983	DEA/EIA/0001036/2018	2014	BAR	Proposed Development of the Tooverberg On-site Eskom Substation and 132kV Power Line for the proposed Tooverberg Wind Energy Facility near Touws River, Western Cape Province	2018-12-06	Genesis Tooverberg Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	EGI	EGI	Approved

Renewable Energy and EGI Projects - Source: SAHRIS

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATUS
14/12/16/3/3/1/1984	Not provided	2014	BAR	Proposed Development of the Tooverberg Wind Energy Facility (WEF) near Touws River, Western Cape Province	06 12 2018	Genesis Tooverberg Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	264	Approved
Not provided	Not provided	2014	BAR	Powerline between the Perdkekraal West Wind Energy Facility and the Eskom Kappa Substation, Western Cape Province	22 03 2016	Perderkraal West Wind Farm (Pty) Ltd	Savannah Environmental	Breede River Local Municipality	Cape Winelands District Municipality	Western Cape	EGI	EGI	Not confirmed

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATUS
14/12/16/3/3/2/1115	Not provided	2014	Scoping and EIA	Proposed Construction of the 325MW Rondekop Wind Energy Facility between Matjiesfontein and Sutherland, Northern Cape Province	14 11 2018	Rondekop Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Karoo Hoogland Local Municipality	Namakwa District Municipality	Northern Cape	Onshore Wind	325	Approved

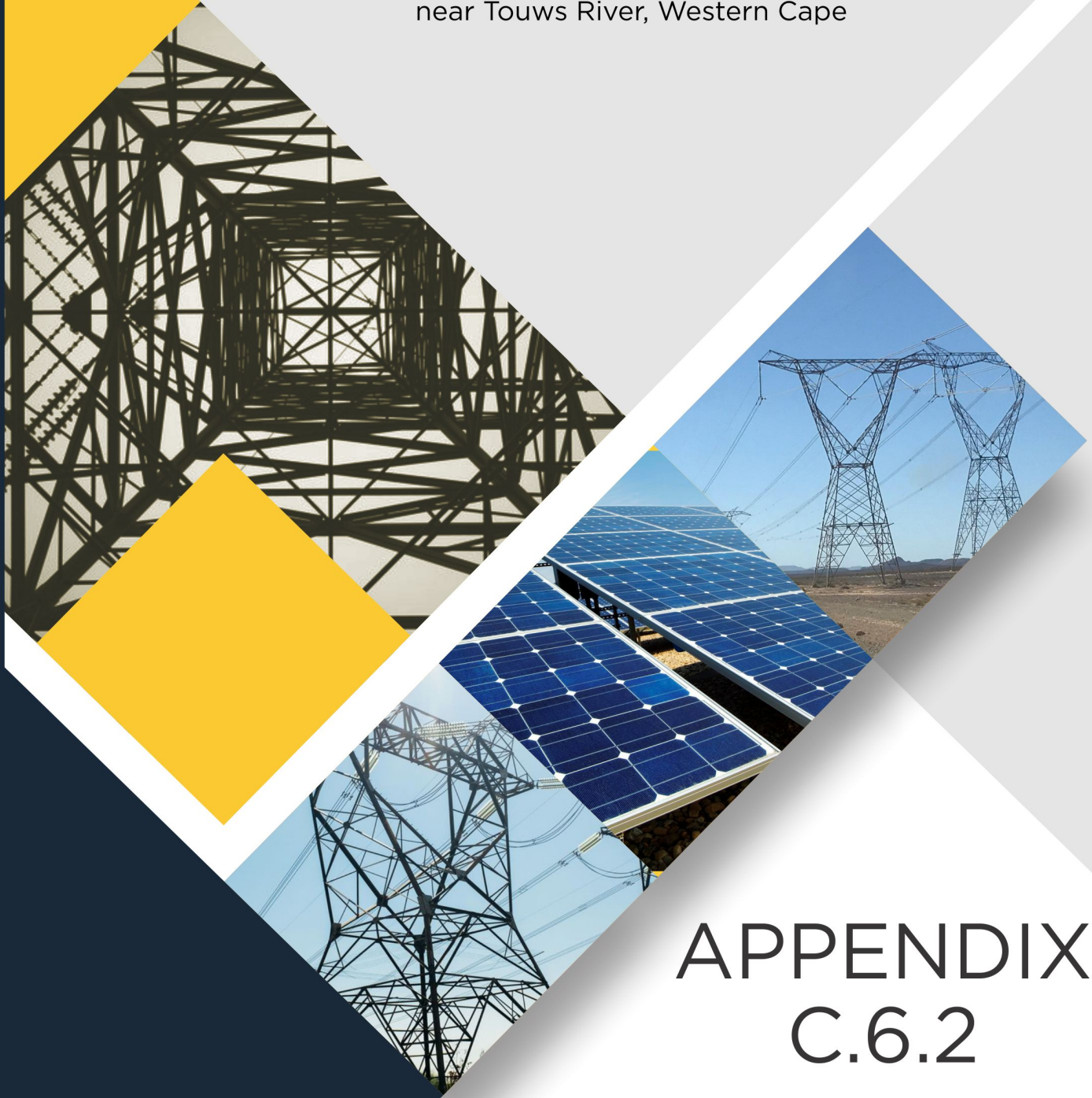
Planned Eskom Lines:

Status / layer source	SUB_PROJEC	Voltage	TDP_ID	TDP_SCHEME	New_Date	GP_Project
Tx Planned Lines	Gamma-Kappa 2nd 765kV line	765	TS019	Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	2022	GPP0288
Tx Planned Lines	Kappa-Sterrekus 2nd 765kV line	765	TS019	Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	2021	GPP0502

Existing Eskom Lines:

Status / layer source	LABEL	DESIGN_VOL	LINE_STATU	SUB_CAT		
Tx Existing Lines	BACCHUS DROERIVIER 1	400	EXISTING	400kv_line		
Tx Existing Lines	DROERIVIER MULDERSVLEI 2	400	EXISTING	400kv_line		
Tx Existing Lines	Gamma-Kappa 1st 765kV line	765	TS015	Cape Corridor Phase 2: Gamma-Omega 765kV Integration	2013	GPP0283
Tx Existing Lines	Kappa-Sterrekus (Omega) 1st 765kV line	765	TS015	Cape Corridor Phase 2: Gamma-Omega 765kV Integration	2015	GPP0500

Basic Assessment for the Proposed Development of Electrical Grid Infrastructure to support the proposed nine 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape



APPENDIX C.6.2

Avifauna Assessment for Grootfontein

AVIFAUNAL SPECIALIST ASSESSMENT

Basic Assessment for the Proposed Development of three 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure known as Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 near Touws River, Western Cape

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Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services P O Box 320 Stellenbosch 7599 South Africa	Chris van Rooyen Consulting P.O. Box 2676 Fourways 2055

October 2020

Executive Summary

The Project Developer, Veroniva (PTY) Ltd (hereinafter referred to as Veroniva), is proposing to design, construct and operate nine 175 MW Solar Photovoltaic (PV) power generation facilities, north-east of Ceres in the Western Cape Province. The proposed projects will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV facility will have a range of associated infrastructure, including an on-site substation and will connect to the Eskom Kappa Substation via a dedicated 132 kV power line. The facilities will be known as Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4. There are nine separate Project Applicants for the proposed projects.

This report serves as the Avifaunal Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed developments of Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, as the associated infrastructure and Electrical Grid Infrastructure.

It is estimated that a total of 100 bird species could potentially occur in the broader area. Of these, 41 species are classified as priority species, of which 17 is expected to occur regularly at the study area. The overall abundance of priority species at the study area was low, with an average of 0.83 birds/km recorded during transect counts. For all birds combined, the index of kilometric abundance (IKA) for transect counts was 8.45 birds/km, which is moderate. The low numbers are not surprising, given the general aridity of the habitat.

POTENTIAL IMPACTS

The following impacts have been identified in the Avifauna Specialist Assessment. Due to the similarity in habitat, the impacts are expected to be essentially identical for all the projects.

Construction Phase

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

Operational Phase

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections

Decommissioning Phase

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

Cumulative Impacts

- Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure
- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels

- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections
- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The table below indicates the overall impact significance for each phase before and after mitigation, as well as cumulative impacts.

Phase	**Overall Impact Significance (Pre Mitigation)**	**Overall Impact Significance (Post Mitigation)**
Construction	Moderate (3)	Low (4)
Operational	Moderate (3)	Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	Moderate (3)	Low (4)
Cumulative - Decommissioning	Moderate (3)	Low (4)

ENVIRONMENTAL SENSITIVITIES

- **PV Solar**

The following environmental sensitivities were identified from an avifaunal perspective for the PV facilities and associated infrastructure:

- **Very High sensitivity (No-Go): Surface water**

  Included are areas within 300m of water troughs, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped.

- **Very High sensitivity (No-Go): Drainage line woodland**

  Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival in this very arid climate. All major drainage lines should be classified as No-Go areas to prevent impact on the sensitive habitat.

- **Very High sensitivity (No-Go): Priority species nests**

  Nest of priority species, particularly those that occur naturally at naturally lower numbers such as raptors, should be protected by No-Go buffer zones to prevent displacement of the breeding birds due to disturbance associated with the construction activity.

- **Electricity grid infrastructure**

The following environmental sensitivities were identified from an avifaunal perspective for the proposed powerline grid connections:

- **High sensitivity (Mitigation required): Surface water**

  Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Powerlines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. If a powerline has to be routed across a high sensitivity zone, mitigation in the form of Bird Flight Diverters will be required.

- **Medium sensitivity (Mitigation potentially required): Succulent Karoo**

  The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan.

MANAGEMENT ACTIONS

The following management actions have been proposed in this assessment:

Construction phase

- Activity should as far as possible be restricted to the footprint of the infrastructure.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.
- Access to the rest of the property must be restricted.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.

Operational phase

- The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.
- A 300m infrastructure-free buffer must be maintained around the water reservoirs (refer to the sensitivity map in Figure 12).
- No solar PV arrays must be constructed in drainage lines (refer to the sensitivity map).
- A single perimeter fence should be used.
- Use underground cabling for the internal reticulation network.
- The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.

De-commissioning phase

- Activity should as far as possible be restricted to the footprint of the infrastructure.
- Measures to control noise and dust should be applied according to current best practice in the industry.

- Maximum use should be made of existing access roads and the construction of new roads during the decommissioning phase should be kept to a minimum as far as practical.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.

STATEMENT AND REASONED OPINION

The expected impacts of the Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3 solar PV facilities, associated infrastructure and the electrical grid infrastructure were rated to be Moderately negative pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (refer to the summary table above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the Environmental Management Programme (EMPr) (Section 9 of the report) are strictly implemented.

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List of Abbreviations

BA	Basic Assessment
BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
DEFF	Department of Environment, Forestry and Fisheries
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
IBA	Important Bird Area
IKA	Index of Kilometric Abundance
IUCN	International Union for Conservation of Nature
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NPAES	National Protected Areas Expansion Strategy
PV	Photovoltaic
REDZs	Renewable Energy Development Zones
SABAP 1	South African Bird Atlas 1
SABAP 2	South African Bird Atlas 2
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa National Protected Areas Database

Glossary

Definitions	
Study area	The area covered by the proposed application sites and the powerline corridor.
Broader area	A consolidated data set for a total of 12 pentads where the study area is located.
PV footprint	The actual development footprint containing the PV solar arrays and associated infrastructure.
Priority species	• South African Red Data species. • South African endemics and near-endemics. • Raptors • Waterbirds
Cumulative impact	Impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts.

The Project Developer, Veroniva (PTY) Ltd (hereinafter referred to as Veroniva), is proposing to design, construct and operate nine 175 MW Solar Photovoltaic (PV) power generation facilities, north-east of Ceres in the Western Cape Province. The proposed projects will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV facility will have a range of associated infrastructure, including an on-site substation and will connect to the Eskom Kappa Substation via a dedicated 132 kV power line. The facilities will be known as Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4. There are nine separate Project Applicants for the proposed projects.

The proposed PV facilities will be constructed on the following farm portions:

- Remainder of Grootfontein Farm 149;
- Portion 5 of Grootfontein Farm 149;
- Remainder of Witte Wall Farm 171; and
- Portion 1 of Hoek Doornen Farm 172.
- The power lines will traverse these aforementioned farm portions, as well as the Die Brak 241 and Platfontein 240.

This report serves as the Avifaunal Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed developments of the Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, as well as all associated infrastructure, including Electrical Grid Infrastructure.

1. Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The purpose of the report is to assess the potential impacts of the Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3 and 4 PV facilities, as well as all associated infrastructure, including Electrical Grid Infrastructure, on avifauna, to provide a reasoned opinion on whether the projects should proceed or not from an avifaunal impact perspective, and to recommend measures for the mitigation of identified impacts, should the project proceed.

1.2 Details of Specialist

This specialist assessment has been undertaken by Chris van Rooyen and Albert Froneman of Chris van Rooyen Consulting. Chris van Rooyen works under the supervision of Albert Froneman who is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 400177/09 in the field of Zoology. Curriculum vitae are included in Appendix A of this specialist assessment.

In addition, a signed specialist statement of independence is included in Appendix B of this specialist assessment.

1.3 Terms of Reference

The terms of reference for the specialist study are as follows:

- Describe the affected environment from an avifaunal perspective.
- Map the sensitivity of the site in terms of avifaunal features such as habitat use, roosting, feeding and nesting / breeding.
- Discuss gaps in baseline data and other limitations.
- Adhere to the content requirements for specialist reports in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations 2014, as amended.
- Provide an overview of all applicable legislation.
- Provide an overview of assessment methodology used.

- Confirm the impact status, use of the land, and sensitivity of the site in comparison to the National Department of Environment, Forestry and Fisheries (DEFF) National Environmental Web-based Screening Tool (National Screening Tool) and associated protocols.
- Identify and assess the potential impacts of the proposed development on avifauna including cumulative impacts.
- Provide sufficient mitigation measures to include in the Environmental Management Programme (EMPr), as well as review of the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that need to be included.
- Conclude with an impact statement whether the PV facility is fatally flawed or may be authorised.

2. Approach and Methodology

The following approach was followed to conduct this study:

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the proposed development area is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 12 pentads where the study area is located, henceforth called the broader area. The SABAP2 data covers the period 2007 to 2020. The relevant pentads are 3250_1950, 3250_1955, 3250_2000, 3255_1950, 3255_1955, 3255_2000, 3300_1950, 3300_1955, 3300_2000, 3305_1950, 3305_1955, 3305_2000 (see Figure 1).
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map (2018) accessed via the South African National Biodiversity Institute (SANBI) Biodiversity Geographic Information System (BGIS) map viewer (SANBI 2020).
- 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, Lesotho and Swaziland (Taylor *et al*. 2015).
- The global threatened status of all priority species was determined by consulting the latest (2020.2) International Union for Conservation of Nature (IUCN) Red List of Threatened Species.
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- The SANBI BGIS map viewer was used to determine the locality of the study area relative to National Protected Areas and National Protected Areas Expansion Strategy (NPAES) focus areas.
- The DEFF National Screening Tool was used to determine the assigned avian sensitivity of the study area.
- Satellite imagery was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- A desktop investigation was conducted to source information on the impacts of solar facilities and Electrical Grid Infrastructure on avifauna.
- On-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2) according to the best practice guidelines for avifaunal impact studies for solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*. 2017). Monitoring was conducted in the following manner:
    - Eighteen walk transects were identified totalling 1km each in the study area and counted once per survey. One observer walking slowly recorded all birds on both sides of the transect. The observer stopped at regular intervals to listen to bird calls and to scan the environment with binoculars.
    - The following variables were recorded:
        - Species;
        - Number of birds;
        - Date;
        - Start time and end time;
        - Estimated distance from transect (m);
        - Wind direction;

- Wind strength (estimated Beaufort scale 1 - 7);
- 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.

- All incidental sightings of priority species were recorded.
- Three potential avifaunal focal points were also identified namely two water reservoirs and a small dam.

See Figure 1 below for the extent of the broader area.

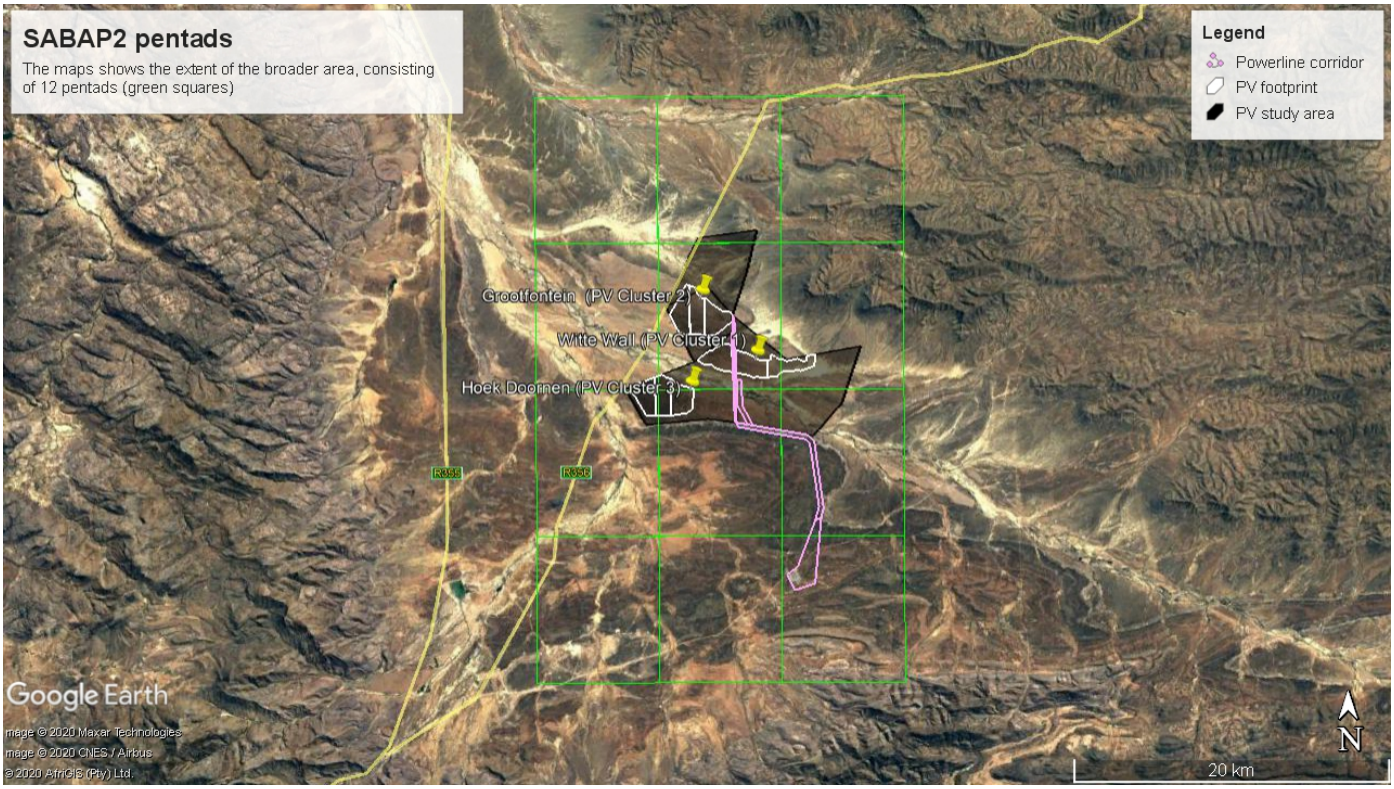

Figure 1: Area covered by the twelve SABAP 2 pentads (broader area = green squares).

See Figure 2 for the location of walk transects and focal points.

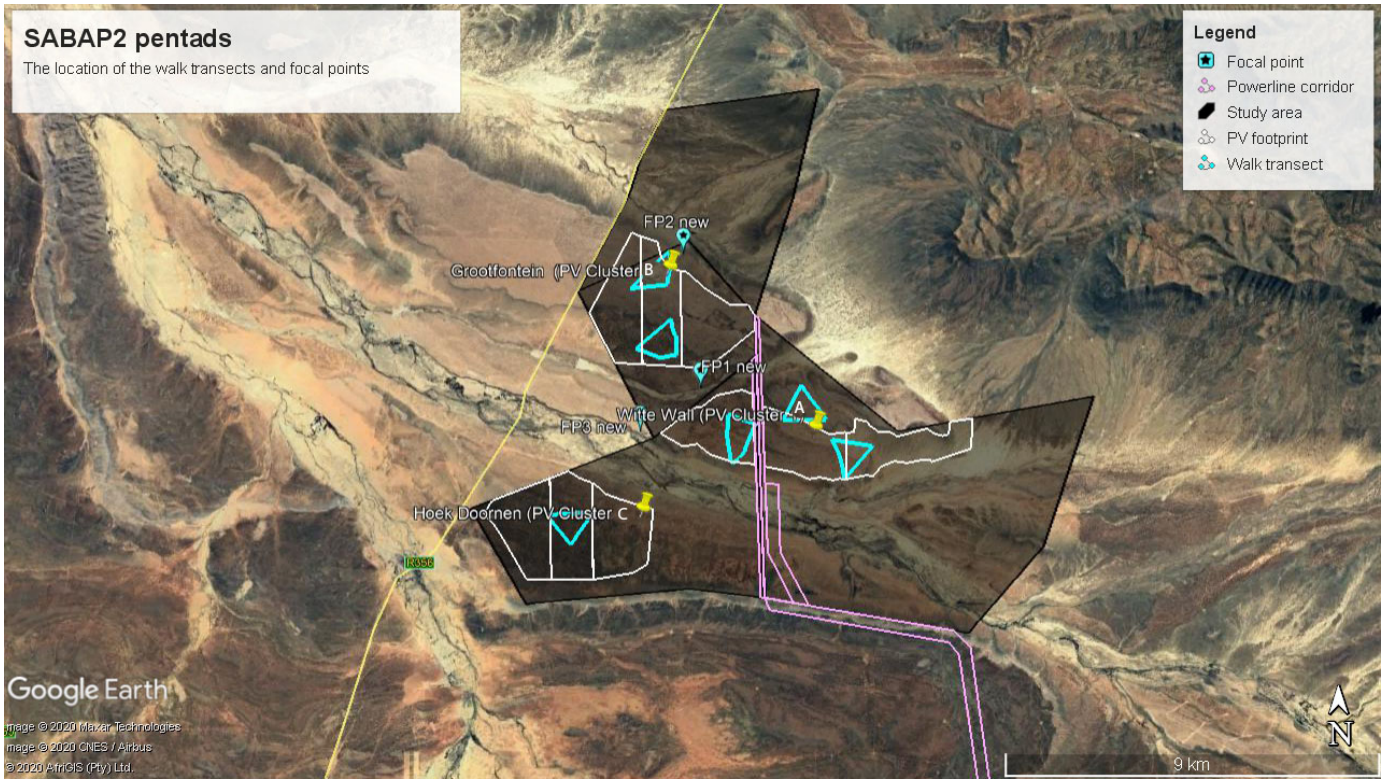

Figure 2: The location of the walk transects and focal points

2.1 Information Sources

The following data sources were used to compile this report:

Data / Information	Source	Date	Type	Description
South African Protected Areas Database (SAPAD)	Department of Environment, Forestry and Fisheries (DEFF)	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Atlas of Southern African Birds 1 (SABAP1)	University of Cape Town	1987-1991	Spatial, reference	SABAP1, which took place from 1987-1991.
South African Bird Atlas Project 2 (SABAP2)	University of Cape Town	October 2020	Spatial, database	SABAP2 is the follow-up project to the SABAP1. The second bird atlas project started on 1 July 2007 and is still growing. The project aims to map the distribution and relative abundance of birds in southern Africa.
National Vegetation Map	South African National Biodiversity Institute (SANBI) (BGIS)	2018	Spatial	The National Vegetation Map Project (VEGMAP) is a large collaborative project established to classify, map and sample the vegetation of South Africa, Lesotho and Swaziland.
Red Data Book of Birds of South Africa, Lesotho and Swaziland	BirdLife South Africa	2015	Reference	The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland is an updated and peer-reviewed conservation status assessment of the 854 bird species occurring in South Africa undertaken in collaboration between BirdLife South Africa, the Animal Demography Unit of the University of Cape Town, and the SANBI.
IUCN Red List of Threatened Species (2020.2)	IUCN	2020. 2	Online reference source	Established in 1964, the International Union for Conservation of Nature's Red List of Threatened Species is the world's most comprehensive information source on the global extinction risk status of animal, fungus and plant species.
Important Bird and Biodiversity Areas of South Africa	BirdLife South Africa	2015	Reference work	Important Bird and Biodiversity Areas (IBAs), as defined by BirdLife International, constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative and

Data / Information	Source	Date	Type	Description
				scientifically agreed criteria.
National Protected Areas and National Protected Areas Expansion Strategy (NPAES)	DEFF	2016	Spatial	The goal of NPAES is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion.
Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa	Department of Environmental Affairs, 2015. Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa. CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.	2015	SEA	The SEA identifies areas where large scale wind and solar PV energy facilities can be developed in terms of Strategic Infrastructure Project (SIP) 8 and in a manner that limits significant negative impacts on the natural environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs).
DEFF National Screening Tool	Department of Environment and Forestry (DEFF)	2020	Online assessment tool	The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an application for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity.

2.2 Assumptions, Knowledge Gaps and Limitations

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

- A total of 70 SABAP2 full protocol lists had been completed for the broader area where the proposed project is located (i.e. bird listing surveys lasting a minimum of two hours each). In addition, 48 ad hoc protocol lists (i.e. bird listing surveys lasting less than two hours but still giving useful data) were also recorded. The SABAP2 data was therefore regarded as an adequate indicator of the avifauna which could occur at the study area, and it was further supplemented by data collected during the on-site surveys.
- The focus of the study was primarily on the potential impacts of the proposed solar PV facility and associated grid connection on priority species.
- Priority species were defined as follows:
  - South African Red Data species.
  - South African endemics and near-endemics.
  - Raptors
  - Waterbirds
- Only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser *et al.* 2018) currently exists. Some reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the 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 study area.
- Cumulative impacts include all renewable energy projects within a 30 km radius that have received an EA at the time of starting this BA (i.e. by August 2020). Cumulative impacts also included the consideration of approved (i.e. received EA at the start of this BA), existing and two proposed power line projects within the 30 km radius. The list of projects was provided by the CSIR, and it is assumed that the list is complete.
- Conclusions drawn in this study are based on experience of the specialist on the species found on site and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The broader area is defined as the area encompassed by the 12 pentads where the project is located (see Figure 1 above). The study area is defined as the area covered by the application sites and the powerline corridor. The PV footprint is the where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure.

2.3 Consultation Processes Undertaken

No specific consultative processes were undertaken during the compilation of this assessment.

3. Description of Project Aspects relevant to Avifauna

The following project components are relevant as far as avifauna is concerned:

- Solar Field, comprising Solar Arrays with a maximum height of 10 m and maximum footprint of 250 hectares.
- Building Infrastructure
  - Offices (maximum height 7 m and footprint of 1000 m^2);
  - Operational and maintenance control centre (maximum height 7 m and footprint 500 m^2);
  - Warehouse/workshop (maximum height 7 m and footprint 500 m^2);
  - Ablution facilities (maximum height 7 m and footprint 50 m^2);
  - Converter/inverter stations (height from 2.5 m to 7 m (maximum) and footprint 2500 m^2);
  - On-site substation and/or a switching substation (footprint 20 000 m^2); and
  - Guard Houses (height 3 m, footprint 40 m^2).

- Associated Infrastructure
  - 132 kV overhead power line to connect to the existing Eskom Kappa Substation with a length of 22 – 23km;
  - Internal 33 kV power lines/underground cables (either underground to maximum depth of 1.6 m or above ground with height of 9 m);
  - Battery storage for each Solar PV project. The proposed battery technology is a Lithium Ion Battery, that will cover an area of up to 8 hectares (within the laydown area) and a height of up to 5 – 10 m;
  - Access roads with width ranging between 4 - 8 m. Approximately 3 km for the Grootfontein PV Projects;
  - Internal gravel roads and service road below the power line (width of 4 m);
  - Fencing (between 2 – 3 m high) around the PV Facilities - Access points will be managed and monitored by an appointed security service provider. The type of fencing will either be of palisade, mesh type or a fully electrified option;
  - Game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm, Hoekdoornen and Grootfontein; and
  - Construction work area (i.e. laydown area of maximum 13 ha).

It must be noted that the specifications provided above apply to a single PV facility and are the same for Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, unless where specified.

4. Baseline Environmental Description

4.1 General Description

4.1.1 Important Bird Areas (IBAs)

The Cedarberg - Koue Bokkeveld Complex IBA SA101 is the closest IBA and is located approximately 16km west of the study area. The proposed development is not expected to have any impact on the avifauna in this IBA.

4.1.2 Protected Areas

The study area does not form part of a formally protected area. The closest protected area is the Inverdoorn Private Nature Reserve which is located approximately 6-10km away at its closest point. The proposed development is not expected to have any impact on the avifauna in this nature reserve.

4.1.3 National Protected Areas Expansion Strategy

The study area is not included in the NPAES except for a small section of the powerline corridor which falls within the Tankwa-Cederberg-Roggeveld focus area which should not result in a significant impact for the focus area.

4.1.4 The Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa

The study area falls within the Komsberg Renewable Energy Zone (REDZ) and is classified as Low Sensitivity for avifauna from a solar PV perspective.

4.1.5 Climate, topography and habitat classes

The study area is located in the Succulent Karoo biome, in the Rainshadow Valley Karoo Bioregion (Mucina & Rutherford 2006). The topography is very flat. The Tankwa Karoo is one of the most arid sections of the

Karoo. Isohyets of mean annual rainfall (mm) for the Karoo indicate that the Tankwa-Karoo National Park, which is situated approximately 50km north of the study area in the same bioregion, falls into the 0-100mm range, with 75% of the mean annual precipitation in winter (https://www.sanparks.org/).

The mean July minimum temperature is 6°C (lowest measured -1°C), and the mean January maximum temperature is 38°C (highest measured 50°C). The highest average maximum temperatures occur from November to March with the hottest months being January and February. The highest wind speeds occur from October to March (https://www.sanparks.org/). The land use in the study area is primarily game farming.

The most important anthropogenic avifaunal-relevant habitat modifications currently present in the study area which could potentially influence the avifaunal community that were recorded in or close to the study area are earth dams, boreholes with water reservoirs and troughs, fences and transmission lines.

The habitat in the study area is discussed in more detail below. The priority species associated with each habitat class are listed in Table 1.

- **Succulent Karoo**

Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (Harrison *et al.* 1997). The dominant vegetation type in the study area is Tankwa Karoo (Mucina & Rutherford 2006), which occurs on the plains where study area is located. The plains are very sparsely vegetated with low succulent shrubland, and in extreme precipitation-poor years could appear almost barren (Mucina & Rutherford 2006). The study area is intersected by several drainage lines, supporting a mosaic of succulent shrublands and clumps of *Vachellia karroo* thickets (drainage line woodland). The stunted *Vachellia karoo* trees are used by a number of species for nesting including priority species such as Pale Chanting Goshawk and various smaller shrubland/woodland species.

