AVIFAUNAL SPECIALIST REPORT

9 x PV Facilities and Associated Infrastructure near Stilfontein, North-West Province

Swallow PV

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EXECUTIVE SUMMARY

The applicant, South Africa Mainstream Renewable Power Developments (Pty) Ltd, proposes the construction and operation of the nine (9) photovoltaic (PV) facilities with up to 150 MW generation capacity each, including grid connections, BESS and associated infrastructure. The facilities will be known as the Stilfontein PV Cluster and are located in the City of Matlosana and JB Marks Local Municipalities and Dr Kenneth Kaunda District Municipality in the North West province. The cumulative assessment area, comprising the nine PV sites, is located approximately 13 km east of the town of Stilfontein along the N12. The assessment area is situated within a Renewable Energy Development Zone (REDZ) known as the Klerksdorp REDZ (REDZ10) and within the Central Strategic Transmission Corridor (STC).

The Stilfontein PV Cluster comprises nine proposed PV facilities, each with an assessment area of ~220 to 405 ha: Spoonbill (Project 1), Sunbird (Project 2), Swallow (Project 3), Snipe (Project 4), Shrike (Project 5), Stilfontein (Project 6), Sparrow (Project 7), Starling (Project 8) and Swift (Project 9).

1 POTENTIAL IMPACTS

The potential impacts on priority avifauna identified in the course of the study are:

Construction Phase

- Displacement of certain avifaunal priority species due to disturbance associated with the construction of the solar PV plant and associated infrastructure.
- Displacement of certain avifaunal priority species due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure.

Operational Phase

- Mortality of certain avifaunal priority species due to collisions with the solar panels.
- Mortality of certain avifaunal priority species due to entrapment in perimeter fences.
- Mortality of certain avifaunal priority species due to electrocutions in the onsite substations and 11-33kV medium voltage overhead lines.
- Mortality of certain avifaunal priority species due to collisions with the 11-33kV medium voltage overhead lines.

Decommissioning Phase

- Displacement of certain avifaunal priority species due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure.

ENVIRONMENTAL SENSITIVITIES

The following environmental sensitivities were identified at the proposed Stilfontein PV Cluster facilities:

- Water reservoirs (waterbodies): Very High sensitivity (Solar panel exclusion zone where relocation is not possible or required)

There are a number of water reservoirs scattered through-out the cumulative assessment area. Sensitive areas are those areas within 100m of these water reservoirs. Water reservoirs are crucially important for priority avifauna and many non-priority species. Relocation of these waterpoints is possible however and can be undertaken to ensure that water sources are retained where relocation is required for the installation of the PV panels. The relocated water points would require approval from an avifaunal specialist when submitting the final layout to the Department.

IMPACT ASSESSMENT

The table below provides a summarised assessment of the impact ratings for each PV site (it should be noted that all impacts are identical for each site).

Impact	Significance rating prior to mitigation	Significance rating post mitigation	Affected priority species
Displacement of certain priority avifaunal species due to disturbance associated with construction of the PV plant and associated infrastructure.	Low	Very Low	Cape White-eye Cloud Cisticola Fiscal Flycatcher Gabar Goshawk Greater Kestrel Karoo Thrush Lanner Falcon Pied Starling Spotted Eagle-Owl White-backed Vulture
Displacement of certain priority avifaunal species due to habitat destruction associated with construction of the PV plant and associated infrastructure.	High	Medium	Amur Falcon Black-headed Heron Black-winged Kite Cape White-eye Common Buzzard Fiscal Flycatcher Gabar Goshawk Greater Kestrel Karoo Thrush Lanner Falcon Lesser Kestrel South African Cliff Swallow Spotted Eagle-Owl White-backed Vulture
Mortality of certain avifaunal priority species due to collisions with solar panels	Very low	Very low	Blacksmith Lapwing Cape White-eye Cloud Cisticola Fiscal Flycatcher Karoo Thrush Pied Starling South African Cliff Swallow
Mortality of certain avifaunal priority species due to entrapment of birds in the perimeter fence	Low	Very Low	Black-headed Heron Spotted Eagle-Owl
Mortality of certain avifaunal priority species due to electrocution on the 11-33kV MV lines and in the onsite substations	High	Low	Amur Falcon Black-headed Heron Black-winged Kite Common Buzzard Egyptian Goose Gabar Goshawk Greater Kestrel Lanner Falcon Lesser Kestrel Spotted Eagle-Owl White-backed Vulture
Mortality of certain priority avifaunal species due to collisions with the 11-33kV medium voltage overhead lines	Medium	Low	Black-headed Heron Egyptian Goose Spotted Eagle-Owl Western Cattle Egret White-backed Vulture
Displacement of certain priority avifaunal species due to disturbance associated with decommissioning of the PV plant and associated infrastructure.	Low	Very Low	Cape White-eye Cloud Cisticola Fiscal Flycatcher Gabar Goshawk Greater Kestrel Karoo Thrush Lanner Falcon Pied Starling Spotted Eagle-Owl White-backed Vulture

MANAGEMENT ACTIONS

The following management actions are proposed for each PV project:

Construction phase

- Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- 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 as far as practically possible, and the construction of new roads should be kept to a minimum.
- The mitigation measures proposed by the botanical/biodiversity specialist must be strictly enforced.
- Retain or relocate existing waterpoints to ensure at least one waterpoint is retained within the project area, where applicable.

Operational phase

- Single wire fence: The spacing between at least the top two wires of the perimeter fence must be a minimum of 30 cm, and they must be correctly tensioned to reduce the snaring risk for owls.
- If possible, a single perimeter fence should be used.
- Substations: Due to the complicated design of the substation hardware, pro-active mitigation in the form of insulation of all live components is not a practical option. Instead, the situation must be monitored, and should electrocutions of priority species be recorded, reactive mitigation could be applied in the form of insulation of relevant live components. This is an acceptable approach because Red List priority species are unlikely to frequent the switching station and substation and be electrocuted.
- The medium voltage cables (11-33kV) must be buried as far as possible. Those sections that will run above ground due to technical reasons must be fitted with bird flight diverters as per the applicable Eskom standard valid at the time.
- In instances where the medium voltage cables cannot be buried due to technical constraints, a bird-friendly pole design must be used for the overhead lines. The best design to use is the inverted T design with a cross-arm and suspended insulators to provide safe perching space for large birds, especially vultures. The avifaunal specialist must approve the final pole design.

De-commissioning phase

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

REASONED OPINION

The assessment area and immediate environment is classified as **Low and Medium** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme of the National Web-Based Environmental Screening Tool. The low and medium sensitivity classification is not linked to avifauna but rather terrestrial sensitivity since no specific avifaunal features or buffer sensitivities were identified according to the database.

The virtual absence of species of conservation concern (SCC) was confirmed during the project site surveys. However, White-backed Vulture (SA Status Endangered) was recorded in the assessment area roosting on the high voltage lines running through the site. This was the only SCC recorded during surveys, but based on the criteria in the Protocol, the study area should therefore be classified as **High** sensitivity due to the presence of an SCC. However, the potential impact on White-backed Vultures can be effectively mitigated, primarily through the use of bird-friendly designs for the internal 11-33kV power lines.

IMPACT STATEMENT

It is recommended that the PV project is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables and the EMPr (Appendix D) are strictly implemented.

Minimum report requirements listed in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020)	
Contact details and relevant experience as well as the SACNASP Registration number of the specialist preparing the assessment including a curriculum vitae;	Appendix A
A signed statement of independence by the specialist;	Appendix B
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2
A description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant;	Section 2 and Appendix E
A description of the mean density of observations/number of sample sites per unit area and the site inspection observations;	Section 4
A description of the assumptions made and any uncertainties or gaps in knowledge or data;	Section 2
The location of areas not suitable for development and to be avoided during construction where relevant;	Section 5
Impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Appendix D
A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and	Section 12
A motivation must be provided if there were any development footprints identified as per paragraph 2.2.12 above that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered. appropriate.	Section 5

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List of Abbreviations

BA	Basic Assessment
BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
DFFE	Department of Forestry, Fisheries and the Environment
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)
OHL	Overhead Line
PV	Photovoltaic
REDZs	Renewable Energy Development Zones
SABAP 1	South African Bird Atlas Project 1
SABAP 2	South African Bird Atlas Project 2
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa Protected Areas Database

Glossary

Definitions	
PV site	The area comprising an individual proposed PV site.
Broader area	A consolidated data set for the pentads where the project site is located.
Assessment area	The combined area containing the nine Stilfontein PV Cluster solar projects.
Stilfontein PV Cluster	The nine proposed Stilfontein PV projects.
Priority species	• South African Red Data species. • South African endemics and near-endemics. • Raptors • Waterbirds

1 INTRODUCTION

The applicant, South Africa Mainstream Renewable Power Developments (Pty) Ltd, proposes the construction and operation of the nine (9) photovoltaic (PV) facilities with up to 150 MW generation capacity each, including grid connections, BESS and associated infrastructure. The facilities will be known as the Stilfontein PV Cluster and is located in the City of Matlosana and JB Marks Local Municipalities and Dr Kenneth Kaunda District Municipality in the North West province. The assessment area, comprising the nine PV sites, is located approximately 6 km east of the town of Stilfontein along the N12. The assessment area is situated within a Renewable Energy Development Zone (REDZ) known as the Klerksdorp REDZ (REDZ10) and within the Central Strategic Transmission Corridor (STC).

The Stilfontein PV Cluster comprises nine proposed PV facilities, each with an assessment area of ~220 to 405 ha: Spoonbill (Project 1), Sunbird (Project 2), Swallow (Project 3), Snipe (Project 4), Shrike (Project 5), Stilfontein (Project 6), Sparrow (Project 7), Starling (Project 8) and Swift (Project 9) (see Figure 1).

Each PV facility comprises the following key components:

- PV single axis tracking arrays with a maximum export capacity of up to 150 MW and a maximum height of up to 5 m. Panel technology will be either monofacial or bifacial;
- Internal gravel roads with a maximum width of up to 12 m;
- Power transformers;
- Fencing and lighting;
- Material laydown areas;
- Stormwater infrastructure;
- Water supply and water storage infrastructure;
- Offices, including ablutions with septic / conservancy tank sewage treatment infrastructure;
- Operational control centre and maintenance area; and
- Battery Energy Storage System (BESS);
- IPP-side of the 11-33/132kV on-site substation, each serving one PV facility. The proposed step-up substation facility will have a development footprint of up to 4 ha, with a 100 m wide buffer around each on-site substation to accommodate powerline tie-ins at any point of the substation and other associated activities. Two alternative locations are identified for each substation;
- Medium voltage 11-33kV underground cabling and / or overhead power lines between the PV facilities and on-site substation;
- Material laydown area (temporary for construction phase and permanent for operation phase).

1.1 Scope, Purpose and Objectives of this Specialist Report

The purpose of the report is to assess the potential impacts of each of the Stilfontein PV Cluster facilities, as well as all associated infrastructure, on avifauna, and to recommend measures, if any, for the mitigation of identified impacts.

1.2 Terms of Reference

The terms of reference for the Specialist Report are as follows:

- Describe the affected environment from an avifaunal perspective.
- Discuss gaps in baseline data and other limitations.
- Describe the methodology that was used for the field surveys.
- Compare the site sensitivity recorded in the field with the sensitivity classification in the DFFE National Screening Tool and adjust if necessary.
- Provide an overview of all applicable legislation.
- Provide an overview of assessment methodology.
- Identify and assess the potential impacts of the proposed development on avifauna.
- Provide sufficient mitigation measures to include in the Environmental Management Programme (EMPr).

- Conclude with an impact statement.

See Figure 1 for the area covered by the proposed Stilfontein PV Cluster, and individual PV projects within the cluster.

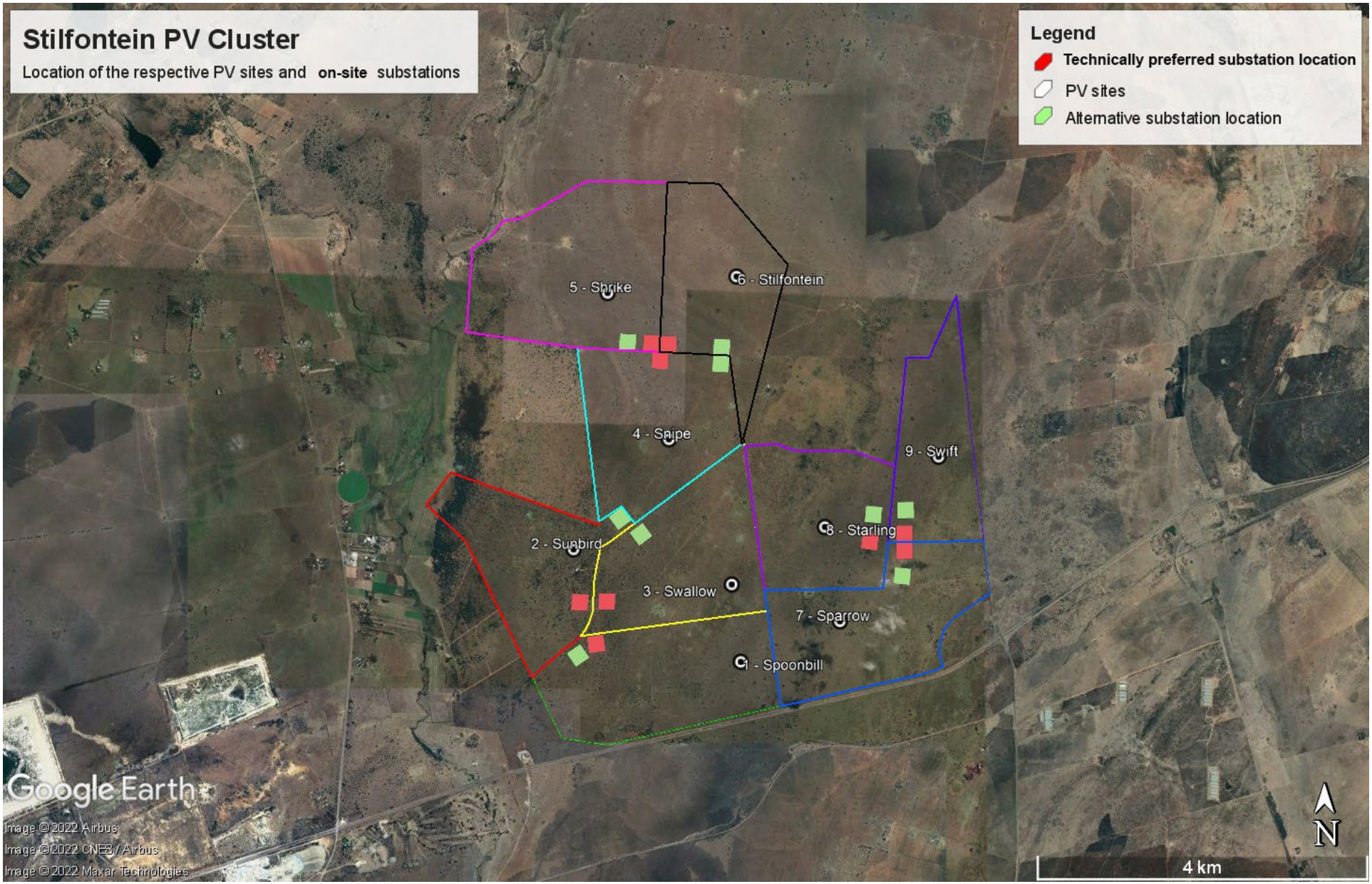


Figure 1: Map of the proposed Stilfontein PV Cluster.

2 APPROACH AND METHODOLOGY

The below approach was followed to conduct this study:

- Bird distribution data of the Southern African Bird Atlas Project 2 (SABAP 2) was obtained from the FitzPatrick Institute of African Ornithology, University of Cape Town, to ascertain which species occurs within the broader area i.e., within a block consisting of 2 pentad grid cells within which the proposed project is situated. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. To date, a total of 89 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 22 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation types in the assessment area was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2021) was used in order to view the broader assessment area on a landscape level and to help identify sensitive bird habitat.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the proposed assessment area.
- An on-site Site Sensitivity Verification (SSV) survey was conducted on 03 February 2022. The assessment area was inspected with a 4x4 vehicle and on foot. All birds were recorded.
- Additional on-site surveys were conducted from 9-10 February 2022 at the assessment area, based on 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:
    - Two drive transects of 8.1 km and 8.72 km respectively were identified in the project site and surveyed four times over a period of 2 days. One observer driving slowly recorded all birds on both sides of the transect. The observer stopped at regular intervals and moved a distance away from the vehicle 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 focal points of bird activity, namely two water troughs and a small farm dam, were also monitored during the course of the two day monitoring period.

See Figure 2 below for the extent of the broader area.