Images of the typical vegetation structure on the study area is shown below in Figure 3 and Figure 4.

Figure 3: An example of the dominant Succulent Karoo habitat in the study area, consisting mostly of dwarf shrubs with open ground in between.

Figure 4: An example of a drainage line with shrubs and stunted trees.

See Table 1 for a list of priority species that could utilise the Succulent Karoo habitat associated with the study area.

- **Surface water**

Surface water is of specific importance to avifauna in this semi-arid environment. The study area contains a few earth dams located in ephemeral drainage lines, but these are generally dry for most of the year. The dams and drainage lines hold water after good rains, when it is attractive to various bird species, including large raptors, to drink and bath. It also serves as an attraction to waterbirds when it contains water during the winter season, although it must be noted that the study site is generally dry for most of the year. Pools of standing water form in the drainage lines after good rains, which can last for several weeks, depending on the level of precipitation. The study area also contains boreholes with water reservoirs, where surface water becomes available in the form of water troughs, which is an important source of permanent surface water. These water troughs are a big attractant for birds, as they often are the only source of permanent surface water in the area. The wind pumps at the boreholes are also used by a number of species for nesting, including priority species such as Greater Kestrel.

See Figures 5 and 6 for examples of surface water in the study area.

Figure 5: An earth dam in the study area where water is pumped. The dams are dry for most of the year. Note that this dam is located on the Farm Kareekolk (outside of the footprint for the proposed PV plants and power lines).

Figure 6: A borehole and water trough in the study area

See Table 1 for a list of priority species that could utilise the surface water in the study area.

- **Transmission lines**

Transmission lines are an important breeding substrate for raptors in the Karoo, due to the lack of large trees (Jenkins *et al.* 2006, 2013). There are no transmission lines in the PV study area itself, but the powerline corridor is crossed by the 2 Droërivier Muldersvlei – Kappa 400kV transmission line. There is a nest originally built by Martial Eagles situated approximately 3.7km from the powerline corridor at its closest point on Tower 26 of the Kappa Muldersvlei 400kV transmission line. The pair of eagles have not bred there in the 2019 and 2020 breeding season, and the nest was used in both years by a pair of Lanner Falcons (see Figure 7).

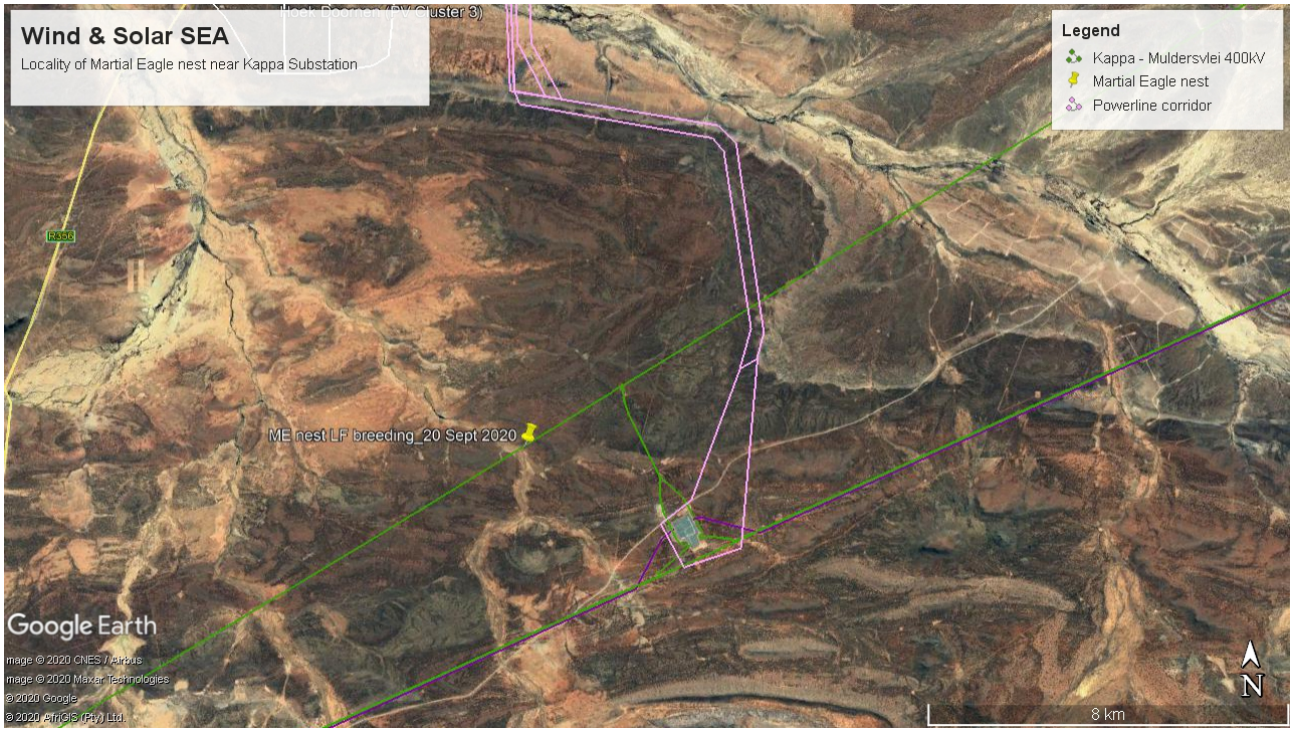

Figure 7: A pair of Lanner Falcons breeding on the Tower 26 of Kappa – Droërivier Muldersvlei 400kV transmission line.

See Table 1 for a list of priority species that could utilise the transmission lines near the study area.

- **Fences**

The study area contains a number of fences (see Figure 8 below). Farm fences provide important perching substrate for a wide range of birds in this virtually treeless environment where natural perches are scarce, as a staging post for territorial displays by small birds and also for perch hunting by raptors such as Greater Kestrel, Rock Kestrel, Jackal Buzzard and Pale Chanting Goshawk.

Table 1 lists the priority species which are associated with fences in the study area.

Figure 8: The study area contains many fences.

- **Agriculture**

The principal land-use in the study area is game farming, with the game subsisting on the natural vegetation. Crops are cultivated on a very limited scale and consist mostly of supplementary fodder, especially lucerne, which is usually located near drainage lines and irrigated through a system of boreholes. The agricultural lands attract certain priority species, e.g. Ludwig's Bustard, Spur-winged Goose, Black-headed Heron, Hadeda Ibis and Egyptian Goose.

Table 1 lists the priority species which are associated with cultivation in the study area.

4.1.6 Avifauna

- **Southern African Bird Atlas 2**

It is estimated that a total of 100 bird species could potentially occur in the broader area. Please refer to Appendix F which provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring so far. Of these, 41 species are classified as priority species, and 17 could occur regularly in the study area. The probability of a priority species occurring regularly in the study area is indicated in Table 1.

Table 1 below lists all the priority species and the possible impact on the respective species by the proposed PV facilities, power lines, and associated infrastructure.

- EN = Endangered
- VU = Vulnerable
- NT = Near threatened
- LC = least concern
- L= Low
- M = Medium
- H = High

Table 1: Priority species occurring in the broader area. The likelihood of regular occurrence in the study area is also indicated

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Drainage line woodland	Surface water	Agricultural lands	Transmission lines	Fences	PV panel collisions	Displacement - disturbance	Displacement - habitat loss	Entrapment in fences	Electrocution on 33kV OHL	Collision with the 132kV grid connection
African Spoonbill	*Platalea alba*	0.00	4.17	x					x	L				x									x
Black Harrier	*Circus maurus*	8.57	8.33	x	VU	EN	Near endemic	x		L		x					x	x	x	x		x	
Black-headed Canary	*Serinus alario*	14.29	4.17	x			Near endemic			H		x			x		x	x	x	x			
Black-headed Heron	*Ardea melanocephala*	2.86	0.00	x					x	L				x	x							x	
Booted Eagle	*Aquila pennatus*	8.57	4.17	x				x		M		x		x			x		x	x		x	
Cape Bulbul	*Pycnonotus capensis*	20.00	4.17	x			Endemic			H			x	x			x	x	x				
Cape Clapper Lark	*Mirafra apiata*	0.00	0.00	x			Endemic			L	x	x					x	x	x	x			
Cape Spurfowl	*Pternistis capensis*	2.86	0.00	x			Near endemic			L			x					x	x		x		
Cape Weaver	*Ploceus capensis*	17.14	4.17	x			Near endemic			H			x				x		x				
Egyptian Goose	*Alopochen aegyptiacus*	5.71	4.17	x					x	H	x			x	x	x		x				x	x
Fairy Flycatcher	*Stenostira scita*	17.14	0.00	x			Near endemic			H			x					x	x				
Great Crested Grebe	*Podiceps cristatus*	0.00	4.17	x					x	L				x				x					
Greater Kestrel	*Falco rupicoloides*	11.43	0.00	x				x		H	x	x				x	x	x	x	x		x	
Grey Tit	*Parus afer*	45.71	4.17	x			Near endemic			H	x	x	x					x	x	x			
Grey-winged Francolin	*Scleroptila africanus*	2.86	4.17	x			Endemic			L		x						x	x	x	x		
Hadeda Ibis	*Bostrychia hagedash*	14.29	0.00	x					x	H			x	x	x								
Jackal Buzzard	*Buteo rufofuscus*	8.57	0.00	x			Near endemic	x		M	x	x		x		x	x		x	x		x	
Karoo Eremomela	*Eremomela gregalis*	25.71	0.00	x			Near endemic			H	x	x	x					x	x	x			

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Drainage line woodland	Surface water	Agricultural lands	Transmission lines	Fences	PV panel collisions	Displacement - disturbance	Displacement - habitat loss	Entrapment in fences	Electrocution on 33kV OHL	Collision with the 132kV grid connection
Karoo Korhaan	*Eupodotis vigorsii*	14.29	0.00	x	LC	NT				H	x	x							x	x	x		x
Karoo Lark	*Calendulauda albescens*	0.00	0.00	x			Endemic			L	x	x						x	x	x			
Karoo Prinia	*Prinia maculosa*	54.29	16.67	x			Near endemic			H	x		x					x	x	x			
Lanner Falcon	*Falco biarmicus*	2.86	0.00	x	LC	VU		x		M		x	x	x	x	x	x	x	x	x		x	
Large-billed Lark	*Galerida magnirostris*	51.43	25.00	x			Near endemic			H	x	x					x	x	x	x			
Layard's Tit-babbler	*Parisoma layardi*	8.57	0.00	x			Near endemic			H			x					x	x	x			
Ludwig's Bustard	*Neotis ludwigii*	5.71	0.00	x	EN	EN				H	x	x			x				x	x	x		x
Martial Eagle	*Polemaetus bellicosus*	5.71	0.00	x	EN	EN		x		M	x	x	x	x	x	x			x	x		x	
Namaqua Warbler	*Phragmacia substriata*	14.29	4.17	x			Near endemic			H			x					x	x	x			
Pale Chanting Goshawk	*Melierax canorus*	68.57	45.83	x				x		H	x	x	x	x	x	x	x	x	x	x		x	
Pied Avocet	*Recurvirostra avosetta*	2.86	0.00	x					x	L	x			x				x					
Pied Starling	*Spreo bicolor*	8.57	0.00	x			Endemic			L	x	x	x	x			x	x	x	x			
Red-knobbed Coot	*Fulica cristata*	2.86	4.17	x					x	L				x				x					x
Rock Kestrel	*Falco rupicolus*	22.86	0.00	x				x		H		x					x		x	x		x	
Sickle-winged Chat	*Cercomela sinuata*	2.86	0.00	x			Near endemic			L	x	x	x				x	x	x	x			
South African Shelduck	*Tadorna cana*	14.29	0.00	x					x	M	x			x				x					x
Southern Black Korhaan	*Afrotis afra*	2.86	4.17	x	VU	VU	Endemic			L		x							x	x	x		x
Southern Double-collared Sunbird	*Cinnyris chalybeus*	0.00	0.00	x			Endemic			L	x		x					x	x				
Spotted Eagle-owl	*Bubo africanus*	8.57	0.00	x				x		M	x	x	x		x		x	x	x			x	
Spur-winged Goose	*Plectropterus gambensis*	2.86	0.00	x					x	L				x	x			x					x
Three-banded Plover	*Charadrius tricollaris*	17.14	12.50	x				x		L	x			x				x	x				
Verreaux's Eagle	*Aquila verreauxii*	11.43	12.50	x	LC	VU		x		L		x		x		x			x	x		x	

- **Pre-construction surveys**

As noted above, on-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2). Surveys were conducted according to a Regime 2 site (medium sensitivity) as defined in the best practice guidelines for avifaunal impact studies at solar developments, compiled by BLSA in 2017 (Jenkins *et al.* 2017).

The abundance of priority species (birds/km) recorded during the walk transects is displayed in Figure 9 below.

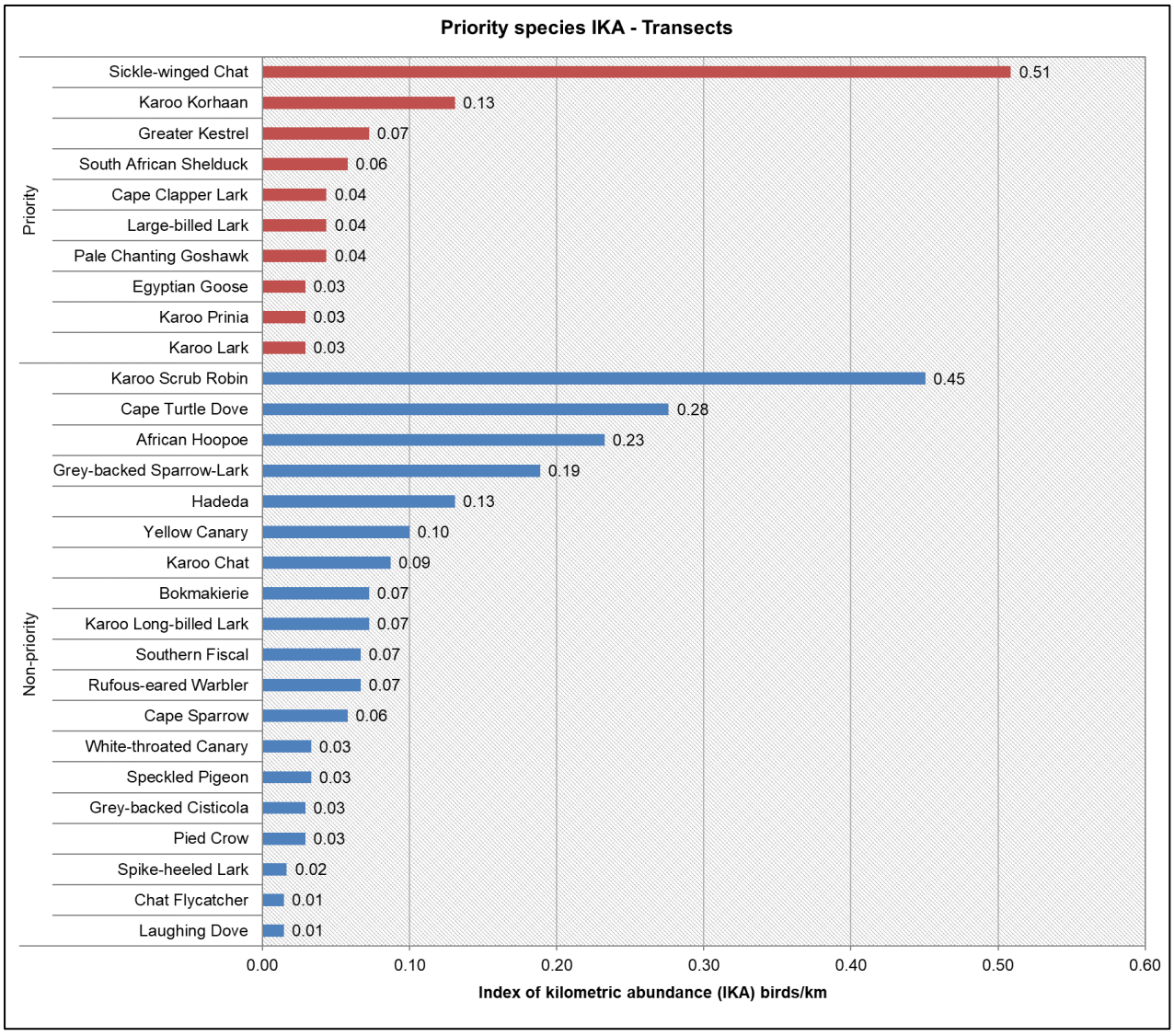

Figure 9: The abundance of priority species recorded during transect counts.

The species which were recorded at focal points are listed in Table 2 below

Table 2: Species recorded at focal points. Priority species are shaded in red.

FP1	FP2	FP3
Karoo Chat	Karoo Korhaan	Brown-throated Martin
Speckled Pigeon	Karoo Chat	Pearl-breasted Swallow
Cape Sparrow	Cape Wagtail	Pied Avocet
Southern Fiscal	Egyptian Goose	South African Shelduck
Yellow Canary	Malachite Sunbird	Three-banded Plover
Karoo Lark	Yellow Canary	Yellow Canary
Bokmakierie	Pied Crow	
Cape Bunting	Cape Turtle Dove	
Malachite Sunbird		
Grey Tit		
Southern Double-collared Sunbird		
Lark-like Bunting		
White-throated Canary		

Table 3 lists the priority species which were recorded as incidental records.

Table 3: Priority species which were recorded as incidental records.

Species	Number
Karoo Korhaan	5
Karoo Lark	3
Ludwig's Bustard	3
Pale Chanting Goshawk	3
Pied Starling	3
Grey Heron	2
Karoo Prinia	2
South African Shelduck	2
Greater Kestrel	1
Jackal Buzzard	1
Karoo Eremomela	1
Large-billed Lark	1
Martial Eagle	1
Spotted Eagle-Owl	1

The overall abundance of priority species at the site was low, with an average of 0.83 birds/km recorded during transect counts. For all birds combined, the index of kilometric abundance (IKA) for transect counts was 8.45 birds/km, which is moderate. The low numbers are not surprising, given the general aridity of the habitat.

4.2. Project Specific Description

4.2.1 Grootfontein PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor near the Eskom Kappa Substation.

4.2.2 Grootfontein PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). There is one small earth dam located in the south of the PV footprint. The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor near the Eskom Kappa substation.

4.2.3 Grootfontein PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor near the Eskom Kappa substation.

4.3. Identification of Environmental Sensitivities

4.3.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

The study area and immediate environment is classified as low sensitivity for avifauna from a PV perspective, except drainage lines (including the Groot River) and a few earth dams which are classified as high sensitivity. No reason is offered for the high classification, but surface water attracts avifauna and that could be the reason for attributing a high sensitivity rating. It should be noted that the Screening Tool did not identify any known nests or roosts.

The site investigation revealed that the study area is generally low sensitivity for avifauna from a PV perspective, with a few areas of high sensitivity namely water reservoirs (permanent surface water) and drainage lines (ephemeral water resource and drainage line woodland habitat) and one priority species nest, namely a Greater Kestrel. The earth dams are very small and basically dry for the majority of the year, therefore from a solar PV perspective, they constitute low sensitive habitat.

There is no specific powerline theme for avifauna in the DEFF Screening Tool, and the study area is classified as mostly medium sensitivity for Animal Species Theme, with small areas of low and high sensitivity. The medium sensitivity rating is linked to the presence of Ludwig's Bustard. The High and Low sensitivity ratings are not linked to avifauna.

See Appendix C for the Site Sensitivity Verification report and Figures 10 and 11 for maps of the sensitivities identified by the screening tool for PV solar (Avifauna) and powerlines (Animal Species Theme).

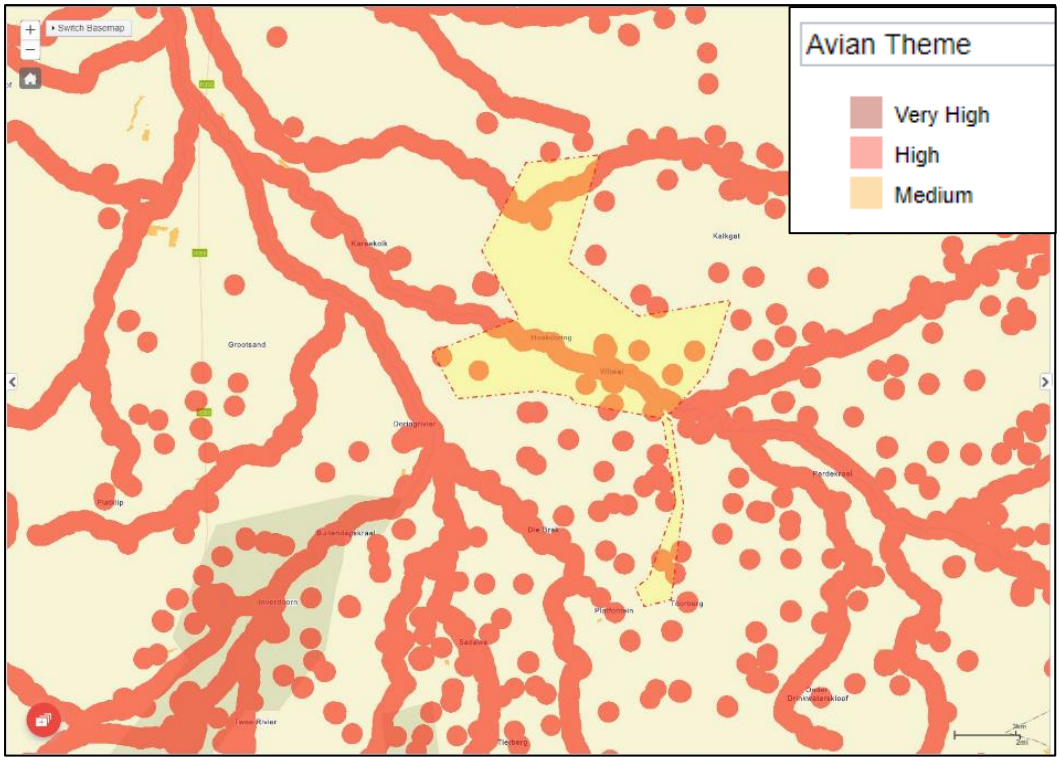

Figure 10: The National Web-Based Environmental Screening Tool map of the consolidated study area, indicating sensitivities for the solar PV avifaunal theme.

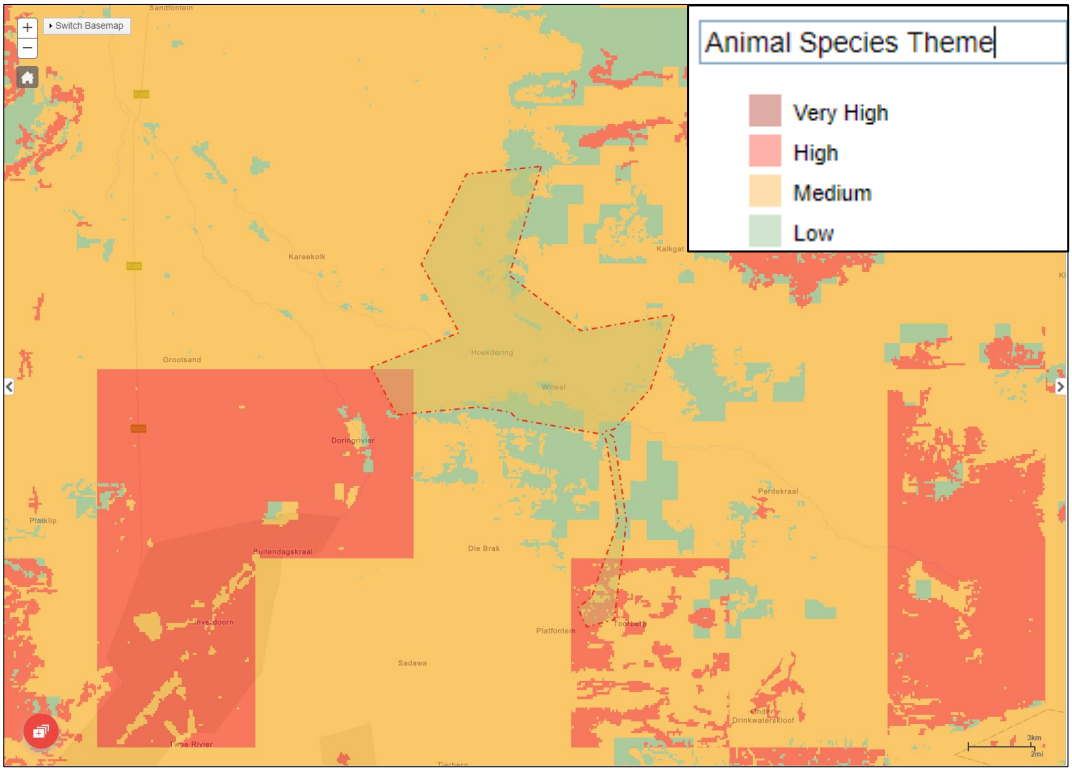

Figure 11: The National Web-Based Environmental Screening Tool map of the consolidated study area, indicating sensitivities for the powerline general animal species theme.

4.3.1.1 Grootfontein PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.1.2 Grootfontein PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.1.3 Grootfontein PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.2 Specialist Sensitivity Analysis and Verification

- **PV Solar**

The following environmental sensitivities were identified from an avifaunal perspective for the PV facilities:

- **Very High sensitivity (No-Go): Surface water**

  Included are areas within 300m of water troughs, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped.

- **Very High sensitivity (No-Go): Drainage line woodland**

  Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival in this very arid climate. All major drainage lines should be classified as No-Go areas to prevent impact on the sensitive habitat.

- **Very High sensitivity (No-Go): Priority species nests**

  Nest of priority species, particularly those that occur naturally at naturally lower numbers such as raptors, should be protected by No-Go buffer zones to prevent displacement of the breeding birds due to disturbance associated with the construction activity.

- **Electricity grid infrastructure**

The following environmental sensitivities were identified from an avifaunal perspective for the proposed powerline grid connections:

- **High sensitivity (Mitigation required): Surface water**

  Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Powerlines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. Powerlines may be routed through High sensitivity buffers, but mitigation will be required in the form of Bird Flight Diverters.

- **Medium sensitivity (Mitigation potentially required): Succulent Karoo**

  The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan.

See Figures 12 and 13 for the avifaunal sensitivities identified from a PV solar and powerline perspective at the three Grootfontein PV facilities, electrical grid infrastructure and associated infrastructure.

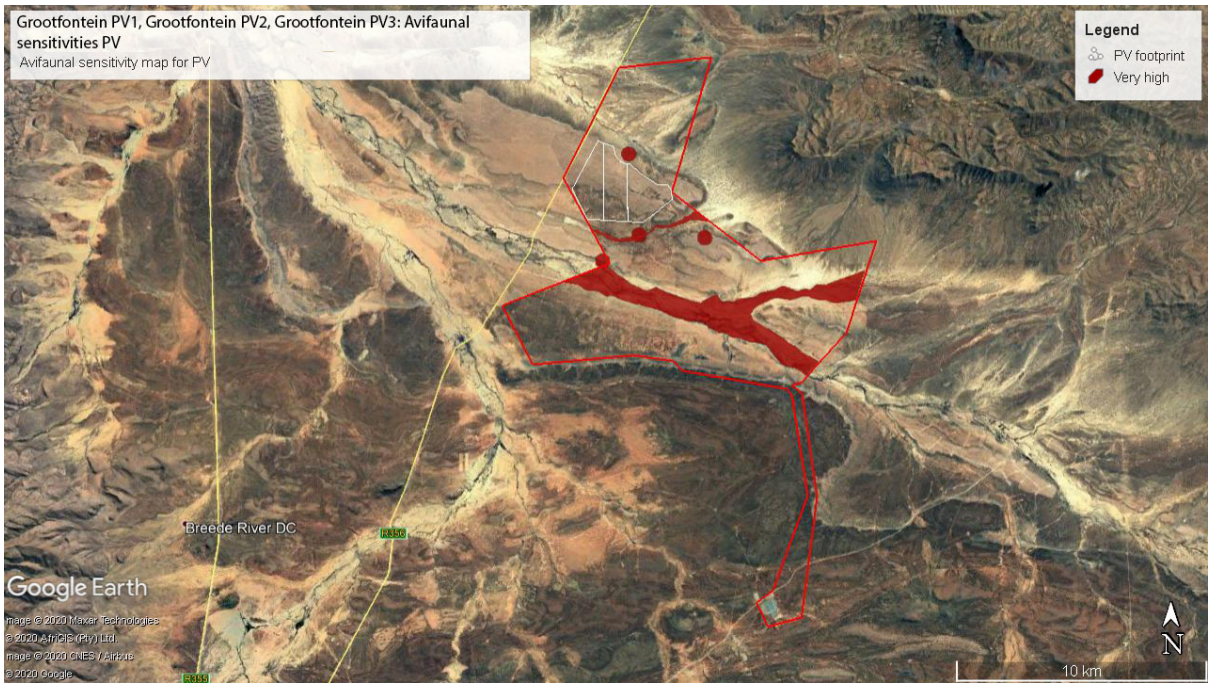

Figure 12: Avifaunal sensitivities (for the PV solar) at the three Grootfontein PV facilities and associated infrastructure.

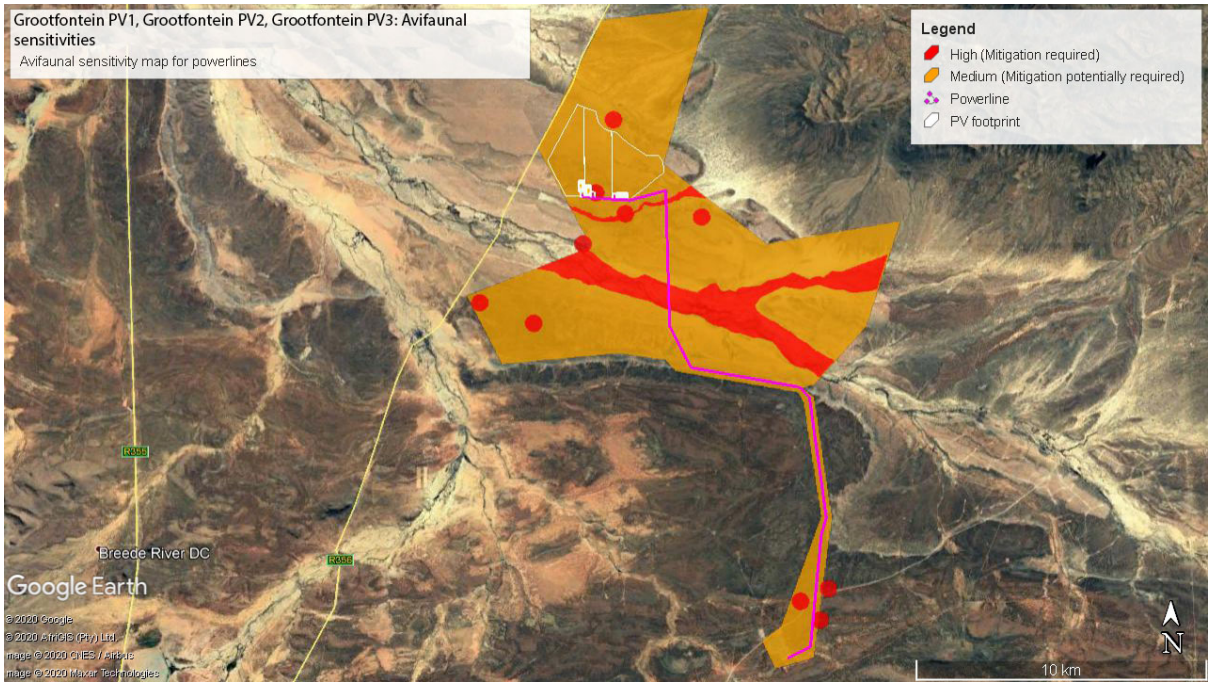

Figure 13: Avifaunal sensitivities (for the powerlines) at the three Grootfontein PV facilities and associated electrical grid infrastructure.