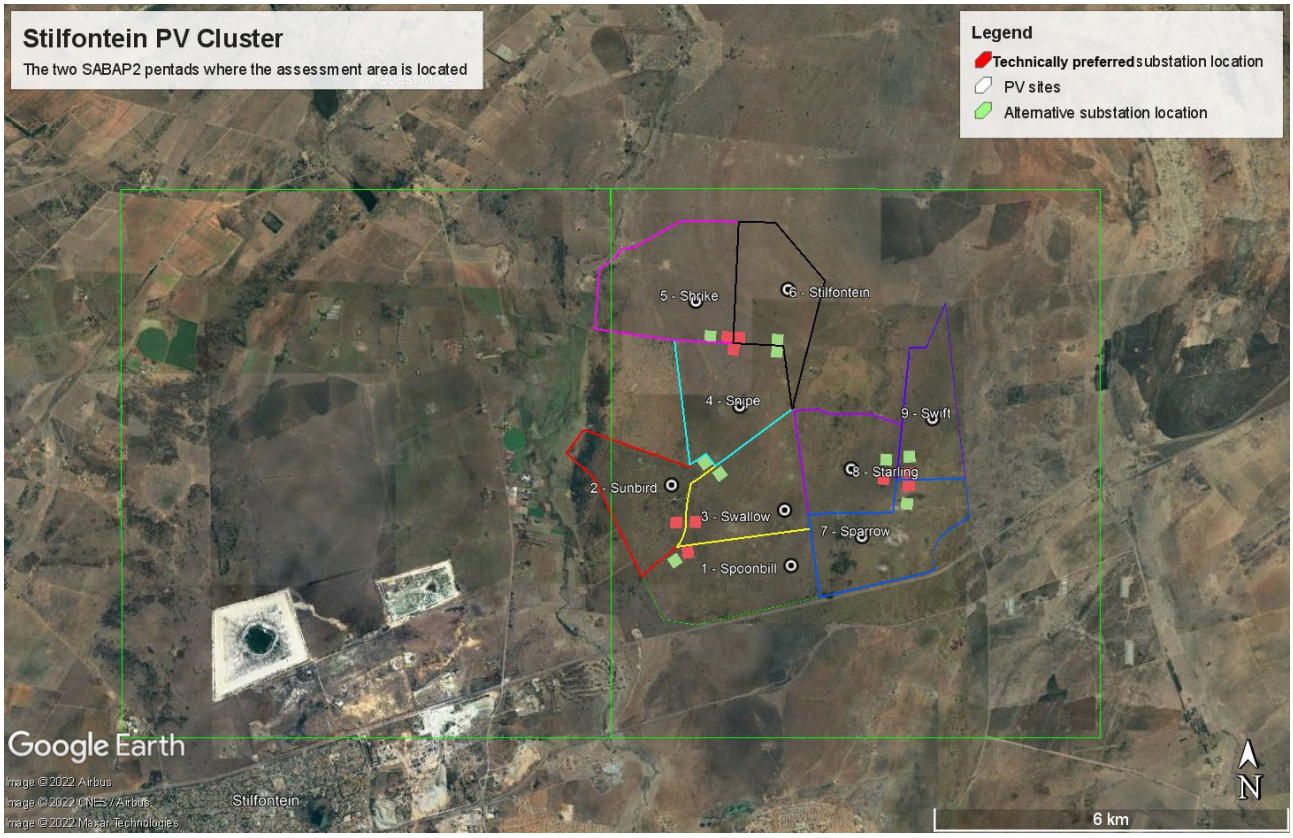


Figure 2: Area covered by the broader area (2 x SABAP2 pentad grid cells = green squares).

See Figure 3 for the location of drive transects and focal points.

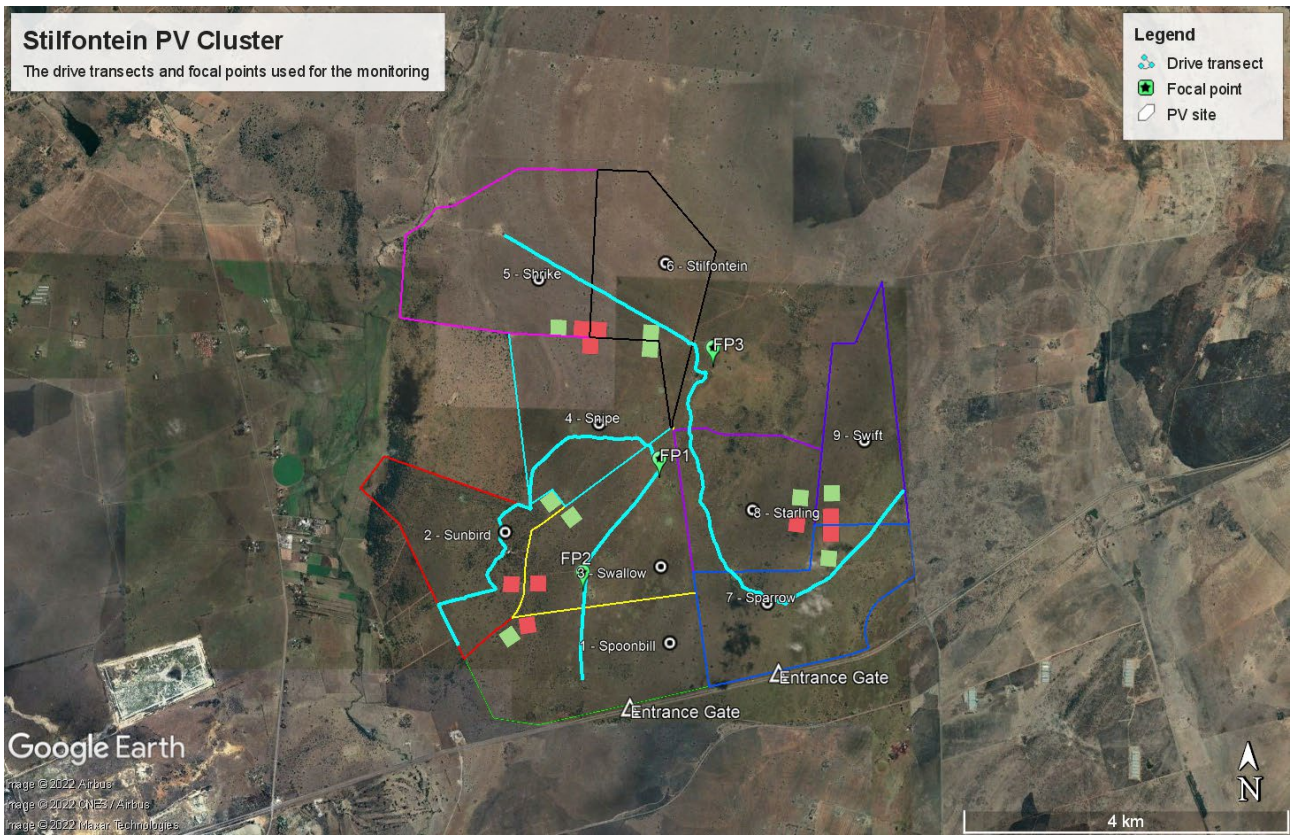


Figure 3: The location of the drive transects and focal points relative to the proposed Stilfontein PV Cluster projects.

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 Forestry, Fisheries and the Environment (DFFE)	2021, Q3	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	February 2022	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 (2021.3)	IUCN	2022.2	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.
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:	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).

Data / Information	Source	Date	Type	Description
	CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.			
Phase 2 Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa	Department of Environment, Forestry and Fisheries, 2019. Phase 2 Strategic Environmental Assessment for wind and solar PV energy in South Africa. CSIR Report Number: CSIR/SPLA/SECO/ER/2019/0085 Stellenbosch, Western Cape.	2019	SEA	The SEA identifies additional 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). These are referred to as FA9 eMalahleni (solar PV), FA10 Klerksdorp and. (solar PV) and FA11 Beaufort West (wind). The numbers are a continuation from the already gazetted eight REDZs from the Phase 1 wind and solar PV SEA.
The National Screening Tool	Department of Forestry, Fisheries and the Environment	February 2022	Spatial	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:

- It was assumed that the SABAP 2 is an accurate representation of the avifauna that are likely to occur in the broader area, based on the large number of completed lists for this area.
- The focus of the study was primarily on the potential impacts of the proposed solar PV facility on priority species. Priority species were identified on the basis of (i) potential susceptibility to impacts caused by PV facilities, and/or (ii) conservation significance.
- Priority species were defined as follows:
  - South African Red Data species: High conservation significance
  - South African endemics and near-endemics: High conservation significance
  - Raptors: High conservation significance. Raptors are at the top of the food chain and play a key role in their ecosystems. When populations of birds of prey go down, then the numbers of their prey species go up, creating an imbalance in the ecosystem.
  - Waterbirds: Evidence indicate that waterbirds may be particular susceptible to collisions with solar arrays due to the so-called lake effect, caused by the reflection of the sun of the smooth surface of solar panels.
- Only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser *et al.* 2019) 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.
- Conclusions drawn in this study are based on experience of the specialist in relation to the species found on site and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that would be valid under all circumstances.
- The **broader area** is defined as the area encompassed by the two pentads where the project is located (see Figure 2 above). The **assessment area** is the area comprising the combined cluster of nine PV projects

making up the Stilfontein PV Cluster. A **project site** is the area taken up by an individual PV site i.e. the footprint containing the PV solar arrays and associated infrastructure.

3 LEGISLATIVE AND PERMIT REQUIREMENTS

3.1 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*. These guidelines were consulted in this assessment.

3.1.1 Agreements and conventions

Relevant international agreements and conventions are described in this section.

Table 1: International agreements and conventions which South Africa is party to, and which are relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The 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 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

Convention name	Description	Geographic scope
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

3.1.2 National legislation

3.1.2.1 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.

3.1.2.2 The National Environmental Management Act NEMA (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.

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020) is applicable in the case of potential impacts on avifauna by solar PV developments.

3.1.2.3 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.

3.1.3 Provincial legislation

3.1.3.1 North-West Biodiversity Management Act, No 4 of 2016

The Act provides for the management and conservation of the North West Province's biophysical environment and protected areas within the framework of the National Environmental Management Act, 1998 (Act No 107 of 1998) including the protection of species and ecological- systems that warrant provincial protection.

4 BASELINE ENVIRONMENTAL DESCRIPTION

4.1 General Description

4.1.1 Important Bird Areas (IBAs)

According to the latest directory of Important Bird Areas (IBAs) published by BirdLife South Africa (Marnewick *et al.* 2015) the Sandveld and Bloemhof Dam Nature Reserves IBA SA039 is the closest IBA and is located approximately 102 km south-west of the site. The proposed development is not expected to have any impact on the avifauna in this IBA due to the distance from the development.

4.1.2 Protected Areas

The site does not form part of a formally protected area. The closest protected area is the Faan Meintjies Private Nature Reserve which is located approximately 10 km to the west at its closest point. The proposed development is not expected to have any impact on the avifauna in this nature reserve due to the distance from the development.

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

On 16 February 2018, Minister Edna Molewa published Government Notice No. 114 in Government Gazette No. 41445 which identified eight renewable energy development zones (REDZ) important for the development of large scale wind and solar photovoltaic facilities. The Government Notice included procedures to be followed when applying for environmental authorisation for large scale wind and solar photovoltaic energy facilities when occurring in these REDZs.

On 26 February 2021, Minister Barbara Dallas Creecy, published Government Notice No. 142, 144 and 145 in Government Gazette No. 44191 which identified three additional REDZs for implementation as well as the procedures to be followed when applying for environmental authorisation for electricity transmission or distribution infrastructure or large scale wind and solar photovoltaic energy facilities in these REDZs.

The REDZs were identified through the undertaking of two Strategic Environmental Assessments (SEAs), the first being finalised in 2015 and the second being finalised in 2019. The site falls within the Klerksdorp REDZ10 Renewable Energy Zone (REDZ), which was identified during the second SEA.

4.1.4 Bird Habitat

The assessment area is situated approximately 7 km north-east of the town of Stilfontein, in the North West Province. It is located in the Grassland Biome, in the Dry Highveld Grassland Bioregion, in a mixture of open to dense woodland with a strong grassland component. The habitat in the broader area is more variable and consists of fallow fields (recovering grassland), natural grassland, shrub- and woodland, some wetland and pans, and some agricultural and industrial activities. Mucina & Rutherford (2006) classifies the natural

vegetation in the assessment area as a mixture of Vaal Reefs Dolomite Sinkhole Woodland and Carletonville Dolomite Grassland

The Stilfontein area has a semi-arid climate (according to the Köppen-Geiger climate classification), with warm to hot summers and cool, dry winters. The average annual precipitation is ~482 mm, with most of the rainfall occurring during summer. It should be noted that photos from the field surveys were taken in the high (rainy) season (i.e., summer).

The following features with relevance to avifauna are present in the assessment area:

- Open Woodland
- Water Points
- High Voltage Overhead Powerlines

4.1.4.1 Open Woodland

The dominant habitat type of the assessment area is that of open woodland with a prominent grassy component (see Figures 4 & 5). The woodland consists of mainly fine-leaved, semi-deciduous *Vachellia*-dominated shrubs up to medium-sized trees. The density of the woodland ranges from relatively dense in places to open tracts of grassland with scattered shrubs.

Figure 4: Open woodland habitat in the proposed assessment area.

Figure 5: A large *Vachellia* sp. tree with weaver bird nests in the open woodland of the proposed assessment area.

The following solar priority avifauna with a high or medium likelihood of occurrence could use open woodland habitat in the development area:

- Amur Falcon
- Black-headed Heron
- Black-winged Kite
- Cape White-eye
- Cloud Cisticola
- Common Buzzard
- Fiscal Flycatcher
- Gabar Goshawk
- Greater Kestrel
- Karoo Thrush
- Lanner Falcon
- Lesser Kestrel
- Pied Starling
- South African Cliff Swallow
- Spotted Eagle-Owl
- Western Cattle Egret
- White-backed Vulture

4.1.4.2 Surface water

Surface water is important to avifauna in this semi-arid area. The assessment area contains several artificial impoundments (cement water troughs and water reservoirs) scattered throughout the area which are the only permanent sources of water (aside from the Koekemoerspruit located to the west of the project area) and provide habitat for some waterbirds and many other non-priority species (see Figures 6 & 7). Vultures most likely use the water troughs in the assessment area on occasion for drinking and bathing. Some raptors could be attracted to the water points for bathing, drinking and to hunt other birds coming to drink.

Figure 6: Cement water trough in assessment area.

Figure 7: Cement water reservoir in the assessment area.

The following solar priority avifauna with a high or medium likelihood of occurrence could use water points in the development area:

- Black-headed Heron
- Blacksmith Lapwing
- Common Buzzard
- Egyptian Goose

- Gabar Goshawk
- Lanner Falcon
- Pied Starling
- Western Cattle Egret
- White-backed Vulture

4.1.4.3 High Voltage Overhead Powerlines

The Hermes – Pluto 1 & 2 400kV transmission lines cross the assessment area in a north-south direction (see Figure 8). These transmission lines are used by White-backed Vultures for roosting, as well as a variety of other priority raptors.

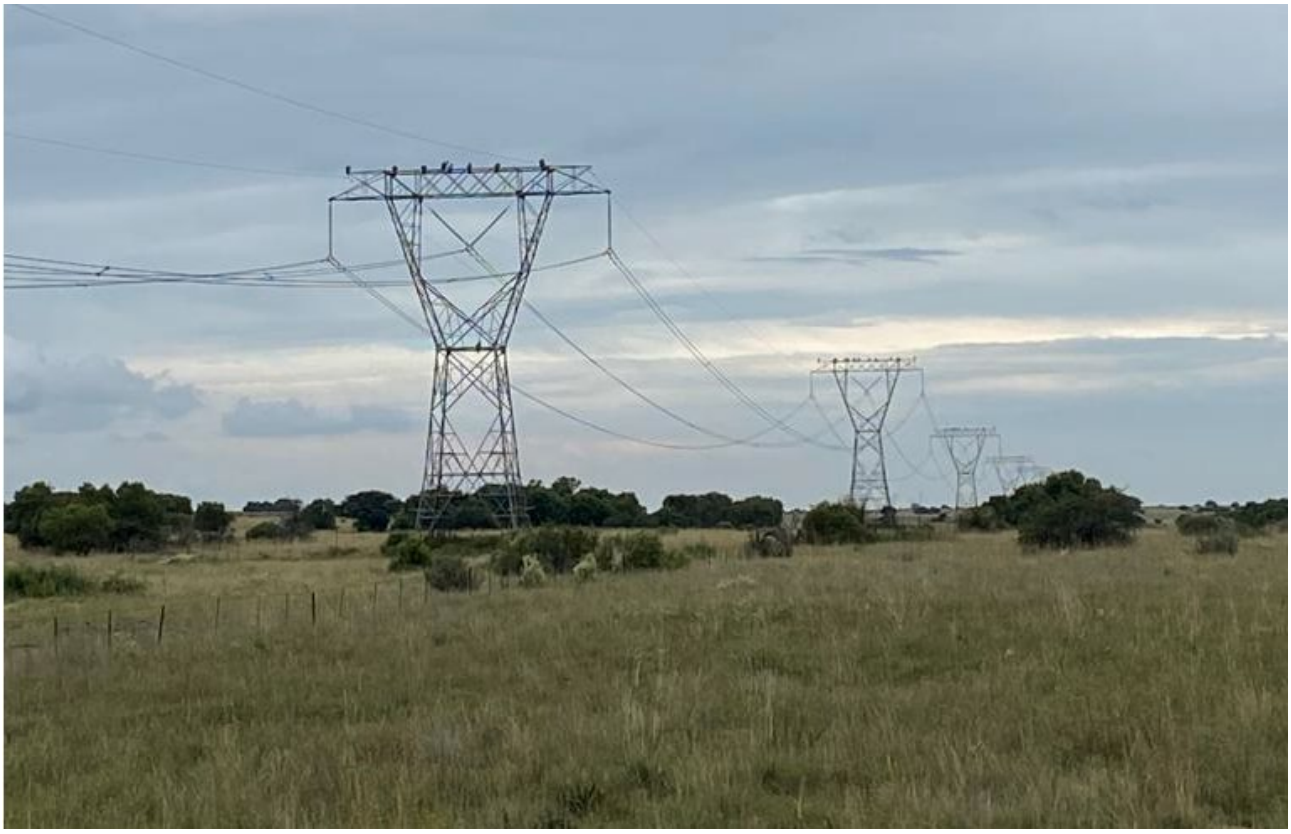


Figure 8: White-backed vultures roosting on the Hermes – Pluto 1 400kV transmission line the assessment area.

The following solar priority avifauna with a high or medium likelihood of occurrence could use overhead powerlines in the assessment area:

- Amur Falcon
- Black-headed Heron
- Black-winged Kite
- Common Buzzard
- Egyptian Goose
- Greater Kestrel
- Lanner Falcon
- Lesser Kestrel
- Spotted Eagle-Owl

4.1.5 Avifauna

4.1.5.1 Southern African Bird Atlas Project 2

A total of 211 species could potentially occur within the broader area where the project is located (see Appendix C1). Of these, 67 are classified as priority species. Of the 67 priority species, 19 have a medium to high probability of occurring in the assessment area. Of these, 5 were recorded during site surveys.

The probability of a priority species occurring regularly in the assessment area is indicated in Table 2. **Due to the similarity in habitat and associated avifaunal composition, the likelihood of occurrence and potential impacts as listed in Table 2 is applicable to each of the nine PV project sites.**

Table 2 below lists all priority species and the possible impact on the respective species by the Stilfontein PV facilities and associated infrastructure.
Status is defined as follows:
CR = Critically endangered
VU = Vulnerable
LC = Least concern
M = Medium
H = High

Table 2: Priority species occurring in the broader area with a medium to high likelihood of regular occurrence in the assessment area.

Species name	Taxonomic name	SABAP2 reporting rate		Status				Habitat			Potential impact				
		Full protocol	Ad hoc protocol	Global status	National status	Likelihood of occurrence	Recorded during monitoring	Woodland	Waterpoints	High voltage lines	Solar - Collisions with solar panels	Solar - Displacement: Disturbance	Solar - Displacement: Habitat transformation	Solar - Entanglement in fences	Powerline - Electrocution MV lines and substations
Amur Falcon	*Falco amurensis*	5.62	0.00	-	-	M		x		x			x		x
Black-headed Heron	*Ardea melanocephala*	16.85	4.55	-	-	M		x	x	x			x	x	x
Blacksmith Lapwing	*Vanellus armatus*	83.15	18.18	-	-	H	x		x		x				
Black-winged Kite	*Elanus caeruleus*	58.43	36.36	-	-	H		x		x			x		x
Cape White-eye	*Zosterops virens*	7.87	0.00	-	-	M		x			x	x	x		
Cloud Cisticola	*Cisticola textrix*	22.47	0.00	-	-	H	x	x			x	x			
Common Buzzard	*Buteo buteo*	5.62	0.00	-	-	M		x	x	x			x		x
Egyptian Goose	*Alopochen aegyptiaca*	24.72	0.00	-	-	H			x	x					x
Fiscal Flycatcher	*Melaenornis silens*	69.66	4.55	-	-	H	x	x			x	x	x		
Gabar Goshawk	*Micronisus gabar*	7.87	0.00	-	-	M		x	x			x	x		x
Greater Kestrel	*Falco rupicoloides*	10.11	4.55	-	-	M		x		x		x	x		x
Karoo Thrush	*Turdus smithi*	26.97	4.55	-	-	H		x			x	x	x		
Lanner Falcon	*Falco biarmicus*	3.37	0.00	LC	VU	M		x	x	x		x	x		x
Lesser Kestrel	*Falco naumanni*	6.74	0.00	-	-	M		x		x			x		x
Pied Starling	*Lamprotornis bicolor*	34.83	4.55	-	-	H	x	x	x		x	x			
South African Cliff Swallow	*Petrochelidon spilodera*	25.84	22.73	-	-	H		x			x		x		
Spotted Eagle-Owl	*Bubo africanus*	1.12	0.00	-	-	M		x		x		x	x	x	x
Western Cattle Egret	*Bubulcus ibis*	83.15	36.36	-	-	H	x	x	x						
White-backed Vulture	*Gyps africanus*	0.00	0.00	CR	CR	M		x	x	x		x	x		x

4.1.5.2 Pre-construction surveys

As noted above, surveys were conducted on 03 February 2022 and again from 9 – 10 February 2022 at the assessment area, during the high (wet) season, when five of the SABAP 2 priority species were recorded. The abundance of these priority species (Index of Kilometric Abundance i.e. birds/km = IKA) recorded during the drive transects in the project site is displayed in Figure 9 below.

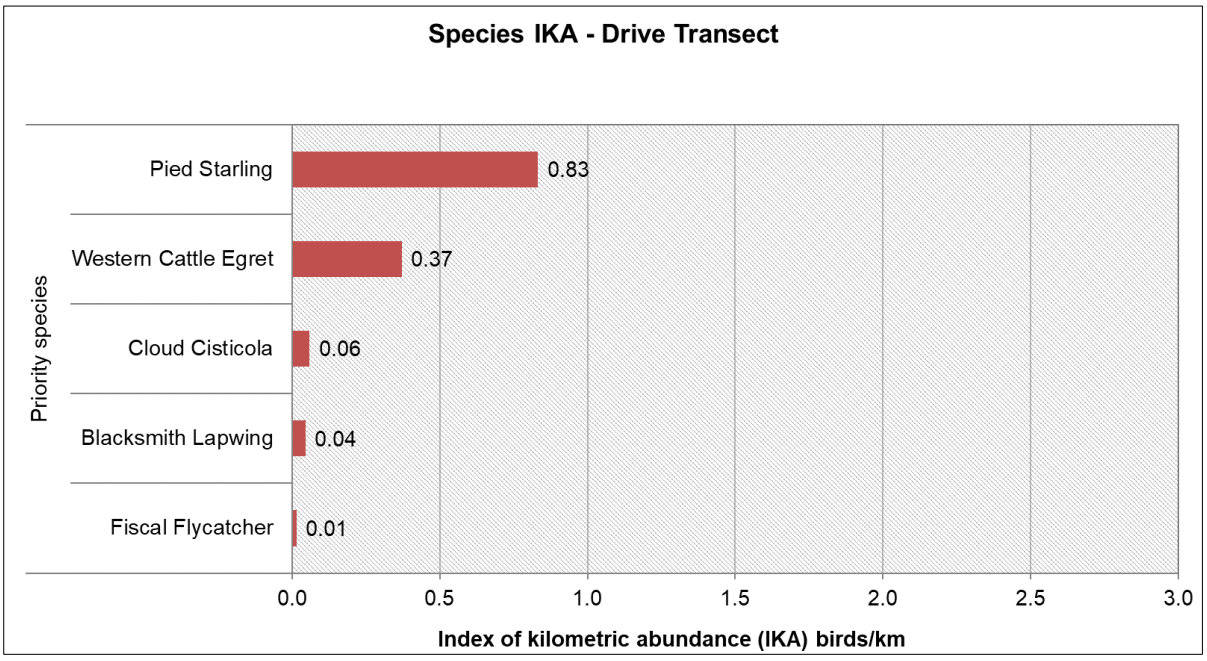


Figure 9: The abundance of priority species recorded during transect counts in the assessment area.

Three focal points of bird activity, namely two water troughs and a small farm dam, were also monitored during the course of the two-day monitoring period.

Table 3 lists the priority species which were recorded at the focal points in the assessment area.

Table 3: Priority species which were recorded at focal points in the assessment area.

Species	Sci name	Total
Red-billed Teal	*Anas erythrorhyncha*	3
White-faced Whistling Duck	*Dendrocygna viduata*	2
Yellow-billed Duck	*Anas undulata*	1
Pied Starling	*Lamprotornis bicolor*	1

The overall abundance of priority species at the project site was low, with an average of 1.32 birds/km recorded during drive transect counts.

See Figure 10 for the location of priority species recorded during the surveys.

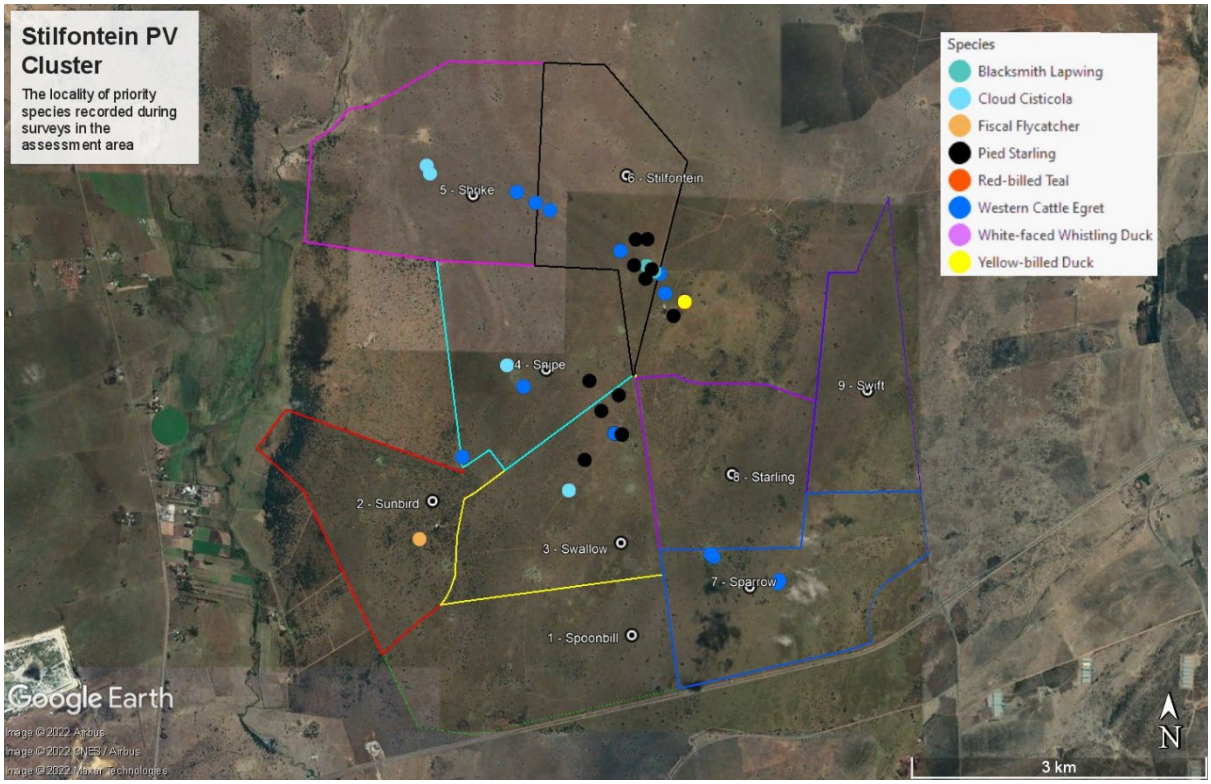


Figure 10: Priority species recorded during surveys at the assessment area.
The map includes species with a low likelihood of regular occurrence in addition to those listed in Table 2 i.e. with a medium to high likelihood of regular occurrence.

5 IDENTIFICATION OF ENVIRONMENTAL SENSITIVITIES

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

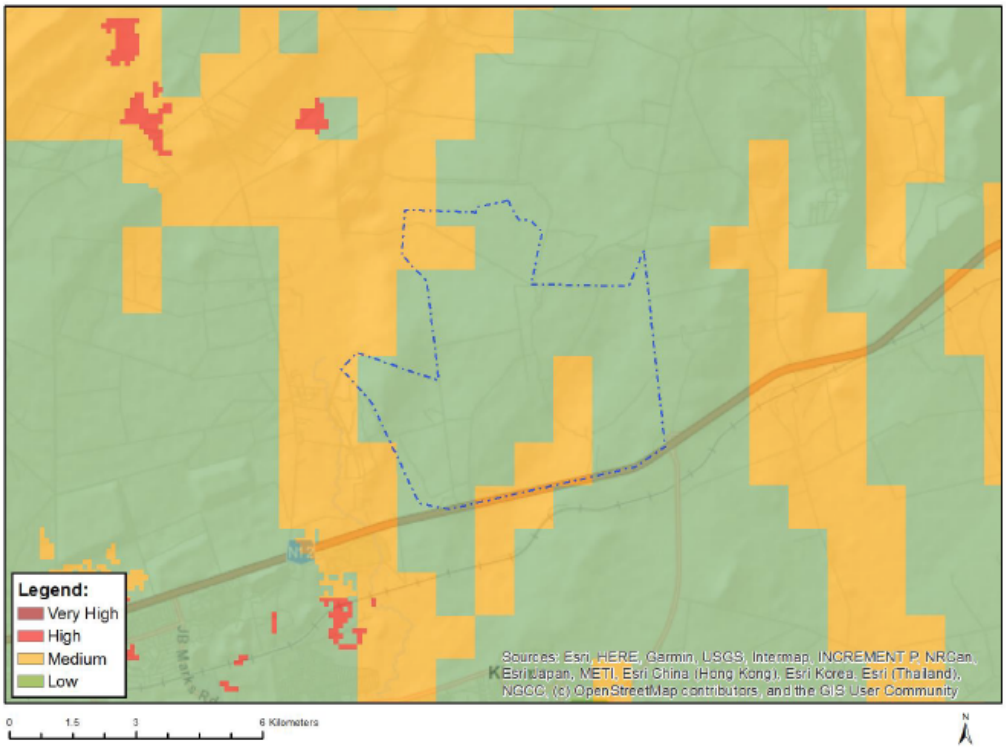
The assessment area and immediate environment is classified as **Low and Medium** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme (see Figure 11). The low and medium sensitivity classification is not linked to avifauna but rather terrestrial sensitivity since no specific avifaunal features or buffer sensitivities were identified according to the database.

The project site contains marginal habitat for most species of conservation concern (SCC)[1]. The virtual absence of SCC was confirmed during the project site surveys. However, White-backed Vulture (SA Status Endangered) was recorded in the assessment area roosting on the high voltage lines running through the site. This was the only SCC recorded during surveys, but based on the criteria in the Protocol the study area should therefore be classified as **High** sensitivity due to the presence of an SCC.

See Appendix E for the Site Sensitivity Report.

[1] As defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020), namely listed on the:
- IUCN Red List of Threatened Species or
- South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity
Medium	Mammalia-Hydrictis maculicollis

Figure 11: The National Web-Based Environmental Screening Tool map of the project site, indicating sensitivities for the Terrestrial Animal Species theme. The low and medium sensitivity is not related to avifauna but rather terrestrial sensitivity since no specific avifaunal features or buffer sensitivities were identified according to the database.

5.2 Specialist Sensitivity Analysis and Verification

The avifaunal sensitivities that were identified in the project area are discussed below. **The spatial distribution of sensitivities relative to the individual PV sites is covered in Appendix D.**

5.2.1 Water reservoirs (surface water): Very High sensitivity

Sensitive areas are those areas within 100m of these water reservoirs. Water reservoirs are crucially important for priority avifauna, and many non-priority species. It is therefore important to retain or relocate existing waterpoints to ensure at least one waterpoint is retained in the project site, if applicable.

See Figure 12 for the location of waterpoints at the assessment area.

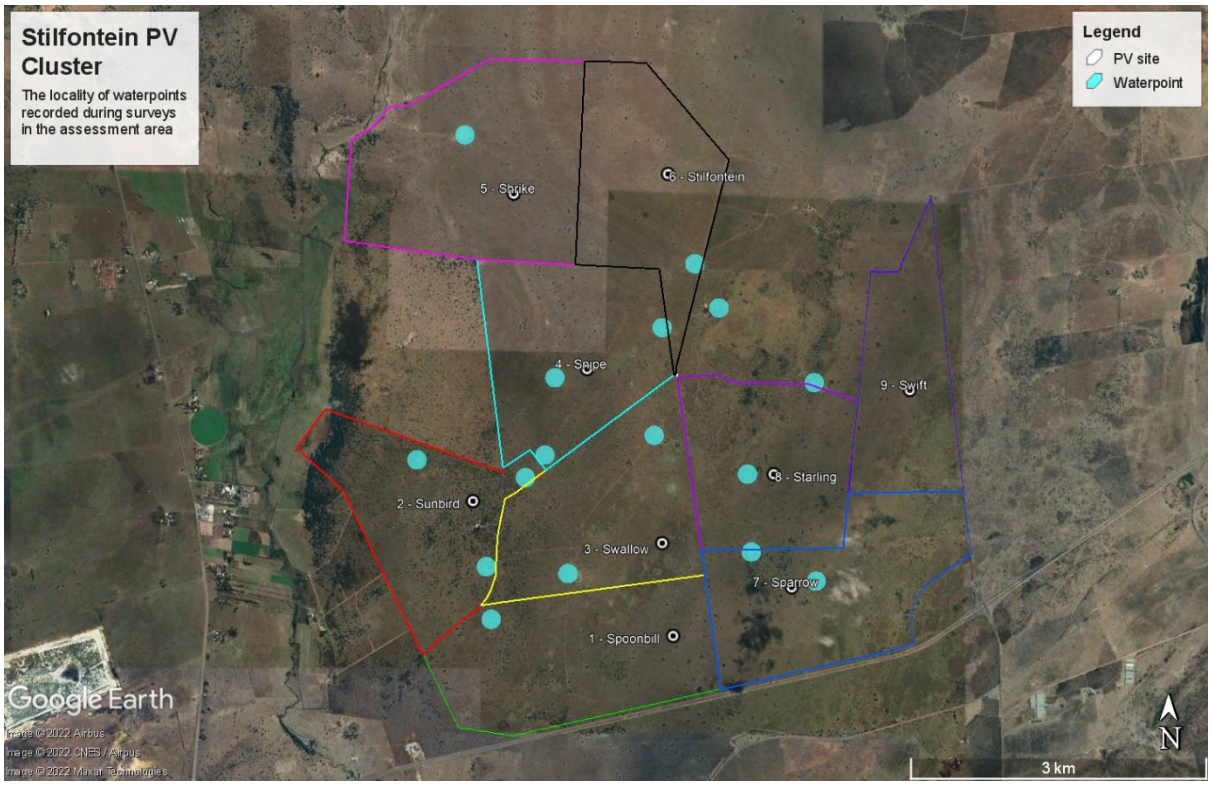


Figure 12: Waterpoints in the assessment area.

6 ISSUES, RISKS AND IMPACTS

6.1 Identification of Potential Impacts/Risks

The potential impacts on priority avifauna identified in the course of the study are:

6.1.1 Construction Phase

- Displacement of certain priority avifaunal species due to disturbance associated with the construction of the solar PV plant and associated infrastructure.
- Displacement of certain priority avifaunal species due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure.

6.1.2 Operational Phase

- Mortality of certain avifaunal priority species due to collisions with the solar panels
- Mortality of certain avifaunal priority species due to entrapment in perimeter fences
- Mortality of certain avifaunal priority species due to electrocutions in the onsite substations and 11-33kV medium voltage reticulation lines

- Mortality of certain avifaunal priority species due to collisions with the 11-33kV medium voltage overhead lines

6.1.3 Decommissioning Phase

- Displacement of certain avifaunal priority species due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure.