4.3.2.1. Grootfontein PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.2.2. Grootfontein PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.2.3. Grootfontein PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.3. Sensitivity Analysis Summary Statement

- PV solar: Avifaunal theme

The site investigation revealed that the site is generally **low** sensitivity with a few **very highly (no-go)** sensitive areas namely water reservoirs, drainage lines and priority species nests. The sensitivity ratings in the DEFF screening tool are therefore partially confirmed as far as the low sensitivity areas are concerned. However, a few very highly sensitive areas were identified which do not appear in the screening tool.

- Powerline: Animal Species theme

The site investigation revealed that the sensitivity rating of **medium** sensitivity is accurate for avifauna, but there are also areas of **high sensitivity**, namely water reservoirs, drainage lines and earth dams, which will require mitigation. There are no No-Go areas as far as powerlines are concerned.

See Appendix C for the site verification reports.

5. Issues, Risks and Impacts

5.1 Identification of Potential Impacts/Risks

The potential impacts identified in the course of the study are:

5.1.1 Construction Phase

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

5.1.2 Operational Phase

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections

5.1.3 Decommissioning Phase

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

5.1.4 Cumulative Impacts

- Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure
- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences

- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections
- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

6. Impact Assessment

6.1 Introduction

Increasingly, human-induced climate change is recognized as a fundamental driver of biological processes and patterns. Historic climate change is known to have caused shifts in the geographic ranges of many plants and animals, and future climate change is expected to result in even greater redistributions of species (National Audubon Society 2015). In 2006, the World Wide Fund for Nature (WWF) Australia produced a report on the envisaged impact of climate change on birds worldwide (Wormworth & Mallon 2006). The report found that:

- Climate change now affects bird species' behaviour, ranges and population dynamics;
- Some bird species are already experiencing strong negative impacts from climate change; and
- In future, subject to greenhouse gas emissions levels and climatic response, climate change will put large numbers 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, loss occurs without accompanying range expansion.
- For 188 species, 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 10 developing countries required to significantly reduce their carbon emissions (Seymore *et al.* 2014), and the introduction of low-carbon technologies into the country's compliment of power generation will greatly assist with achieving this important objective (Walwyn & Brent 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri 2009; Munzhedi & Sebitosi 2009), it is clear that solar power generation should feature prominently in future efforts to convert to a more sustainable energy mix in order to combat climate change, also from an avifaunal impact perspective. However, while the expansion of solar power generation is undoubtedly a positive development for avifauna in the longer term in that it will help reduce the effect of climate change and thus habitat transformation, it must also be acknowledged that renewable energy facilities, including solar PV facilities, in themselves have some potential for negative impacts on avifauna.

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 source 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-west United States. In South Africa, only one published scientific study has been completed on the impacts of PV plants in a South African context (Visser *et al.* 2019).

6.2 Impacts associated with PV plants and associated infrastructure

6.2.1 Impact trauma (collisions)

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 photovoltaic 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.

Weekly mortality searches at 20% coverage were conducted at the 250MW, 1300ha 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

[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.

facilities, including the 550MW, 1 600ha Desert Sunlight PV plant in California. 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 96MW 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 30km east of Postmasburg in the Northern Cape Province (Visser *et al.* 2019). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 hectares with the capacity to deliver 180 000 MWh 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 the 14th of September 2015 until the 6th of December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per hectare 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/yr (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 solar energy facilities across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser *et al.* 2019).

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 facility 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, and possibly raptors which prey on them.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.2 Entrapment in perimeter fences

Visser *et al.* (2019) recorded a fence-line fatality (Orange River Francolin *Scleroptila gutturalis*) resulting from the bird being trapped between the inner and outer perimeter fence of the facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (e.g. Red-crested Korhaan *Lophotis ruficrista*) (Visser *et al.* 2019). 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.

It is not foreseen that entrapment in perimeter fences will be a significant impact. The priority species which could potentially be affected by this impact are most likely medium to large terrestrial species.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.3 Displacement due to disturbance and habitat transformation associated with the construction and operation of the solar PV facilities

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 solar energy facilities, 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).

Solar energy facilities 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 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 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 vs 46), supporting the view that solar development is 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.* (2019) gathered bird transect data at the 180 hectares, 96MW 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*. (2019) 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 specialist species 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 Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 projects, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities.

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 Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 facilities. In addition, raptors and large terrestrial species could also be impacted.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.4 Electrocutions

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, on the internal 33kV powerlines within the footprint of the PV facilities, should the decision be to not go underground with the reticulation network. This is especially a major problem for the larger Red Listed species, e.g. Martial Eagle, as it is envisaged that they will frequently perch on the power poles.

See Table 1 for list of species which could potentially be affected by this impact.

6.3 Impacts associated with electricity grid infrastructure

Negative impacts on birds by electricity infrastructure generally take two principal forms, namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins *et al.* 2010). In this instance, the major potential impact with the 132kV grid connections is powerline collisions.

6.3.1 Collisions with the 132kV grid connections

Collisions are probably the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004; Shaw 2013). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. 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 power lines (van Rooyen 2004; Shaw 2013).

In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with power lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini *et al*. 2005, Jenkins *et al*. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the low-resolution and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin *et al*. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown *et al.* 1987, Henderson *et al.* 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown *et al*. 1987, APLIC 1994).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span

lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins *et al.* 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown *et al.* 1987, Faanes 1987, Bevanger 1994)."

As mentioned by Shaw (2013) in the extract above, several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is essential to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes and White Storks. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35° respectively are sufficient to render the birds blind in the direction of travel; in storks head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (*Accipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes and are also known to be vulnerable to power line collisions.

Thus visual field topographies which have evolved primarily to meet visual challenges associated with foraging may render certain bird species particularly vulnerable to collisions with human artefacts, such as power lines and wind turbines that extend into the otherwise open airspace above their preferred habitats. For these species placing devices upon power lines to render them more visible may have limited success since no matter what the device the birds may not see them. It may be that in certain situations it may be necessary to distract birds away from the obstacles, or encourage them to land nearby (for example by the use of decoy models of conspecifics, or the provision of sites attractive for roosting) since increased marking of the obstacle cannot be guaranteed to render it visible if the visual field configuration prevents it being detected. Perhaps most importantly, the results indicate that collision mitigation may need to vary substantially for different collision prone species, taking account of species specific behaviours, habitat and foraging preferences, since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all (Martin & Shaw 2010).

Despite evidence that line marking might be ineffective for some species due to differences in visual fields and behaviour, or have only a small reduction in mortality in certain situations for certain species, particularly bustards (Martin & Shaw 2010; Barrientos *et al.* 2012; Shaw 2013), it is generally accepted that marking a line with PVC spiral type Bird Flight Diverters can reduce the collision mortality rates (Sporer *et al.* 2013; Barrientos *et al.* 2012, Alonso & Alonso 1999; Koops & De Jong 1982). Regardless of statistical significance, a slight mortality reduction may be very biologically

relevant in areas, species or populations of high conservation concern (e.g. Ludwig's Bustard) (Barrientos *et al.* 2012). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. A study reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease in bird collisions. At unmarked lines, there were 0.21 deaths/1000 birds (n = 339,830) that flew among lines or over lines. At marked lines, the mortality rate was 78% lower (n = 1,060,746) (Barrientos *et al.* 2011). Koops and De Jong (1982) found that the spacing of the Bird Flight Diverters were critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5 metres, whereas using the same devices at 10 metre intervals only reduces the mortality by 57%. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important, as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (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).

Quantifying the collision impact in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from incidental record keeping by the EWT, it is possible to give a measure of what species are susceptible to powerline collisions (see Figure 14). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

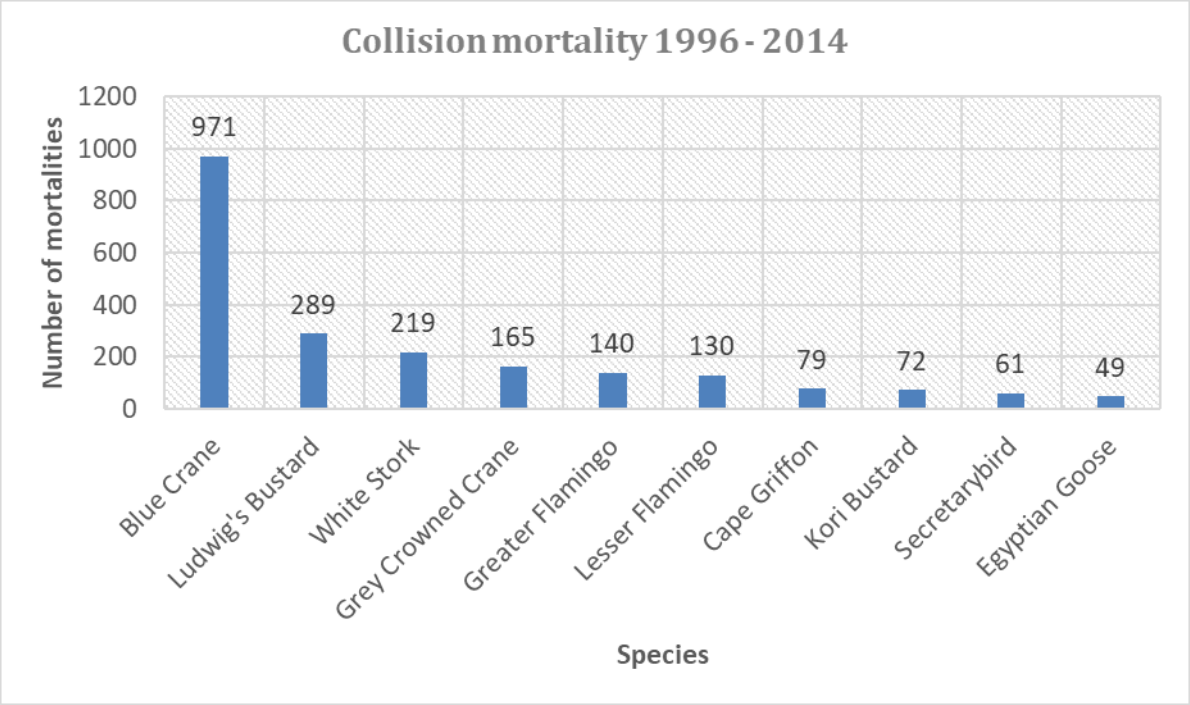

Figure 14: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data 2014).

Species potentially at risk of collisions with the 132kV grid connection are listed in Table 1.

6.4 Cumulative impacts

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy developments that have received an Environmental Authorisation within at least a 30km radius of the proposed site, as well as the nine proposed Veroniva Ceres PV developments and associated grid connections (i.e. total of nine power lines). There are currently 11 renewable energy projects authorised within a 30km radius around the proposed nine Veroniva Ceres PV projects. Of these, only two are solar PV projects, and one is a hybrid wind and solar PV project. The locality of renewable projects (land parcels) which are authorised are displayed in Figure 15 and listed in Appendix G.

The total affected land parcel area taken up by authorised renewable energy projects and their grid connections within the 30km radius is approximately 44 578 ha. The total affected land parcel area of the nine Veroniva Ceres PV projects and grid connections comprises approximately 18 232ha. If one assumes that all nine Veroniva projects will be authorised, the combined land parcel area affected by renewable energy developments within the 30km radius around the Veroniva projects will equal 62 810 ha. The total area within the 30km radius around the proposed projects equates to about 502 776ha of similar habitat. The total combined size of the land parcels affected by renewable energy projects and their grid connections will thus equate to 12.4% of the available habitat in the 30km radius. However, the actual physical footprint of the renewable energy facilities will be much smaller than the land parcel areas themselves, for example in the case of wind energy, the physical footprint comprises less than 5% of the project area. Furthermore, each of these projects must still be subject to a competitive bidding process where only the most competitive projects will win a power purchase agreement required for the project to proceed to construction. The cumulative impact of the Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3 solar PV projects is thus anticipated to be **low** after mitigation.

The proposed grid connections of the 9 Veroniva Ceres PV projects equates to about 184km. However, approximately 135km of line will be routed parallel in one “highway”, which means that as far as bird collision impacts are concerned, the additional length of powerline effectively equates to about 64km. There are approximately 221km of existing and 83km (total = 304km) of planned transmission lines within the 30km radius around the Veroniva Ceres PV projects. These projects will thus increase the total number of planned and existing high voltage lines by 21%. The cumulative impact of the planned grid connections is therefore considered to be **moderate** from a potential bird collision perspective after mitigation.

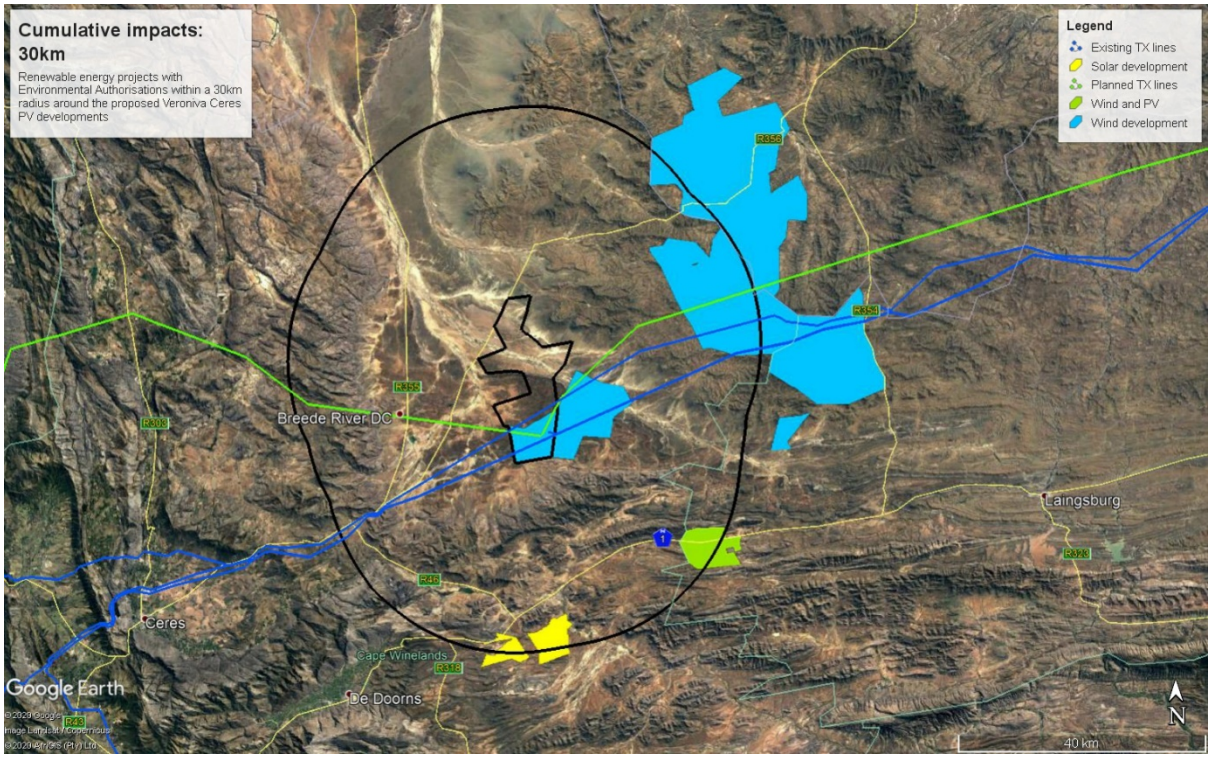

Figure 15: Map showing location of land parcels with authorised renewable energy projects within a 30km radius around the study area. This map also shows proposed and existing power lines within the 30km radius.

6.5 No-go option

The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained, which will be to the advantage of the avifauna. No fatal flaws were discovered in the course of the investigations.

6.6 Grootfontein PV 1, PV 2, and PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure[2]

This section includes a description of the assessment of the potential impacts identified for avifauna for the proposed Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3 and all associated infrastructure, including the power lines. No indirect impacts have been identified for the proposed project from an avifaunal perspective.

[2] Due to the similarity in habitat, the impacts are expected to be essentially identical for all the projects

6.6.1. Potential Impacts during the Construction Phase

The following impacts have been identified for the construction phase.

6.6.1.1. **Impact 1: Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure**

The noise and movement associated with the construction activities at the proposed PV footprints for Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3, and associated infrastructure (including roads and substation) will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.1.2 below.

6.6.1.2. **Impact Summary Tables: Construction Phase**

The rating of the impacts identified for the construction phase is discussed in this section.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Impact 1: Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure	*Status*	*Negative*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.* ▪ *Access to the rest of the property must be restricted.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.*	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.2. Potential Impacts during the Operational Phase

The following impacts have been identified for the operational phase.

6.6.2.1. **Impact 1**: Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.

This impact relates to the total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure. This impact is rated as negative, with a site specific spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and very likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.2.6 below.

6.6.2.2. **Impact 2:** Bird mortality through collisions with the solar panels.

This impact relates to the bird kills and injury as a result of potential collisions with the solar panels. This impact is rated as negative, with a site specific spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a slight consequence and unlikely probability, which will render the impact significance as very low. As detailed in Section 6.6.2.6 below, no mitigation is required due to the very low impact significance.

6.6.2.3. **Impact 3:** Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.

This impact pertains to the entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality. This impact is rated as negative, with a site specific spatial extent and a long term duration due to the long timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is rated with a moderate consequence and likely probability, which will result in a low impact significance, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to very low. The recommended mitigation measure includes using a single perimeter fence around the PV Facility.

6.6.2.4. **Impact 4:** Electrocution of priority species on the internal 33kV powerlines.

This impact deals with the potential electrocution of priority species on the internal 33kV powerlines at the Grootfontein PV 1, Grootfontein PV 2 and Grootfontein PV 3 facilities. This impact is rated as negative, with a local spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will result in an impact significance of high, without the implementation of mitigation measures. With the implementation of mitigation measures (i.e. use underground cabling), the significance of the impact is reduced to very low.

6.6.2.5. **Impact 5:** Collisions with the 132kV grid connections

This impact deals with potential collisions with the 132kV grid connections. This impact is rated as negative, with a local spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.2.6 below.

6.6.2.6. **Impact Summary Tables: Operational Phase**

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.	*Status*	*Negative*	*High (2)*	▪ *The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.* ▪ *A 300m infrastructure-free buffer must be maintained around the water reservoirs (see sensitivity map Figure 12).* ▪ *No solar PV arrays must be constructed in drainage lines (see sensitivity map Figure 12).*	*Moderate (3)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Mortality through collisions with the solar panels	*Status*	*Negative*	*Very low (5)*	*No mitigation is required due to the very low significance*	*Very low (5)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Slight*				
	Probability	*Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	*Status*	*Negative*	*Low (4)*	*A single perimeter fence should be used.*	*Very low (5)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Electrocution of priority species on the internal 33kV powerlines.	*Status*	*Negative*	*High (2)*	*Use underground cabling*	*Very Low (5)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Collision mortality of priority species due to the 132kV grid connections.	*Status*	*Negative*	*High (2)*	*The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.*	*Moderate (3)*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.3. Potential Impacts during the Decommissioning Phase

The following impacts have been identified for the decommissioning phase.

6.6.3.1. **Impact 1:** Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The noise and movement associated with the potential decommissioning activities will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.3.2 below.

6.6.3.2. **Impact Summary Tables: Decommissioning Phase**

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the study area will be a source of disturbance which would lead to the displacement of avifauna from the area.	*Status*	*Negative*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads during the decommissioning phase should be kept to a minimum as far as practical.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned*	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.4. Cumulative Impacts

The following cumulative impacts have been identified.

6.6.4.1. **Impact 1: Construction Phase -** Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure

The noise and movement associated with the construction activities of similar projects within the 30 km radius will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.7 below.

6.6.4.2. **Impact 2**: Operational Phase - Habitat transformation, collisions with the solar panels, entrapment in fences, and electrocution on internal reticulation lines

This impact deals with the following during the operational phase with regards to other similar projects in the 30 km radius:

- Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure;
- Bird mortality and injury as a result of collisions with the solar panels;
- Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality;
- Electrocution of priority species on the internal 33kV powerlines; and
- Collisions with the 132kV grid connections.

This impact is rated as negative, with a regional spatial extent and a long term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.8 below.

6.6.4.3. **Impact 3 Operational Phase -** Collisions with the 132kV grid connections

This impact deals with potential collisions with the 132kV grid connections during the operational phase with regards to other similar projects in the 30 km radius. This impact is rated as negative, with a local spatial extent and a long term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.4.8 below.

6.6.4.4. **Impact 4 Decommissioning Phase -** Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The noise and movement associated with the potential decommissioning activities (in terms of other similar projects in the 30 km radius) will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.8 below.

6.6.4.5. **Impact Summary Tables: Cumulative Impacts**

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure	*Status*	*Negative*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.* ▪ *Access to the rest of the property must be restricted.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.*	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				
OPERATIONAL PHASE						
Habitat transformation, collisions with the solar panels, entrapment in fences, and electrocution on internal reticulation lines,	*Status*	*Negative*	*Moderate (3)*	▪ *The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.* ▪ *Infrastructure-free buffers must be maintained around the water reservoirs*	*Low (4)*	*Medium*
	Spatial Extent	*Regional*				
	Duration	*Long term*				
	Consequence	*Substantial*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
				▪ No solar PV arrays must be constructed in drainage lines ▪ A single perimeter fence should be used. ▪ Use underground cabling		
Collisions with the 132kV grid connection	Status	Negative	High (2)	The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.	Moderate (3)	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Severe				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	Low				
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the	Status	Negative	Moderate (3)	▪ Activity should as far as possible be restricted to the footprint of the infrastructure.	Low (4)	Medium
	Spatial Extent	Site specific				
	Duration	Short term				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
study area will be a source of disturbance which would lead to the displacement of avifauna from the area	*Consequence*	*Substantial*		▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads during the decommissioning phase should be kept to a minimum as far as practical.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned*		
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

7 Impact Assessment Summary

The overall impact significance is provided in this section, in terms of pre- and post-mitigation.

Table 4: Overall Impact Significance (Pre- and Post Mitigation)

Phase	Overall Impact Significance (Pre Mitigation)	Overall Impact Significance (Post Mitigation)
Construction	Moderate (3)	Low (4)
Operational	Moderate (3)	Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	Moderate (3)	Low (4)
Cumulative - Decommissioning	Moderate (3)	Low (4)

8 Legislative and Permit Requirements

8.1 Legislative Framework

There is no legislation pertaining specifically to the impact of solar facilities and associated electrical grid infrastructure on avifauna. There are best practice guidelines available which were compiled under the auspices of BLSA i.e. Jenkins, A.R., Ralston-Patton, Smit- Robinson, A.H. 2017. *Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa*. This guideline has been considered in this assessment.

8.1.1 Agreements and conventions

International agreements and conventions are described in this section.

Table 5: International agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of 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 Convention on Biological Diversity (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; and • The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global

Convention name	Description	Geographic scope
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 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

8.1.2 National legislation

8.1.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

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

8.1.2.2 The National Environmental Management Act (Act 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 a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) 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 (via the promulgation of the EIA Regulations (2014, as amended), which may significantly affect the environment, may be performed only after an EIA or BA has been undertaken and environmental authorisation has been obtained from the relevant competent 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.

8.1.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 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 (Act 10 of 2004, as amended) read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they 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. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals (as noted in Table 5 above). The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

8.1.2.4 Provincial legislation

8.1.2.4.1 Western Cape Nature Conservation Laws Amendment Act, 2000

This statute provides for the amendment of various laws on nature conservation in order 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.

9 Environmental Management Programme Inputs

Please see a description of the key mitigation and monitoring recommendations for each applicable mitigation measure identified for all phases of the project.

9.1 Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Entrapment					
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Prevent mortality of avifauna	1. A single perimeter fence should be used[3].	Design the facility with a single perimeter fence.	Once-off during the planning phase.	Project Developer
Avifauna: Displacement					
Displacement of avifauna due to habitat loss in the development footprint.	Prevent displacement of avifauna	1. A 300m infrastructure-free buffer must be maintained at waterpoints in terms of the sensitivities determined for the power lines. 2. No solar panels to be constructed in drainage lines	Design the facility with 300m buffers around boreholes and with no solar panels in drainage lines.	Once-off during the planning phase.	Project Developer
Avifauna: Electrocution					
Electrocution of raptors on the internal 33kV poles	Prevent electrocutions	1. Use underground cabling	Design the facility with underground cabling	Once-off during the planning phase.	Project Developer

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

9.2 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 botanical 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. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO
Avifauna: Mortality due to collisions with the 132kV grid connection					
Bird collisions with the earthwire of the proposed 132kV grid connection.	Prevention of collision mortality on the powerline.	Pro-active marking of identified high risk spans with Bird Flight Diverters (BFDs), based on walk-through by the avifaunal specialist.	1. Walk-through by avifaunal specialist prior to implementation to identify high risk spans.	1. Once-off during the construction phase. 2. Once-off during the construction phase.	1. Developer 2. Facility operational manager

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			2. Implementation of appropriate measures e.g. marking of the earthwire with BFDs on high risk spans.		

9.3 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) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. 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
Avifauna: Mortality due to collisions with the 132kV grid connection					
Bird collisions with the earthwire of the proposed 132kV grid connections.	Prevention of collision mortality on the powerlines.	Reactive marking of identified high risk spans with Bird Flight Diverters (BFDs), based on regular powerline inspections by the avifaunal specialist.	1. Powerline inspections by avifaunal specialist to look for carcasses. 2. Implementation of appropriate measures e.g. marking of the earthwire with BFDs on high risk spans.	1. Monthly 2. Monthly	1. Facility Environmental Manager 2. Facility Operational Manager

10 Final Specialist Statement and Authorisation Recommendation

10.1 Statement and Reasoned Opinion

The expected impacts of the Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3 solar PV facilities, electrical grid infrastructure and associated infrastructure were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (see Table 4 above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the EMPr (Section 9) are strictly implemented.

10.2 EA Condition Recommendations

The proposed mitigation measures are detailed in Section 9 above.

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Appendices

Appendix A: Specialist Expertise

Appendix B: Specialist statement of independence

Appendix C: Site sensitivity verification

Appendix D: Impact Assessment methodology

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Appendix F: Species List

Appendix G: List of renewable energy projects within 30km radius

Appendix A - Specialist Expertise

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	22 years

Key Experience

Chris van Rooyen has twenty-two years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Key Project Experience

Bird Impact Assessment Studies and avifaunal monitoring for wind-powered generation facilities:

1. Eskom Klipheuwel Experimental Wind Power Facility, Western Cape
2. Mainstream Wind Facility Jeffreys Bay, Eastern Cape (EIA and monitoring)
3. Biotherm, Swellendam, (Excelsior), Western Cape (EIA and monitoring)
4. Biotherm, Napier, (Matjieskloof), Western Cape (pre-feasibility)
5. Windcurrent SA, Jeffreys Bay, Eastern Cape (2 sites) (EIA and monitoring)
6. Caledon Wind, Caledon, Western Cape (EIA)
7. Innowind (4 sites), Western Cape (EIA)
8. Renewable Energy Systems (RES) Oyster Bay, Eastern Cape (EIA and monitoring)
9. Oelsner Group (Kerriefontein), Western Cape (EIA)
10. Oelsner Group (Langefontein), Western Cape (EIA)
11. InCa Energy, Vredendal Wind Energy Facility Western Cape (EIA)
12. Mainstream Loeriesfontein Wind Energy Facility (EIA and monitoring)
13. Mainstream Noupoort Wind Energy Facility (EIA and monitoring)
14. Biotherm Port Nolloth Wind Energy Facility (Monitoring)
15. Biotherm Laingsburg Wind Energy Facility (EIA and monitoring)
16. Langhoogte Wind Energy Facility (EIA)
17. Vleesbaai Wind Energy Facility (EIA and monitoring)
18. St. Helena Bay Wind Energy Facility (EIA and monitoring)
19. Electrawind, St Helena Bay Wind Energy Facility (EIA and monitoring)
20. Electrawind, Vredendal Wind Energy Facility (EIA)
21. SAGIT, Langhoogte and Wolseley Wind Energy facilities
22. Renosterberg Wind Energy Project – 12-month preconstruction avifaunal monitoring project
23. De Aar – North (Mulilo) Wind Energy Project – 12-month preconstruction avifaunal monitoring project
24. De Aar – South (Mulilo) Wind Energy Project – 12-month bird monitoring
25. Namies – Aggenys Wind Energy Project – 12-month bird monitoring
26. Pofadder - Wind Energy Project – 12-month bird monitoring
27. Dwarsrug Loeriesfontein - Wind Energy Project – 12-month bird monitoring
28. Waaihoek – Utrecht Wind Energy Project – 12-month bird monitoring

29. Amathole – Butterworth Utrecht Wind Energy Project – 12-month bird monitoring & EIA specialist
30. Phezukomoya and San Kraal Wind Energy Projects 12-month bird monitoring & EIA specialist study (Innowind)
31. Beaufort West Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
32. Leeuwdraai Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
33. Sutherland Wind Energy Facility 12-month bird monitoring (Mainstream)
34. Maralla Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
35. Esizayo Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
36. Humansdorp Wind Energy Facility 12-month bird monitoring & EIA specialist study (Cennergi)
37. Aletta Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
38. Eureka Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
39. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
40. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
41. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
42. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
43. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
44. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
45. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
46. Dassieklip Wind Energy Facility 3 years post-construction monitoring (Biotherm)
47. Loeriesfontein 2 Wind Energy Facility 2 years post-construction monitoring (Mainstream)
48. Khobab Wind Energy Facility 2 years post-construction monitoring (Mainstream)
49. Excelsior Wind Energy Facility 18 months construction phase monitoring (Biotherm)
50. Boesmansberg Wind Energy Facility 12-months pre-construction bird monitoring (juwi)
51. Mañhica Wind Energy Facility, Mozambique, 12-months pre-construction monitoring (Windlab)
52. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
53. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO).
54. Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
55. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
56. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
57. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
58. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
59. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
60. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
61. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
62. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
63. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
64. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
65. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
66. Pofadder Wind Energy Facility, Northren Cape, Screening Report (Atlantic Energy)
67. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
68. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
69. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment Studies for Solar Energy Plants:

1. Concentrated Solar Power Plant, Upington, Northern Cape.
2. Globeleq De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos PV project, Copperton, Northern Cape

4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena PV Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla PV Project, Aggeneys, Northern Cape
8. Biotherm Sendawo PV Project, Vryburg, North-West
9. Biotherm Tlisitseng PV Project, Lichtenburg, North-West
10. JUWI Hotazel Solar Park Project, Hotazel, Northern Cape
11. Namakwa Solar Project, Aggeneys, Northern Cape
12. Brypaal Solar Power Project, Kakamas, Northern Cape
13. ABO Vryburg 1,2,3 Solar PV Project, Vryburg, North-West
14. Scatec Solar Kenhardt PV 4, PV 5 and PV6 Projects, Kenhardt, Northern Cape
15. NamPower CSP Facility near Arandis, Namibia
16. Dayson Klip PV Facility near Upington, Northern Cape
17. Geelkop PV Facility near Upington, Northern Cape
18. Oya PV Facility, Ceres, Western Cape
19. Vrede and Rondawel PV Facilities, Free State
20. Kolkies & Sadawa PV Facilities, Western Cape
21. Leeudoringstad PV Facility, North-West

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV
14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation
37. Braamhoek 22kV

38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV
94. Riversong 88kV

95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
118. Matla-Glockner 400kV
119. Delmas North 44kV
120. Houwhoek 11kV Refurbishment
121. Clau-Clau 132kV
122. Ngwedi-Silwerkrans 134kV
123. Nieuwehoop 400kV walk-through
124. Booysendal 132kV Switching Station
125. Tarlton 132kV
126. Medupi - Witkop 400kV walk-through
127. Germiston Industries Substation
128. Sekgame 132kV
129. Botswana – South Africa 400kV Transfrontier Interconnector
130. Syferkuil – Rampheri 132kV
131. Queens Substation and associated 132kV powerlines
132. Oranjemond 400kV Transmission line
133. Aries – Helios – Juno walk-down
134. Kuruman Phase 1 and 2 Wind Energy facilities 132kV Grid connection
135. Transnet Thaba 132kV

Bird Impact Assessment Studies for the following residential and industrial developments:

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Somerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm Blesbokfontein)
8. N17 Section: Springs To Leandra – “Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek 314 Ir)
9. South African Police Services Gauteng Radio Communication System: Portion 136 Of The Farm 528 Jq, Lindley.
10. Report for the proposed upgrade and extension of the Zeekoegat Wastewater Treatment Works, Gauteng.