7 IMPACT ASSESSMENT

7.1 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 of bird species at risk of extinction, with estimates of extinction rates varying from 2 to 72%, depending on the region, climate scenario and potential for birds to shift to new habitat.

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

- 314 of 588 species modelled (53%) lose more than half of their current geographic range in all three modelled scenarios.
- For 126 species, 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).

7.2 Impacts on priority avifauna associated with PV plants and associated infrastructure

7.2.1 Construction Phase: Displacement of certain avifaunal priority species due to disturbance and habitat transformation associated with the construction 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 cumulatively – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the semi-arid 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 conservancy / septic system(s);
- 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 at or near the development area 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 that bird density and bird diversity was higher in the boundary and untransformed landscape than in the solar development area, however, the difference 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 appeared to be negatively affected by the presence of the PV facility. In contrast, open country/grassland and generalist species, were favoured by solar development (Visser *et al.* 2019).

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

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, perhaps more so for shrubland species than grassland species, as explained above, will manifest itself at the proposed project. In addition, raptors and terrestrial species could also be impacted.

The priority species with a medium to high likelihood of occurrence in the assessment area which could be affected by this impact, are the following:

- Cape White-eye
- Cloud Cisticola
- Fiscal Flycatcher
- Gabar Goshawk
- Greater Kestrel
- Karoo Thrush
- Lanner Falcon
- Pied Starling
- Spotted Eagle-Owl
- White-backed Vulture

7.2.2 Operational Phase: Mortality of certain avifaunal priority species due to collisions with the solar panels

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

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

An extremely rare but potentially related problem is the so-called “lake effect” i.e. it seems possible that reflections from solar facilities' infrastructure, particularly large sheets of dark blue photovoltaic panels, may attract birds in flight across the open desert, who mistake the broad reflective surfaces for water (Kagan *et al.* 2014)[2]. The unusually high percentage of waterbird mortalities at the Desert Sunlight PV facility in California (44% of all fatalities were waterbirds) 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). Kosciuch *et al.* (2020) analysed the results from fatality monitoring studies at 10 photovoltaic solar facilities across 13 site years in the Sonoran and Mojave Deserts Bird Conservation Region in California and Nevada in the USA. They found no evidence of mass mortality related to the lake effect despite the occurrence of water-obligate birds, which rely on water for take-off and landing, occurring at 90% (9/10) of site-years in the Sonoran and Mojave Deserts Bird Conservation Region. However, until such time that enough scientific evidence has been collected to discount the “lake effect” hypothesis completely, 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 and carcass removal trials.

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. 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)

[2] 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.

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 96MW 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 to 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 (Kosciuch *et al.* 2020). Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely 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 affected by this impact are mostly small, ground-dwelling birds which forage between the solar panels, and a variety of waterbirds which may be at risk due to the “lake effect”.

The priority species with a medium to high likelihood of occurrence in the assessment area which could be affected by this impact, are the following:

- Blacksmith Lapwing
- Cape White-eye
- Cloud Cisticola
- Fiscal Flycatcher
- Karoo Thrush
- Pied Starling
- South African Cliff Swallow

7.2.2 Operational phase: Mortality of certain avifaunal priority species due to 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. Another potential problem is birds, particularly owls, that get stuck between the strands of barbed wire fences of single wire fences.

It is not foreseen that entrapment in perimeter fences will be a significant impact for priority avifauna at the PV facility.

The priority species with a medium to high likelihood of occurrence in the assessment area which could be affected by this impact, are the following:

- Black-headed Heron
- Spotted Eagle-Owl

7.2.3 Operational phase: Mortality of certain avifaunal priority species due to 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 (clearance) 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.

The existing Hermes-Pluto 400kV 1 and 2 transmission lines running though the assessment area do not pose a material risk of electrocution to birds, as the clearances are too big to bridge for even the largest birds.

However, there could be an electrocution risk to certain species, mostly raptors and vultures, but also some waterbirds, on the smaller proposed internal 33kV powerlines, due to the smaller clearances, unless a bird-friendly structure is used. Electrocutions within the proposed substations are possible, however, the likelihood of this impact on the more sensitive Red List priority species is remote, as these species are unlikely to regularly utilise the infrastructure within the substation yard for perching or roosting.

The priority species with a medium to high likelihood of occurrence in the assessment area which could be affected by this impact, are the following:

- Amur Falcon
- Black-headed Heron
- Black-winged Kite
- Common Buzzard
- Egyptian Goose
- Gabar Goshawk
- Greater Kestrel
- Lanner Falcon
- Lesser Kestrel
- Spotted Eagle-Owl
- White-backed Vulture

7.2.4 Operational phase: Mortality of certain avifaunal priority avifauna due to powerline collisions

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

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to powerline collisions in South Africa (see Figure 13 below).

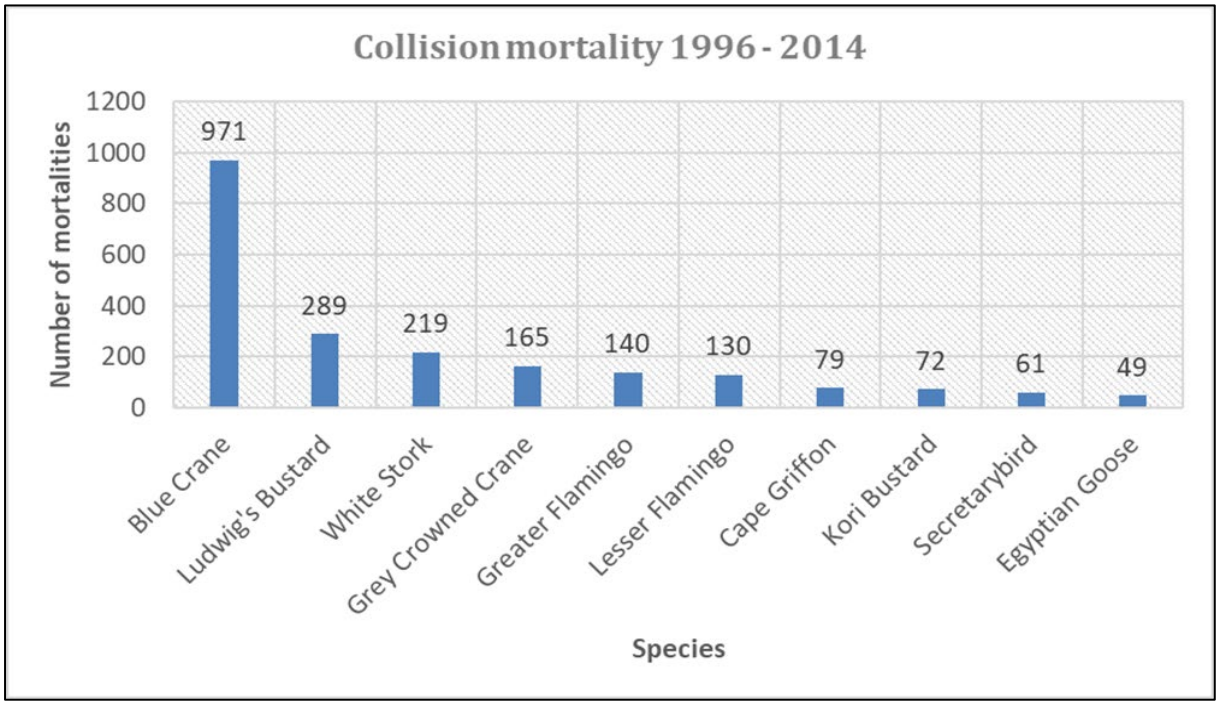


Figure 13: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

There are many studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduces mortality rates (e.g. Bernardino *et al.,* 2018; Sporer *et al.* 2013, Barrientos *et al.* 2011; Jenkins *et al.* 2010; Alonso & Alonso, 1999; Koops & De Jong, 1982). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. Barrientos *et al.* (2011) 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 of 55–94% in bird mortalities. Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5m, whereas using the same devices at 10m intervals only reduces the mortality by 57%. Barrientos *et al.* (2012) found that larger BFDs were more effective in reducing Great Bustard collisions than smaller ones. 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 *Anthropoides paradiseus*, 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 (*Neotis ludwigii*). 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.* 2018).

Distribution lines i.e. 11kV to 88kV are often overlooked in collision studies, but given their far greater extent they can represent a serious source of mortality (Shaw *et al.* 2010a, 2010b).

The priority species with a medium to high likelihood of occurrence in the assessment area which could be affected by this impact, are the following:

- Black-headed Heron
- Egyptian Goose
- Spotted Eagle-Owl
- Western Cattle Egret
- White-backed Vulture

7.3 No-go option

The no-go option will result in no additional impacts on priority avifauna and will result in the ecological *status quo* being maintained, which will be to the advantage of the avifauna in the short term, but perhaps less so in the longer term, given the expected impact of climate change on avifauna in the longer term, as discussed in 7.1. No fatal flaws of the project were identified during the study.

8 IMPACT RATING METHODOLOGY

Impacts criteria according to SRK's prescribed impact assessment methodology are presented below. The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring, including possible irreversibility of impacts and/or loss of irreplaceable resources, and the **probability** that the impact will occur.

The criteria used to determine impact consequence are presented in the table below.

Table 4: Criteria used to determine the consequence of the impact

Rating	Definition of Rating	Score
A. *Extent* *– the area (distance) over which the impact will be experienced*		
Local	Confined to project area (e.g. the development site and immediate surrounds)	1
Regional	The region (e.g. municipality or Quaternary catchment)	2
(Inter) national	Nationally or beyond	3
B. ***Intensity*** *– the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered and/or irreplaceable resources[3] are lost	3
C. ***Duration*** *– the timeframe over which the impact will be reversed*		
Short-term	Up to 2 years	1
Medium-term	2 to 15 years	2
Long-term	More than 15 years or irreversible	3

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

[3] Defined as important cultural or biological resource which occur nowhere else, and for which there are no substitutes.

Table 5: Method used to determine the consequence score

***Combined Score* (A+B+C)**	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Once the consequence was derived, the probability of the impact occurring was considered, using the probability classifications presented in the table below.

Table 6: Probability classification

Probability *– the likelihood of the impact occurring*	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

The overall **significance** of impacts was determined by considering consequence and probability using the rating system prescribed in the table below.

Table 7: Impact significance ratings

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Finally the impacts were also considered in terms of their status (positive or negative impact) and the confidence in the ascribed impact significance rating. The prescribed system for considering impacts status and confidence (in assessment) is laid out in the table below.

Table 8: Impact status and confidence classification

Status of impact	
Indication whether the impact is adverse (negative) or beneficial (positive).	+ ve (positive – a 'benefit')
	– ve (negative – a 'cost')
Confidence of assessment	
The degree of confidence in predictions based on available information, SRK's judgment and/or specialist knowledge.	Low
	Medium
	High

The impact significance rating should be considered by authorities in their decision-making process based on the implications of ratings ascribed below:

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity/development.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity/development.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity/development.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity/development.

- **HIGH**: the potential impact **will** affect the decision regarding the proposed activity/development.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

Practicable mitigation and optimisation measures are recommended and impacts are rated in the prescribed way both without and with the assumed effective implementation of mitigation and optimisation measures. Mitigation and optimisation measures are either:

- **Essential**: measures that must be implemented and are non-negotiable; and
- **Best Practice:** recommended to comply with best practice, with adoption dependent on the proponent's risk profile and commitment to adhere to best practice, and which must be shown to have been considered and sound reasons provided by the applicant if not implemented.

9 IMPACT RATING

See Appendix D for the impact ratings per individual PV site.

10 ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

Refer to Appendix D for a description of the key mitigation and monitoring recommendations for each applicable mitigation measure identified for all phases of the project.

11 CUMULATIVE IMPACTS

For the purposes of this report, cumulative impacts are defined as 'direct and indirect impacts that act together with existing or future potential impacts of other activities or proposed activities in the area / region that affect the same resources and / or receptors.

For the most part, cumulative effects or aspects thereof are too uncertain to be quantifiable, due mainly to a lack of data availability and accuracy. This is particularly true of cumulative effects arising from potential or future projects, the design or details of which may not be finalised or available and the direct and indirect impacts of which have not yet been assessed.

For practical reasons, the identification and management of cumulative impacts are limited to those effects generally recognised as important on the basis of scientific concerns and/or concerns of affected communities. From an avifaunal impact perspective, the cumulative impacts that are likely to be the most significant as far as renewable energy projects are concerned, are the following:

- Displacement of priority avifauna due to habitat transformation
- Mortality of priority avifauna due to electrocution on the associated medium voltage reticulation lines

The renewable energy projects within a 30km radius around the Stilfontein PV Cluster facilities that were considered for purposes of cumulative impacts, are listed in Table 9 and shown in the map in Figure 14.

Table 9: Renewable energy projects within a 30km radius around the Stilfontein PV Cluster facilities (Source: DFFE Q3 2022 REEA database)

Project	DFFE Reference	Capacity	EA Status
Kabi Vaalkop PV Facility	12/12/20/2513/4/AM1	n/a	Approved
Kabi Vaalkop PV Facility	12/12/20/2513/4	75 MW	Approved
YMS Mineral Resources PV Plant	12/12/20/2629/AM1	20 MW	Approved
Buffels Solar PV 1	14/12/16/3/3/2/777	75 MW	Approved
Buffels Solar PV 2	14/12/16/3/3/2/778	100 MW	Approved
Orkney Solar PV	14/12/16/3/3/2/954/AM1	100 MW	Approved
Vaal River Solar 3 PV facility	12/12/20/2513/3/AM6	250 MW	Approved
Witkop Solar PV II	12/12/20/2507/2	61 MW	In process
Paleso Solar PV	14/12/16/3/3/1/2365	150 MW	Approved
Siyanda Solar PV	14/12/16/3/3/2/1/2369	150 MW	Approved

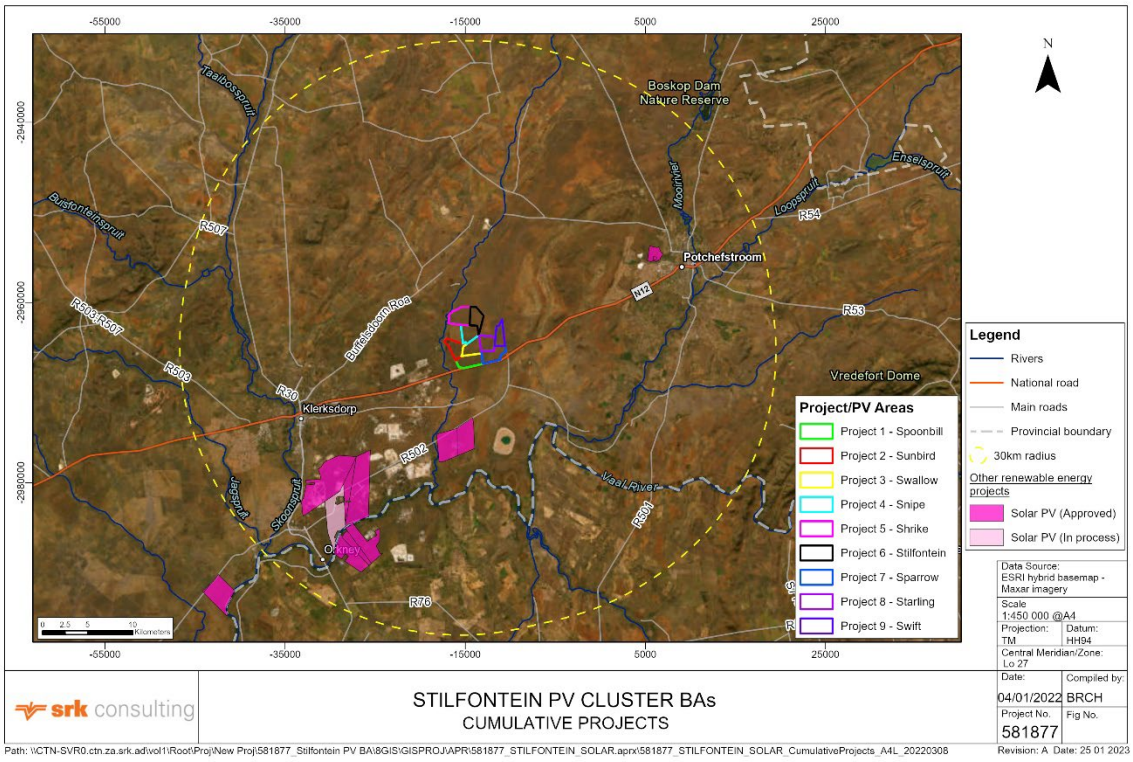


Figure 14: Stilfontein Solar Facilities Cluster - cumulative projects (Source: DFFE Q3 2022 REEA database)

- Displacement of priority avifauna due to habitat transformation

The total affected land parcel area taken up by authorised and proposed renewable energy projects within the 30km radius, is ~63 km². The total area affected by the proposed Stilfontein PV Cluster projects equates to ~30 km². The combined area affected by authorised/proposed renewable energy developments within the 30 km radius and the proposed Stilfontein PV Cluster projects, thus equals ~93 km². The proposed Stilfontein PV Cluster projects constitute ~32.5% of this area.

The contribution of the Stilfontein PV Cluster projects to the cumulative impact of all the proposed projects within a 30 km radius is thus anticipated to be **moderate to high** as far as habitat transformation is concerned.

The total area within the 30 km radius around the proposed projects equates to about 2 827km². The total combined size of the land parcel area potentially affected by renewable energy projects will thus equate to only ~3.2% of the total area in the 30km radius, should all the projects be constructed. The natural habitat within the 30km radius has been severely impacted by agriculture, urbanisation and industrial developments, with the result that very little relatively untransformed grassland habitat remains. This has obviously had a severe impact on the avifauna as well, especially ground-living grassland species, although it could also be argued that the development has benefited certain species, e.g. White-backed Vultures are most likely attracted to the area due to the presence of food (cattle carcasses) and suitable roosting substrate (transmission lines).

The cumulative impact of the proposed Stilfontein PV Cluster projects and the other authorised PV projects on priority avifauna within in the 30km radius is considered **Low**, given the relatively small area that will be affected and the current transformed state of the natural habitat within this area, which has already depleted the numbers of priority avifauna.

- Mortality of priority avifauna due to electrocution on the associated medium voltage reticulation lines

The potential cumulative impact of electrocutions of priority species on medium voltage reticulation lines associated with the PV developments must also be considered. The total length of existing reticulation lines (i.e. 11kV and 22kV lines) within the 30km radius is unknown but can safely be assumed to be in the hundreds of kilometres. Many of these lines could pose an electrocution risk to large raptors, and particularly vultures, given the fact that many lines may have been constructed before bird-friendly designs became the norm. However, if the proposed 11-33kV medium voltage lines at the proposed Stilfontein PV Cluster projects are designed to be bird-friendly, their cumulative impact will be **Negligible**.

12 FINAL SPECIALIST STATEMENT AND AUTHORISATION RECOMMENDATION

12.1 Statement and Reasoned Opinion

The assessment area and immediate environment is classified as Low and Medium sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme of the National Web-Based Environmental Screening Tool. The medium sensitivity classification is not linked to avifauna but rather terrestrial sensitivity since no specific avifaunal features or buffer sensitivities were identified according to the database.

The virtual absence of SCC was confirmed during the project site surveys[4]. However, White-backed Vulture (SA Status Endangered) was recorded in the assessment area roosting on the high voltage lines running through the site. This was the only SCC recorded during surveys, but based on the criteria in the Protocol, the study area should therefore be classified as **High** sensitivity due to the presence of an SCC. However, the potential project impact on White-backed Vultures can be effectively mitigated, primarily through the use of bird-friendly designs for the internal 11-33kV power lines.

It is therefore recommended that the project is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables and the EMPr (Appendix D) are strictly implemented.

[4] As defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020), namely listed on the:
- IUCN Red List of Threatened Species or
- South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable

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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	:	25 years

Key Experience

Chris van Rooyen has twenty-five 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 Facility (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 Roan 1 & 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, Northern Cape, Screening Report (Atlantic Energy)
67. 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. Veroniva Ceres 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 22 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 Roan 1 & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
40. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
41. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
42. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
43. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
44. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
45. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
46. Pofadder Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
47. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
48. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
49. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment studies and / or GIS analysis:

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

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

Proposed development the Stilfontein Cluster, North West Province, with separate EA applications for:
- **Nine Photovoltaic (PV) facilities and associated infrastructure: Spoonbill, Sunbird, Swallow, Snipe, Shrike, Stilfontein, Sparrow, Starling and Swift;**
- **Three collector substations and associated infrastructure: Voelnessie A, Voelnessie B, Voelnessie C; and**
- **One Main Transmission Substation and associated infrastructure.**

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

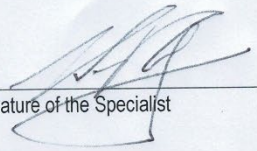
1. SPECIALIST INFORMATION

Specialist Company Name:	Afrimage Photography (Pty) Ltd t/a Chris van Rooyen Consulting			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4		
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, 2122			
Postal address:	P.O. Box 2676, Fourways			
Postal code:	2055			
Telephone:	0824549570			
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Christiaan Stephanus 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

Chris van Rooyen Consulting

Name of Company:

05 May 2022

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Christiaan Stephanus 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 (Pty) Ltd

Name of Company

10 May 2022

Date

7132220-5 SGT
NGUBOMBI

Signature of the Commissioner of Oaths

SOUTH AFRICAN POLICE SERVICE
PLETTENBERG BAY
2022 -05- 10
PLETTENBERGBAAI
SUID-AFRIKAANSE POLISIEDIENS

2022-05-10

Date

APPENDIX C1: SPECIES LIST FOR BROADER AREA

Group	Species name	Taxonomic name	Full protocol	Ad hoc protocol	Global status	Regional status
	Bokmakierie	*Telophorus zeylonus*	37.08	4.55	-	-
	Brubru	*Nilaus afer*	10.11	0.00	-	-
	Mallard	*Anas platyrhynchos*	1.12	0.00	-	-
	Neddicky	*Cisticola fulvicapilla*	66.29	4.55	-	-
	Quailfinch	*Ortygospiza atricollis*	29.21	4.55	-	-
Duck	African Black Duck	*Anas sparsa*	1.12	0.00	-	-
Apalis	Bar-throated Apalis	*Apalis thoracica*	3.37	0.00	-	-
Darter	African Darter	*Anhinga rufa*	4.49	0.00	-	-
Barbet	Acacia Pied Barbet	*Tricholaema leucomelas*	84.27	27.27	-	-
Barbet	Black-collared Barbet	*Lybius torquatus*	22.47	0.00	-	-
Barbet	Crested Barbet	*Trachyphonus vaillantii*	61.80	4.55	-	-
Batis	Chinspot Batis	*Batis molitor*	8.99	0.00	-	-
Batis	Pririt Batis	*Batis pririt*	8.99	0.00	-	-
Bee-eater	European Bee-eater	*Merops apiaster*	30.34	0.00	-	-
Bee-eater	Little Bee-eater	*Merops pusillus*	29.21	9.09	-	-
Bee-eater	White-fronted Bee-eater	*Merops bullockoides*	12.36	0.00	-	-
Bishop	Southern Red Bishop	*Euplectes orix*	85.39	27.27	-	-
Bishop	Yellow-crowned Bishop	*Euplectes afer*	19.10	4.55	-	-
Bulbul	African Red-eyed Bulbul	*Pycnonotus nigricans*	95.51	27.27	-	-
Bunting	Cape Bunting	*Emberiza capensis*	1.12	0.00	-	-
Bunting	Cinnamon-breasted Bunting	*Emberiza tahapisi*	30.34	4.55	-	-
Bunting	Golden-breasted Bunting	*Emberiza flaviventris*	1.12	0.00	-	-
Eagle	African Fish Eagle	*Haliaeetus vocifer*	1.12	0.00	-	-
Canary	Black-throated Canary	*Crithagra atrogularis*	79.78	36.36	-	-
Canary	Yellow Canary	*Crithagra flaviventris*	70.79	13.64	-	-
Canary	Yellow-fronted Canary	*Crithagra mozambica*	3.37	0.00	-	-
Chat	Ant-eating Chat	*Myrmecocichla formicivora*	12.36	0.00	-	-
Chat	Familiar Chat	*Oenanthe familiaris*	17.98	0.00	-	-
Cisticola	Desert Cisticola	*Cisticola aridulus*	48.31	0.00	-	-
Cisticola	Levaillant's Cisticola	*Cisticola tinniens*	26.97	9.09	-	-
Cisticola	Rattling Cisticola	*Cisticola chiniana*	31.46	0.00	-	-
Cisticola	Wing-snapping Cisticola	*Cisticola ayresii*	2.25	0.00	-	-
Cisticola	Zitting Cisticola	*Cisticola juncidis*	32.58	13.64	-	-
Rail	African Rail	*Rallus caerulescens*	1.12	0.00	-	-
Ibis	African Sacred Ibis	*Threskiornis aethiopicus*	42.70	9.09	-	-
Snipe	African Snipe	*Gallinago nigripennis*	6.74	0.00	-	-
Spoonbill	African Spoonbill	*Platalea alba*	6.74	0.00	-	-
Coucal	Burchell's Coucal	*Centropus burchellii*	5.62	0.00	-	-
Swamphen	African Swamphen	*Porphyrio madagascariensis*	2.25	0.00	-	-

Group	Species name	Taxonomic name	Full protocol	Ad hoc protocol	Global status	Regional status
Crombec	Long-billed Crombec	*Sylvietta rufescens*	6.74	0.00	-	-
Falcon	Amur Falcon	*Falco amurensis*	5.62	0.00	-	-
Cuckoo	Diederik Cuckoo	*Chrysococcyx caprius*	34.83	0.00	-	-
Cuckoo	Great Spotted Cuckoo	*Clamator glandarius*	1.12	0.00	-	-
Cuckoo	Jacobin Cuckoo	*Clamator jacobinus*	2.25	0.00	-	-
Heron	Black-headed Heron	*Ardea melanocephala*	16.85	4.55	-	-
Dove	Cape Turtle Dove	*Streptopelia capicola*	58.43	4.55	-	-
Dove	Laughing Dove	*Spilopelia senegalensis*	94.38	40.91	-	-
Dove	Namaqua Dove	*Oena capensis*	48.31	18.18	-	-
Dove	Red-eyed Dove	*Streptopelia semitorquata*	77.53	0.00	-	-
Dove	Rock Dove	*Columba livia*	44.94	4.55	-	-
Crake	Black Crake	*Zapornia flavirostra*	2.25	0.00	-	-
Heron	Black-crowned Night Heron	*Nycticorax nycticorax*	1.12	0.00	-	-
Lapwing	Blacksmith Lapwing	*Vanellus armatus*	83.15	18.18	-	-
Kite	Black-winged Kite	*Elanus caeruleus*	58.43	36.36	-	-
White-eye	Cape White-eye	*Zosterops virens*	7.87	0.00	-	-
Stilt	Black-winged Stilt	*Himantopus himantopus*	6.74	0.00	-	-
Shoveler	Cape Shoveler	*Spatula smithii*	3.37	0.00	-	-
Cisticola	Cloud Cisticola	*Cisticola textrix*	22.47	0.00	-	-
Buzzard	Common Buzzard	*Buteo buteo*	5.62	0.00	-	-
Eremomela	Yellow-bellied Eremomela	*Eremomela icteropygialis*	1.12	0.00	-	-
Goose	Egyptian Goose	*Alopochen aegyptiaca*	24.72	0.00	-	-
Moorhen	Common Moorhen	*Gallinula chloropus*	4.49	0.00	-	-
Finch	Cut-throat Finch	*Amadina fasciata*	3.37	0.00	-	-
Finch	Red-headed Finch	*Amadina erythrocephala*	32.58	27.27	-	-
Firefinch	African Firefinch	*Lagonosticta rubricata*	1.12	0.00	-	-
Firefinch	Jameson's Firefinch	*Lagonosticta rhodopareia*	5.62	0.00	-	-
Firefinch	Red-billed Firefinch	*Lagonosticta senegala*	25.84	4.55	-	-
Fiscal	Southern Fiscal	*Lanius collaris*	89.89	27.27	-	-
Flycatcher	African Paradise Flycatcher	*Terpsiphone viridis*	10.11	0.00	-	-
Flycatcher	Spotted Flycatcher	*Muscicapa striata*	19.10	0.00	-	-
Sandpiper	Curlew Sandpiper	*Calidris ferruginea*	1.12	0.00	NT	LC
Flycatcher	Fiscal Flycatcher	*Melaenornis silens*	69.66	4.55	-	-
Francolin	Orange River Francolin	*Scleroptila gutturalis*	8.99	0.00	-	-
Go-away-bird	Grey Go-away-bird	*Crinifer concolor*	7.87	0.00	-	-
Honey-buzzard	European Honey-buzzard	*Pernis apivorus*	1.12	0.00	-	-
Goose	Domestic Goose	*Anser anser domesticus*	42.70	22.73	-	-
Flycatcher	Fairy Flycatcher	*Stenostira scita*	2.25	0.00	-	-
Goshawk	Gabar Goshawk	*Micronisus gabar*	7.87	0.00	-	-
Kestrel	Greater Kestrel	*Falco rupicoloides*	10.11	4.55	-	-
Ibis	Glossy Ibis	*Plegadis falcinellus*	8.99	0.00	-	-

Group	*Species name*	Taxonomic name	Full protocol	Ad hoc protocol	Global status	Regional status
Grebe	Great Crested Grebe	*Podiceps cristatus*	1.12	0.00	-	-
Ibis	Hadada Ibis	*Bostrychia hagedash*	70.79	4.55	-	-
Egret	Great Egret	*Ardea alba*	3.37	0.00	-	-
Guineafowl	Helmeted Guineafowl	*Numida meleagris*	75.28	4.55	-	-
Heron	Grey Heron	*Ardea cinerea*	8.99	0.00	-	-
Gull	Grey-headed Gull	*Chroicocephalus cirrocephalus*	1.12	0.00	-	-
	Hamerkop	*Scopus umbretta*	1.12	0.00	-	-
Egret	Intermediate Egret	*Ardea intermedia*	3.37	0.00	-	-
Honeyguide	Lesser Honeyguide	*Indicator minor*	1.12	0.00	-	-
Hoopoe	African Hoopoe	*Upupa africana*	47.19	0.00	-	-
Thrush	Karoo Thrush	*Turdus smithi*	26.97	4.55	-	-
Plover	Kittlitz's Plover	*Charadrius pecuarius*	2.25	0.00	-	-
Falcon	Lanner Falcon	*Falco biarmicus*	3.37	0.00	-	VU
Indigobird	Dusky Indigobird	*Vidua funerea*	2.25	0.00	-	-
Indigobird	Purple Indigobird	*Vidua purpurascens*	2.25	0.00	-	-
Indigobird	Village Indigobird	*Vidua chalybeata*	11.24	0.00	-	-
Kestrel	Lesser Kestrel	*Falco naumanni*	6.74	0.00	-	-
Korhaan	Northern Black Korhaan	*Afrotis afraoides*	83.15	22.73	-	-
Kingfisher	Brown-hooded Kingfisher	*Halcyon albiventris*	3.37	0.00	-	-
Egret	Little Egret	*Egretta garzetta*	6.74	0.00	-	-
Grebe	Little Grebe	*Tachybaptus ruficollis*	11.24	0.00	-	-
Stint	Little Stint	*Calidris minuta*	1.12	0.00	-	-
Crow	Pied Crow	*Corvus albus*	93.26	50.00	-	-
Kingfisher	Malachite Kingfisher	*Corythornis cristatus*	2.25	4.55	-	-
Lapwing	African Wattled Lapwing	*Vanellus senegallus*	1.12	0.00	-	-
Lapwing	Crowned Lapwing	*Vanellus coronatus*	95.51	31.82	-	-
Lark	Eastern Clapper Lark	*Mirafra fasciolata*	47.19	0.00	-	-
Lark	Red-capped Lark	*Calandrella cinerea*	5.62	4.55	-	-
Lark	Rufous-naped Lark	*Mirafra africana*	62.92	22.73	-	-
Lark	Sabota Lark	*Calendulauda sabota*	15.73	4.55	-	-
Lark	Spike-heeled Lark	*Chersomanes albofasciata*	5.62	0.00	-	-
Longclaw	Cape Longclaw	*Macronyx capensis*	35.96	0.00	-	-
Martin	Banded Martin	*Riparia cincta*	8.99	0.00	-	-
Martin	Brown-throated Martin	*Riparia paludicola*	6.74	0.00	-	-
Owl	Marsh Owl	*Asio capensis*	2.25	0.00	-	-
Mousebird	Red-faced Mousebird	*Urocolius indicus*	67.42	13.64	-	-
Mousebird	Speckled Mousebird	*Colius striatus*	23.60	0.00	-	-
Mousebird	White-backed Mousebird	*Colius colius*	43.82	4.55	-	-
Myna	Common Myna	*Acridotheres tristis*	86.52	22.73	-	-
Ostrich	Common Ostrich	*Struthio camelus*	8.99	0.00	-	-
Sandpiper	Marsh Sandpiper	*Tringa stagnatilis*	2.25	0.00	-	-

Group	*Species name*	Taxonomic name	Full protocol	Ad hoc protocol	Global status	Regional status
Pigeon	Speckled Pigeon	*Columba guinea*	68.54	0.00	-	-
Pipit	African Pipit	*Anthus cinnamomeus*	56.18	4.55	-	-
Pipit	Buffy Pipit	*Anthus vaalensis*	1.12	0.00	-	-
Pipit	Plain-backed Pipit	*Anthus leucophrys*	3.37	0.00	-	-
Goshawk	Pale Chanting Goshawk	*Melierax canorus*	1.12	0.00	-	-
Avocet	Pied Avocet	*Recurvirostra avosetta*	2.25	0.00	-	-
Kingfisher	Pied Kingfisher	*Ceryle rudis*	5.62	0.00	-	-
Prinia	Black-chested Prinia	*Prinia flavicans*	94.38	27.27	-	-
Prinia	Tawny-flanked Prinia	*Prinia subflava*	6.74	0.00	-	-
Pytilia	Green-winged Pytilia	*Pytilia melba*	20.22	9.09	-	-
Quelea	Red-billed Quelea	*Quelea quelea*	68.54	22.73	-	-
Starling	Pied Starling	*Lamprotornis bicolor*	34.83	4.55	-	-
Robin-Chat	Cape Robin-Chat	*Cossypha caffra*	40.45	4.55	-	-
Teal	Red-billed Teal	*Anas erythrorhyncha*	13.48	0.00	-	-
Coot	Red-knobbed Coot	*Fulica cristata*	11.24	0.00	-	-
Cormorant	Reed Cormorant	*Microcarbo africanus*	17.98	4.55	-	-
Scimitarbill	Common Scimitarbill	*Rhinopomastus cyanomelas*	10.11	0.00	-	-
Scrub Robin	Kalahari Scrub Robin	*Cercotrichas paena*	68.54	4.55	-	-
Scrub Robin	White-browed Scrub Robin	*Cercotrichas leucophrys*	2.25	0.00	-	-
Swallow	South African Cliff Swallow	*Petrochelidon spilodera*	25.84	22.73	-	-
Shelduck	South African Shelduck	*Tadorna cana*	2.25	0.00	-	-
Shrike	Crimson-breasted Shrike	*Laniarius atrococcineus*	12.36	0.00	-	-
Shrike	Lesser Grey Shrike	*Lanius minor*	5.62	4.55	-	-
Shrike	Red-backed Shrike	*Lanius collurio*	28.09	18.18	-	-
Pochard	Southern Pochard	*Netta erythrophthalma*	1.12	0.00	-	-
Sparrow	Cape Sparrow	*Passer melanurus*	85.39	4.55	-	-
Sparrow	House Sparrow	*Passer domesticus*	68.54	9.09	-	-
Sparrow	Southern Grey-headed Sparrow	*Passer diffusus*	70.79	4.55	-	-
Sparrow	Yellow-throated Bush Sparrow	*Gymnoris superciliaris*	3.37	0.00	-	-
Sparrow-Lark	Chestnut-backed Sparrow-Lark	*Eremopterix leucotis*	4.49	4.55	-	-
Sparrow-Weaver	White-browed Sparrow-Weaver	*Plocepasser mahali*	95.51	31.82	-	-
Eagle-Owl	Spotted Eagle-Owl	*Bubo africanus*	1.12	0.00	-	-
Spurfowl	Swainson's Spurfowl	*Pternistis swainsonii*	80.90	9.09	-	-
Goose	Spur-winged Goose	*Plectropterus gambensis*	6.74	0.00	-	-
Starling	Cape Starling	*Lamprotornis nitens*	80.90	22.73	-	-
Starling	Wattled Starling	*Creatophora cinerea*	39.33	18.18	-	-
Heron	Squacco Heron	*Ardeola ralloides*	2.25	0.00	-	-
Plover	Three-banded Plover	*Charadrius tricollaris*	7.87	0.00	-	-
Stonechat	African Stonechat	*Saxicola torquatus*	74.16	13.64	-	-