11. Bird Impact Assessment for Portion 265 (a portion of Portion 163) of the farm Rietfontein 189-JR, Gauteng.
12. Bird Impact Assessment Study for Portions 54 and 55 of the Farm Zwartkop 525 JQ, Gauteng.
13. Bird Impact Assessment Study Portions 8 and 36 of the Farm Nooitgedacht 534 JQ, Gauteng.
14. Shumba's Rest Bird Impact Assessment Study
15. Randfontein Golf Estate Bird Impact Assessment Study
16. Zilkaatsnek Wildlife Estate
17. Regenstein Communications Tower (Namibia)
18. Avifaunal Input into Richards Bay Comparative Risk Assessment Study
19. Maquasa West Open Cast Coal Mine
20. Glen Erasmia Residential Development, Kempton Park, Gauteng
21. Bird Impact Assessment Study, Weltevreden Mine, Mpumalanga
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Mpumalanga
24. Lindley Estate, Lanseria, Gauteng
25. Proposed open cast iron ore mine on the farm Lylyveld 545, Northern Cape
26. Avifaunal monitoring for the Sishen Mine in the Northern Cape as part of the EMPr requirements
27. Steelpoort CNC Bird Impact Assessment Study

Professional affiliations

I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	20 years

Key Qualifications

Albert Froneman **(**Pr.Sci.Nat) has more than 18 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. Oysterbay 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 Kolkies & 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 Assesment 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 Powerline 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 Origstad 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 Tswane – 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 Powerline 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 powerlines – GIS Specialist & Mapping
45. ESKOM Magopela- Pitsong 132kV line and new substation – GIS Specialist & Mapping

Professional affiliations

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

Appendix B - Specialist Statement of Independence

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

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)

PROJECT TITLE

Basic Assessments for the Proposed Development of three 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Grootfontein 1; Grootfontein 2; and Grootfontein 3), near Touws River, Western Cape

Kindly note the following:

1. This form must always be used for 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 01 September 2018. 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.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Afrimage Photography (Pty) Ltd t/a Chris van Rooyen Consulting			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 4	Percentage Procurement recognition	
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.			
Physical address:	6 Pladda Drive Plettenberg Bay			
Postal address:	P.O Box 2676, Fourways			
Postal code:	2055			
Telephone:	0824549570			
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Chris van Rooyen declare that –

- I act as the independent specialist in this application;
- 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 Act.

Signature of the Specialist

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company:

1 November 2020

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Chris van Rooyen, 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

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company

1 November 2020

Date

Signature of the Commissioner of Oaths

2020-11-01

Date

SOUTH AFRICAN POLICE SERVICE
PLETTENBERG BAY
2020 -11- 0 1
PLETTENBERGBAAI
SOUTH AFRICAN POLICE SERVICE

Appendix C: Site Sensitivity Verification

Prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification was 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).

The details of the site sensitivity verification are noted below:

Date of Site Visit	25-27 August 2020 and 16 – 19 September 2020
Specialist Name	Chris van Rooyen
Professional Registration Number	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.
Specialist Affiliation / Company	Chris van Rooyen Consulting

1 Methodology

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the study area is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 12 pentads where the study area is located, henceforth called the broader area. The SABAP2 data covers the period 2007 to 2020. The relevant pentads are 3250_1950, 3250_1955, 3250_2000, 3255_1950, 3255_1955, 3255_2000, 3300_1950, 3300_1955, 3300_2000, 3305_1950, 3305_1955, 3305_2000.
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map (2018) accessed via the South African National Biodiversity BGIS map viewer (SANBI 2020).
- Satellite imagery was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- On-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2) according to the best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*. 2017).

2 Results

The study area and immediate environment is classified as low sensitivity for avifauna from a PV perspective, except drainage lines (including the Groot River) and a few earth dams which are classified as high sensitivity. No reason is offered for the high classification, but surface water attracts avifauna and that could be the reason for attributing a high sensitivity rating. It should be noted that the screening tool did not identify any known nests or roosts.

The site investigation revealed that the study area is generally low sensitivity for avifauna from a PV perspective, with a few areas of very high sensitivity namely water reservoirs (permanent surface water) and drainage lines (ephemeral water resource and drainage line woodland habitat) and one priority species nest, namely a Greater Kestrel. The earth dams are very small and basically dry for the majority of the year, therefore from a solar PV perspective, they constitute low sensitive habitat.

There is no specific powerline theme for avifauna in the DEFF screening tool, and the study area is classified as mostly medium sensitivity for Animal Species Theme, with small areas of low and high sensitivity. The medium sensitivity rating is linked to the presence of Ludwig's Bustard. The High and Low sensitivity ratings are not linked to avifauna.

3 Concluding statement

The expected impacts of the Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3 solar PV facilities, electrical grid infrastructure and associated infrastructure were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (see Table 4). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the EMPr (Section 9) are strictly implemented.

Appendix D: Impact Assessment Methodology

The following impact assessment was used in this study.

The impact assessment includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFF Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D1).

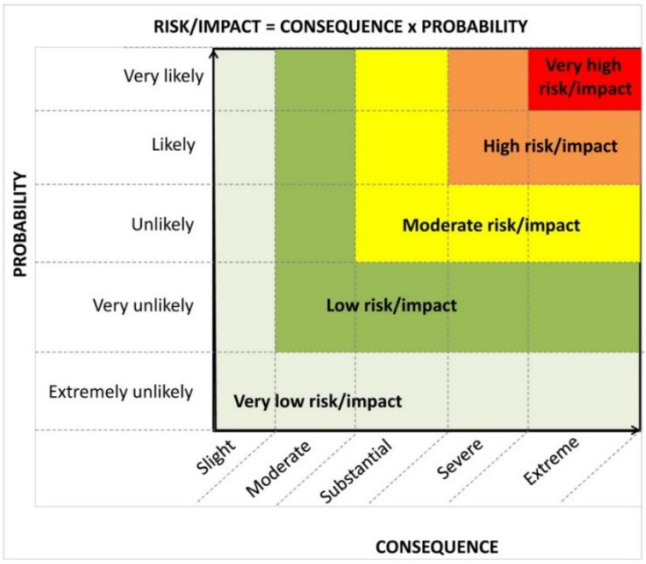


Figure D1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:
- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	***Section where this has been addressed in the Specialist Report***
1. (1) A specialist report prepared in terms of these Regulations must contain - *a) details of -* *i. the specialist who prepared the report; and* *ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;*	*Appendix A*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Appendix B*
c) an indication of the scope of, and the purpose for which, the report was prepared;	*Section 1*
(cA) an indication of the quality and age of base data used for the specialist report;	*Section 2*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*Section 4 and Section 6*
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*Section 4*
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	*Section 2 and Section 4*
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	*Section 4 and Section 5*
g) an identification of any areas to be avoided, including buffers;	*Section 4*
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	*Section 4*
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Section 2 (i.e. Section 2.2)*
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	*Section 6 and Section 10*
k) any mitigation measures for inclusion in the EMPr;	*Section 6 and Appendix H*
l) any conditions for inclusion in the environmental authorisation;	*Appendix H*
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*Appendix H*
n) a reasoned opinion- *i. whether the proposed activity, activities or portions thereof should be authorised;* *(iA) regarding the acceptability of the proposed activity or activities; and* *ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;*	*Section 10*
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	*Not Applicable*
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*Not Applicable. Refer to the BA Report for additional information.*
q) any other information requested by the competent authority.	*Not Applicable. Refer to the BA Report for additional information.*
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	*Appendix C (i.e. Part A of the Assessment Protocols published in GN 320 on 20 March 2020 (i.e. Site sensitivity verification requirements where a specialist assessment is*

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	*Section where this has been addressed in the Specialist Report*
	required but no specific assessment protocol has been prescribed)).

Appendix F: Species Lists

Species recorded by SABAP2 in the broader area

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
Acacia Pied Barbet	*Tricholaema leucomelas*	14.29	0.00				
African Black Swift	*Apus barbatus*	2.86	0.00				
African Pipit	*Anthus cinnamomeus*	0.00	4.17				
African Reed-warbler	*Acrocephalus baeticatus*	2.86	0.00				
African Spoonbill	*Platalea alba*	0.00	4.17	x			
Alpine Swift	*Tachymarptis melba*	11.43	4.17				
Anteating Chat	*Myrmecocichla formicivora*	5.71	0.00				
Barn Swallow	*Hirundo rustica*	11.43	4.17				
Black Harrier	*Circus maurus*	8.57	8.33	x	VU	EN	Near endemic
Black-headed Canary	*Serinus alario*	14.29	4.17	x			Near endemic
Black-headed Heron	*Ardea melanocephala*	2.86	0.00	x			
Bokmakierie	*Telophorus zeylonus*	54.29	4.17				
Booted Eagle	*Aquila pennatus*	8.57	4.17	x			
Brown-throated Martin	*Riparia paludicola*	20.00	0.00				
Cape Bulbul	*Pycnonotus capensis*	20.00	4.17	x			Endemic
Cape Bunting	*Emberiza capensis*	57.14	29.17				
Cape Penduline-tit	*Anthoscopus minutus*	8.57	0.00				
Cape Robin-chat	*Cossypha caffra*	5.71	0.00				
Cape Sparrow	*Passer melanurus*	77.14	20.83				
Cape Spurfowl	*Pternistis capensis*	2.86	0.00	x			Near endemic
Cape Turtle-dove	*Streptopelia capicola*	28.57	0.00				
Cape Wagtail	*Motacilla capensis*	40.00	12.50				
Cape Weaver	*Ploceus capensis*	17.14	4.17	x			Near endemic
Capped Wheatear	*Oenanthe pileata*	0.00	4.17				
Cardinal Woodpecker	*Dendropicos fuscescens*	2.86	0.00				
Chestnut-vented Tit-babbler	*Parisoma subcaeruleum*	28.57	8.33				
Common Fiscal	*Lanius collaris*	57.14	16.67				
Common Ostrich	*Struthio camelus*	11.43	0.00				
Common Quail	*Coturnix coturnix*	2.86	0.00				
Common Waxbill	*Estrilda astrild*	17.14	4.17				
Dusky Sunbird	*Cinnyris fuscus*	5.71	4.17				
Egyptian Goose	*Alopochen aegyptiacus*	5.71	4.17	x			
European Bee-eater	*Merops apiaster*	14.29	4.17				
Fairy Flycatcher	*Stenostira scita*	17.14	0.00	x			Near endemic
Familiar Chat	*Cercomela familiaris*	45.71	0.00				
Great Crested Grebe	*Podiceps cristatus*	0.00	4.17	x			
Greater Kestrel	*Falco rupicoloides*	11.43	0.00	x			
Greater Striped Swallow	*Hirundo cucullata*	8.57	8.33				
Grey Tit	*Parus afer*	45.71	4.17	x			Near endemic
Grey-backed Cisticola	*Cisticola subruficapilla*	62.86	12.50				
Grey-backed Sparrowlark	*Eremopterix verticalis*	5.71	0.00				
Grey-winged Francolin	*Scleroptila africanus*	2.86	4.17	x			Endemic (SA, Lesotho, Swaziland)
Hadeda Ibis	*Bostrychia hagedash*	14.29	0.00	x			
Helmeted Guineafowl	*Numida meleagris*	0.00	4.17				
House Sparrow	*Passer domesticus*	14.29	0.00				

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
Jackal Buzzard	*Buteo rufofuscus*	8.57	0.00	x			Near endemic
Karoo Chat	*Cercomela schlegelii*	100.00	41.67				
Karoo Eremomela	*Eremomela gregalis*	25.71	0.00	x			Near endemic
Karoo Korhaan	*Eupodotis vigorsii*	14.29	0.00	x	LC	NT	
Karoo Lark	*Calendulauda albescens*	74.29	33.33				Near endemic
Karoo Long-billed Lark	*Certhilauda subcoronata*	25.71	4.17				
Karoo Prinia	*Prinia maculosa*	54.29	16.67	x			Near endemic
Karoo Scrub-robin	*Cercotrichas coryphoeus*	62.86	12.50				
Kittlitz's Plover	*Charadrius pecuarius*	2.86	0.00				
Lanner Falcon	*Falco biarmicus*	2.86	0.00	x	LC	VU	
Large-billed Lark	*Galerida magnirostris*	51.43	25.00	x			Near endemic
Lark-like Bunting	*Emberiza impetuani*	14.29	0.00				
Laughing Dove	*Streptopelia senegalensis*	2.86	0.00				
Layard's Tit-babbler	*Parisoma layardi*	8.57	0.00	x			Near endemic
Little Swift	*Apus affinis*	17.14	0.00				
Long-billed Crombec	*Sylvietta rufescens*	17.14	0.00				
Ludwig's Bustard	*Neotis ludwigii*	5.71	0.00	x	EN	EN	
Malachite Sunbird	*Nectarinia famosa*	31.43	12.50				
Martial Eagle	*Polemaetus bellicosus*	5.71	0.00	x	EN	EN	
Mountain Wheatear	*Oenanthe monticola*	2.86	16.67				
Namaqua Dove	*Oena capensis*	14.29	12.50				
Namaqua Sandgrouse	*Pterocles namaqua*	17.14	0.00				
Namaqua Warbler	*Phragmacia substriata*	14.29	4.17	x			Near endemic
Neddicky	*Cisticola fulvicapilla*	2.86	0.00				
Pied Avocet	*Recurvirostra avosetta*	2.86	0.00	x			
Pied Crow	*Corvus albus*	51.43	16.67				
Pied Starling	*Spreo bicolor*	8.57	0.00	x			Endemic (SA, Lesotho, Swaziland)
Pin-tailed Whydah	*Vidua macroura*	0.00	4.17				
Pririt Batis	*Batis pririt*	20.00	0.00				
Red-capped Lark	*Calandrella cinerea*	2.86	4.17				
Red-faced Mousebird	*Urocolius indicus*	8.57	0.00				
Red-knobbed Coot	*Fulica cristata*	2.86	4.17	x			
Rock Kestrel	*Falco rupicolus*	22.86	0.00	x			
Rock Martin	*Hirundo fuligula*	62.86	25.00				
Rufous-eared Warbler	*Malcorus pectoralis*	68.57	25.00				
Sickle-winged Chat	*Cercomela sinuata*	2.86	0.00	x			Near endemic
South African Shelduck	*Tadorna cana*	14.29	0.00	x			
Southern Black Korhaan	*Afrotis afra*	2.86	4.17	x	VU	VU	Endemic
Southern Double-collared Sunbird	*Cinnyris chalybeus*	42.86	4.17				Near endemic
Southern Masked-weaver	*Ploceus velatus*	22.86	0.00				
Southern Pale Chanting Goshawk	*Melierax canorus*	68.57	45.83	x			
Speckled Pigeon	*Columba guinea*	34.29	16.67				
Spike-heeled Lark	*Chersomanes albofasciata*	45.71	4.17				
Spotted Eagle-owl	*Bubo africanus*	8.57	0.00	x			
Spur-winged Goose	*Plectropterus gambensis*	2.86	0.00	x			
Three-banded Plover	*Charadrius tricollaris*	17.14	12.50	x			
Tractrac Chat	*Cercomela tractrac*	22.86	0.00				
Verreaux's Eagle	*Aquila verreauxii*	11.43	12.50	x	LC	VU	
White-backed Mousebird	*Colius colius*	34.29	4.17				

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
White-breasted Cormorant	*Phalacrocorax carbo*	0.00	4.17	x			
White-necked Raven	*Corvus albicollis*	20.00	4.17				
White-rumped Swift	*Apus caffer*	14.29	0.00				
White-throated Canary	*Crithagra albogularis*	57.14	12.50				
Willow Warbler	*Phylloscopus trochilus*	2.86	0.00				
Yellow Canary	*Crithagra flaviventris*	85.71	37.50				
Yellow-bellied Eremomela	*Eremomela icteropygialis*	8.57	8.33				

Species recorded during the pre-construction monitoring

Priority Species		Transects	Focal point	Incidental
Cape Clapper Lark	*Mirafra apiata*	*		
Egyptian Goose	*Alopochen aegyptiaca*	*	*	
Greater Kestrel	*Falco rupicoloides*	*		*
Grey Heron	*Ardea cinerea*			*
Grey Tit	*Melaniparus afer*		*	
Jackal Buzzard	*Buteo rufofuscus*			*
Karoo Eremomela	*Eremomela gregalis*			*
Karoo Korhaan	*Eupodotis vigorsii*	*	*	*
Karoo Lark	*Calendulauda albescens*	*	*	*
Karoo Prinia	*Prinia maculosa*	*		*
Large-billed Lark	*Galerida magnirostris*	*		*
Ludwig's Bustard	*Neotis ludwigii*			*
Martial Eagle	*Polemaetus bellicosus*			*
Pale Chanting Goshawk	*Melierax canorus*	*		*
Pied Avocet	*Recurvirostra avosetta*		*	
Pied Starling	*Lamprotornis bicolor*			*
Sickle-winged Chat	*Emarginata sinuata*	*		
South African Shelduck	*Tadorna cana*	*	*	*
Southern Double-collared Sunbird	*Cinnyris chalybeus*		*	
Spotted Eagle-Owl	*Bubo africanus*			*
Three-banded Plover	*Charadrius tricollaris*		*	
Yellow-billed Kite	*Milvus aegyptius*			*
22	*Priority Species sub-total:*	10	8	15
Non-Priority Species		**Transects**	**Focal point**	
African Hoopoe	*Upupa africana*	*		
Bokmakierie	*Telophorus zeylonus*	*	*	
Brown-throated Martin	*Riparia paludicola*		*	
Cape Bunting	*Emberiza capensis*		*	
Cape Sparrow	*Passer melanurus*	*	*	

Species recorded during the pre-construction monitoring				
Cape Turtle Dove	*Streptopelia capicola*	*	*	
Non-Priority Species		**Transects**	**Focal point**	
Cape Wagtail	*Motacilla capensis*		*	
Chat Flycatcher	*Melaenornis infuscatus*	*		
Grey-backed Cisticola	*Cisticola subruficapilla*	*		
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	*		
Hadeda	*Bostrychia hagedash*	*		
Karoo Chat	*Emarginata schlegelii*	*	*	
Karoo Long-billed Lark	*Certhilauda subcoronata*	*		
Karoo Scrub Robin	*Cercotrichas coryphoeus*	*		
Lark-like Bunting	*Emberiza impetuani*		*	
Laughing Dove	*Spilopelia senegalensis*	*		
Malachite Sunbird	*Nectarinia famosa*		*	
Pearl-breasted Swallow	*Hirundo dimidiata*		*	
Pied Crow	*Corvus albus*	*	*	
Rufous-eared Warbler	*Malcorus pectoralis*	*		
Southern Fiscal	*Lanius collaris*	*	*	
Speckled Pigeon	*Columba guinea*	*	*	
Spike-heeled Lark	*Chersomanes albofasciata*	*		
White-throated Canary	*Crithagra albogularis*	*	*	
Yellow Canary	*Crithagra flaviventris*	*	*	
25	*Non-priority Species sub-total:*	19	15	
	Grand total:	**29**	**23**	

Appendix G: List of renewable energy projects within 30km radius

Renewable Energy Projects - Source: DEA REEA, 2020 Q2 (2020-08-31)

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
14/12/16/3/3/1/1976	DEA/EIA/0001017/2018	2014	BAR	Proposed development of the 325MW Kudusberg Wind Energy Facility and associated infrastructure in Western and Northern Cape Provinces	2018-11-13	Kudusberg Wind Farm (Pty) Ltd	CSIR	Karoo Hoogland Local Municipality	Namakwa District Municipality	Northern Cape	Onshore Wind	325	Approved
								Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape			
12/12/20/1783/1	DEAT/EIA/12233/2011	2010	Scoping and EIA	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2012-12-01	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	150	Approved
12/12/20/1783/2	DEAT/EIA/12233/2011	2010	Scoping and EIA	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 2	2012-12-01	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	150	Approved
12/12/20/1783/2/AM1	DEA/EIA/AMEND/000468/2014	2010	Amend ment	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2014-10-03	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
12/12/20/1783/2/AM3	To Review	2014	Amend ment	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2017-09-20	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1783/2/AM4	To Review	2014	Amend ment	Proposed development of a WEF at the Perdekraal Site 2, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1783/2/AM4	To Review	2014	Amend ment	Proposed development of a WEF at the Perdekraal Site 2, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	150	Approved
12/12/20/1783/2/AM5	To Review	2014	Amend ment	Proposed development of a Wind Energy Facility at Perdekraal, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1787	DEAT/EIA/12346/ 2011	2010	Scoping and EIA	Proposed Renewable Energy Facility at Konstabel	2010-01-29	South Africa Mainstream Renewable Power Developmen ts (Pty) Ltd	Environmental Resource Management (Pty) Ltd	Laingsburg Local Municipality	Central Karoo District Municipality	Western Cape	Onshore Wind and Solar PV	170	Approved
12/12/20/1956	DEAT/EIA/12205/ 2011	2010	Scoping and EIA	Proposed Touwsrivier Solar Energy Facility	2010-06-07	CPV Power Plant No.1 Pty Ltd	University of Cape Town Environmental Evaluation	Breede Valley Local Municipality	Cape Winelands District Municipality	Western Cape	Solar PV	36	Approved
12/12/20/1988	DEAT/EIA/12460/ 2011	2010	Scoping and EIA	Proposed Construction of the 750 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality of	2012-11-16	G7 Renewable Energies Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Namakwa District Municipality	Western Cape	Onshore Wind	750	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
				the Northern Cape Province and within the Laingsburg Local Municipality of the Western Cape Province									
12/12/20/1988/1/AM1	DEA/EIA/AMEND/0000529/2015	2010	Amendment	Proposed Construction of the 750 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality of the Northern Cape Province and within the Laingsburg Local Municipality of the Western Cape Province	2014-12-05	G7 Renewable Energies Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Namakwa District Municipality	Western Cape	Onshore Wind	0	Approved
14/12/16/3/3/2/899	DEA/EIA/000258/2016	2014	Scoping and EIA	140 MW Rietkloof WE, near Sutherland, Northern Cape and Western Cape	2016-01-19	Rietkloof Wind Farm (Pty) Ltd	EOH Coastal and Environmental Services (Pty) Ltd	Laingsburg Local Municipality	Central Karoo District Municipality	Western Cape	Onshore Wind	36	Approved
14/12/16/3/3/2/810	To Review	2014	Scoping and EIA	75 MW Montague Road Solar PV SEF on Vredefort No. 34 Near Touws River within the Breede Valley Local Municipality in the Western Cape Province	2015-05-29	Montague Road Energy (Pty) Ltd	Sharples Environmental Services cc	Breede Valley Local Municipality	Cape Winelands District Municipality	Western Cape	Solar PV	75	Approved
14/12/16/3/3/2/900	DEA/EIA/0000259/2016	2014	Scoping and EIA	147 MW Brandvalley Wind Energy Facility north of the town of Matjiesfontein within Karoo Hoogland Local Municipality	2016-01-19	Brandvalley Wind Farm (Pty) Ltd.	EOH Coastal and Environmental Services	!Kheis Local Municipality	Z F Mgcawu District Municipality	Western Cape	Onshore Wind	147	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
14/12/16/3/3/1/1983	DEA/EIA/0001036/2018	2014	BAR	Proposed Development of the Tooverberg On-site Eskom Substation and 132kV Power Line for the proposed Tooverberg Wind Energy Facility near Touws River, Western Cape Province	2018-12-06	Genesis Tooverberg Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	EGI	EGI	Approved

Renewable Energy and EGI Projects - Source: SAHRIS

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATUS
14/12/16/3/3/1/1984	Not provided	2014	BAR	Proposed Development of the Tooverberg Wind Energy Facility (WEF) near Touws River, Western Cape Province	06 12 2018	Genesis Tooverberg Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	264	Approved
Not provided	Not provided	2014	BAR	Powerline between the Perdkekraal West Wind	22 03 2016	Perderkraal West Wind Farm (Pty) Ltd	Savannah Environmental	Breede River Local Municipality	Cape Winelands District Municipality	Western Cape	EGI	EGI	Not confirmed

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATUS
				Energy Facility and the Eskom Kappa Substation, Western Cape Province									
14/12/16/3/3/2/1115	Not provided	2014	Scoping and EIA	Proposed Construction of the 325MW Rondekop Wind Energy Facility between Matjiesfontein and Sutherland, Northern Cape Province	14 11 2018	Rondekop Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Karoo Hoogland Local Municipality	Namakwa District Municipality	Northern Cape	Onshore Wind	325	Approved

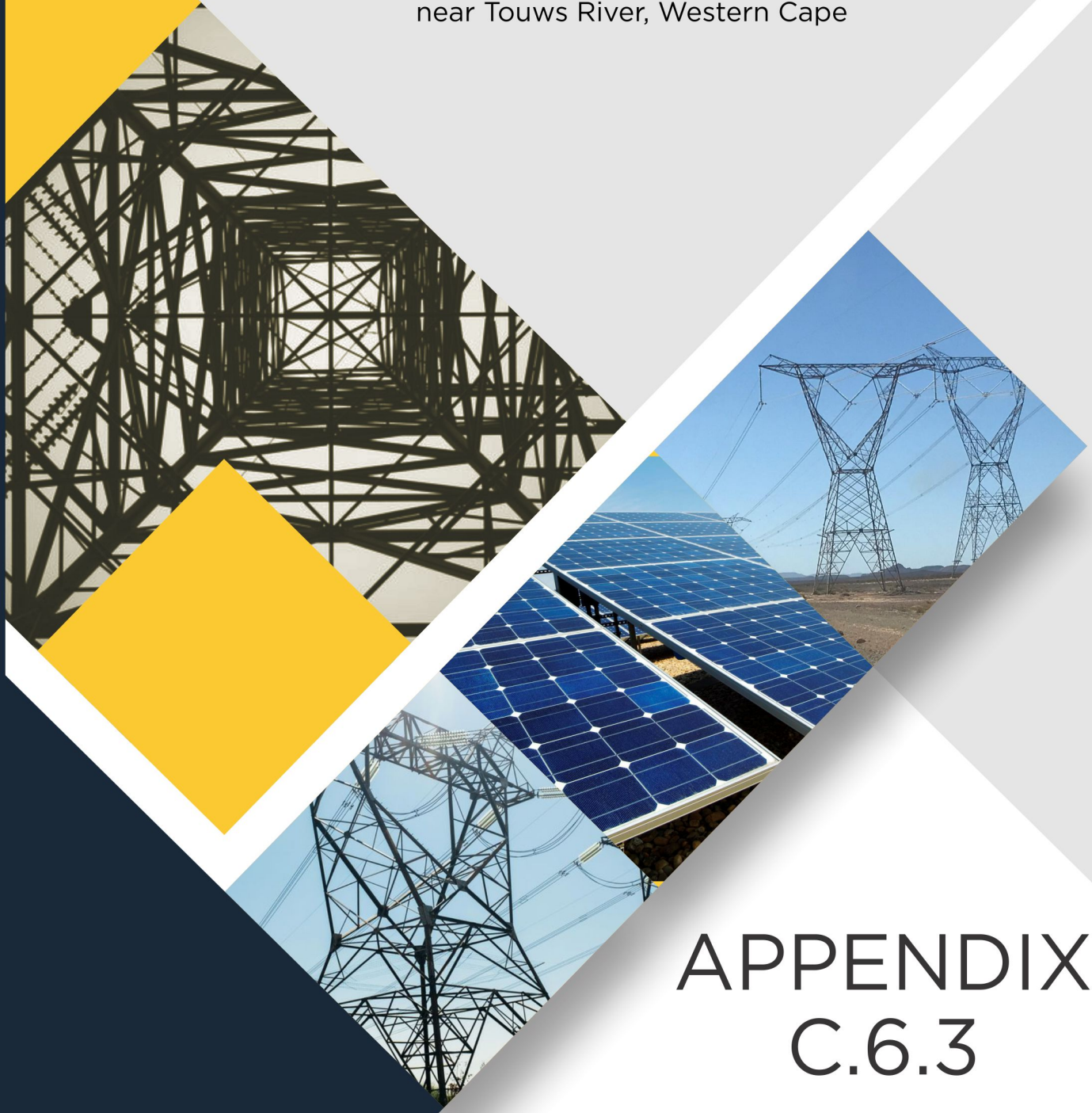
Planned Eskom Lines:

Status / layer source	SUB_PROJEC	Voltage	TDP_ID	TDP_SCHEME	New_Date	GP_Project
Tx Planned Lines	Gamma-Kappa 2nd 765kV line	765	TS019	Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	2022	GPP0288
Tx Planned Lines	Kappa-Sterrekus 2nd 765kV line	765	TS019	Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	2021	GPP0502

Existing Eskom Lines

Status / layer source	LABEL	DESIGN_VOL	LINE_STATU	SUB_CAT		
Tx Existing Lines	BACCHUS DROERIVIER 1	400	EXISTING	400kv_line		
Tx Existing Lines	DROERIVIER MULDERSVLEI 2	400	EXISTING	400kv_line		
Tx Existing Lines	Gamma-Kappa 1st 765kV line	765	TS015	Cape Corridor Phase 2: Gamma-Omega 765kV Integration	2013	GPP0283
Tx Existing Lines	Kappa-Sterrekus (Omega) 1st 765kV line	765	TS015	Cape Corridor Phase 2: Gamma-Omega 765kV Integration	2015	GPP0500

Basic Assessment for the Proposed Development of Electrical Grid Infrastructure to support the proposed nine 175 MW Solar Photovoltaic Facilities and associated Infrastructure (i.e. Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4), near Touws River, Western Cape



APPENDIX C.6.3

Avifauna Assessment for Hoek Doornen

AVIFAUNAL SPECIALIST ASSESSMENT

Basic Assessment for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure known as Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4, near Touws River, Western Cape

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Report prepared for:	*Report prepared by:*
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October 2020

Executive Summary

The Project Developer, Veroniva (PTY) Ltd (hereinafter referred to as Veroniva), is proposing to design, construct and operate nine 175 MW Solar Photovoltaic (PV) power generation facilities, north-east of Ceres in the Western Cape Province. The proposed projects will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV facility will have a range of associated infrastructure, including an on-site substation and will connect to the Eskom Kappa Substation via a dedicated 132 kV power line. The facilities will be known as Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4. There are nine separate Project Applicants for the proposed projects.