Group	*Species name*	Taxonomic name	Full protocol	Ad hoc protocol	Global status	Regional status
Egret	Western Cattle Egret	*Bubulcus ibis*	83.15	36.36	-	-
Sunbird	Amethyst Sunbird	*Chalcomitra amethystina*	6.74	0.00	-	-
Sunbird	White-bellied Sunbird	*Cinnyris talatala*	23.60	0.00	-	-
Tern	Whiskered Tern	*Chlidonias hybrida*	1.12	0.00	-	-
Swallow	Barn Swallow	*Hirundo rustica*	35.96	0.00	-	-
Swallow	Greater Striped Swallow	*Cecropis cucullata*	52.81	9.09	-	-
Swallow	Lesser Striped Swallow	*Cecropis abyssinica*	1.12	0.00	-	-
Swallow	Red-breasted Swallow	*Cecropis semirufa*	4.49	0.00	-	-
Swallow	White-throated Swallow	*Hirundo albigularis*	21.35	4.55	-	-
Vulture	White-backed Vulture	*Gyps africanus*	0.00	0.00	CR	CR
Swift	African Palm Swift	*Cypsiurus parvus*	48.31	13.64	-	-
Swift	Little Swift	*Apus affinis*	28.09	9.09	-	-
Swift	White-rumped Swift	*Apus caffer*	25.84	0.00	-	-
Tchagra	Brown-crowned Tchagra	*Tchagra australis*	25.84	4.55	-	-
Cormorant	White-breasted Cormorant	*Phalacrocorax lucidus*	2.25	4.55	-	-
Duck	White-faced Whistling Duck	*Dendrocygna viduata*	7.87	0.00	-	-
Tern	White-winged Tern	*Chlidonias leucopterus*	1.12	0.00	-	-
Thick-knee	Spotted Thick-knee	*Burhinus capensis*	7.87	0.00	-	-
Sandpiper	Wood Sandpiper	*Tringa glareola*	6.74	0.00	-	-
Thrush	Groundscraper Thrush	*Turdus litsitsirupa*	2.25	0.00	-	-
Tit	Ashy Tit	*Melaniparus cinerascens*	6.74	4.55	-	-
Tit	Cape Penduline Tit	*Anthoscopus minutus*	1.12	0.00	-	-
Duck	Yellow-billed Duck	*Anas undulata*	20.22	0.00	-	-
Wagtail	Cape Wagtail	*Motacilla capensis*	43.82	4.55	-	-
Warbler	African Reed Warbler	*Acrocephalus baeticatus*	0.00	4.55	-	-
Warbler	Chestnut-vented Warbler	*Curruca subcoerulea*	79.78	9.09	-	-
Warbler	Great Reed Warbler	*Acrocephalus arundinaceus*	1.12	0.00	-	-
Warbler	Icterine Warbler	*Hippolais icterina*	1.12	0.00	-	-
Warbler	Lesser Swamp Warbler	*Acrocephalus gracilirostris*	3.37	0.00	-	-
Warbler	Willow Warbler	*Phylloscopus trochilus*	4.49	0.00	-	-
Waxbill	Black-faced Waxbill	*Brunhilda erythronotos*	8.99	0.00	-	-
Waxbill	Blue Waxbill	*Uraeginthus angolensis*	78.65	22.73	-	-
Waxbill	Common Waxbill	*Estrilda astrild*	3.37	4.55	-	-
Waxbill	Violet-eared Waxbill	*Granatina granatina*	6.74	4.55	-	-
Weaver	Scaly-feathered Weaver	*Sporopipes squamifrons*	49.44	22.73	-	-
Weaver	Southern Masked Weaver	*Ploceus velatus*	97.75	31.82	-	-
Weaver	Thick-billed Weaver	*Amblyospiza albifrons*	1.12	0.00	-	-
Wheatear	Capped Wheatear	*Oenanthe pileata*	21.35	4.55	-	-
Wheatear	Mountain Wheatear	*Myrmecocichla monticola*	7.87	4.55	-	-
Stork	Yellow-billed Stork	*Mycteria ibis*	1.12	0.00	-	EN

Group	*Species name*	Taxonomic name	Full protocol	Ad hoc protocol	Global status	Regional status
White-eye	Orange River White-eye	*Zosterops pallidus*	55.06	4.55	-	-
Whitethroat	Common Whitethroat	*Curruca communis*	2.25	0.00	-	-
Whydah	Long-tailed Paradise Whydah	*Vidua paradisaea*	26.97	22.73	-	-
Whydah	Pin-tailed Whydah	*Vidua macroura*	52.81	0.00	-	-
Whydah	Shaft-tailed Whydah	*Vidua regia*	16.85	4.55	-	-
Widowbird	Long-tailed Widowbird	*Euplectes progne*	40.45	4.55	-	-
Widowbird	Red-collared Widowbird	*Euplectes ardens*	5.62	0.00	-	-
Widowbird	White-winged Widowbird	*Euplectes albonotatus*	11.24	0.00	-	-
Wood Hoopoe	Green Wood Hoopoe	*Phoeniculus purpureus*	7.87	0.00	-	-
Woodpecker	Cardinal Woodpecker	*Dendropicos fuscescens*	3.37	0.00	-	-
Wryneck	Red-throated Wryneck	*Jynx ruficollis*	1.12	0.00	-	-

APPENDIX C2: SPECIES LIST FOR THE SITE SURVEYS

Priority Species		**Transects**	**Incidental**
Blacksmith Lapwing	*Vanellus armatus*	*	
Cloud Cisticola	*Cisticola textrix*	*	
Fiscal Flycatcher	*Melaenornis silens*	*	
Pied Starling	*Lamprotornis bicolor*	*	*
Red-billed Teal	*Anas erythrorhyncha*		*
Western Cattle Egret	*Bubulcus ibis*	*	
White-faced Whistling Duck	*Dendrocygna viduata*		*
Yellow-billed Duck	*Anas undulata*		*
White-backed Vulture	*Gyps africanus*		*
9		**5**	**5**
Non-Priority Species		**Transects**	**Incidental**
Acacia Pied Barbet	*Tricholaema leucomelas*	*	*
African Pipit	*Anthus cinnamomeus*	*	*
African quail-finch	*Ortygospiza atricollis*		*
African Red-eyed Bulbul	*Pycnonotus nigricans*	*	*
Ant-eating Chat	*Myrmecocichla formicivora*	*	
Banded Martin	*Riparia cincta*	*	
Barn Swallow	*Hirundo rustica*	*	
Black-chested Prinia	*Prinia flavicans*	*	
Black-faced Waxbill	*Estrilda erythronotos*	*	*
Blue Waxbill	*Uraeginthus angolensis*	*	
Bokmakierie	*Telophorus zeylonus*	*	*
Brown-crowned Tchagra	*Tchagra australis*	*	
Brubru	*Nilaus afer*	*	*
Cape glossy starling	*Lamprotornis nitens*	*	
Cape Longclaw	*Macronyx capensis*	*	*
Cape Sparrow	*Passer melanurus*	*	*
Cape turtle dove	*Streptopelia capicola*	*	*
Chestnut-backed Sparrow-Lark	*Eremopterix leucotis*	*	
Chestnut-vented Tit-babbler	*Sylvia subcoerulea*	*	*
Chinspot Batis	*Batis molitor*	*	
Common Ostrich	*Struthio camelus*	*	
Common Waxbill	*Estrilda astrild*		*
Coqui Francolin	*Peliperdix coqui*	*	
Crested Barbet	*Trachyphonus vaillantii*	*	
Crimson-breasted Shrike	*Laniarius atrococcineus*	*	
Crowned Lapwing	*Vanellus coronatus*	*	
Desert Cisticola	*Cisticola aridulus*	*	*
Diederik Cuckoo	*Chrysococcyx caprius*	*	*
Eastern Clapper Lark	*Mirafra fasciolata*	*	

Hadeda ibis	*Bostrychia hagedash*	*	*
Non-Priority Species		**Transects**	**Incidental**
Helmeted Guineafowl	*Numida meleagris*	*	*
House Sparrow	*Passer domesticus*	*	
Kalahari Scrub Robin	*Cercotrichas paena*	*	*
Laughing Dove	*Spilopelia senegalensis*	*	
Lesser Grey Shrike	*Lanius minor*	*	
Little Bee-eater	*Merops pusillus*	*	
Long-billed Crombec	*Sylvietta rufescens*	*	*
Namaqua Dove	*Oena capensis*	*	
Neddicky	*Cisticola fulvicapilla*	*	*
Northern Black Korhaan	*Afrotis afraoides*	*	
Orange River Francolin	*Scleroptila gutturalis*	*	
Orange River White-eye	*Zosterops pallidus*	*	
Pied Crow	*Corvus albus*	*	*
Pin-tailed Whydah	*Vidua macroura*	*	*
Plain-backed Pipit	*Anthus leucophrys*	*	
Rattling Cisticola	*Cisticola chiniana*	*	
Red-backed Shrike	*Lanius collurio*	*	*
Red-eyed Dove	*Streptopelia semitorquata*	*	
Red-faced Mousebird	*Urocolius indicus*	*	
Red-throated Wryneck	*Jynx ruficollis*	*	
Rufous-naped Lark	*Mirafra africana*	*	*
Sabota Lark	*Calendulauda sabota*	*	*
Scaly-feathered finch	*Sporopipes squamifrons*	*	
Southern Fiscal	*Lanius collaris*	*	
Southern Grey-headed Sparrow	*Passer diffusus*	*	*
Southern Masked Weaver	*Ploceus velatus*	*	*
Southern Red Bishop	*Euplectes orix*	*	
Speckled Mousebird	*Colius striatus*		*
Speckled Pigeon	*Columba guinea*	*	
Spike-heeled Lark	*Chersomanes albofasciata*	*	
Spotted Flycatcher	*Muscicapa striata*	*	
Spotted Thick-knee	*Burhinus capensis*	*	
Swainson's Spurfowl	*Pternistis swainsonii*	*	
Violet-eared Waxbill	*Uraeginthus granatinus*	*	
White-backed Mousebird	*Colius colius*	*	*
White-browed Scrub Robin	*Cercotrichas leucophrys*	*	
White-browed Sparrow-Weaver	*Plocepasser mahali*	*	*
Willow Warbler	*Phylloscopus trochilus*	*	*
Yellow Canary	*Crithagra flaviventris*	*	
Yellow-crowned Bishop	*Euplectes afer*		*
Zitting Cisticola	*Cisticola juncidis*	*	*
71	Subtotal	67	32
	Grand total	**72**	**37**

APPENDIX D: IMPACT RATINGS SWALLOW PV

1 Baseline aspects

The following distinct features relevant to avifauna are present in the PV site:

1.1 Natural habitat

- Open Woodland

1.2 Anthropogenic modifications

- Water Points
- High Voltage Overhead Powerlines (along the eastern border of the PV site)

2 Sensitivity map

The PV site contains the following sensitivities:

- Water reservoirs: Sensitive areas are those areas within 100m of these water reservoirs. Water reservoirs are crucially important for priority avifauna, and many non-priority species. It is therefore important to retain or relocate existing waterpoints to ensure at least one waterpoint is retained within the project site.

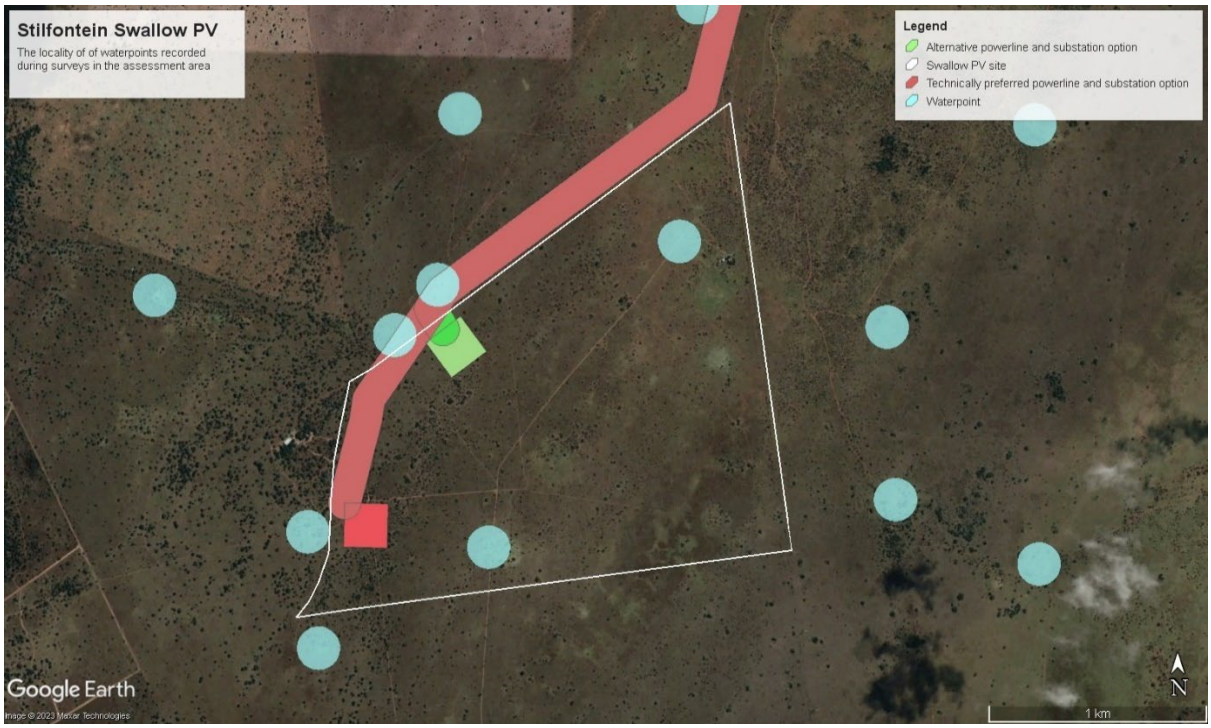


Figure D1: Swallow PV sensitivities map showing waterpoints, powerline options and on-site substation options.

3 Impact rating

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

3.1 Construction Phase

- Displacement of priority avifaunal species due to disturbance associated with the construction of the solar PV plant and associated infrastructure.

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	High 3	Short-term 1	**Low** **5**	Definite	**LOW**	– ve	High
Essential mitigation measures: • Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.								
With mitigation	Local 1	Medium 2	Short-term 1	**Very low** **4**	Definite	**VERY LOW**	– ve	High

- Displacement of priority avifaunal species due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure.

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	High 3	Long-term 3	**High** **7**	Probable	**HIGH**	– ve	Medium
Essential mitigation measures: • Construction activity should be restricted to the immediate footprint of the infrastructure • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. • The mitigation measures proposed by the botanical specialist must be strictly enforced. • Retain or relocate existing waterpoints to ensure at least one waterpoint is retained near the project.								
With mitigation	Local 1	Medium 2	Long-term 3	**Medium** **6**	Probable	**MEDIUM**	– ve	Medium

3.2 Operational Phase

- Mortality of avifaunal priority species due to collisions with the solar panels

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Possible	**VERY LOW**	– ve	Medium
Essential mitigation measures: • None								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Improbable	**VERY LOW**	– ve	Medium

- Mortality of priority avifaunal species due to entrapment in perimeter fences

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local 1	Medium 2	Long-term 3	**Medium** **6**	Possible	**LOW**	– ve	High
Essential mitigation measures: • Single wire fences: Increasing the spacing between at least the top two wires (to a minimum of 30cm) and ensuring they are correctly tensioned will reduce the snaring risk for owls. • If possible, a single perimeter fence should be used.								
With mitigation	Local 1	Low 1	Long-term 3	**Low** **5**	Improbable	**VERY LOW**	– ve	High

- Mortality of priority avifaunal species due to electrocutions on the 33kV medium voltage overhead lines and in the onsite substation

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Regional 2	High 3	Long-term 3	**Very high** **8**	Possible	**HIGH**	– ve	High
Essential mitigation measures: • Medium voltage (33kV) cables must be buried as far as possible • In instances where the medium voltage cables cannot be buried due to technical constraints, a bird-friendly pole design must be used for the overhead lines. The best design to use is the inverted T design with a cross-arm and suspended insulators to provide safe perching space for large birds, especially vultures. The avifaunal specialist must approve the final pole design. • The hardware within the proposed on-site substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List priority species are unlikely to frequent the switching station and substation and be electrocuted.								
With mitigation	Regional 2	Low 1	Long-term 3	**Medium** **6**	Improbable	**LOW**	– ve	High

- Mortality of priority avifaunal species due to collisions with the 33kV medium voltage overhead lines

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Regional 2	High 3	Long-term 3	**Very high** **8**	Possible	**HIGH**	– ve	High
Essential mitigation measures: • All the sections of 33kV overhead lines must be marked with Eskom approved Bird Flight Diverters according to the applicable Eskom standard.								
With mitigation	Regional	Low	Long-term	**Medium**	Improbable	**LOW**	– ve	High

1.2 Decommissioning Phase

- Displacement of priority avifaunal species due to disturbance associated with the decommissioning of the solar PV plant and associated infrastructure.