This report serves as the Avifaunal Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed developments of Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4, as the associated infrastructure and Electrical Grid Infrastructure.

It is estimated that a total of 100 bird species could potentially occur in the broader area. Of these, 41 species are classified as priority species, of which 17 is expected to occur regularly at the study area. The overall abundance of priority species at the study area was low, with an average of 0.83 birds/km recorded during transect counts. For all birds combined, the index of kilometric abundance (IKA) for transect counts was 8.45 birds/km, which is moderate. The low numbers are not surprising, given the general aridity of the habitat.

POTENTIAL IMPACTS

The following impacts have been identified in the Avifauna Specialist Assessment. Due to the similarity in habitat, the impacts are expected to be essentially identical for all the projects.

Construction Phase

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

Operational Phase

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections

Decommissioning Phase

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

Cumulative Impacts

- Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure
- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences

- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections
- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The table below indicates the overall impact significance for each phase before and after mitigation, as well as cumulative impacts.

Phase	**Overall Impact Significance (Pre Mitigation)**	**Overall Impact Significance (Post Mitigation)**
Construction	Moderate (3)	Low (4)
Operational	Moderate (3)	Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	Moderate (3)	Low (4)
Cumulative - Decommissioning	Moderate (3)	Low (4)

ENVIRONMENTAL SENSITIVITIES

- **PV Solar**

The following environmental sensitivities were identified from an avifaunal perspective for the PV facilities and associated infrastructure:

- **Very High sensitivity (No-Go): Surface water**

  Included are areas within 300m of water troughs, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped.

- **Very High sensitivity (No-Go): Drainage line woodland**

  Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival in this very arid climate. All major drainage lines should be classified as No-Go areas to prevent impact on the sensitive habitat.

- **Very High sensitivity (No-Go): Priority species nests**

  Nest of priority species, particularly those that occur naturally at naturally lower numbers such as raptors, should be protected by No-Go buffer zones to prevent displacement of the breeding birds due to disturbance associated with the construction activity.

- **Electricity grid infrastructure**

The following environmental sensitivities were identified from an avifaunal perspective for the proposed powerline grid connections:

- **High sensitivity (Mitigation required): Surface water**

  Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Powerlines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. If a powerline has to be routed across a high sensitivity zone, mitigation in the form of Bird Flight Diverters will be required.

- **Medium sensitivity (Mitigation potentially required): Succulent Karoo**

  The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan.

MANAGEMENT ACTIONS

The following management actions have been proposed in this assessment:

Construction phase

- Activity should as far as possible be restricted to the footprint of the infrastructure.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.
- Access to the rest of the property must be restricted.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.

Operational phase

- The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.
- A 300m infrastructure-free buffer must be maintained around the water reservoirs (refer to the sensitivity map in Figure 12).
- No solar PV arrays must be constructed in drainage lines (refer to the sensitivity map).
- A single perimeter fence should be used.
- Use underground cabling for the internal reticulation network.
- The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.

De-commissioning phase

- Activity should as far as possible be restricted to the footprint of the infrastructure.
- Measures to control noise and dust should be applied according to current best practice in the industry.

- Maximum use should be made of existing access roads and the construction of new roads during the decommissioning phase should be kept to a minimum as far as practical.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.

STATEMENT AND REASONED OPINION

The expected impacts of the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 solar PV facilities, associated infrastructure and the electrical grid infrastructure were rated to be Moderately negative pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (refer to the table above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the Environmental Management Programme EMPr (see Section 9) are strictly implemented.

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List of Abbreviations

BA	Basic Assessment
BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
DEFF	Department of Environment, Forestry and Fisheries
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
IBA	Important Bird Area
IKA	Index of Kilometric Abundance
IUCN	International Union for Conservation of Nature
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
NPAES	National Protected Areas Expansion Strategy
PV	Photovoltaic
REDZs	Renewable Energy Development Zones
SABAP 1	South African Bird Atlas 1
SABAP 2	South African Bird Atlas 2
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa National Protected Areas Database

Glossary

Definitions	
Study area	The area covered by the proposed application sites and the powerline corridor.
Broader area	A consolidated data set for a total of 12 pentads where the study area is located.
PV footprint	The actual development footprint containing the PV solar arrays and associated infrastructure.
Priority species	• South African Red Data species. • South African endemics and near-endemics. • Raptors • Waterbirds
Cumulative impact	Impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts.

The Project Developer, Veroniva (PTY) Ltd (hereinafter referred to as Veroniva), is proposing to design, construct and operate nine 175 MW Solar Photovoltaic (PV) power generation facilities, north-east of Ceres in the Western Cape Province. The proposed projects will make use of PV solar technology to generate electricity from energy derived from the sun. Each solar PV facility will have a range of associated infrastructure, including an on-site substation and will connect to the Eskom Kappa Substation via a dedicated 132 kV power line. The facilities will be known as Witte Wall PV 1, Witte Wall PV 2, Grootfontein PV 1, Grootfontein PV 2, and Grootfontein PV 3, Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4. There are nine separate Project Applicants for the proposed projects.

The proposed PV facilities will be constructed on the following farm portions:

- Remainder of Grootfontein Farm 149;
- Portion 5 of Grootfontein Farm 149;
- Remainder of Witte Wall Farm 171; and
- Portion 1 of Hoek Doornen Farm 172.
- The power lines will traverse these aforementioned farm portions, as well as the Die Brak 241 and Platfontein 240.

This report serves as the Avifaunal Specialist Assessment that was prepared as part of the Basic Assessments (BAs) for the proposed developments of Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4, as well as all associated infrastructure, including Electrical Grid Infrastructure.

1. Introduction

1.1 Scope, Purpose and Objectives of this Specialist Report

The purpose of the report is to assess the potential impacts of the Hoek Doornen 1, 2, 3 and 4 PV facilities, as well as all associated infrastructure, including Electrical Grid Infrastructure, on avifauna, to provide a reasoned opinion on whether the projects should proceed or not from an avifaunal impact perspective, and to recommend measures for the mitigation of identified impacts, should the project proceed.

1.2 Details of Specialist

This specialist assessment has been undertaken by Chris van Rooyen and Albert Froneman of Chris van Rooyen Consulting. Chris van Rooyen works under the supervision of Albert Froneman who is registered with the South African Council for Natural and Scientific Professions (SACNASP), with Registration Number 400177/09 in the field of Zoology. Curriculum vitae are included in Appendix A of this specialist assessment.

In addition, a signed specialist statement of independence is included in Appendix B of this specialist assessment.

1.3 Terms of Reference

The terms of reference for the specialist study are as follows:

- Describe the affected environment from an avifaunal perspective.
- Map the sensitivity of the site in terms of avifaunal features such as habitat use, roosting, feeding and nesting / breeding.
- Discuss gaps in baseline data and other limitations.
- Adhere to the content requirements for specialist reports in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations 2014, as amended.
- Provide an overview of all applicable legislation.
- Provide an overview of assessment methodology used.

- Confirm the impact status, use of the land, and sensitivity of the site in comparison to the National Department of Environment, Forestry and Fisheries (DEFF) National Environmental Web-based Screening Tool (National Screening Tool) and associated protocols.
- Identify and assess the potential impacts of the proposed development on avifauna including cumulative impacts.
- Provide sufficient mitigation measures to include in the
- Environmental Management Programme (EMPr), as well as review of the Generic EMPr for 1) Power Lines and 2) Substations (GN 435) and confirm if there are any specific environmental sensitivities or attributes present on the site and any resultant site specific impact management outcomes and actions that need to be included.
- Conclude with an impact statement whether the PV facility is fatally flawed or may be authorised.

2. Approach and Methodology

The following approach was followed to conduct this study:

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the proposed development area is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 12 pentads where the study area is located, henceforth called the broader area. The SABAP2 data covers the period 2007 to 2020. The relevant pentads are 3250_1950, 3250_1955, 3250_2000, 3255_1950, 3255_1955, 3255_2000, 3300_1950, 3300_1955, 3300_2000, 3305_1950, 3305_1955, 3305_2000 (see Figure 1).
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map (2018) accessed via the South African National Biodiversity Institute (SANBI) Biodiversity Geographic Information System (BGIS) map viewer (SANBI 2020).
- 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, Lesotho and Swaziland (Taylor *et al*. 2015).
- The global threatened status of all priority species was determined by consulting the latest (2020.2) International Union for Conservation of Nature (IUCN) Red List of Threatened Species.
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- The SANBI BGIS map viewer was used to determine the locality of the study area relative to National Protected Areas and National Protected Areas Expansion Strategy (NPAES) focus areas.
- The DEFF National Screening Tool was used to determine the assigned avian sensitivity of the study area.
- Satellite imagery was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- A desktop investigation was conducted to source information on the impacts of solar facilities and Electrical Grid Infrastructure on avifauna.
- On-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2) according to the best practice guidelines for avifaunal impact studies for solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*. 2017). Monitoring was conducted in the following manner:
    - Eighteen walk transects were identified totalling 1km each in the study area and counted once per survey. One observer walking slowly recorded all birds on both sides of the transect. The observer stopped at regular intervals to listen to bird calls and to scan the environment with binoculars.
    - The following variables were recorded:
        - Species;
        - Number of birds;
        - Date;
        - Start time and end time;
        - Estimated distance from transect (m);

- Wind direction;
- Wind strength (estimated Beaufort scale 1 - 7);
- 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.

- All incidental sightings of priority species were recorded.
- Three potential avifaunal focal points were also identified namely two water reservoirs and a small dam.

See Figure 1 below for the extent of the broader area.

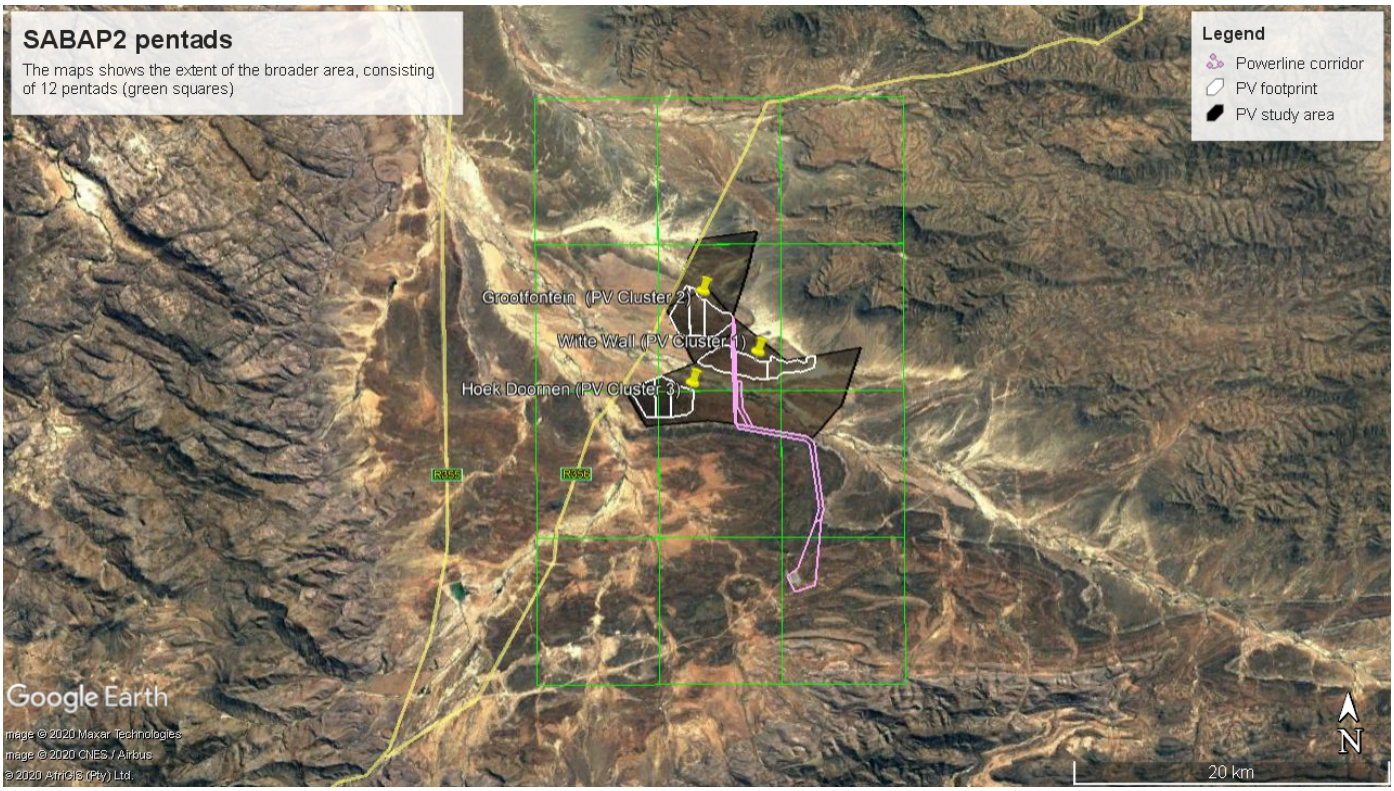

Figure 1: Area covered by the twelve SABAP 2 pentads (broader area = green squares).

See Figure 2 for the location of walk transects and focal points.

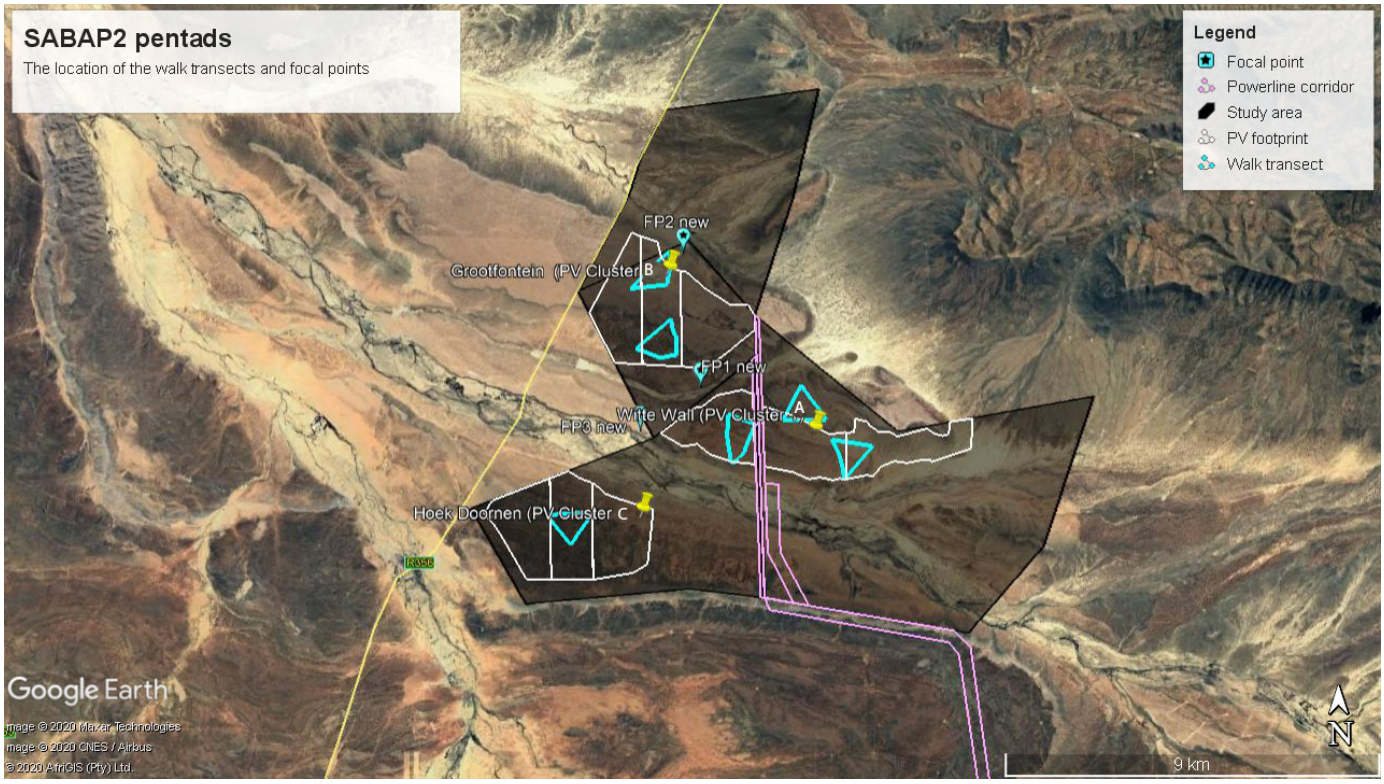

Figure 2: The location of the walk transects and focal points

2.1 Information Sources

The following data sources were used to compile this report:

Data / Information	Source	Date	Type	Description
South African Protected Areas Database (SAPAD)	Department of Environment, Forestry and Fisheries (DEFF)	2020, Q2	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Atlas of Southern African Birds 1 (SABAP1)	University of Cape Town	1987-1991	Spatial, reference	SABAP1, which took place from 1987-1991.
South African Bird Atlas Project 2 (SABAP2)	University of Cape Town	October 2020	Spatial, database	SABAP2 is the follow-up project to the SABAP1. The second bird atlas project started on 1 July 2007 and is still growing. The project aims to map the distribution and relative abundance of birds in southern Africa.
National Vegetation Map	South African National Biodiversity Institute (SANBI) (BGIS)	2018	Spatial	The National Vegetation Map Project (VEGMAP) is a large collaborative project established to classify, map and sample the vegetation of South Africa, Lesotho and Swaziland.
Red Data Book of Birds of South Africa, Lesotho and Swaziland	BirdLife South Africa	2015	Reference	The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland is an updated and peer-reviewed conservation status assessment of the 854 bird species occurring in South Africa undertaken in collaboration between BirdLife South Africa, the Animal Demography Unit of the University of Cape Town, and the SANBI.
IUCN Red List of Threatened Species (2020.2)	IUCN	2020. 2	Online reference source	Established in 1964, the International Union for Conservation of Nature's Red List of Threatened Species is the world's most comprehensive information source on the global extinction risk status of animal, fungus and plant species.
Important Bird and Biodiversity Areas of South Africa	BirdLife South Africa	2015	Reference work	Important Bird and Biodiversity Areas (IBAs), as defined by BirdLife International, constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria.
National Protected Areas and	DEFF	2009	Spatial	The goal of the NPAES is to achieve cost effective protected area expansion for ecological sustainability

Data / Information	Source	Date	Type	Description
National Protected Areas Expansion Strategy (NPAES)				and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion.
Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa	Department of Environmental Affairs, 2015. Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa. CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.	2015	SEA	The SEA identifies areas where large scale wind and solar PV energy facilities can be developed in terms of Strategic Infrastructure Project (SIP) 8 and in a manner that limits significant negative impacts on the natural environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs).
DEFF National Screening Tool	Department of Environment and Forestry (DEFF)	2020	Online assessment tool	The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an application for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity.

2.2 Assumptions, Knowledge Gaps and Limitations

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

- A total of 70 SABAP2 full protocol lists had been completed for the broader area where the proposed project is located (i.e. bird listing surveys lasting a minimum of two hours each). In addition, 48 ad hoc protocol lists (i.e. bird listing surveys lasting less than two hours but still giving useful data) were also recorded. The SABAP2 data was therefore regarded as an adequate indicator of the avifauna which could occur at the study area, and it was further supplemented by data collected during the on-site surveys.
- The focus of the study was primarily on the potential impacts of the proposed solar PV facility and associated grid connection on priority species.
- Priority species were defined as follows:
  - South African Red Data species.
  - South African endemics and near-endemics.
  - Raptors
  - Waterbirds
- Only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser *et al.* 2018) currently exists. Some reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the 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 study area.
- Cumulative impacts include all renewable energy projects within a 30 km radius that have received an EA at the time of starting this BA (i.e. by August 2020). Cumulative impacts also included the consideration of approved (i.e. received EA at the start of this BA), existing and two proposed power line projects within the 30 km radius. The list of projects was provided by the CSIR, and it is assumed that the list is complete.
- Conclusions drawn in this study are based on experience of the specialist on the species found on site and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The broader area is defined as the area encompassed by the 12 pentads where the project is located (see Figure 1 above). The study area is defined as the area covered by the application sites and the powerline corridor. The PV footprint is the where the actual development will be located, i.e. the footprint containing the PV solar arrays and associated infrastructure.

2.3 Consultation Processes Undertaken

No specific consultative processes were undertaken during the compilation of this assessment.

3. Description of Project Aspects relevant to Avifauna

The following project components are relevant as far as avifauna is concerned:

- Solar Field, comprising Solar Arrays with a maximum height of 10 m and maximum footprint of 250 hectares.
- Building Infrastructure
  - Offices (maximum height 7 m and footprint of 1000 m^2);
  - Operational and maintenance control centre (maximum height 7 m and footprint 500 m^2);
  - Warehouse/workshop (maximum height 7 m and footprint 500 m^2);
  - Ablution facilities (maximum height 7 m and footprint 50 m^2);
  - Converter/inverter stations (height from 2.5 m to 7 m (maximum) and footprint 2500 m^2);
  - On-site substation and/or a switching substation (footprint 20 000 m^2); and
  - Guard Houses (height 3 m, footprint 40 m^2).

- Associated Infrastructure
  - 132 kV overhead power line to connect to the existing Eskom Kappa Substation with a length of 18 – 21km;
  - Internal 33 kV power lines/underground cables (either underground to maximum depth of 1.6 m or above ground with height of 9 m);
  - Battery storage for each Solar PV project. The proposed battery technology is a Lithium Ion Battery, that will cover an area of up to 8 hectares (within the laydown area) and a height of up to 5 – 10 m;
  - Access roads with width ranging between 4 - 8 m. Approximately 10 - 12 km for the Hoek Doornen PV Project; as well as re-routing of an existing road;
  - Internal gravel roads and service road below the power line (width of 4 m);
  - Fencing (between 2 – 3 m high) around the PV Facilities - Access points will be managed and monitored by an appointed security service provider. The type of fencing will either be of palisade, mesh type or a fully electrified option;
  - Game fences will be constructed along the power line route to fence off the servitudes across the farms Witte Wall and Die Brak. No fencing will be constructed along the power line where it traverses the Platfontein Farm, Hoekdoornen and Grootfontein; and
  - Construction work area (i.e. laydown area of maximum 13 ha).

It must be noted that the specifications provided above apply to a single PV facility and are the same for Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4, unless where specified.

4. Baseline Environmental Description

4.1 General Description

4.1.1 Important Bird Areas (IBAs)

The Cedarberg - Koue Bokkeveld Complex IBA SA101 is the closest IBA and is located approximately 16km west of the study area. The proposed development is not expected to have any impact on the avifauna in this IBA.

4.1.2 Protected Areas

The study area does not form part of a formally protected area. The closest protected area is the Inverdoorn Private Nature Reserve which is located approximately 6 - 10km away at its closest point. The proposed development is not expected to have any impact on the avifauna in this nature reserve.

4.1.3 National Protected Areas Expansion Strategy

The study area is not included in the NPAES except for a small section of the powerline corridor which falls within the Tankwa-Cederberg-Roggeveld focus area, which should not result in a significant impact for the focus area.

4.1.4 The Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa

The study area falls within the Komsberg Renewable Energy Zone (REDZ) and is classified as Low Sensitivity for avifauna from a solar PV perspective.

4.1.5 Climate, topography and habitat classes

The study area is located in the Succulent Karoo biome, in the Rainshadow Valley Karoo Bioregion (Mucina & Rutherford 2006). The topography is very flat. The Tankwa Karoo is one of the most arid sections of the

Karoo. Isohyets of mean annual rainfall (mm) for the Karoo indicate that the Tankwa-Karoo National Park, which is situated approximately 50km north of the study area in the same bioregion, falls into the 0-100mm range, with 75% of the mean annual precipitation in winter (https://www.sanparks.org/).

The mean July minimum temperature is 6°C (lowest measured -1°C), and the mean January maximum temperature is 38°C (highest measured 50°C). The highest average maximum temperatures occur from November to March with the hottest months being January and February. The highest wind speeds occur from October to March (https://www.sanparks.org/). The land use in the study area is primarily game farming.

The most important anthropogenic avifaunal-relevant habitat modifications currently present in the study area which could potentially influence the avifaunal community that were recorded in or close to the study area are earth dams, boreholes with water reservoirs and troughs, fences and transmission lines.

The habitat in the study area is discussed in more detail below. The priority species associated with each habitat class are listed in Table 1.

- **Succulent Karoo**

Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (Harrison *et al.* 1997). The dominant vegetation type in the study area is Tankwa Karoo (Mucina & Rutherford 2006), which occurs on the plains where study area is located. The plains are very sparsely vegetated with low succulent shrubland, and in extreme precipitation-poor years could appear almost barren (Mucina & Rutherford 2006). The study area is intersected by several drainage lines, supporting a mosaic of succulent shrublands and clumps of *Vachellia karroo* thickets (drainage line woodland). The stunted *Vachellia karoo* trees are used by a number of species for nesting including priority species such as Pale Chanting Goshawk and various smaller shrubland/woodland species.

Images of the typical vegetation structure on the study area is shown below in Figure 3 and Figure 4.

Figure 3: An example of the dominant Succulent Karoo habitat in the study area, consisting mostly of dwarf shrubs with open ground in between.

Figure 4: An example of a drainage line with shrubs and stunted trees.

See Table 1 for a list of priority species that could utilise the Succulent Karoo habitat associated with the study area.

- **Surface water**

Surface water is of specific importance to avifauna in this semi-arid environment. The study area contains a few earth dams located in ephemeral drainage lines, but these are generally dry for most of the year. The dams and drainage lines hold water after good rains, when it is attractive to various bird species, including large raptors, to drink and bath. It also serves as an attraction to waterbirds when it contains water during the winter season, although it must be noted that the study site is generally dry for most of the year. Pools of standing water form in the drainage lines after good rains, which can last for several weeks, depending on the level of precipitation. The study area also contains boreholes with water reservoirs, where surface water becomes available in the form of water troughs, which is an important source of permanent surface water. These water troughs are a big attractant for birds, as they often are the only source of permanent surface water in the area. The wind pumps at the boreholes are also used by a number of species for nesting, including priority species such as Greater Kestrel.

See Figures 5 and 6 for examples of surface water in the study area.

Figure 5: An earth dam in the study area where water is pumped. The dams are dry for most of the year. Note that this dam is located on the Farm Kareekolk (outside of the footprint for the proposed PV plants and power lines).

Figure 6: A borehole and water trough in the study area

See Table 1 for a list of priority species that could utilise the surface water in the study area.

- **Transmission lines**

Transmission lines are an important breeding substrate for raptors in the Karoo, due to the lack of large trees (Jenkins *et al.* 2006, 2013). There are no transmission lines in the PV study area itself, but the powerline corridor is crossed by the 2 Droërivier Muldersvlei – Kappa 400kV transmission line. There is a nest originally built by Martial Eagles situated approximately 3.7km from the powerline corridor at its closest point on Tower 26 of the Kappa Muldersvlei 400kV transmission line. The pair of eagles have not bred there in the 2019 and 2020 breeding season, and the nest was used in both years by a pair of Lanner Falcons (see Figure 7).

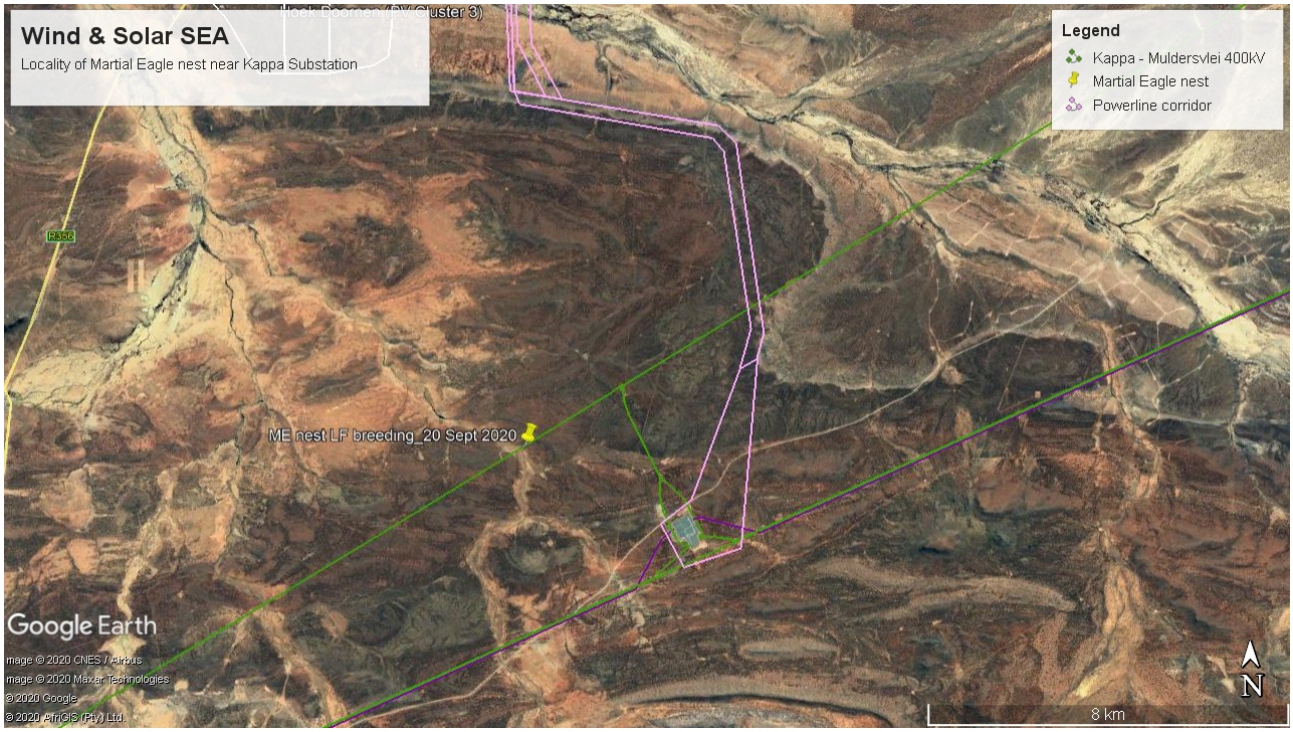

Figure 7: A pair of Lanner Falcons breeding on the Tower 26 of Kappa – Droërivier Muldersvlei 400kV transmission line. High voltage lines are represented by the green and dark purple lines.

See Table 1 for a list of priority species that could utilise the transmission lines near the study area.

- **Fences**

The study area contains a number of fences (see Figure 8 below). Farm fences provide important perching substrate for a wide range of birds in this virtually treeless environment where natural perches are scarce, as a staging post for territorial displays by small birds and also for perch hunting by raptors such as Greater Kestrel, Rock Kestrel, Jackal Buzzard and Pale Chanting Goshawk.

Table 1 lists the priority species which are associated with fences in the study area.

Figure 8: The study area contains many fences.

- **Agriculture**

The principal land-use in the study area is game farming, with the game subsisting on the natural vegetation. Crops are cultivated on a very limited scale and consist mostly of supplementary fodder, especially lucerne, which is usually located near drainage lines and irrigated through a system of boreholes. The agricultural lands attract certain priority species, e.g. Ludwig's Bustard, Spur-winged Goose, Black-headed Heron, Hadeda Ibis and Egyptian Goose.

Table 1 lists the priority species which are associated with cultivation in the study area.

4.1.6 Avifauna

- **Southern African Bird Atlas 2**

It is estimated that a total of 100 bird species could potentially occur in the broader area. Please refer to Appendix F which provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring so far. Of these, 41 species are classified as priority species, and 17 could occur regularly in the study area. The probability of a priority species occurring regularly in the study area is indicated in Table 1.

Table 1 below lists all the priority species and the possible impact on the respective species by the proposed PV facilities, power lines, and associated infrastructure.

- EN = Endangered
- VU = Vulnerable
- NT = Near threatened
- LC = least concern
- L= Low
- M = Medium
- H = High

Table 1: Priority species occurring in the broader area. The likelihood of regular occurrence in the study area is also indicated

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Drainage line woodland	Surface water	Agricultural lands	Transmission lines	Fences	PV panel collisions	Displacement - disturbance	Displacement - habitat loss	Entrapment in fences	Electrocution on 33kV OHL	Collision with the 132kV grid connection
African Spoonbill	*Platalea alba*	0.00	4.17	x					x	L				x									x
Black Harrier	*Circus maurus*	8.57	8.33	x	VU	EN	Near endemic	x		L		x					x	x	x	x		x	
Black-headed Canary	*Serinus alario*	14.29	4.17	x			Near endemic			H		x			x		x	x	x	x			
Black-headed Heron	*Ardea melanocephala*	2.86	0.00	x					x	L				x	x							x	
Booted Eagle	*Aquila pennatus*	8.57	4.17	x				x		M		x		x			x		x	x		x	
Cape Bulbul	*Pycnonotus capensis*	20.00	4.17	x			Endemic			H			x	x			x	x	x				
Cape Clapper Lark	*Mirafra apiata*	0.00	0.00	x			Endemic			L	x	x					x	x	x	x			
Cape Spurfowl	*Pternistis capensis*	2.86	0.00	x			Near endemic			L			x					x	x		x		
Cape Weaver	*Ploceus capensis*	17.14	4.17	x			Near endemic			H			x				x		x				
Egyptian Goose	*Alopochen aegyptiacus*	5.71	4.17	x					x	H	x			x	x	x		x				x	x
Fairy Flycatcher	*Stenostira scita*	17.14	0.00	x			Near endemic			H			x					x	x				
Great Crested Grebe	*Podiceps cristatus*	0.00	4.17	x					x	L				x				x					
Greater Kestrel	*Falco rupicoloides*	11.43	0.00	x				x		H	x	x				x	x	x	x	x		x	
Grey Tit	*Parus afer*	45.71	4.17	x			Near endemic			H	x	x	x					x	x	x			
Grey-winged Francolin	*Scleroptila africanus*	2.86	4.17	x			Endemic			L		x						x	x	x	x		
Hadeda Ibis	*Bostrychia hagedash*	14.29	0.00	x					x	H			x	x	x								
Jackal Buzzard	*Buteo rufofuscus*	8.57	0.00	x			Near endemic	x		M	x	x		x		x	x		x	x		x	
Karoo Eremomela	*Eremomela gregalis*	25.71	0.00	x			Near endemic			H	x	x	x					x	x	x			

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Drainage line woodland	Surface water	Agricultural lands	Transmission lines	Fences	PV panel collisions	Displacement - disturbance	Displacement - habitat loss	Entrapment in fences	Electrocution on 33kV OHL	Collision with the 132kV grid connection
Karoo Korhaan	*Eupodotis vigorsii*	14.29	0.00	x	LC	NT				H	x	x							x	x	x		x
Karoo Lark	*Calendulauda albescens*	0.00	0.00	x			Endemic			L	x	x						x	x	x			
Karoo Prinia	*Prinia maculosa*	54.29	16.67	x			Near endemic			H	x		x					x	x	x			
Lanner Falcon	*Falco biarmicus*	2.86	0.00	x	LC	VU		x		M		x	x	x	x	x	x	x	x	x		x	
Large-billed Lark	*Galerida magnirostris*	51.43	25.00	x			Near endemic			H	x	x					x	x	x	x			
Layard's Tit-babbler	*Parisoma layardi*	8.57	0.00	x			Near endemic			H			x					x	x	x			
Ludwig's Bustard	*Neotis ludwigii*	5.71	0.00	x	EN	EN				H	x	x			x				x	x	x		x
Martial Eagle	*Polemaetus bellicosus*	5.71	0.00	x	EN	EN		x		M	x	x	x	x	x	x			x	x		x	
Namaqua Warbler	*Phragmacia substriata*	14.29	4.17	x			Near endemic			H			x					x	x	x			
Pale Chanting Goshawk	*Melierax canorus*	68.57	45.83	x				x		H	x	x	x	x	x	x	x	x	x	x		x	
Pied Avocet	*Recurvirostra avosetta*	2.86	0.00	x					x	L	x			x				x					
Pied Starling	*Spreo bicolor*	8.57	0.00	x			Endemic			L	x	x	x	x			x	x	x	x			
Red-knobbed Coot	*Fulica cristata*	2.86	4.17	x					x	L				x				x					x
Rock Kestrel	*Falco rupicolus*	22.86	0.00	x				x		H		x					x		x	x		x	
Sickle-winged Chat	*Cercomela sinuata*	2.86	0.00	x			Near endemic			L	x	x	x				x	x	x	x			
South African Shelduck	*Tadorna cana*	14.29	0.00	x					x	M	x			x				x					x
Southern Black Korhaan	*Afrotis afra*	2.86	4.17	x	VU	VU	Endemic			L		x							x	x	x		x
Southern Double-collared Sunbird	*Cinnyris chalybeus*	0.00	0.00	x			Endemic			L	x		x					x	x				
Spotted Eagle-owl	*Bubo africanus*	8.57	0.00	x				x		M	x	x	x		x		x	x	x			x	
Spur-winged Goose	*Plectropterus gambensis*	2.86	0.00	x					x	L				x	x			x					x
Three-banded Plover	*Charadrius tricollaris*	17.14	12.50	x				x		L	x			x				x	x				
Verreaux's Eagle	*Aquila verreauxii*	11.43	12.50	x	LC	VU		x		L		x		x		x			x	x		x	

- **Pre-construction surveys**

As noted above, on-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2). Surveys were conducted according to a Regime 2 site (medium sensitivity) as defined in the best practice guidelines for avifaunal impact studies at solar developments, compiled by BLSA in 2017 (Jenkins *et al.* 2017).

The abundance of priority species (birds/km) recorded during the walk transects is displayed in Figure 9 below.

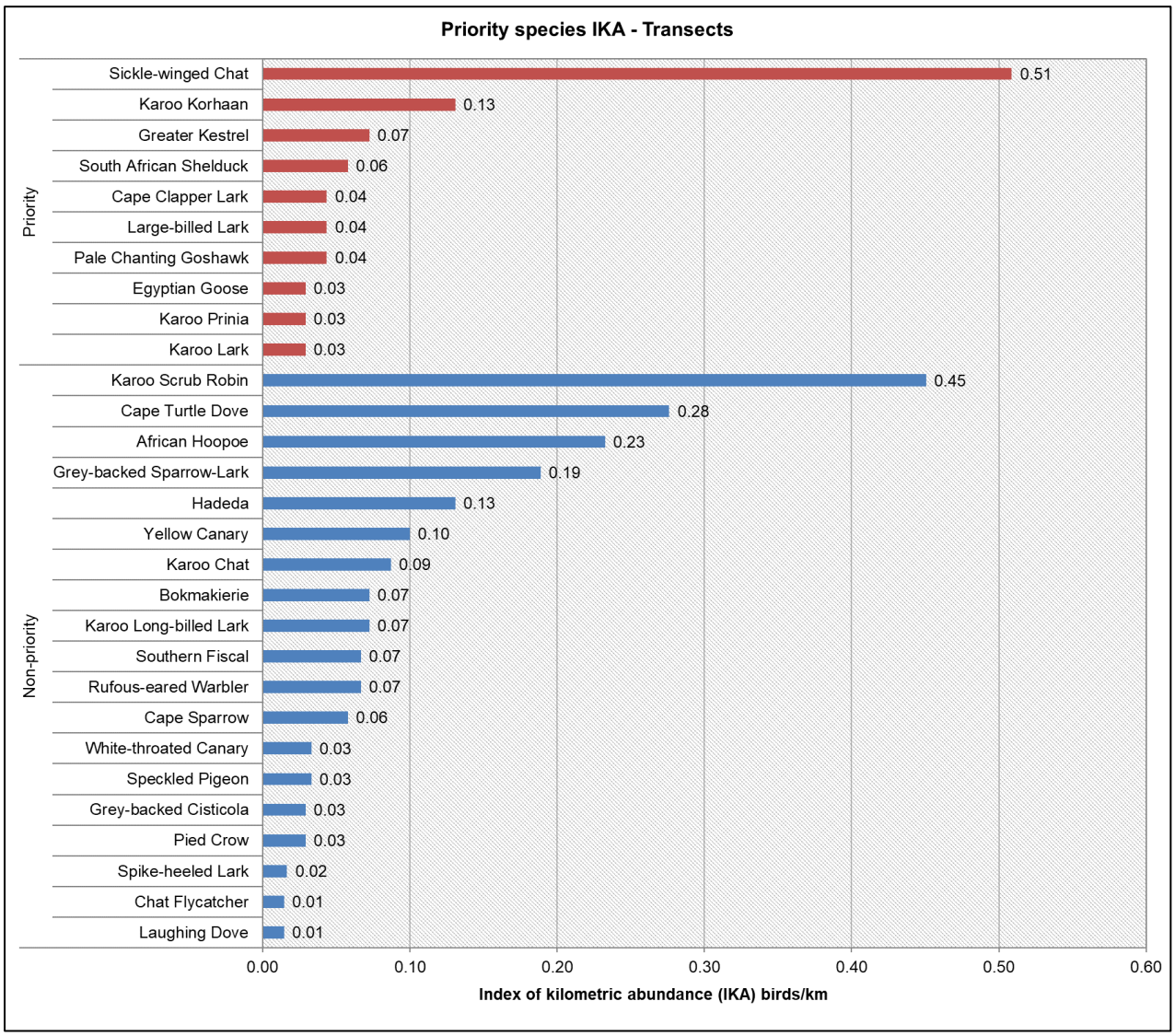

Figure 9: The abundance of priority species recorded during transect counts.

The species which were recorded at focal points are listed in Table 2 below

Table 2: Species recorded at focal points. Priority species are shaded in red.

FP1	FP2	FP3
Karoo Chat	Karoo Korhaan	Brown-throated Martin
Speckled Pigeon	Karoo Chat	Pearl-breasted Swallow
Cape Sparrow	Cape Wagtail	Pied Avocet
Southern Fiscal	Egyptian Goose	South African Shelduck
Yellow Canary	Malachite Sunbird	Three-banded Plover
Karoo Lark	Yellow Canary	Yellow Canary
Bokmakierie	Pied Crow	
Cape Bunting	Cape Turtle Dove	
Malachite Sunbird		
Grey Tit		
Southern Double-collared Sunbird		
Lark-like Bunting		
White-throated Canary		

Table 3 lists the priority species which were recorded as incidental records.

Table 3: Priority species which were recorded as incidental records.

Species	Number
Karoo Korhaan	5
Karoo Lark	3
Ludwig's Bustard	3
Pale Chanting Goshawk	3
Pied Starling	3
Grey Heron	2
Karoo Prinia	2
South African Shelduck	2
Greater Kestrel	1
Jackal Buzzard	1
Karoo Eremomela	1
Large-billed Lark	1
Martial Eagle	1
Spotted Eagle-Owl	1

The overall abundance of priority species at the site was low, with an average of 0.83 birds/km recorded during transect counts. For all birds combined, the index of kilometric abundance (IKA) for transect counts was 8.45 birds/km, which is moderate. The low numbers are not surprising, given the general aridity of the habitat.

4.2 Project Specific Description

4.2.1. Hoek Doornen PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.2.2. Hoek Doornen PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). There is one small earth dam located in the south of the PV footprint. The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.2.3. Hoek Doornen PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small earth dam located in the extreme west of the PV footprint. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.2.4. Hoek Doornen PV 4 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The entire PV footprint and powerline corridor consist of low succulent shrubland (Tankwa Karoo). The powerline corridor is crossed by the 2 Droërivier – Kappa 400kV transmission line. There is one small wetland area located in the powerline corridor and two small earth dams located just east of the corridor.

4.3. Identification of Environmental Sensitivities

4.3.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

The study area and immediate environment is classified as low sensitivity for avifauna from a PV perspective, except drainage lines (including the Groot River) and a few earth dams which are classified as high sensitivity. No reason is offered for the high classification, but surface water attracts avifauna and that could be the reason for attributing a high sensitivity rating. It should be noted that the Screening Tool did not identify any known nests or roosts.

The site investigation revealed that the study area is generally low sensitivity for avifauna from a PV perspective, with a few areas of high sensitivity namely water reservoirs (permanent surface water) and drainage lines (ephemeral water resource and drainage line woodland habitat) and one priority species nest, namely a Greater Kestrel. The earth dams are very small and basically dry for the majority of the year, therefore from a solar PV perspective, they constitute low sensitive habitat.

There is no specific powerline theme for avifauna in the DEFF Screening Tool, and the study area is classified as mostly medium sensitivity for Animal Species Theme, with small areas of low and high

sensitivity. The medium sensitivity rating is linked to the presence of Ludwig's Bustard. The High and Low sensitivity ratings are not linked to avifauna.

See Appendix C for the Site Sensitivity Verification report and Figures 10 and 11 for maps of the sensitivities identified by the screening tool for PV solar (Avifauna) and powerlines (Animal Species Theme).

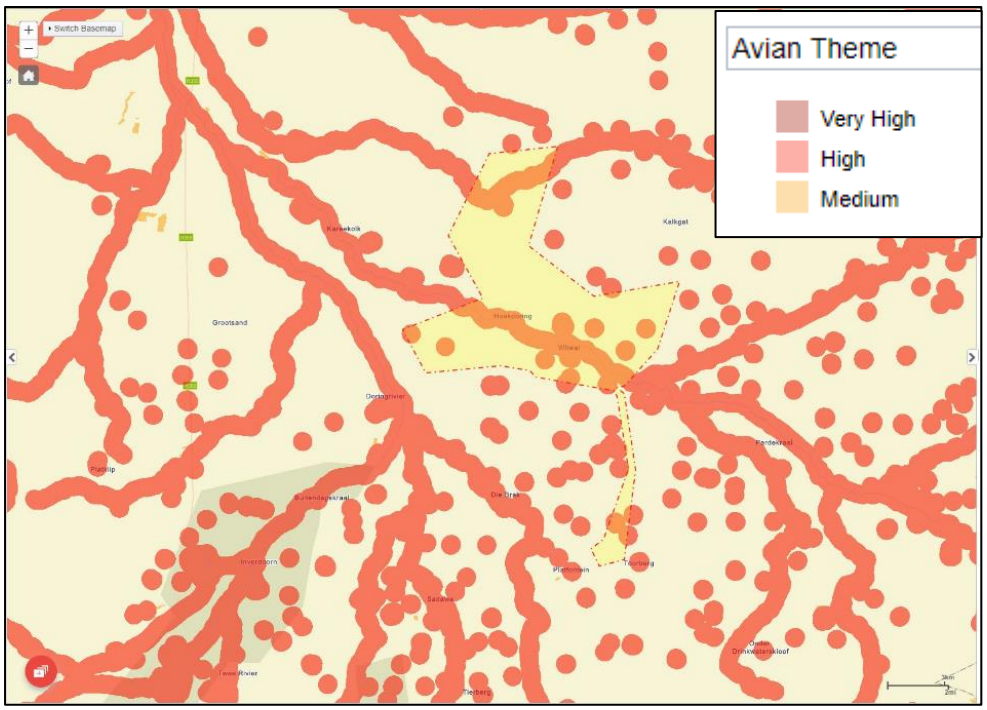

Figure 10: The National Web-Based Environmental Screening Tool map of the consolidated study area, indicating sensitivities for the solar PV avifaunal theme.

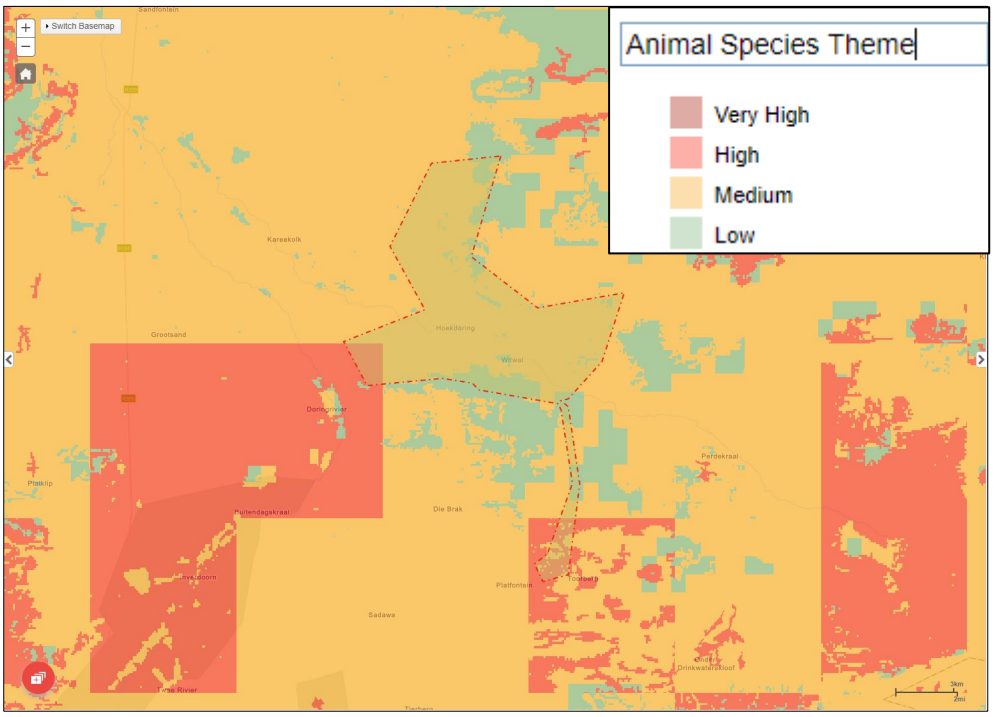

Figure 11: The National Web-Based Environmental Screening Tool map of the consolidated study area, indicating sensitivities for the powerline general animal species theme.

4.3.1.1 Hoek Doornen PV 1 – PV Facility, Electrical Grid Infrastructure and Associated **Infrastructure**

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.1.2 Hoek Doornen PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity with one area of high sensitivity, a small earth dam. The dam is very small and basically dry for the majority of the year. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.1.3 Hoek Doornen PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity with one area of high sensitivity, a small earth dam. The dam is very small and basically dry for the majority of the year. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.1.4 Hoek Doornen PV 4 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

The PV footprint (PV Solar: Avifaunal Theme) is classified as low sensitivity. The PV footprint and powerline corridor (Powerlines: Animal Species Theme) are rated medium sensitivity.

4.3.2 Specialist Sensitivity Analysis and Verification

- **PV Solar**

The following environmental sensitivities were identified from an avifaunal perspective for the PV facilities:

- **Very High sensitivity (No-Go): Surface water**

  Included are areas within 300m of water troughs, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. It is important to leave open space for birds to access and leave the surface water area unhindered. Surface water is also important area for raptors to hunt birds which congregate around water troughs, and they should have enough space for fast aerial pursuit. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped.

- **Very High sensitivity (No-Go): Drainage line woodland**

  Drainage lines are corridors of woodland which provide nesting and foraging opportunities for woodland species which are dependent on this habitat for their survival in this very arid climate. All major drainage lines should be classified as No-Go areas to prevent impact on the sensitive habitat.

- **Very High sensitivity (No-Go): Priority species nests**

  Nest of priority species, particularly those that occur naturally at naturally lower numbers such as raptors, should be protected by No-Go buffer zones to prevent displacement of the breeding birds due to disturbance associated with the construction activity.

- **Electricity grid infrastructure**

The following environmental sensitivities were identified from an avifaunal perspective for the proposed powerline grid connections:

- **High sensitivity (Mitigation required): Surface water**

  Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Black Harrier, and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Powerlines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. If a powerline has to be routed across a high sensitivity zone, mitigation in the form of Bird Flight Diverters will be required.

- **Medium sensitivity (Mitigation potentially required): Succulent Karoo**

  The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan.

See Figures 12 and 13 for the avifaunal sensitivities identified from a PV solar and powerline perspective at the four Hoek Doornen PV facilities, electrical grid infrastructure and associated infrastructure.

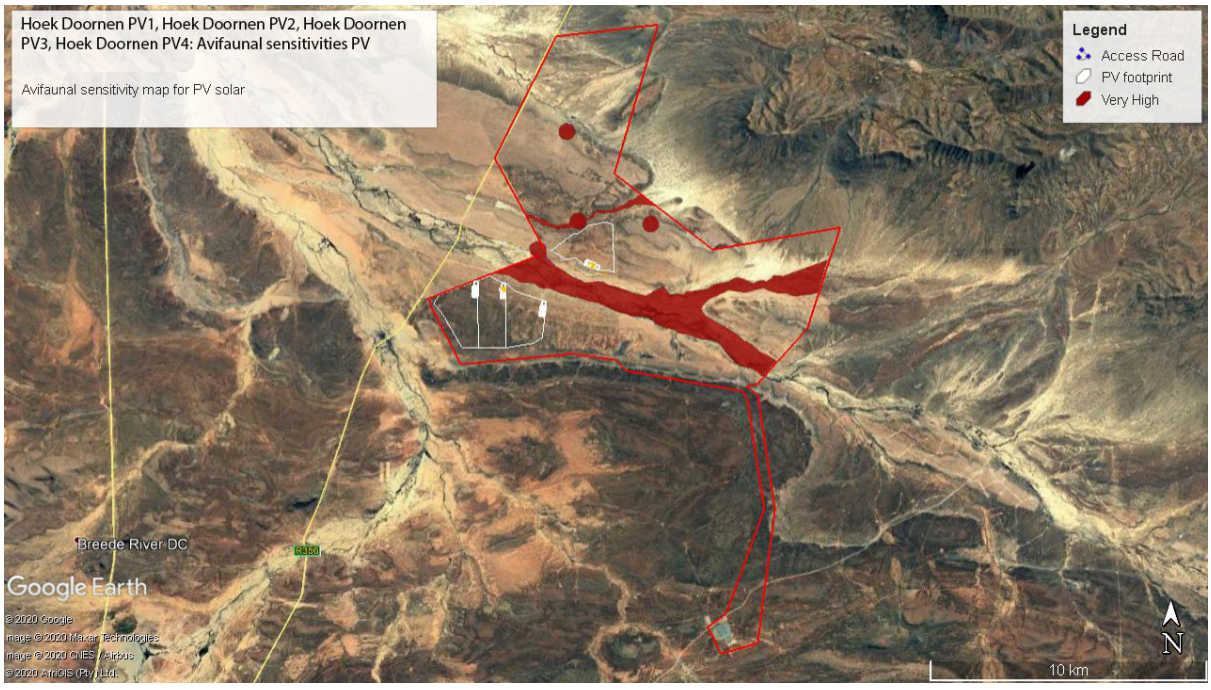

Figure 12: Avifaunal sensitivities (for the PV solar) at the four Hoek Doornen PV facilities and associated infrastructure. These are only for the PV panels, not for associated infrastructure e.g. powerlines.

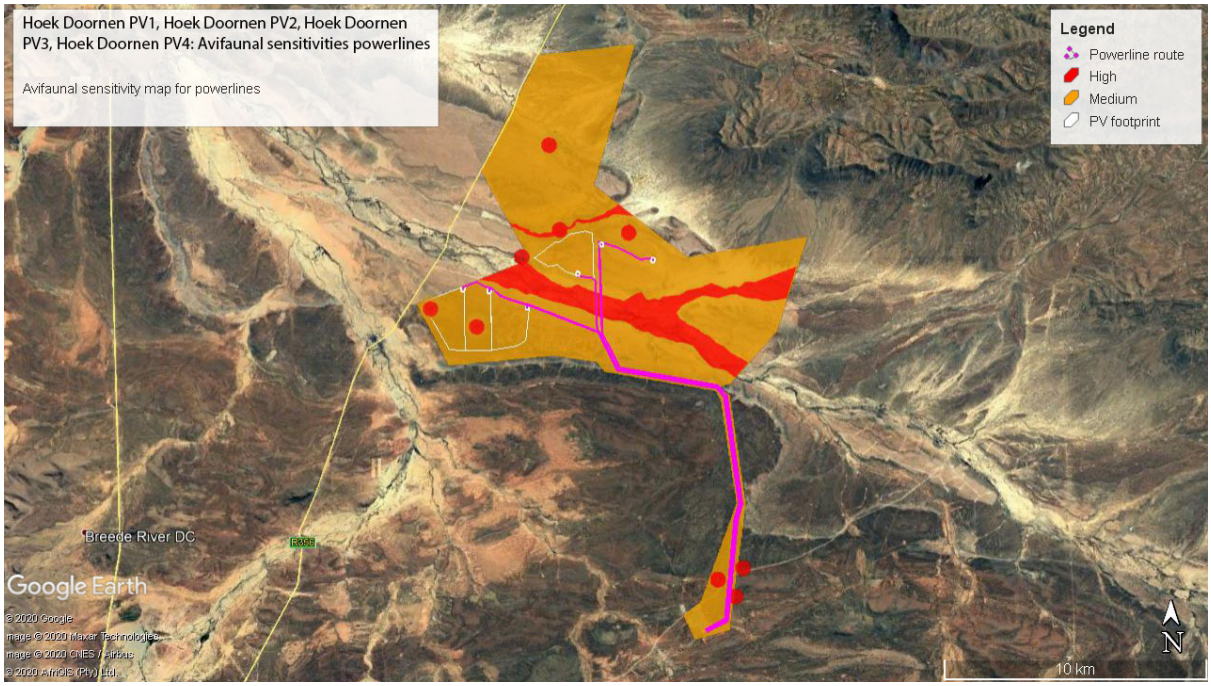

Figure 13: Avifaunal sensitivities (for the powerlines) at the four Hoek Doornen PV facilities and associated electrical grid infrastructure.

4.3.2.1 Hoek Doornen PV 1 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.2.2 Hoek Doornen PV 2 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.2.3 Hoek Doornen PV 3 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.2.4 Hoek Doornen PV 4 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure

Please see Figures 12 and 13 above. Note that Figure 13 only applies to the power lines, even though sensitivities are shown for the entire study area. It must be noted that the sensitivities falling outside of the

power line corridor, in the area of the PV Facilities, are not a concern for the PV Facilities, and must only be maintained and adhered to for the power lines.

4.3.3 Sensitivity Analysis Summary Statement

- PV solar: Avifaunal theme

The site investigation revealed that the site is generally low sensitivity with a few **very highly (No-Go)** sensitive areas namely water reservoirs, drainage lines and priority species nests. The sensitivity ratings in the DEFF screening tool are therefore partially confirmed as far as the low sensitivity areas are concerned. However, a few very highly sensitive areas were identified which do not appear in the screening tool.

- Powerline: Animal Species theme

The site investigation revealed that the sensitivity rating of medium sensitivity is accurate for avifauna as far as powerlines are concerned, but there are also areas of **high sensitivity**, namely water reservoirs, drainage lines and earth dams. There are no No-Go areas as far as powerlines are concerned.

See Appendix C for the site verification reports.

5 Issues, Risks and Impacts

5.1 Identification of Potential Impacts/Risks

The potential impacts identified in the course of the study are:

5.1.1 Construction Phase

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

5.1.2 Operational Phase

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections

5.1.3 Decommissioning Phase

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

5.1.4 Cumulative Impacts

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

- Displacement due to habitat transformation associated with the construction and operation of the solar PV plants and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences
- Electrocutions on the internal 33kV powerlines
- Collisions with the 132kV grid connections
- Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

6 Impact Assessment

6.1 Introduction

Increasingly, human-induced climate change is recognized as a fundamental driver of biological processes and patterns. Historic climate change is known to have caused shifts in the geographic ranges of many plants and animals, and future climate change is expected to result in even greater redistributions of species (National Audubon Society 2015). In 2006, the World Wide Fund for Nature (WWF) Australia produced a report on the envisaged impact of climate change on birds worldwide (Wormworth & Mallon 2006). The report found that:

- Climate change now affects bird species' behaviour, ranges and population dynamics;
- Some bird species are already experiencing strong negative impacts from climate change; and
- In future, subject to greenhouse gas emissions levels and climatic response, climate change will put large numbers 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, loss occurs without accompanying range expansion.
- For 188 species, 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 10 developing countries required to significantly reduce their carbon emissions (Seymore *et al.* 2014), and the introduction of low-carbon technologies into the country's compliment of power generation will greatly assist with achieving this important objective (Walwyn & Brent 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri 2009; Munzhedi & Sebitosi 2009), it is clear that solar power generation should feature prominently in future efforts to convert to a more sustainable energy mix in order to combat climate change, also from an avifaunal impact perspective. However, while the expansion of solar power generation is undoubtedly a positive development for avifauna in the longer term in that it will help reduce the effect of climate change and thus habitat transformation, it must also be acknowledged that renewable energy facilities, including solar PV facilities, in themselves have some potential for negative impacts on avifauna.