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without mitigation	Local 1	High 3	Short-term 1	**Low** **5**	Definite	**LOW**	– ve	High
Essential mitigation measures: • Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.								
With mitigation	Local 1	Medium 2	Short-term 1	**Very low** **4**	Definite	**VERY LOW**	– ve	High

A comparison between pre-and post-mitigation significance ratings is shown in below.

Impact	Significance rating prior to mitigation	Significance rating post mitigation	Affected priority species
Displacement of certain priority avifaunal species due to disturbance associated with construction of the PV plant and associated infrastructure.	Low	Very Low	Cape White-eye Cloud Cisticola Fiscal Flycatcher Gabar Goshawk Greater Kestrel Karoo Thrush Lanner Falcon Pied Starling Spotted Eagle-Owl White-backed Vulture
Displacement of certain priority avifaunal species due to habitat destruction associated with construction of the PV plant and associated infrastructure.	High	Medium	Amur Falcon Black-headed Heron Black-winged Kite Cape White-eye Common Buzzard Fiscal Flycatcher Gabar Goshawk Greater Kestrel Karoo Thrush Lanner Falcon Lesser Kestrel South African Cliff Swallow Spotted Eagle-Owl White-backed Vulture

Impact	Significance rating prior to mitigation	Significance rating post mitigation	Affected priority species
Mortality of certain avifaunal priority species due to collisions with solar panels	Very low	Very low	Blacksmith Lapwing Cape White-eye Cloud Cisticola Fiscal Flycatcher Karoo Thrush Pied Starling South African Cliff Swallow
Mortality of certain avifaunal priority species due to entrapment of birds in the perimeter fence	Low	Very Low	Black-headed Heron Spotted Eagle-Owl
Mortality of certain avifaunal priority species due to electrocution on the 33kV MV lines and in the onsite substations	High	Low	Amur Falcon Black-headed Heron Black-winged Kite Common Buzzard Egyptian Goose Gabar Goshawk Greater Kestrel Lanner Falcon Lesser Kestrel Spotted Eagle-Owl White-backed Vulture
Mortality of certain priority avifaunal species due to collisions with the 33kV medium voltage overhead lines	Medium	Low	Black-headed Heron Egyptian Goose Spotted Eagle-Owl Western Cattle Egret White-backed Vulture
Displacement of certain priority avifaunal species due to disturbance associated with decommissioning of the PV plant and associated infrastructure.	Low	Very Low	Cape White-eye Cloud Cisticola Fiscal Flycatcher Gabar Goshawk Greater Kestrel Karoo Thrush Lanner Falcon Pied Starling Spotted Eagle-Owl White-backed Vulture

4 Selection of preferred substation location

Both substation alternatives are located in open woodland habitat and therefore the expected impact of habitat transformation will be identical for both alternatives. There is no preferred alternative from an avifaunal impact perspective, and both alternatives are deemed to be acceptable.

5 Impact statement

No fatal flaws were discovered at the PV site during the investigations. It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables and the EMPr in this Appendix are strictly implemented.

6 Environmental Management Programme

Management Programme for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Entrapment					
Entrapment of birds in the perimeter fences, leading to mortality.	Prevent mortality of avifauna	1 Increase the spacing between at least the top two wires (to a minimum of 30cm) and ensure they are correctly tensioned. 2 Use a single perimeter fence if possible.	1 Design the facility with a bird-friendly perimeter fence. 2 Use a single perimeter fence if possible.	Once-off during the planning phase.	Project Developer
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 sensitive habitat is protected.	Retain or relocate existing waterpoints to ensure at least one waterpoint is retained within the project site.	Retain or relocate existing waterpoints to ensure at least one waterpoint is retained within the project site.	Once-off during the planning phase.	Project Developer
Avifauna: Electrocution on the 11-33kV medium voltage reticulation lines					
Electrocution of priority species on the 11-33kV medium voltage reticulation lines	Prevent the mortality of priority species	1 Bury cables as far as possible. 2 In instances where the medium voltage cables cannot be buried due to technical constraints, a bird-friendly pole design must be used for the overhead lines. The avifaunal specialist must approve the pole design.	Ensure that a bird friendly design is used for the 11-33kV medium voltage lines.	Once-off during the planning phase.	Project Developer
Avifauna: Collision mortality of priority avifauna on the 11-33kV medium voltage reticulation lines					
Collisions of priority species with the 11-33kV medium voltage reticulation lines	Prevent the mortality of priority species	1 Bury cables as far as possible. 2 In instances where the medium voltage cables cannot be buried due to technical constraints, a bird-friendly pole design must be used for the overhead lines. The avifaunal specialist must approve the pole design. 3 All sections of the medium voltage cables that will be	Ensure that all overhead sections of the MV lines are identified for marking with bird flight diverters.	Once-off during the planning phase.	Project Developer

		constructed as overhead lines must be fitted with Bird Flight Diverters according to the applicable Eskom standard at the time.			

Management Programme 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.	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. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 2. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 3. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 4. 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	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO

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. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop habitat rehabilitation plan (HRP). 2. Site inspections to monitor progress of rehabilitation. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year (or as recommended by the botanical specialist) 3. As and when required	1. Project Developer 2. Facility Environmental Manager or ECO, whichever is applicable 3. Project Developer and Facility Operational Manager

Management Programme for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Electrocution in the onsite substations					
Electrocution of priority species on the 11-33kV medium voltage reticulation lines	Prevent the mortality of Red Data species	Bury cables as far as possible and use a bird-friendly pole design where overhead powerlines are required.	Investigate the electrocution incident and implement appropriate mitigation by insulating the hardware	As and when required	Facility Operational Manager

Management Programme 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	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. Ensure that decommissioning personnel are made aware of the impacts relating to off-road driving. 2. Access roads must be demarcated clearly. Undertake site	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO

		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.	inspections to verify. 3. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 4. 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.		

SITE SENSITIVITY VERIFICATION REPORT

STILFONTEIN PV SOLAR PV CLUSTER

North West Province

February 2022

AFRIMAGE Photography (Pty) Ltd t/a:
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email: vanrooyen.chris@gmail.com
Tel: +27 (0)82 4549570 cell

1. Introduction

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). NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020) is applicable in the case of solar PV developments.

The details of the site sensitivity verification are noted below:

Date of Site Visit	03 February 2022
Supervising Specialist Name	Albert Froneman
Professional Registration Number	MSc Conservation Biology (SACNASP Zoological Science Registration number 400177/09)
Specialist Affiliation / Company	Chris van Rooyen Consulting

2. Methodology

The following methods were used to compile the SSV report:

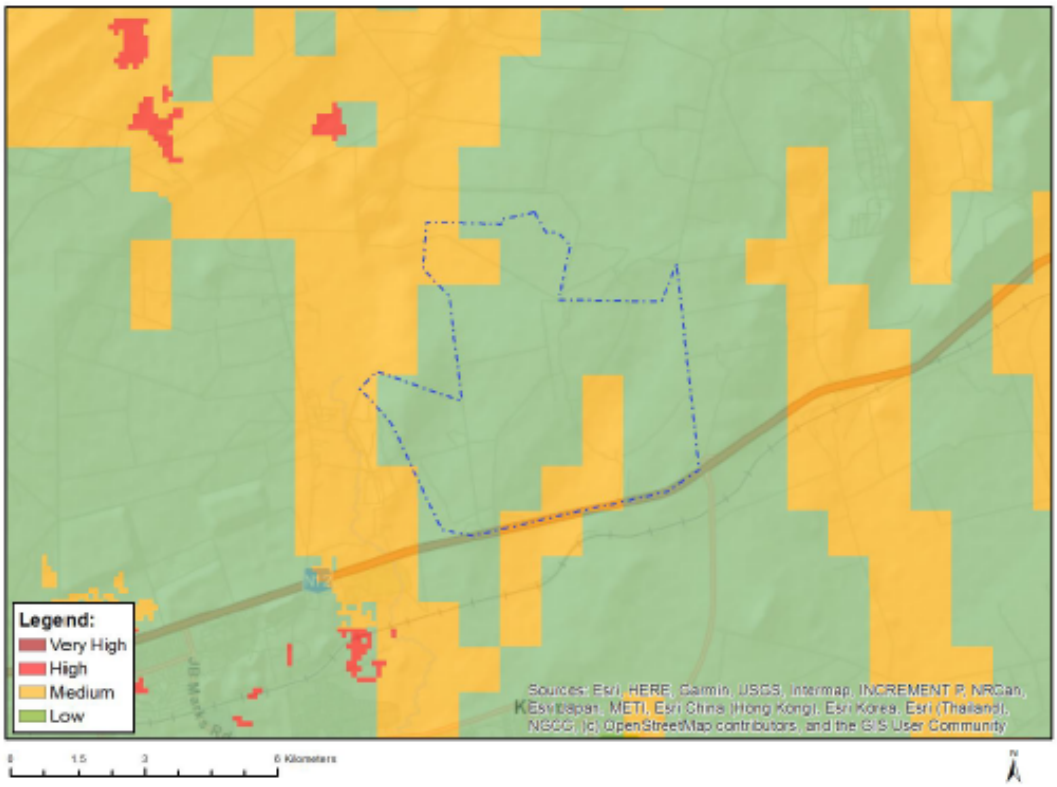
- Bird distribution data of the Southern African Bird Atlas Project 2 (SABAP 2) was obtained from the FitzPatrick Institute of African Ornithology, University of Cape Town (FitzPatrick 2022), to ascertain which species occurs within the broader area i.e., within a block consisting of 2 pentad grid cells within which the proposed project is situated. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. To date, a total of 89 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 22 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al*. 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation types in the development area was obtained from the Southern African Bird Atlas Project 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).

- Satellite imagery (Google Earth ©2021) was used in order to view the broader development area on a landscape level and to help identify sensitive bird habitat.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the proposed development area.
- An on-site survey conducted on 03 February 2022 and 09-10 February 2022. The development area was inspected with a 4x4 vehicle and on foot. All birds were recorded.
- Priority species for solar developments were defined as follows:
  - South African Red Data species.
  - South African endemics and near-endemics.
  - Raptors
  - Waterbirds

3. Results of site assessment

The development area and immediate environment is classified as having a **Low** to **Medium** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme (**Figure 1**). The Medium classification, according to the DFFE Screening Tool, is due to the possible occurrence of a mammal species, the Spotted-necked Otter *Hydrictis maculicollis*, and is not linked to avifauna However, the development area contains suitable habitat for avian species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020, namely species listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable). White-backed Vultures *Gyps africanus* (listed as Critically Endangered) were observed in the development area. Based on the field surveys to date, a classification of **High** sensitivity for avifauna is recommended for the proposed development area.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity
Medium	Mammalia-Hydrictis maculicollis

Figure E1: The National Web-Based Environmental Screening Tool map of the project site, indicating sensitivities for the Terrestrial Animal Species theme. The Medium sensitivity classification is linked to a mammal, Spotted-necked Otter *Hydrictis maculicollis*, and is not linked to avifauna

3.1 Avifauna

Priority avifauna were divided into two categories: solar PV developments priority species and overhead powerline priority species. A total of 211 species could potentially occur within the broader area where the project is located (see Appendix A). Of these, 67 are classified as priority species for solar developments and 48 are classified as powerline priority species.

Of the 67 solar priority species, 19 have a medium to high probability of occurring in the development area. Of the 19 solar priority species with a medium to high probability of occurrence, six (6) were recorded during the site survey.

Of the 48 powerline priority species, 16 have a medium to high probability of occurring in the development site. Of the 16 powerline priority species with a medium to high probability of occurrence, six (6) were recorded during the site survey.

The Critically Endangered White-backed Vulture *Gyps africanus* (a solar and powerline priority species) was observed in the proposed development area.

3.2 Receiving environment

The proposed development area is situated approximately 7 km north-east of the town of Stilfontein, in the North West Province. It is located in the Grassland Biome (**Figure 2**), in the Dry Highveld Grassland Bioregion and is situated in an area that is made up of a mix of open to dense woodland with a strong grassland component. The habitat is quite variable and consists of fallow fields (recovering grassland), natural grassland, shrub- and woodland, some wetland and pans, and some agricultural and industrial activities. Mucina & Rutherford (2006) classifies the area as mix between Vaal Reefs Dolomite Sinkhole Woodland and Carletonville Dolomite Grassland (**Figure 3**).

Figure E2: The Proposed Development Site situated in the Grassland Biome of South Africa – Biomes Map by South African National Biodiversity Institute (SANBI).

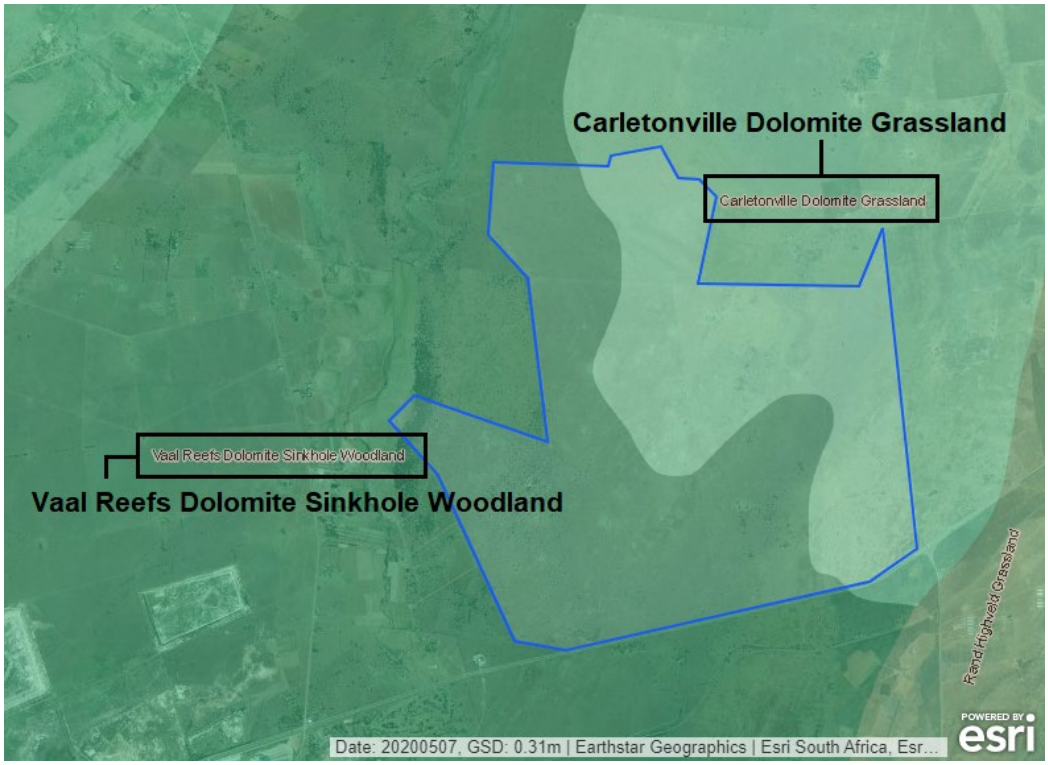


Figure E3: Vegetation Types of the Proposed Development Area - Mucina & Rutherford (2006).

The Stilfontein area has a semi-arid climate (according to the Köppen-Geiger climate classification), with warm to hot summers and cool, dry winters. The average annual precipitation is 482 mm, with most of the rainfall occurring during summer. It should be noted that photos from the field survey were taken in the rainy season (i.e., summer).

The following distinct habitat features are present in the development area:

- Open Woodland
- Water Points
- High Voltage Overhead Powerlines

3.2.1 Open Woodland

The main habitat type of the development area is that of open woodland with a strong grassy component (**Figures 4 & 5**). Woodlands can be important nesting and roosting areas for avian species. The woodland in the development area consists of mainly fine-leaved, semi-deciduous *Vachellia*-dominated habitat.

Figure E4: Open woodland habitat in the proposed development area.

Figure E5: A large *Vachellia* sp. tree with weaver bird nests in the open woodland of the proposed development area.

The following solar priority species with a high or medium likelihood of occurrence could use Open Woodland habitat in the development area:

- Amur Falcon
- Black-headed Heron
- Black-winged Kite
- Cape White-eye
- Cloud Cisticola
- Common Buzzard
- Fiscal Flycatcher
- Gabar Goshawk
- Greater Kestrel
- Karoo Thrush
- Lanner Falcon
- Lesser Kestrel
- Pied Starling
- South African Cliff Swallow
- Spotted Eagle-Owl
- Western Cattle Egret
- White-backed Vulture

The following powerline priority species with a high or medium likelihood of occurrence could use Open Woodland habitat in the development area:

- Amur Falcon
- Black-headed Heron
- Black-winged Kite
- Common Buzzard
- Gabar Goshawk
- Greater Kestrel
- Hadada Ibis
- Helmeted Guineafowl
- Lanner Falcon
- Lesser Kestrel
- Northern Black Korhaan
- Pied Crow
- Spotted Eagle-Owl
- Western Cattle Egret
- White-backed Vulture

3.2.2 Water Points

Surface water is important to avifauna in this semi-arid area. The development area contains several artificial impoundments (cement water troughs and water reservoirs) which provide habitat for waterbirds and many other non-priority species (**Figures 6 & 7**). Raptors will also use these areas to hunt other bird species.

Figure E6: Cement water trough in proposed development area.

Figure E7: Cement water reservoir in the proposed development area.