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 source 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-west United States. In South Africa, only one published scientific study has been completed on the impacts of PV plants in a South African context (Visser *et al.* 2019).

6.2 Impacts associated with PV plants and associated infrastructure

6.2.1 Impact trauma (collisions)

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 photovoltaic 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.

Weekly mortality searches at 20% coverage were conducted at the 250MW, 1300ha 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

[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.

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 550MW, 1 600ha Desert Sunlight PV plant in California. 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 96MW 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 30km east of Postmasburg in the Northern Cape Province (Visser *et al.* 2019). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 hectares with the capacity to deliver 180 000 MWh 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 the 14th of September 2015 until the 6th of December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per hectare 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/yr (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 solar energy facilities across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser *et al.* 2019).

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 facility 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, and possibly raptors which prey on them.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.2 Entrapment in perimeter fences

Visser *et al.* (2019) recorded a fence-line fatality (Orange River Francolin *Scleroptila gutturalis*) resulting from the bird being trapped between the inner and outer perimeter fence of the facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (e.g. Red-crested Korhaan *Lophotis ruficrista*) (Visser *et al.* 2019). 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.

It is not foreseen that entrapment in perimeter fences will be a significant impact. The priority species which could potentially be affected by this impact are most likely medium to large terrestrial species.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.3 Displacement due to disturbance and habitat transformation associated with the construction and operation of the solar PV facilities

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 solar energy facilities, 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).

Solar energy facilities 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 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 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 vs 46), supporting the view that solar development is 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.* (2019) gathered bird transect data at the 180 hectares, 96MW 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*. (2019) 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 specialist species 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 Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 projects, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities.

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 Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 facility. In addition, raptors and large terrestrial species could also be impacted.

See Table 1 for list of species which could potentially be affected by this impact.

6.2.4 Electrocutions

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, on the internal 33kV powerlines within the footprint of the PV facilities, should the decision be to not go underground with the reticulation network. This is

especially a major problem for the larger Red Listed species, e.g. Martial Eagle, as it is envisaged that they will frequently perch on the power poles.

See Table 1 for list of species which could potentially be affected by this impact.

6.3 Impacts associated with electricity grid infrastructure

Negative impacts on birds by electricity infrastructure generally take two principal forms, namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins *et al.* 2010). In this instance, the major potential impact with the 132kV grid connections is powerline collisions.

6.3.1 Collisions with the 132kV grid connections

Collisions are probably the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004; Shaw 2013). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. 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 power lines (van Rooyen 2004; Shaw 2013).

In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with power lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini *et al*. 2005, Jenkins *et al*. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the low-resolution and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin *et al*. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown *et al.* 1987, Henderson *et al.* 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power

lines that they can see but do not have enough flight control to avoid (Brown *et al*. 1987, APLIC 1994).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins *et al.* 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown *et al.* 1987, Faanes 1987, Bevanger 1994)."

As mentioned by Shaw (2013) in the extract above, several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is essential to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin *&* Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes and White Storks. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35° respectively are sufficient to render the birds blind in the direction of travel; in storks head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (*Accipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes and are also known to be vulnerable to power line collisions.

Thus visual field topographies which have evolved primarily to meet visual challenges associated with foraging may render certain bird species particularly vulnerable to collisions with human artefacts, such as power lines and wind turbines that extend into the otherwise open airspace above their preferred habitats. For these species placing devices upon power lines to render them more visible may have limited success since no matter what the device the birds may not see them. It may be that in certain situations it may be necessary to distract birds away from the obstacles, or encourage them to land nearby (for example by the use of decoy models of conspecifics, or the provision of sites attractive for roosting) since increased marking of the obstacle cannot be guaranteed to render it visible if the visual field configuration prevents it being detected. Perhaps most importantly, the results indicate that collision mitigation may need to vary substantially for different collision prone species, taking account of species specific behaviours, habitat and foraging preferences, since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all (Martin & Shaw 2010).

Despite evidence that line marking might be ineffective for some species due to differences in visual fields and behaviour, or have only a small reduction in mortality in certain situations for certain species, particularly bustards (Martin & Shaw 2010; Barrientos *et al.* 2012; Shaw 2013), it is generally accepted that marking a line with PVC spiral type Bird Flight Diverters can reduce the collision mortality rates (Sporer *et al.* 2013; Barrientos *et al.* 2012, Alonso & Alonso 1999; Koops & De Jong 1982). Regardless of statistical significance, a slight mortality reduction may be very biologically relevant in areas, species or populations of high conservation concern (e.g. Ludwig's Bustard) (Barrientos *et al.* 2012). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. A study reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease in bird collisions. At unmarked lines, there were 0.21 deaths/1000 birds (n = 339,830) that flew among lines or over lines. At marked lines, the mortality rate was 78% lower (n = 1,060,746) (Barrientos *et al.* 2011). Koops and De Jong (1982) found that the spacing of the Bird Flight Diverters were critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5 metres, whereas using the same devices at 10 metre intervals only reduces the mortality by 57%. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important, as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (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).

Quantifying the collision impact in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from incidental record keeping by the EWT, it is possible to give a measure of what species are susceptible to powerline collisions (see Figure 14). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

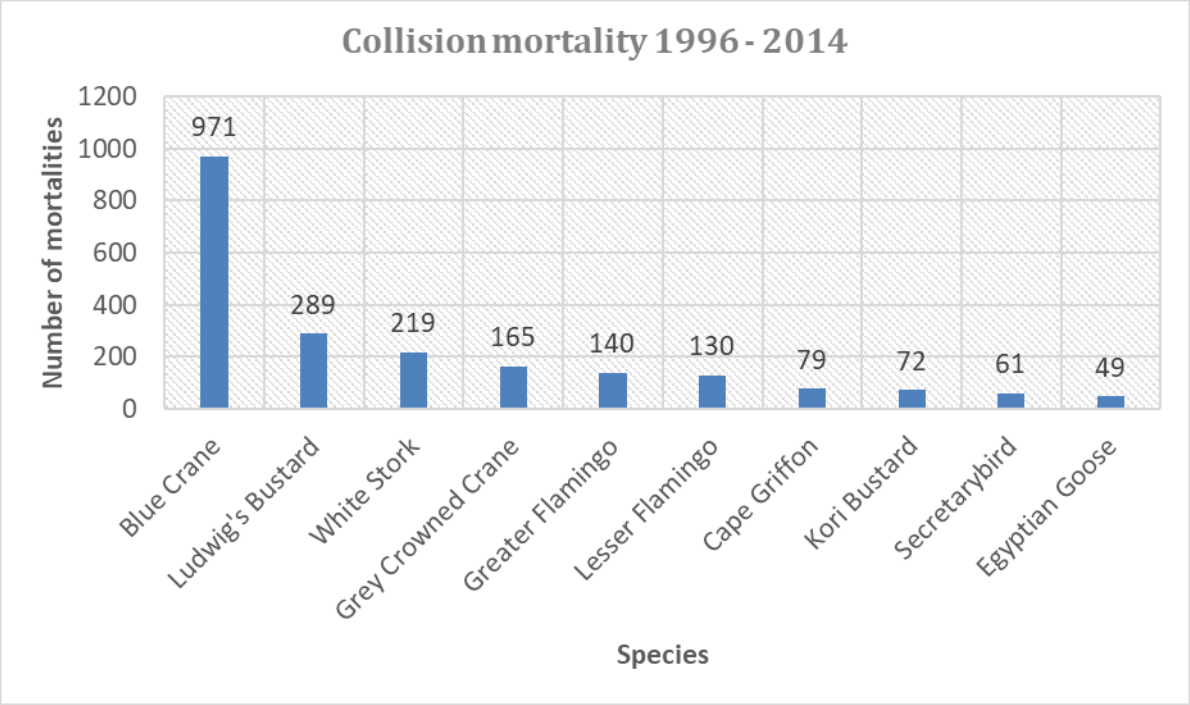

Figure 14: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data 2014).

Species potentially at risk of collisions with the 132kV grid connection are listed in Table 1.

6.4 Cumulative impacts

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy developments that have received an Environmental Authorisation within at least a 30km radius of the proposed site, as well as the nine proposed Veroniva Ceres PV developments and associated grid connections (i.e. total of nine power lines). There are currently 11 renewable energy projects authorised within a 30km radius around the proposed nine Veroniva Ceres PV projects. Of these, only two are solar PV projects, and one is a hybrid wind and solar PV project. The locality of renewable projects (land parcels) which are authorised are displayed in Figure 15 and listed in Appendix G.

The total affected land parcel area taken up by authorised renewable energy projects and their grid connections within the 30km radius is approximately 44 578 ha. The total affected land parcel area of the nine Veroniva Ceres PV projects and grid connections comprises approximately 18 232ha. If one assumes that all nine Veroniva projects will be authorised, the combined land parcel area affected by renewable energy developments within the 30km radius around the Veroniva projects will equal 62 810 ha. The total area within the 30km radius around the proposed projects equates to about 502 776ha of similar habitat. The total combined size of the land parcels affected by renewable energy projects and their grid connections will thus equate to 12.4% of the available habitat in the 30km radius. However, the actual physical footprint of the renewable energy facilities will be much smaller than the land parcel areas themselves, for example in the case of wind energy, the physical footprint comprises less than 5% of the project area. Furthermore, each of these projects must still be subject to a competitive bidding process where only the most competitive projects will win a power purchase agreement required for the project to proceed to construction. The cumulative impact of the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 solar PV projects is thus anticipated to be **low** after mitigation.

The proposed grid connections of the 9 Veroniva Ceres PV projects equates to about 184km. However, approximately 135km of line will be routed parallel in one “highway”, which means that as far as bird collision impacts are concerned, the additional length of powerline effectively equates to about 64km. There are approximately 221km of existing and 83km (total = 304km) of planned transmission lines within the 30km radius around the Veroniva Ceres PV projects. These projects will thus increase the total number of planned and existing high voltage lines by 21%. The cumulative impact of the planned grid connections is therefore considered to be **moderate** from a potential bird collision perspective after mitigation.

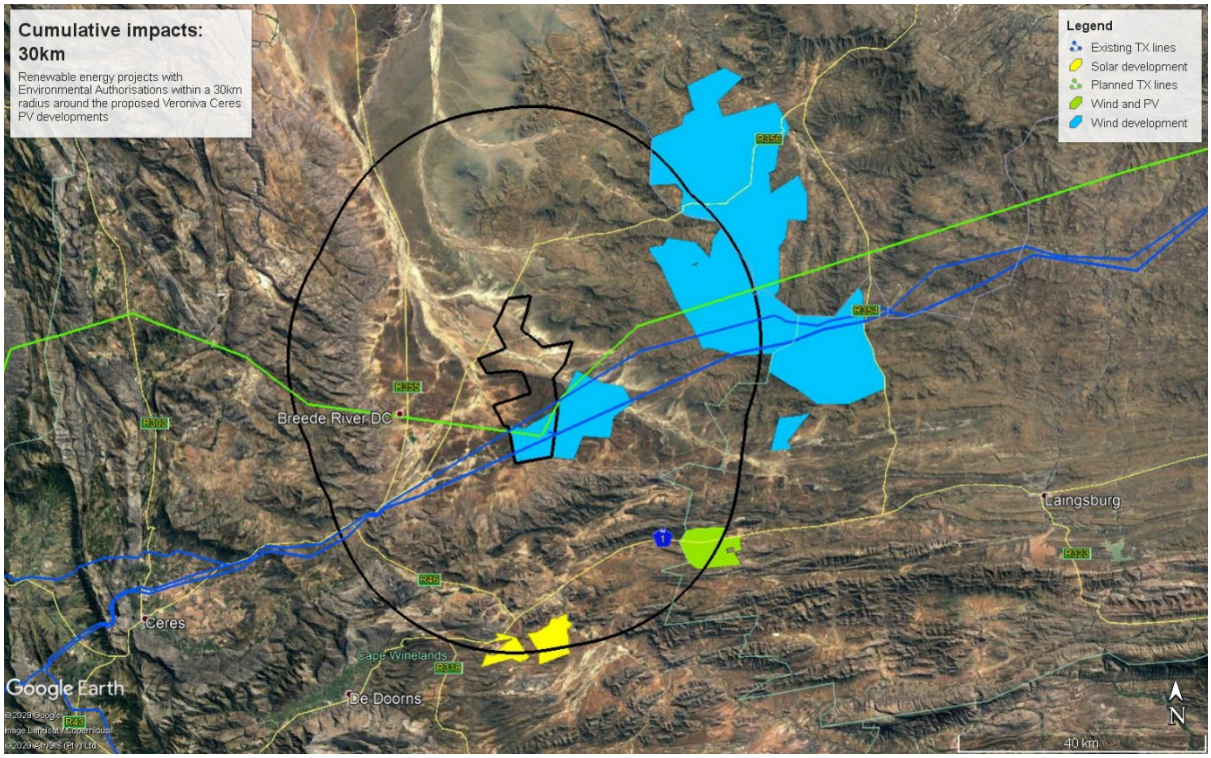

Figure 15: Map showing location of land parcels with authorised renewable energy projects within a 30km radius around the study area. This map also shows proposed and existing power lines within the 30km radius.

6.5 No-go option

The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained, which will be to the advantage of the avifauna. No fatal flaws were discovered in the course of the investigations.

6.6 Hoek Doornen PV 1, PV 2, PV 3 and PV 4 – PV Facility, Electrical Grid Infrastructure and Associated Infrastructure[2]

This section includes a description of the assessment of the potential impacts identified for avifauna for the proposed Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, Hoek Doornen PV 4 and all associated infrastructure, including the power lines. No indirect impacts have been identified for the proposed project from an avifaunal perspective.

[2] Due to the similarity in habitat, the impacts are expected to be essentially identical for all the projects

6.6.1. Potential Impacts during the Construction Phase

The following impacts have been identified for the construction phase.

6.6.1.1. **Impact 1: Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure**

The noise and movement associated with the construction activities at the proposed PV footprints for the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4, and associated infrastructure (including roads and substation) will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.1.2 below.

6.6.1.2. **Impact Summary Tables: Construction Phase**

The rating of the impacts identified for the construction phase is discussed in this section.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Impact 1: Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure	*Status*	*Negative*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.* ▪ *Access to the rest of the property must be restricted.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.*	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.2. Potential Impacts during the Operational Phase

The following impacts have been identified for the operational phase.

6.6.2.1. **Impact 1**: Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.

This impact relates to the total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure. This impact is rated as negative, with a site specific spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and very likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.2.6 below.

6.6.2.2. **Impact 2:** Bird mortality through collisions with the solar panels.

This impact relates to the bird kills and injury as a result of potential collisions with the solar panels. This impact is rated as negative, with a site specific spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a slight consequence and unlikely probability, which will render the impact significance as very low. As detailed in Section 6.6.2.6 below, no mitigation is required due to the very low impact significance.

6.6.2.3. **Impact 3:** Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.

This impact pertains to the entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality. This impact is rated as negative, with a site specific spatial extent and a long term duration due to the long timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is rated with a moderate consequence and likely probability, which will result in a low impact significance, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to very low. The recommended mitigation measure includes using a single perimeter fence around the PV Facility.

6.6.2.4. **Impact 4:** Electrocution of priority species on the internal 33kV powerlines.

This impact deals with the potential electrocution of priority species on the internal 33kV powerlines at the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3, and Hoek Doornen PV 4 facilities. This impact is rated as negative, with a local spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will result in an impact significance of high, without the implementation of mitigation measures. With the implementation of mitigation measures (i.e. use underground cabling), the significance of the impact is reduced to very low.

6.6.2.5. **Impact 5:** Collisions with the 132kV grid connections

This impact deals with potential collisions with the 132kV grid connections. This impact is rated as negative, with a local spatial extent and a long term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years). The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.2.6 below.

6.6.2.6. **Impact Summary Tables: Operational Phase**

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure.	*Status*	*Negative*	*High (2)*	▪ *The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.* ▪ *A 300m infrastructure-free buffer must be maintained around the water reservoirs (see sensitivity map Figure 12).* ▪ *No solar PV arrays must be constructed in drainage lines (see sensitivity map Figure 12).*	*Moderate (3)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL PHASE						
Mortality through collisions with the solar panels	*Status*	*Negative*	*Very low (5)*	*No mitigation is required due to the very low significance*	*Very low (5)*	*Medium*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Slight*				
	Probability	*Unlikely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	*Status*	*Negative*	*Low (4)*	*A single perimeter fence should be used.*	*Very low (5)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Long term*				
	Consequence	*Moderate*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Electrocution of priority species on the internal 33kV powerlines.	*Status*	*Negative*	*High (2)*	*Use underground cabling*	*Very Low (5)*	*High*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				
	Probability	*Likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
OPERATIONAL PHASE						
Collision mortality of priority species due to the 132kV grid connections.	*Status*	*Negative*	*High (2)*	*The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be*	*Moderate (3)*	*Medium*
	Spatial Extent	*Local*				
	Duration	*Long term*				
	Consequence	*Severe*				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
	Probability	*Likely*		*marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.*		
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.3. Potential Impacts during the Decommissioning Phase

The following impacts have been identified for the decommissioning phase.

6.6.3.1. **Impact 1:** Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The noise and movement associated with the potential decommissioning activities will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.3.2 below.

6.6.3.2. **Impact Summary Tables: Decommissioning Phase**

The rating of the impacts identified for the operational phase is discussed in this section.

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the study area will be a source of disturbance which would lead to the displacement of avifauna from the area.	*Status*	*Negative*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads during the decommissioning phase should be kept to a minimum as far as practical.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned*	*Low (4)*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Short term*				
	Consequence	*Substantial*				
	Probability	*Very likely*				
	Reversibility	*High*				
	Irreplaceability	*Low*				

6.6.4. Cumulative Impacts

The following cumulative impacts have been identified.

6.6.4.1. **Impact 1: Construction Phase -** Displacement due to disturbance associated with the construction of the solar PV plants and associated infrastructure

The noise and movement associated with the construction activities of similar projects within the 30 km radius will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration due to the temporary nature of the construction phase. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.7 below.

6.6.4.2. **Impact 2**: **Operational Phase** - Habitat transformation, collisions with the solar panels, entrapment in fences, and electrocution on internal reticulation lines

This impact deals with the following during the operational phase with regards to other similar projects in the 30 km radius:

- Total or partial displacement of avifauna due to habitat transformation associated with the presence of the solar PV plants and associated infrastructure;
- Bird mortality and injury as a result of collisions with the solar panels;
- Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality;
- Electrocution of priority species on the internal 33kV powerlines; and
- Collisions with the 132kV grid connections.

This impact is rated as negative, with a regional spatial extent and a long term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.8 below.

6.6.4.3. **Impact 3: Operational Phase -** Collisions with the 132kV grid connections

This impact deals with potential collisions with the 132kV grid connections during the operational phase with regards to other similar projects in the 30 km radius. This impact is rated as negative, with a local spatial extent and a long term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and likely probability, which will render the impact significance as high, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate. The recommended mitigation measures are detailed Section 6.6.4.8 below.

6.6.4.4. **Impact 4: Decommissioning Phase -** Displacement due to disturbance associated with the decommissioning of the solar PV plants and associated infrastructure

The noise and movement associated with the potential decommissioning activities (in terms of other similar projects in the 30 km radius) will be a source of disturbance which would lead to the displacement of avifauna from the area. This impact is rated as negative, with a site specific spatial extent and a short term duration. The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a substantial consequence and very likely probability, which will render the impact significance as moderate, without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to low. The recommended mitigation measures are detailed Section 6.6.4.8 below.

6.6.4.5. **Impact Summary Tables: Cumulative Impacts**

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CONSTRUCTION PHASE						
Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility* *Irreplaceability*	*Negative* *Site specific* *Short term* *Substantial* *Very likely* *High* *Low*	*Moderate (3)*	▪ *Activity should as far as possible be restricted to the footprint of the infrastructure.* ▪ *Measures to control noise and dust should be applied according to current best practice in the industry.* ▪ *Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.* ▪ *Access to the rest of the property must be restricted.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint is concerned.*	*Low (4)*	*High*
OPERATIONAL PHASE						
Habitat transformation, collisions with the solar panels, entrapment in fences, and electrocution on internal reticulation lines	*Status* *Spatial Extent* *Duration* *Consequence* *Probability* *Reversibility* *Irreplaceability*	*Negative* *Regional* *Long term* *Substantial* *Likely* *High* *Low*	*Moderate (3)*	▪ *The recommendations of the botanical specialist must be strictly implemented, especially as far as limiting the vegetation clearance to what is absolutely necessary, and rehabilitation of transformed areas are concerned.* ▪ *Infrastructure-free buffers must be maintained around the water reservoirs*	*Low (4)*	*Medium*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential mitigation measures	Significance and Ranking (Post-Mitigation)	Confidence Level
				▪ No solar PV arrays must be constructed in drainage lines ▪ A single perimeter fence should be used. ▪ Use underground cabling		
Collisions with the 132kV grid connection	Status	Negative	High (2)	▪ The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.	Moderate (3)	Medium
	Spatial Extent	Local				
	Duration	Long term				
	Consequence	Severe				
	Probability	Likely				
	Reversibility	High				
	Irreplaceability	Low				
DECOMMISSIONING PHASE						
The noise and movement associated with the activities at the study area will be a source of disturbance which would lead to the	Probability	Negative	Moderate (3)	▪ Activity should as far as possible be restricted to the footprint of the infrastructure. ▪ Measures to control noise and dust should be applied according to current best practice in the industry.	Low (4)	Medium
	Reversibility	Site specific				
	Irreplaceability	Short term				
	Consequence	Substantial				
	Probability	Very likely				
	Reversibility	High				

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
displacement of avifauna from the area	*Irreplaceability*	*Low*		▪ *Maximum use should be made of existing access roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical.* ▪ *The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned*		

7 Impact Assessment Summary

The overall impact significance is provided in this section, in terms of pre- and post-mitigation.

Table 4: Overall Impact Significance (Pre- and Post Mitigation)

Phase	Overall Impact Significance (Pre Mitigation)	Overall Impact Significance (Post Mitigation)
Construction	Moderate (3)	Low (4)
Operational	Moderate (3)	Low (4)
Decommissioning	Moderate (3)	Low (4)
Nature of Impact	**Overall Impact Significance**	**Overall Impact Significance**
Cumulative - Construction	Moderate (3)	Low (4)
Cumulative - Operational	Moderate (3)	Low (4)
Cumulative - Decommissioning	Moderate (3)	Low (4)

8 Legislative and Permit Requirements

8.1 Legislative Framework

There is no legislation pertaining specifically to the impact of solar facilities and associated electrical grid infrastructure on avifauna. There are best practice guidelines available which were compiled under the auspices of BLSA i.e. Jenkins, A.R., Ralston-Patton, Smit- Robinson, A.H. 2017. *Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa*. This guideline has been considered in this assessment.

8.1.1 Agreements and conventions

International agreements and conventions are described in this section.

Table 5: International agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of 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 Convention on Biological Diversity (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; and	Global

Convention name	Description	Geographic scope
	• The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 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

8.1.2 National legislation

8.1.2.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

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

8.1.2.2 The National Environmental Management Act (Act 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 a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) 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 (via the promulgation of the EIA Regulations (2014, as amended), which may significantly affect the environment, may be

performed only after an EIA or BA has been undertaken and environmental authorisation has been obtained from the relevant competent 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.

8.1.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 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 (Act 10 of 2004, as amended) read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they 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. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals (as noted in Table 5 above). The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

8.1.2.4 Provincial legislation

8.1.2.4.1 Western Cape Nature Conservation Laws Amendment Act, 2000

This statute provides for the amendment of various laws on nature conservation in order 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.

9 Environmental Management Programme Inputs

Please see a description of the key mitigation and monitoring recommendations for each applicable mitigation measure identified for all phases of the project.

9.1 Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Entrapment					
Entrapment of medium and large terrestrial birds between the perimeter fences, leading to mortality.	Prevent mortality of avifauna	1. A single perimeter fence should be used[3].	Design the facility with a single perimeter fence.	Once-off during the planning phase.	Project Developer
Avifauna: Displacement					
Displacement of avifauna due to habitat loss in the development footprint.	Prevent displacement of avifauna	1. A 300m infrastructure-free buffer must be maintained at waterpoints in terms of the sensitivities determined for the power lines. 2. No solar panels to be constructed in drainage lines	Design the facility with 300m buffers around boreholes and with no solar panels in drainage lines.	Once-off during the planning phase.	Project Developer
Avifauna: Electrocution					
Electrocution of raptors on the internal 33kV poles	Prevent electrocutions	1. Use underground cabling	Design the facility with underground cabling	Once-off during the planning phase.	Project Developer

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

9.2 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 botanical 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. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	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 with the 132kV grid connection					
Bird collisions with the earthwire of the proposed 132kV grid connection.	Prevention of collision mortality on the powerline.	Pro-active marking of identified high risk spans with Bird Flight Diverters (BFDs), based on walk-through by the avifaunal specialist.	1. Walk-through by avifaunal specialist prior to implementation to identify high risk spans. 2. Implementation of appropriate measures e.g. marking of the earthwire with BFDs on high risk spans.	1. Once-off during the construction phase. 2. Once-off during the construction phase.	1. Facility Environmental Manager 2. Facility operational manager

9.3 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) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. 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
Avifauna: Mortality due to collisions with the 132kV grid connection					
Bird collisions with the earthwire of the proposed 132kV grid connections.	Prevention of collision mortality on the powerlines.	Reactive marking of identified high risk spans with Bird Flight Diverters (BFDs), based on regular powerline inspections by the avifaunal specialist.	1. Powerline inspections by avifaunal specialist to look for carcasses. 2. Implementation of	1. Monthly 2. Monthly	1. Facility Environmental Manager 2. Facility Operational Manager

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
			appropriate measures e.g. marking of the earthwire with BFDs on high risk spans.		

10 Final Specialist Statement and Authorisation Recommendation

10.1 Statement and Reasoned Opinion

The expected impacts of the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4 solar PV facilities, electrical grid infrastructure and associated infrastructure were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (see Table 4 above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the EMPr (Section 9) are strictly implemented.

10.2 EA Condition Recommendations

The proposed mitigation measures are detailed in Section 9 above.

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Appendices

Appendix A: Specialist Expertise

Appendix B: Specialist statement of independence

Appendix C: Site sensitivity verification

Appendix D: Impact Assessment methodology

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Appendix F: Species List

Appendix G: List of renewable energy projects within 30km radius

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Appendix A - Specialist Expertise

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	22 years

Key Experience

Chris van Rooyen has twenty-two years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Key Project Experience

Bird Impact Assessment Studies and avifaunal monitoring for wind-powered generation facilities:

1. Eskom Klipheuwel Experimental Wind Power Facility, Western Cape
2. Mainstream Wind Facility Jeffreys Bay, Eastern Cape (EIA and monitoring)
3. Biotherm, Swellendam, (Excelsior), Western Cape (EIA and monitoring)
4. Biotherm, Napier, (Matjieskloof), Western Cape (pre-feasibility)
5. Windcurrent SA, Jeffreys Bay, Eastern Cape (2 sites) (EIA and monitoring)
6. Caledon Wind, Caledon, Western Cape (EIA)
7. Innowind (4 sites), Western Cape (EIA)
8. Renewable Energy Systems (RES) Oyster Bay, Eastern Cape (EIA and monitoring)
9. Oelsner Group (Kerriefontein), Western Cape (EIA)
10. Oelsner Group (Langefontein), Western Cape (EIA)
11. InCa Energy, Vredendal Wind Energy Facility Western Cape (EIA)
12. Mainstream Loeriesfontein Wind Energy Facility (EIA and monitoring)
13. Mainstream Noupoort Wind Energy Facility (EIA and monitoring)
14. Biotherm Port Nolloth Wind Energy Facility (Monitoring)
15. Biotherm Laingsburg Wind Energy Facility (EIA and monitoring)
16. Langhoogte Wind Energy Facility (EIA)
17. Vleesbaai Wind Energy Facility (EIA and monitoring)
18. St. Helena Bay Wind Energy Facility (EIA and monitoring)
19. Electrawind, St Helena Bay Wind Energy Facility (EIA and monitoring)
20. Electrawind, Vredendal Wind Energy Facility (EIA)
21. SAGIT, Langhoogte and Wolseley Wind Energy facilities
22. Renosterberg Wind Energy Project – 12-month preconstruction avifaunal monitoring project
23. De Aar – North (Mulilo) Wind Energy Project – 12-month preconstruction avifaunal monitoring project
24. De Aar – South (Mulilo) Wind Energy Project – 12-month bird monitoring
25. Namies – Aggenys Wind Energy Project – 12-month bird monitoring
26. Pofadder - Wind Energy Project – 12-month bird monitoring
27. Dwarsrug Loeriesfontein - Wind Energy Project – 12-month bird monitoring
28. Waaihoek – Utrecht Wind Energy Project – 12-month bird monitoring

29. Amathole – Butterworth Utrecht Wind Energy Project – 12-month bird monitoring & EIA specialist
30. Phezukomoya and San Kraal Wind Energy Projects 12-month bird monitoring & EIA specialist study (Innowind)
31. Beaufort West Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
32. Leeuwdraai Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
33. Sutherland Wind Energy Facility 12-month bird monitoring (Mainstream)
34. Maralla Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
35. Esizayo Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
36. Humansdorp Wind Energy Facility 12-month bird monitoring & EIA specialist study (Cennergi)
37. Aletta Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
38. Eureka Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
39. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
40. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
41. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
42. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
43. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
44. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
45. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
46. Dassieklip Wind Energy Facility 3 years post-construction monitoring (Biotherm)
47. Loeriesfontein 2 Wind Energy Facility 2 years post-construction monitoring (Mainstream)
48. Khobab Wind Energy Facility 2 years post-construction monitoring (Mainstream)
49. Excelsior Wind Energy Facility 18 months construction phase monitoring (Biotherm)
50. Boesmansberg Wind Energy Facility 12-months pre-construction bird monitoring (juwi)
51. Mañhica Wind Energy Facility, Mozambique, 12-months pre-construction monitoring (Windlab)
52. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
53. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO).
54. Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
55. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
56. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
57. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
58. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
59. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
60. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
61. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
62. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
63. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
64. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
65. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
66. Pofadder Wind Energy Facility, Northren Cape, Screening Report (Atlantic Energy)
67. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
68. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
69. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment Studies for Solar Energy Plants:

1. Concentrated Solar Power Plant, Upington, Northern Cape.
2. Globeleq De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos PV project, Copperton, Northern Cape

4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena PV Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla PV Project, Aggeneys, Northern Cape
8. Biotherm Sendawo PV Project, Vryburg, North-West
9. Biotherm Tlisitseng PV Project, Lichtenburg, North-West
10. JUWI Hotazel Solar Park Project, Hotazel, Northern Cape
11. Namakwa Solar Project, Aggeneys, Northern Cape
12. Brypaal Solar Power Project, Kakamas, Northern Cape
13. ABO Vryburg 1,2,3 Solar PV Project, Vryburg, North-West
14. Scatec Solar Kenhardt PV 4, PV 5 and PV6 Projects, Kenhardt, Northern Cape
15. NamPower CSP Facility near Arandis, Namibia
16. Dayson Klip PV Facility near Upington, Northern Cape
17. Geelkop PV Facility near Upington, Northern Cape
18. Oya PV Facility, Ceres, Western Cape
19. Vrede and Rondawel PV Facilities, Free State
20. Kolkies & Sadawa PV Facilities, Western Cape
21. Leeudoringstad PV Facility, North-West

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV
14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation

37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV

94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
118. Matla-Glockner 400kV
119. Delmas North 44kV
120. Houwhoek 11kV Refurbishment
121. Clau-Clau 132kV
122. Ngwedi-Silwerkrans 134kV
123. Nieuwehoop 400kV walk-through
124. Booysendal 132kV Switching Station
125. Tarlton 132kV
126. Medupi - Witkop 400kV walk-through
127. Germiston Industries Substation
128. Sekgame 132kV
129. Botswana – South Africa 400kV Transfrontier Interconnector
130. Syferkuil – Rampheri 132kV
131. Queens Substation and associated 132kV powerlines
132. Oranjemond 400kV Transmission line
133. Aries – Helios – Juno walk-down
134. Kuruman Phase 1 and 2 Wind Energy facilities 132kV Grid connection
135. Transnet Thaba 132kV

Bird Impact Assessment Studies for the following residential and industrial developments:

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Somerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm Blesbokfontein)
8. N17 Section: Springs To Leandra – “Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek 314 Ir)
9. South African Police Services Gauteng Radio Communication System: Portion 136 Of The Farm 528 Jq, Lindley.
10. Report for the proposed upgrade and extension of the Zeekoegat Wastewater Treatment Works,

Gauteng.

11. Bird Impact Assessment for Portion 265 (a portion of Portion 163) of the farm Rietfontein 189-JR, Gauteng.
12. Bird Impact Assessment Study for Portions 54 and 55 of the Farm Zwartkop 525 JQ, Gauteng.
13. Bird Impact Assessment Study Portions 8 and 36 of the Farm Nooitgedacht 534 JQ, Gauteng.
14. Shumba's Rest Bird Impact Assessment Study
15. Randfontein Golf Estate Bird Impact Assessment Study
16. Zilkaatsnek Wildlife Estate
17. Regenstein Communications Tower (Namibia)
18. Avifaunal Input into Richards Bay Comparative Risk Assessment Study
19. Maquasa West Open Cast Coal Mine
20. Glen Erasmia Residential Development, Kempton Park, Gauteng
21. Bird Impact Assessment Study, Weltevreden Mine, Mpumalanga
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Mpumalanga
24. Lindley Estate, Lanseria, Gauteng
25. Proposed open cast iron ore mine on the farm Lylyveld 545, Northern Cape
26. Avifaunal monitoring for the Sishen Mine in the Northern Cape as part of the EMPr requirements
27. Steelpoort CNC Bird Impact Assessment Study

Professional affiliations

I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	20 years

Key Qualifications

Albert Froneman **(**Pr.Sci.Nat) has more than 18 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. Oysterbay 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 Kolkies & 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 Assesment 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 Powerline 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 Origstad 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 Tswane – 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 Powerline 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 powerlines – GIS Specialist & Mapping
45. ESKOM Magopela- Pitsong 132kV line and new substation – GIS Specialist & Mapping

Professional affiliations

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

Appendix B - Specialist Statement of Independence

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

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)

PROJECT TITLE

Basic Assessments for the Proposed Development of four 175 MW Solar Photovoltaic Facilities and associated Electrical Grid Infrastructure (i.e. Hoek Doornen 1; Hoek Doornen 2; Hoek Doornen 3; and Hoek Doornen 4), near Touws River, Western Cape

Kindly note the following:

1. This form must always be used for 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 01 September 2018. 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.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	Afrimage Photography (Pty) Ltd t/a Chris van Rooyen Consulting			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 4	Percentage Procurement recognition	
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.			
Physical address:	6 Pladda Drive Plettenberg Bay			
Postal address:	P.O Box 2676, Fourways			
Postal code:	2055			
Telephone:	0824549570			
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Chris van Rooyen declare that –

- I act as the independent specialist in this application;
- 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 Act.

Signature of the Specialist

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company:

1 November 2020

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, Chris van Rooyen, 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

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company

1 November 2020

Date

Signature of the Commissioner of Oaths

2020-11-01

Date

SOUTH AFRICAN POLICE SERVICE
PLETTENBERG BAY
2020 -11- 01
PLETTENBERGBAAI
SOUTH AFRICAN POLICE SERVICE

Appendix C: Site Sensitivity Verification

Prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification was 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).

The details of the site sensitivity verification are noted below:

Date of Site Visit	25-27 August 2020 and 16 – 19 September 2020
Specialist Name	Chris van Rooyen
Professional Registration Number	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.
Specialist Affiliation / Company	Chris van Rooyen Consulting

1 Methodology

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the study area is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 12 pentads where the study area is located, henceforth called the broader area. The SABAP2 data covers the period 2007 to 2020. The relevant pentads are 3250_1950, 3250_1955, 3250_2000, 3255_1950, 3255_1955, 3255_2000, 3300_1950, 3300_1955, 3300_2000, 3305_1950, 3305_1955, 3305_2000.
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map (2018) accessed via the South African National Biodiversity BGIS map viewer (SANBI 2020).
- Satellite imagery was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- On-site surveys were conducted from 25 – 27 August 2020 (Survey 1) and 16 – 19 September 2020 (Survey 2) according to the best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*. 2017).

2 Results

The study area and immediate environment is classified as low sensitivity for avifauna from a PV perspective, except drainage lines (including the Groot River) and a few earth dams which are classified as high sensitivity. No reason is offered for the high classification, but surface water attracts avifauna and that could be the reason for attributing a high sensitivity rating. It should be noted that the screening tool did not identify any known nests or roosts.

The site investigation revealed that the study area is generally low sensitivity for avifauna from a PV perspective, with a few areas of very high sensitivity namely water reservoirs (permanent surface water) and drainage lines (ephemeral water resource and drainage line woodland habitat) and one priority species nest, namely a Greater Kestrel. The earth dams are very small and basically dry for the majority of the year, therefore from a solar PV perspective, they constitute low sensitive habitat.

There is no specific powerline theme for avifauna in the DEFF screening tool, and the study area is classified as mostly medium sensitivity for Animal Species Theme, with small areas of low and high sensitivity. The medium sensitivity rating is linked to the presence of Ludwig's Bustard. The High and Low sensitivity ratings are not linked to avifauna.

3 Concluding statement

The expected impacts of the Hoek Doornen PV 1, Hoek Doornen PV 2, Hoek Doornen PV 3 and Hoek Doornen PV 4solar PV facilities, electrical grid infrastructure and associated infrastructure were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of all the identified impacts should be reduced to Low negative (see Table 4). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 6 of the report) and the EMPr (Section 9) are strictly implemented.

Appendix D: Impact Assessment Methodology

The following impact assessment was used in this study.

The impact assessment includes:

- *the nature, significance and consequences of the impact and risk;*
- *the extent and duration of the impact and risk;*
- *the probability of the impact and risk occurring;*
- *the degree to which impacts and risks can be mitigated;*
- *the degree to which the impacts and risks can be reversed; and*
- *the degree to which the impacts and risks can cause loss of irreplaceable resources.*

As per the DEFF Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- *Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.*
- *Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.*
- *Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.*

The impact assessment methodology includes the following aspects:

- *Nature of impact/risk - The type of effect that a proposed activity will have on the environment.*

- *Status - Whether the impact/risk on the overall environment will be:*
    - *Positive - environment overall will benefit from the impact/risk;*
    - *Negative - environment overall will be adversely affected by the impact/risk; or*
    - *Neutral - environment overall not be affected.*

- *Spatial extent – The size of the area that will be affected by the impact/risk:*
    - *Site specific;*
    - *Local (<10 km from site);*
    - *Regional (<100 km of site);*
    - *National; or*
    - *International (e.g. Greenhouse Gas emissions or migrant birds).*

- *Duration – The timeframe during which the impact/risk will be experienced:*
    - *Very short term (instantaneous);*
    - *Short term (less than 1 year);*
    - *Medium term (1 to 10 years);*
    - *Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or*
    - *Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).*

- *Consequence – The anticipated consequence of the risk/impact:*
    - *Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);*
    - *Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*

- *Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);*
- *Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or*
- *Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).*

- *Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);*
  - *Moderate reversibility of impacts;*
  - *Low reversibility of impacts; or*
  - *Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).*

- *Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):*
  - *High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);*
  - *Moderate irreplaceability of resources;*
  - *Low irreplaceability of resources; or*
  - *Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).*

Using the criteria above, the impacts have been further assessed in terms of the following:

- *Probability – The probability of the impact/risk occurring:*
  - *Extremely unlikely (little to no chance of occurring);*
  - *Very unlikely (<30% chance of occurring);*
  - *Unlikely (30-50% chance of occurring)*
  - *Likely (51 – 90% chance of occurring); or*
  - *Very Likely (>90% chance of occurring regardless of prevention measures).*

To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D1).

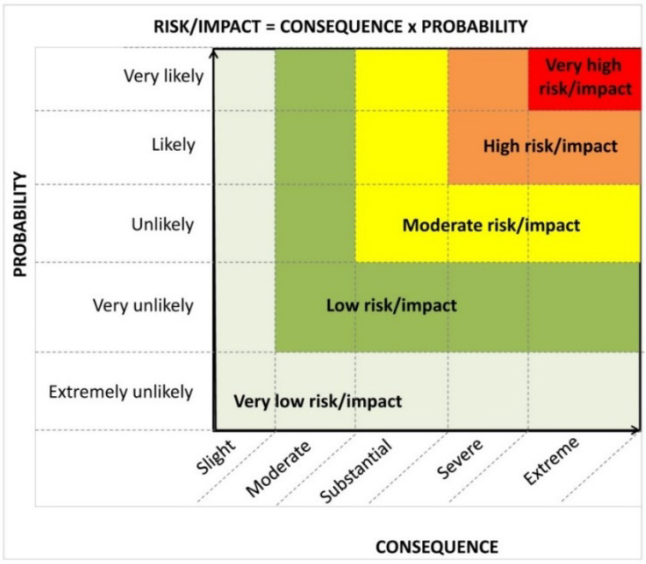

Figure D1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
    - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
    - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
    - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
    - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:
- *Low;*
- *Medium; or*
- *High.*

Appendix E: Compliance with the Appendix 6 of the 2014 EIA Regulations (as amended)

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	***Section where this has been addressed in the Specialist Report***
1. (1) A specialist report prepared in terms of these Regulations must contain - *a) details of -* *i. the specialist who prepared the report; and* *ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;*	*Appendix A*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Appendix B*
c) an indication of the scope of, and the purpose for which, the report was prepared;	*Section 1*
(cA) an indication of the quality and age of base data used for the specialist report;	*Section 2*
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	*Section 4 and Section 6*
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	*Section 4*
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	*Section 4*
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	*Section 5*
g) an identification of any areas to be avoided, including buffers;	*Section 4*
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	*Section 4*
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Section 2 (i.e. Section 2.2)*
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	*Section 6 and Section 10*
k) any mitigation measures for inclusion in the EMPr;	*Section 6 and Appendix H*
l) any conditions for inclusion in the environmental authorisation;	*Appendix H*
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*Appendix H*
n) a reasoned opinion- *i. whether the proposed activity, activities or portions thereof should be authorised;* *(iA) regarding the acceptability of the proposed activity or activities; and* *ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;*	*Section 10*
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	*Not Applicable*
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*Not Applicable. Refer to the BA Report for additional information.*
q) any other information requested by the competent authority.	*Not Applicable. Refer to the BA Report for additional information.*
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	*Appendix C (i.e. Part A of the Assessment Protocols published in GN 320 on 20 March 2020 (i.e. Site sensitivity verification*

Requirements of Appendix 6 (Specialist Reports) of Government Notice R326 (Environmental Impact Assessment (EIA) Regulations of 2014, as amended)	*Section where this has been addressed in the Specialist Report*
	requirements where a specialist assessment is required but no specific assessment protocol has been prescribed)).

Appendix F: Species Lists

Species recorded by SABAP2 in the broader area

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
Acacia Pied Barbet	*Tricholaema leucomelas*	14.29	0.00				
African Black Swift	*Apus barbatus*	2.86	0.00				
African Pipit	*Anthus cinnamomeus*	0.00	4.17				
African Reed-warbler	*Acrocephalus baeticatus*	2.86	0.00				
African Spoonbill	*Platalea alba*	0.00	4.17	x			
Alpine Swift	*Tachymarptis melba*	11.43	4.17				
Anteating Chat	*Myrmecocichla formicivora*	5.71	0.00				
Barn Swallow	*Hirundo rustica*	11.43	4.17				
Black Harrier	*Circus maurus*	8.57	8.33	x	VU	EN	Near endemic
Black-headed Canary	*Serinus alario*	14.29	4.17	x			Near endemic
Black-headed Heron	*Ardea melanocephala*	2.86	0.00	x			
Bokmakierie	*Telophorus zeylonus*	54.29	4.17				
Booted Eagle	*Aquila pennatus*	8.57	4.17	x			
Brown-throated Martin	*Riparia paludicola*	20.00	0.00				
Cape Bulbul	*Pycnonotus capensis*	20.00	4.17	x			Endemic
Cape Bunting	*Emberiza capensis*	57.14	29.17				
Cape Penduline-tit	*Anthoscopus minutus*	8.57	0.00				
Cape Robin-chat	*Cossypha caffra*	5.71	0.00				
Cape Sparrow	*Passer melanurus*	77.14	20.83				
Cape Spurfowl	*Pternistis capensis*	2.86	0.00	x			Near endemic
Cape Turtle-dove	*Streptopelia capicola*	28.57	0.00				
Cape Wagtail	*Motacilla capensis*	40.00	12.50				
Cape Weaver	*Ploceus capensis*	17.14	4.17	x			Near endemic
Capped Wheatear	*Oenanthe pileata*	0.00	4.17				
Cardinal Woodpecker	*Dendropicos fuscescens*	2.86	0.00				
Chestnut-vented Tit-babbler	*Parisoma subcaeruleum*	28.57	8.33				
Common Fiscal	*Lanius collaris*	57.14	16.67				
Common Ostrich	*Struthio camelus*	11.43	0.00				
Common Quail	*Coturnix coturnix*	2.86	0.00				
Common Waxbill	*Estrilda astrild*	17.14	4.17				
Dusky Sunbird	*Cinnyris fuscus*	5.71	4.17				
Egyptian Goose	*Alopochen aegyptiacus*	5.71	4.17	x			
European Bee-eater	*Merops apiaster*	14.29	4.17				
Fairy Flycatcher	*Stenostira scita*	17.14	0.00	x			Near endemic
Familiar Chat	*Cercomela familiaris*	45.71	0.00				
Great Crested Grebe	*Podiceps cristatus*	0.00	4.17	x			
Greater Kestrel	*Falco rupicoloides*	11.43	0.00	x			
Greater Striped Swallow	*Hirundo cucullata*	8.57	8.33				
Grey Tit	*Parus afer*	45.71	4.17	x			Near endemic
Grey-backed Cisticola	*Cisticola subruficapilla*	62.86	12.50				
Grey-backed Sparrowlark	*Eremopterix verticalis*	5.71	0.00				
Grey-winged Francolin	*Scleroptila africanus*	2.86	4.17	x			Endemic (SA, Lesotho, Swaziland)
Hadeda Ibis	*Bostrychia hagedash*	14.29	0.00	x			
Helmeted Guineafowl	*Numida meleagris*	0.00	4.17				
House Sparrow	*Passer domesticus*	14.29	0.00				

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
Jackal Buzzard	*Buteo rufofuscus*	8.57	0.00	x			Near endemic
Karoo Chat	*Cercomela schlegelii*	100.00	41.67				
Karoo Eremomela	*Eremomela gregalis*	25.71	0.00	x			Near endemic
Karoo Korhaan	*Eupodotis vigorsii*	14.29	0.00	x	LC	NT	
Karoo Lark	*Calendulauda albescens*	74.29	33.33				Near endemic
Karoo Long-billed Lark	*Certhilauda subcoronata*	25.71	4.17				
Karoo Prinia	*Prinia maculosa*	54.29	16.67	x			Near endemic
Karoo Scrub-robin	*Cercotrichas coryphoeus*	62.86	12.50				
Kittlitz's Plover	*Charadrius pecuarius*	2.86	0.00				
Lanner Falcon	*Falco biarmicus*	2.86	0.00	x	LC	VU	
Large-billed Lark	*Galerida magnirostris*	51.43	25.00	x			Near endemic
Lark-like Bunting	*Emberiza impetuani*	14.29	0.00				
Laughing Dove	*Streptopelia senegalensis*	2.86	0.00				
Layard's Tit-babbler	*Parisoma layardi*	8.57	0.00	x			Near endemic
Little Swift	*Apus affinis*	17.14	0.00				
Long-billed Crombec	*Sylvietta rufescens*	17.14	0.00				
Ludwig's Bustard	*Neotis ludwigii*	5.71	0.00	x	EN	EN	
Malachite Sunbird	*Nectarinia famosa*	31.43	12.50				
Martial Eagle	*Polemaetus bellicosus*	5.71	0.00	x	EN	EN	
Mountain Wheatear	*Oenanthe monticola*	2.86	16.67				
Namaqua Dove	*Oena capensis*	14.29	12.50				
Namaqua Sandgrouse	*Pterocles namaqua*	17.14	0.00				
Namaqua Warbler	*Phragmacia substriata*	14.29	4.17	x			Near endemic
Neddicky	*Cisticola fulvicapilla*	2.86	0.00				
Pied Avocet	*Recurvirostra avosetta*	2.86	0.00	x			
Pied Crow	*Corvus albus*	51.43	16.67				
Pied Starling	*Spreo bicolor*	8.57	0.00	x			Endemic (SA, Lesotho, Swaziland)
Pin-tailed Whydah	*Vidua macroura*	0.00	4.17				
Pririt Batis	*Batis pririt*	20.00	0.00				
Red-capped Lark	*Calandrella cinerea*	2.86	4.17				
Red-faced Mousebird	*Urocolius indicus*	8.57	0.00				
Red-knobbed Coot	*Fulica cristata*	2.86	4.17	x			
Rock Kestrel	*Falco rupicolus*	22.86	0.00	x			
Rock Martin	*Hirundo fuligula*	62.86	25.00				
Rufous-eared Warbler	*Malcorus pectoralis*	68.57	25.00				
Sickle-winged Chat	*Cercomela sinuata*	2.86	0.00	x			Near endemic
South African Shelduck	*Tadorna cana*	14.29	0.00	x			
Southern Black Korhaan	*Afrotis afra*	2.86	4.17	x	VU	VU	Endemic
Southern Double-collared Sunbird	*Cinnyris chalybeus*	42.86	4.17				Near endemic
Southern Masked-weaver	*Ploceus velatus*	22.86	0.00				
Southern Pale Chanting Goshawk	*Melierax canorus*	68.57	45.83	x			
Speckled Pigeon	*Columba guinea*	34.29	16.67				
Spike-heeled Lark	*Chersomanes albofasciata*	45.71	4.17				
Spotted Eagle-owl	*Bubo africanus*	8.57	0.00	x			
Spur-winged Goose	*Plectropterus gambensis*	2.86	0.00	x			
Three-banded Plover	*Charadrius tricollaris*	17.14	12.50	x			
Tractrac Chat	*Cercomela tractrac*	22.86	0.00				
Verreaux's Eagle	*Aquila verreauxii*	11.43	12.50	x	LC	VU	
White-backed Mousebird	*Colius colius*	34.29	4.17				

Species	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Endemic/near endemic - South Africa
White-breasted Cormorant	*Phalacrocorax carbo*	0.00	4.17	x			
White-necked Raven	*Corvus albicollis*	20.00	4.17				
White-rumped Swift	*Apus caffer*	14.29	0.00				
White-throated Canary	*Crithagra albogularis*	57.14	12.50				
Willow Warbler	*Phylloscopus trochilus*	2.86	0.00				
Yellow Canary	*Crithagra flaviventris*	85.71	37.50				
Yellow-bellied Eremomela	*Eremomela icteropygialis*	8.57	8.33				

Species recorded during the pre-construction monitoring

Priority Species		Transects	Focal point	Incidental
Cape Clapper Lark	*Mirafra apiata*	*		
Egyptian Goose	*Alopochen aegyptiaca*	*	*	
Greater Kestrel	*Falco rupicoloides*	*		*
Grey Heron	*Ardea cinerea*			*
Grey Tit	*Melaniparus afer*		*	
Jackal Buzzard	*Buteo rufofuscus*			*
Karoo Eremomela	*Eremomela gregalis*			*
Karoo Korhaan	*Eupodotis vigorsii*	*	*	*
Karoo Lark	*Calendulauda albescens*	*	*	*
Karoo Prinia	*Prinia maculosa*	*		*
Large-billed Lark	*Galerida magnirostris*	*		*
Ludwig's Bustard	*Neotis ludwigii*			*
Martial Eagle	*Polemaetus bellicosus*			*
Pale Chanting Goshawk	*Melierax canorus*	*		*
Pied Avocet	*Recurvirostra avosetta*		*	
Pied Starling	*Lamprotornis bicolor*			*
Sickle-winged Chat	*Emarginata sinuata*	*		
South African Shelduck	*Tadorna cana*	*	*	*
Southern Double-collared Sunbird	*Cinnyris chalybeus*		*	
Spotted Eagle-Owl	*Bubo africanus*			*
Three-banded Plover	*Charadrius tricollaris*		*	
Yellow-billed Kite	*Milvus aegyptius*			*
22	*Priority Species sub-total:*	10	8	15
Non-Priority Species		**Transects**	**Focal point**	
African Hoopoe	*Upupa africana*	*		
Bokmakierie	*Telophorus zeylonus*	*	*	
Brown-throated Martin	*Riparia paludicola*		*	
Cape Bunting	*Emberiza capensis*		*	
Cape Sparrow	*Passer melanurus*	*	*	

Cape Turtle Dove	*Streptopelia capicola*	*	*	
Non-Priority Species		**Transects**	**Focal point**	
Cape Wagtail	*Motacilla capensis*		*	
Chat Flycatcher	*Melaenornis infuscatus*	*		
Grey-backed Cisticola	*Cisticola subruficapilla*	*		
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	*		
Hadeda	*Bostrychia hagedash*	*		
Karoo Chat	*Emarginata schlegelii*	*	*	
Karoo Long-billed Lark	*Certhilauda subcoronata*	*		
Karoo Scrub Robin	*Cercotrichas coryphoeus*	*		
Lark-like Bunting	*Emberiza impetuani*		*	
Laughing Dove	*Spilopelia senegalensis*	*		
Malachite Sunbird	*Nectarinia famosa*		*	
Pearl-breasted Swallow	*Hirundo dimidiata*		*	
Pied Crow	*Corvus albus*	*	*	
Rufous-eared Warbler	*Malcorus pectoralis*	*		
Southern Fiscal	*Lanius collaris*	*	*	
Speckled Pigeon	*Columba guinea*	*	*	
Spike-heeled Lark	*Chersomanes albofasciata*	*		
White-throated Canary	*Crithagra albogularis*	*	*	
Yellow Canary	*Crithagra flaviventris*	*	*	
25	*Non-priority Species sub-total:*	19	15	
	Grand total:	**29**	**23**	

Appendix G: List of renewable energy projects within 30km radius

Renewable Energy Projects - Source: DEA REEA, 2020 Q2 (2020-08-31)

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
14/12/16/3/3/1/1976	DEA/EIA/0001017/2018	2014	BAR	Proposed development of the 325MW Kudusberg Wind Energy Facility and associated infrastructure in Western and Northern Cape Provinces	2018-11-13	Kudusberg Wind Farm (Pty) Ltd	CSIR	Karoo Hoogland Local Municipality	Namakwa District Municipality	Northern Cape	Onshore Wind	325	Approved
								Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape			
12/12/20/1783/1	DEAT/EIA/12233/2011	2010	Scoping and EIA	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2012-12-01	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	150	Approved
12/12/20/1783/2	DEAT/EIA/12233/2011	2010	Scoping and EIA	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 2	2012-12-01	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	150	Approved
12/12/20/1783/2/AM1	DEA/EIA/AMEND/000468/2014	2010	Amendment	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2014-10-03	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technology	0	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
12/12/20/1783/2/AM3	To Review	2014	Amend ment	Proposed development of a Renewable Energy Facility at Perdekraal, Western Cape - Split 1	2017-09-20	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1783/2/AM4	To Review	2014	Amend ment	Proposed development of a WEF at the Perdekraal Site 2, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1783/2/AM4	To Review	2014	Amend ment	Proposed development of a WEF at the Perdekraal Site 2, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	150	Approved
12/12/20/1783/2/AM5	To Review	2014	Amend ment	Proposed development of a Wind Energy Facility at Perdekraal, Western Cape	2018-05-30	South Africa Mainstream Renewable Power Perdekraal East Pty Ltd	To Review	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	No Technol ogy	0	Approved
12/12/20/1787	DEAT/EIA/12346/ 2011	2010	Scoping and EIA	Proposed Renewable Energy Facility at Konstabel	2010-01-29	South Africa Mainstream Renewable Power Developmen ts (Pty) Ltd	Environmental Resource Management (Pty) Ltd	Laingsburg Local Municipality	Central Karoo District Municipality	Western Cape	Onshore Wind and Solar PV	170	Approved
12/12/20/1956	DEAT/EIA/12205/ 2011	2010	Scoping and EIA	Proposed Touwsrivier Solar Energy Facility	2010-06-07	CPV Power Plant No.1 Pty Ltd	University of Cape Town Environmental Evaluation	Breede Valley Local Municipality	Cape Winelands District Municipality	Western Cape	Solar PV	36	Approved
12/12/20/1988	DEAT/EIA/12460/ 2011	2010	Scoping and EIA	Proposed Construction of the 750 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality of	2012-11-16	G7 Renewable Energies Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Namakwa District Municipality	Western Cape	Onshore Wind	750	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
				the Northern Cape Province and within the Laingsburg Local Municipality of the Western Cape Province									
12/12/20/1988/1/AM1	DEA/EIA/AMEND/0000529/2015	2010	Amendment	Proposed Construction of the 750 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality of the Northern Cape Province and within the Laingsburg Local Municipality of the Western Cape Province	2014-12-05	G7 Renewable Energies Pty Ltd	Environmental Resource Management (Pty) Ltd	Witzenberg Local Municipality	Namakwa District Municipality	Western Cape	Onshore Wind	0	Approved
14/12/16/3/3/2/899	DEA/EIA/000258/2016	2014	Scoping and EIA	140 MW Rietkloof WE, near Sutherland, Northern Cape and Western Cape	2016-01-19	Rietkloof Wind Farm (Pty) Ltd	EOH Coastal and Environmental Services (Pty) Ltd	Laingsburg Local Municipality	Central Karoo District Municipality	Western Cape	Onshore Wind	36	Approved
14/12/16/3/3/2/810	To Review	2014	Scoping and EIA	75 MW Montague Road Solar PV SEF on Vredefort No. 34 Near Touws River within the Breede Valley Local Municipality in the Western Cape Province	2015-05-29	Montague Road Energy (Pty) Ltd	Sharples Environmental Services cc	Breede Valley Local Municipality	Cape Winelands District Municipality	Western Cape	Solar PV	75	Approved
14/12/16/3/3/2/900	DEA/EIA/0000259/2016	2014	Scoping and EIA	147 MW Brandvalley Wind Energy Facility north of the town of Matjiesfontein within Karoo Hoogland Local Municipality	2016-01-19	Brandvalley Wind Farm (Pty) Ltd.	EOH Coastal and Environmental Services	!Kheis Local Municipality	Z F Mgcawu District Municipality	Western Cape	Onshore Wind	147	Approved

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATU
14/12/16/3/3/1/1983	DEA/EIA/0001036/2018	2014	BAR	Proposed Development of the Tooverberg On-site Eskom Substation and 132kV Power Line for the proposed Tooverberg Wind Energy Facility near Touws River, Western Cape Province	2018-12-06	Genesis Tooverberg Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	EGI	EGI	Approved

Renewable Energy and EGI Projects - Source: SAHRIS

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATUS
14/12/16/3/3/1/1984	Not provided	2014	BAR	Proposed Development of the Tooverberg Wind Energy Facility (WEF) near Touws River, Western Cape Province	06 12 2018	Genesis Tooverberg Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Witzenberg Local Municipality	Cape Winelands District Municipality	Western Cape	Onshore Wind	264	Approved
Not provided	Not provided	2014	BAR	Powerline between the Perdkekraal West Wind	22 03 2016	Perderkraal West Wind Farm (Pty) Ltd	Savannah Environmental	Breede River Local Municipality	Cape Winelands District Municipality	Western Cape	EGI	EGI	Not confirmed

DEA_REF	NEAS_REF	REGULATION	EIA_PROCES	PROJ_TITLE	APP_RECEIV	APPLICANT	EAP	LOCAL_MUN	DISTRICT_M	PROVINCE	TECHNOLOGY	MEGAWATT	PROJ_STATUS
				Energy Facility and the Eskom Kappa Substation, Western Cape Province									
14/12/16/3/3/2/1115	Not provided	2014	Scoping and EIA	Proposed Construction of the 325MW Rondekop Wind Energy Facility between Matjiesfontein and Sutherland, Northern Cape Province	14 11 2018	Rondekop Wind Farm (Pty) Ltd	SiVEST SA (Pty) Ltd	Karoo Hoogland Local Municipality	Namakwa District Municipality	Northern Cape	Onshore Wind	325	Approved

Planned Eskom Lines:

Status / layer source	SUB_PROJECT	Voltage	TDP_ID	TDP_SCHEME	New_Date	GP_Project
Tx Planned Lines	Gamma-Kappa 2nd 765kV line	765	TS019	Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	2022	GPP0288
Tx Planned Lines	Kappa-Sterrekus 2nd 765kV line	765	TS019	Cape Corridor Phase 4: 2nd Zeus-Per-Gam-Ome 765kV Line	2021	GPP0502

Existing Eskom Lines

Status / layer source	LABEL	DESIGN_VOL	LINE_STATU	SUB_CAT		
Tx Existing Lines	BACCHUS DROERIVIER 1	400	EXISTING	400kv_line		
Tx Existing Lines	DROERIVIER MULDERSVLEI 2	400	EXISTING	400kv_line		
Tx Existing Lines	Gamma-Kappa 1st 765kV line	765	TS015	Cape Corridor Phase 2: Gamma-Omega 765kV Integration	2013	GPP0283
Tx Existing Lines	Kappa-Sterrekus (Omega) 1st 765kV line	765	TS015	Cape Corridor Phase 2: Gamma-Omega 765kV Integration	2015	GPP0500