The following solar priority species with a high or medium likelihood of occurrence could use Water Points in the development area:

- Black-headed Heron
- Blacksmith Lapwing
- Common Buzzard
- Egyptian Goose

- Gabar Goshawk
- Lanner Falcon
- Pied Starling
- Western Cattle Egret
- White-backed Vulture

The following powerline priority species with a high or medium likelihood of occurrence could use Water Points in the development area:

- Black-headed Heron
- Common Buzzard
- Egyptian Goose
- Gabar Goshawk
- Hadada Ibis
- Helmeted Guineafowl
- Lanner Falcon
- Pied Crow
- Western Cattle Egret
- White-backed Vulture

3.2.3 High Voltage Overhead Powerlines

The is a high voltage overhead powerline that crosses the development area (**Figure 8**). Birds, such as raptors and crows, often use powerlines as perches or even nesting sites.

Figure E8: High voltage overhead powerline in the proposed development area.

The following solar priority species with a high or medium likelihood of occurrence could use Overhead Powerlines in the development area:

- Amur Falcon
- Black-headed Heron
- Black-winged Kite
- Common Buzzard
- Egyptian Goose
- Greater Kestrel
- Lanner Falcon
- Lesser Kestrel
- Spotted Eagle-Owl
- White-backed Vulture

The following powerline priority species with a high or medium likelihood of occurrence could use Overhead Powerlines in the development area:

- Amur Falcon
- Black-headed Heron
- Black-winged Kite
- Common Buzzard
- Egyptian Goose
- Greater Kestrel
- Hadada Ibis
- Helmeted Guineafowl
- Lanner Falcon
- Lesser Kestrel
- Pied Crow
- Spotted Eagle-Owl
- White-backed Vulture

4. Environmental sensitivities

The following environmental sensitivities have been identified to date:

- **Surface Water (Water Reservoirs): Very High sensitivity (Solar panel exclusion zone)**

Included are areas within 100m of water points. Surface water and water points are important for priority avifauna and many non-priority species. It is important to leave open space for birds to access and leave the water points unhindered. Surface water is a focal point for some species of raptors which hunt birds that congregate around waterbodies, and they should have enough space for fast aerial pursuit. Vultures are also likely to be attracted to the water reservoirs. It is therefore important to retain or relocate existing waterpoints to ensure at least one waterpoint is retained for each of the proposed PV projects, where applicable.

5. Conclusions

Based on the field survey to date, a classification of **High** sensitivity for avifauna is recommended for the proposed development area.

Appendix E1: Bird species list for the broader area

Common Name	Scientific Name	Recorded during Site Visit
Bokmakierie	*Telophorus zeylonus*	X
Brubru	*Nilaus afer*	
Mallard	*Anas platyrhynchos*	
Neddicky	*Cisticola fulvicapilla*	
Quailfinch	*Ortygospiza atricollis*	
African Black Duck	*Anas sparsa*	
Bar-throated Apalis	*Apalis thoracica*	
African Darter	*Anhinga rufa*	
Acacia Pied Barbet	*Tricholaema leucomelas*	
Black-collared Barbet	*Lybius torquatus*	
Crested Barbet	*Trachyphonus vaillantii*	
Chinspot Batis	*Batis molitor*	
Pririt Batis	*Batis pririt*	X
European Bee-eater	*Merops apiaster*	
Little Bee-eater	*Merops pusillus*	
White-fronted Bee-eater	*Merops bullockoides*	
Southern Red Bishop	*Euplectes orix*	
Yellow-crowned Bishop	*Euplectes afer*	
African Red-eyed Bulbul	*Pycnonotus nigricans*	
Cape Bunting	*Emberiza capensis*	X
Cinnamon-breasted Bunting	*Emberiza tahapisi*	
Golden-breasted Bunting	*Emberiza flaviventris*	
African Fish Eagle	*Haliaeetus vocifer*	
Black-throated Canary	*Crithagra atrogularis*	
Yellow Canary	*Crithagra flaviventris*	X
Yellow-fronted Canary	*Crithagra mozambica*	
Ant-eating Chat	*Myrmecocichla formicivora*	X
Familiar Chat	*Oenanthe familiaris*	X
Desert Cisticola	*Cisticola aridulus*	
Levaillant's Cisticola	*Cisticola tinniens*	
Rattling Cisticola	*Cisticola chiniana*	
Wing-snapping Cisticola	*Cisticola ayresii*	
Zitting Cisticola	*Cisticola juncidis*	
African Rail	*Rallus caerulescens*	
African Sacred Ibis	*Threskiornis aethiopicus*	
African Snipe	*Gallinago nigripennis*	
African Spoonbill	*Platalea alba*	
Burchell's Coucal	*Centropus burchellii*	
African Swamphen	*Porphyrio madagascariensis*	
Long-billed Crombec	*Sylvietta rufescens*	X
Amur Falcon	*Falco amurensis*	

Diederik Cuckoo	*Chrysococcyx caprius*	
Great Spotted Cuckoo	*Clamator glandarius*	
Jacobin Cuckoo	*Clamator jacobinus*	
Black-headed Heron	*Ardea melanocephala*	
Cape Turtle Dove	*Streptopelia capicola*	X
Laughing Dove	*Spilopelia senegalensis*	
Namaqua Dove	*Oena capensis*	
Red-eyed Dove	*Streptopelia semitorquata*	
Rock Dove	*Columba livia*	
Black Crake	*Zapornia flavirostra*	
Black-crowned Night Heron	*Nycticorax nycticorax*	
Blacksmith Lapwing	*Vanellus armatus*	X
Black-winged Kite	*Elanus caeruleus*	
Cape White-eye	*Zosterops virens*	
Black-winged Stilt	*Himantopus himantopus*	
Cape Shoveler	*Spatula smithii*	
Cloud Cisticola	*Cisticola textrix*	X
Common Buzzard	*Buteo buteo*	
Yellow-bellied Eremomela	*Eremomela icteropygialis*	X
Egyptian Goose	*Alopochen aegyptiaca*	
Common Moorhen	*Gallinula chloropus*	
Cut-throat Finch	*Amadina fasciata*	
Red-headed Finch	*Amadina erythrocephala*	
African Firefinch	*Lagonosticta rubricata*	
Jameson's Firefinch	*Lagonosticta rhodopareia*	
Red-billed Firefinch	*Lagonosticta senegala*	
Southern Fiscal	*Lanius collaris*	X
African Paradise Flycatcher	*Terpsiphone viridis*	
Spotted Flycatcher	*Muscicapa striata*	
Curlew Sandpiper	*Calidris ferruginea*	
Fiscal Flycatcher	*Melaenornis silens*	X
Orange River Francolin	*Scleroptila gutturalis*	
Grey Go-away-bird	*Crinifer concolor*	
European Honey-buzzard	*Pernis apivorus*	
Domestic Goose	*Anser anser domesticus*	
Fairy Flycatcher	*Stenostira scita*	
Gabar Goshawk	*Micronisus gabar*	
Greater Kestrel	*Falco rupicoloides*	
Glossy Ibis	*Plegadis falcinellus*	
Great Crested Grebe	*Podiceps cristatus*	
Hadada Ibis	*Bostrychia hagedash*	X
Great Egret	*Ardea alba*	
Helmeted Guineafowl	*Numida meleagris*	X
Grey Heron	*Ardea cinerea*	

Grey-headed Gull	*Chroicocephalus cirrocephalus*	
Hamerkop	*Scopus umbretta*	
Intermediate Egret	*Ardea intermedia*	
Lesser Honeyguide	*Indicator minor*	
African Hoopoe	*Upupa africana*	
Karoo Thrush	*Turdus smithi*	
Kittlitz's Plover	*Charadrius pecuarius*	
Lanner Falcon	*Falco biarmicus*	
Dusky Indigobird	*Vidua funerea*	
Purple Indigobird	*Vidua purpurascens*	
Village Indigobird	*Vidua chalybeata*	
Lesser Kestrel	*Falco naumanni*	
Northern Black Korhaan	*Afrotis afraoides*	X
Brown-hooded Kingfisher	*Halcyon albiventris*	
Little Egret	*Egretta garzetta*	
Little Grebe	*Tachybaptus ruficollis*	
Little Stint	*Calidris minuta*	
Pied Crow	*Corvus albus*	X
Malachite Kingfisher	*Corythornis cristatus*	
African Wattled Lapwing	*Vanellus senegallus*	
Crowned Lapwing	*Vanellus coronatus*	
Eastern Clapper Lark	*Mirafra fasciolata*	
Red-capped Lark	*Calandrella cinerea*	
Rufous-naped Lark	*Mirafra africana*	
Sabota Lark	*Calendulauda sabota*	
Spike-heeled Lark	*Chersomanes albofasciata*	X
Cape Longclaw	*Macronyx capensis*	
Banded Martin	*Riparia cincta*	
Brown-throated Martin	*Riparia paludicola*	
Marsh Owl	*Asio capensis*	
Red-faced Mousebird	*Urocolius indicus*	
Speckled Mousebird	*Colius striatus*	
White-backed Mousebird	*Colius colius*	
Common Myna	*Acridotheres tristis*	
Common Ostrich	*Struthio camelus*	
Marsh Sandpiper	*Tringa stagnatilis*	
Speckled Pigeon	*Columba guinea*	X
African Pipit	*Anthus cinnamomeus*	
Buffy Pipit	*Anthus vaalensis*	
Plain-backed Pipit	*Anthus leucophrys*	
Pale Chanting Goshawk	*Melierax canorus*	
Pied Avocet	*Recurvirostra avosetta*	
Pied Kingfisher	*Ceryle rudis*	
Black-chested Prinia	*Prinia flavicans*	

Tawny-flanked Prinia	*Prinia subflava*	
Green-winged Pytilia	*Pytilia melba*	
Red-billed Quelea	*Quelea quelea*	
Pied Starling	*Lamprotornis bicolor*	X
Cape Robin-Chat	*Cossypha caffra*	
Red-billed Teal	*Anas erythrorhyncha*	
Red-knobbed Coot	*Fulica cristata*	
Reed Cormorant	*Microcarbo africanus*	
Common Scimitarbill	*Rhinopomastus cyanomelas*	
Kalahari Scrub Robin	*Cercotrichas paena*	
White-browed Scrub Robin	*Cercotrichas leucophrys*	
South African Cliff Swallow	*Petrochelidon spilodera*	
South African Shelduck	*Tadorna cana*	
Crimson-breasted Shrike	*Laniarius atrococcineus*	
Lesser Grey Shrike	*Lanius minor*	
Red-backed Shrike	*Lanius collurio*	
Southern Pochard	*Netta erythrophthalma*	
Cape Sparrow	*Passer melanurus*	X
House Sparrow	*Passer domesticus*	
Southern Grey-headed Sparrow	*Passer diffusus*	
Yellow-throated Bush Sparrow	*Gymnoris superciliaris*	
Chestnut-backed Sparrow-Lark	*Eremopterix leucotis*	
White-browed Sparrow-Weaver	*Plocepasser mahali*	
Spotted Eagle-Owl	*Bubo africanus*	
Swainson's Spurfowl	*Pternistis swainsonii*	
Spur-winged Goose	*Plectropterus gambensis*	
Cape Starling	*Lamprotornis nitens*	
Wattled Starling	*Creatophora cinerea*	
Squacco Heron	*Ardeola ralloides*	
Three-banded Plover	*Charadrius tricollaris*	
African Stonechat	*Saxicola torquatus*	
Western Cattle Egret	*Bubulcus ibis*	X
Amethyst Sunbird	*Chalcomitra amethystina*	
White-bellied Sunbird	*Cinnyris talatala*	
Whiskered Tern	*Chlidonias hybrida*	
Barn Swallow	*Hirundo rustica*	X
Greater Striped Swallow	*Cecropis cucullata*	
Lesser Striped Swallow	*Cecropis abyssinica*	
Red-breasted Swallow	*Cecropis semirufa*	
White-throated Swallow	*Hirundo albigularis*	
White-backed Vulture	*Gyps africanus*	X
African Palm Swift	*Cypsiurus parvus*	
Little Swift	*Apus affinis*	
White-rumped Swift	*Apus caffer*	

Brown-crowned Tchagra	*Tchagra australis*	
White-breasted Cormorant	*Phalacrocorax lucidus*	
White-faced Whistling Duck	*Dendrocygna viduata*	X
White-winged Tern	*Chlidonias leucopterus*	
Spotted Thick-knee	*Burhinus capensis*	
Wood Sandpiper	*Tringa glareola*	
Groundscraper Thrush	*Turdus litsitsirupa*	
Ashy Tit	*Melaniparus cinerascens*	
Cape Penduline Tit	*Anthoscopus minutus*	
Yellow-billed Duck	*Anas undulata*	X
Cape Wagtail	*Motacilla capensis*	
African Reed Warbler	*Acrocephalus baeticatus*	
Chestnut-vented Warbler	*Curruca subcoerulea*	
Great Reed Warbler	*Acrocephalus arundinaceus*	
Icterine Warbler	*Hippolais icterina*	
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	
Willow Warbler	*Phylloscopus trochilus*	
Black-faced Waxbill	*Brunhilda erythronotos*	
Blue Waxbill	*Uraeginthus angolensis*	
Common Waxbill	*Estrilda astrild*	
Violet-eared Waxbill	*Granatina granatina*	
Scaly-feathered Weaver	*Sporopipes squamifrons*	
Southern Masked Weaver	*Ploceus velatus*	X
Thick-billed Weaver	*Amblyospiza albifrons*	
Capped Wheatear	*Oenanthe pileata*	
Mountain Wheatear	*Myrmecocichla monticola*	X
Yellow-billed Stork	*Mycteria ibis*	
Orange River White-eye	*Zosterops pallidus*	
Common Whitethroat	*Curruca communis*	
Long-tailed Paradise Whydah	*Vidua paradisaea*	
Pin-tailed Whydah	*Vidua macroura*	
Shaft-tailed Whydah	*Vidua regia*	
Long-tailed Widowbird	*Euplectes progne*	
Red-collared Widowbird	*Euplectes ardens*	
White-winged Widowbird	*Euplectes albonotatus*	
Green Wood Hoopoe	*Phoeniculus purpureus*	
Cardinal Woodpecker	*Dendropicos fuscescens*	
Red-throated Wryneck	*Jynx ruficollis*	

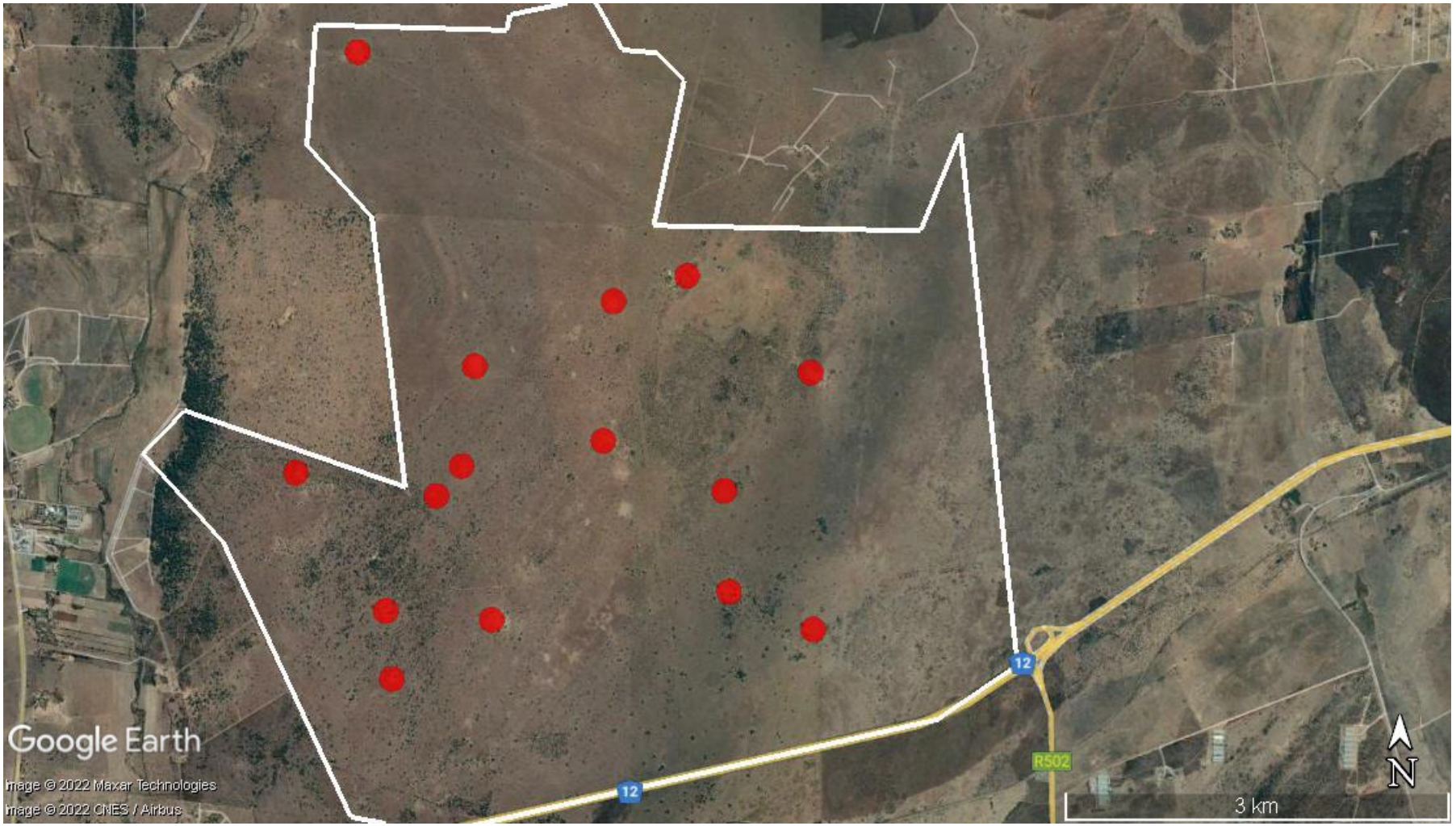


Figure E9: Waterpoints buffered by 100 m (indicated in red) in the assessment area.