

Appendix G.3

AVIFUANA ASSESSMENT



AVIFAUNAL SPECIALIST SCOPING REPORT INPUTS:

Scoping and Environmental Impact Assessment (EIA)

**For the Proposed Development of the Igolide Wind Energy Facility
and associated infrastructure, near Fochville, Gauteng Province**



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Executive Summary

The Project Applicant, Igolide Wind (Pty) Ltd, is proposing to develop the Igolide Wind Energy Facility (WEF) of up to 100 MW, together with its associated infrastructure, and grid connection solution (subject to a separate application for Environmental Authorisation), near Fochville in the Merafong City Local Municipality of Gauteng Province. The proposed WEF and associated infrastructure are subject to a full Scoping and EIA process in terms of the 2014 National Environmental Management Act (NEMA) EIA Regulations, as amended. The project developer aims to bid the Project into the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or a similar procurement programme under the Integrated Resource Plan (IRP).

The proposed Project will be developed within a project area of approximately 680 hectares (ha). Within this project area, the extent of the Project footprint will be approximately 130 hectares (ha), subject to finalization based on technical and environmental requirements.

The proposed WEF will be constructed on the following farm portions:

- Portion 14 of Farm 147 Kraalkop
- Portion 20 of Farm 147 Kraalkop
- Portion RE/22 of Farm 147 Kraalkop
- Portion 8 of Farm 356 Leeuwpoot
- Portion 57 of Farm 356 Leeuwpoot
- Portion 65 of Farm 356 Leeuwpoot
- Portion 66 of Farm 356 Leeuwpoot

This report serves as the Avifaunal Specialist Scoping Report input that was prepared as part of the Scoping and Environmental Impact Assessment (S&EIA) for the proposed Project.

Avifauna

A total of 307 species could potentially occur within the Broader Area where the Project Site is located (see **Appendix E**). Of these, 32 are classified as priority species for wind energy developments. Of these 32 priority species, 11 have a medium to high probability of occurring regularly in the Project Area of Influence (PAOI). Of these 32 priority species, 12 were recorded during the on-site field surveys. Ten (10) of the priority species recorded in the Broader Area are also Species of Conservation Concern (SCC). Two (2) SCC were recorded during the on-site surveys thus far, namely Secretarybird (Globally Endangered and Regionally Vulnerable) and Lanner Falcon (Regionally Vulnerable). There is also confirmed habitat for African Grass Owl (Regionally Vulnerable) within the PAOI.

Identification of Potential Impacts/Risks on Priority Avifauna

The potential impacts identified during the study (i.e., for the Scoping Phase) are listed below.

Construction Phase

- Total or partial displacement due to noise disturbance and habitat transformation associated with the construction of the wind turbines and associated infrastructure.

Operational Phase

- Total or partial displacement due to habitat transformation associated with the presence of the wind turbines and associated infrastructure.
- Collisions with the wind turbines.
- Electrocutions in the onsite substation and on the internal 33kV network.
- Collisions with the internal 33kV network.

Decommissioning Phase

- Total or partial displacement due to disturbance associated with the decommissioning of the wind turbines and associated infrastructure.

Cumulative Impacts

- Total or partial displacement due to disturbance and habitat transformation associated with the construction and decommissioning of the wind energy facilities and associated infrastructure.
- Displacement due to habitat transformation associated with the presence of the wind turbines.
- Collisions with the wind turbines.
- Collisions with the internal 33kV network.
- Electrocutions in the onsite substations and on the internal 33kV network.

Sensitivities identified by the National Web-Based Environmental Screening Tool

The PAOI contains confirmed habitat for Species of Conservation Concern (SCC), namely African Grass Owl and Secretarybird (Globally Endangered and Regionally Vulnerable), 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). During the

on-site surveys, two SCC were also recorded. These SCC were: Lanner Falcon (Regionally Vulnerable), and Secretarybird (Globally Endangered and Regionally Vulnerable).

Based on the Site Sensitivity Verification survey and the integrated pre-construction monitoring conducted at the PAOI, the classification of **High sensitivity** for avifauna is suggested for the Igolide WEF.

Specialist Sensitivity Analysis and Verification

- ***Very high sensitivity: Turbine exclusion zone***

Drainage lines, wetlands, dams: A wind turbine exclusion zone (including the rotor swept area) should be implemented within a 50m buffer around the centre line of the drainage lines, wetlands, dams and in all African Grass Owl breeding habitat¹. Wetlands (including dam margins) are important breeding, roosting and foraging habitat for a variety of Species of Conservation Concern (SCC), most notably for African Grass Owl (Regionally Vulnerable), Greater Flamingo (Regionally Near Threatened), Maccoa Duck (Globally Vulnerable, Regionally Near Threatened), and Yellow-billed Stork (Regionally Endangered). These SCC have all been recorded in the Broader Area through the Southern African Bird Atlas Project (SABAP2). It should also be noted that any road and/or grid line crossings across these features should be restricted to what is unavoidable.

- ***High sensitivity: Limited infrastructure zone***

High sensitivity grassland: Natural grassland. Development in the remaining natural grassland in the PAOI must be limited as far as possible. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads. The grassland is vital breeding, roosting and foraging habitat for a variety of SCC. These include African Grass-owl (Globally Least Concern, Regionally Vulnerable), and Secretarybird (Globally Endangered, Regionally Vulnerable).

Impact Assessment Summary

The overall impact significance is provided in the table below, in terms of pre- and post-mitigation.

¹ The extent of the African Grass Owl breeding habitat will be refined during the EIA phase.

Executive summary table: overall Impact Significance (Pre- and Post-Mitigation)

Phase	Overall Impact Significance (Pre-Mitigation)	Overall Impact Significance (Post Mitigation)
Construction	Moderate	Low
Operational	Moderate	Low
Decommissioning	Moderate	Low

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List of Abbreviations

BLSA	BirdLife South Africa
DFFE	Department of Forestry, Fisheries and Environment
NEMA	National Environmental Management Act 107 of 1998 (as amended)
REDZ	Renewable Energy Development Zone
S&EIA	Scoping and Environmental Impact Assessment
SABAP	South African Bird Atlas Project
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
WEF	Wind Energy Facility

Table 1: Definitions of key terminology in this scoping report

Definitions	
Wind Priority Species	Priority species for wind development were identified from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Ralston-Paton et al., 2017; Retief et al., 2012).
Broader Area	The area encompassed by the four pentads where the Project Site is located.
Project Site	The area covered by the land parcels where the project will be located, totalling approximately 680 hectares. This is where the actual development will be located, i.e., the footprint containing the wind turbines and associated infrastructure.
Project Area of Impact (PAOI)	The primary impact zone of the wind energy facility, encompassing the project footprint and a 1km buffer around it.
Pentad	A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km.

1. Project Description

The Project Applicant, Igolide Wind (Pty) Ltd, is proposing to develop the Igolide Wind Energy Facility (WEF) of up to 100 MW, together with its associated infrastructure and grid connection solution (subject to a separate application for Environmental Authorisation), near Fochville in the Merafong City Local Municipality of Gauteng Province (**Figure 1**). The proposed WEF and associated infrastructure are subject to a full scoping and EIA process in terms of the 2014 NEMA EIA Regulations, as amended. The project developer aims to bid the Project into the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or a similar procurement programme under the Integrated Resource Plan (IRP).

The proposed Project will be developed within a project area of approximately 680 hectares (ha). Within this project area, the extent of the Project footprint will be approximately 130 ha, subject to finalization based on technical and environmental requirements.

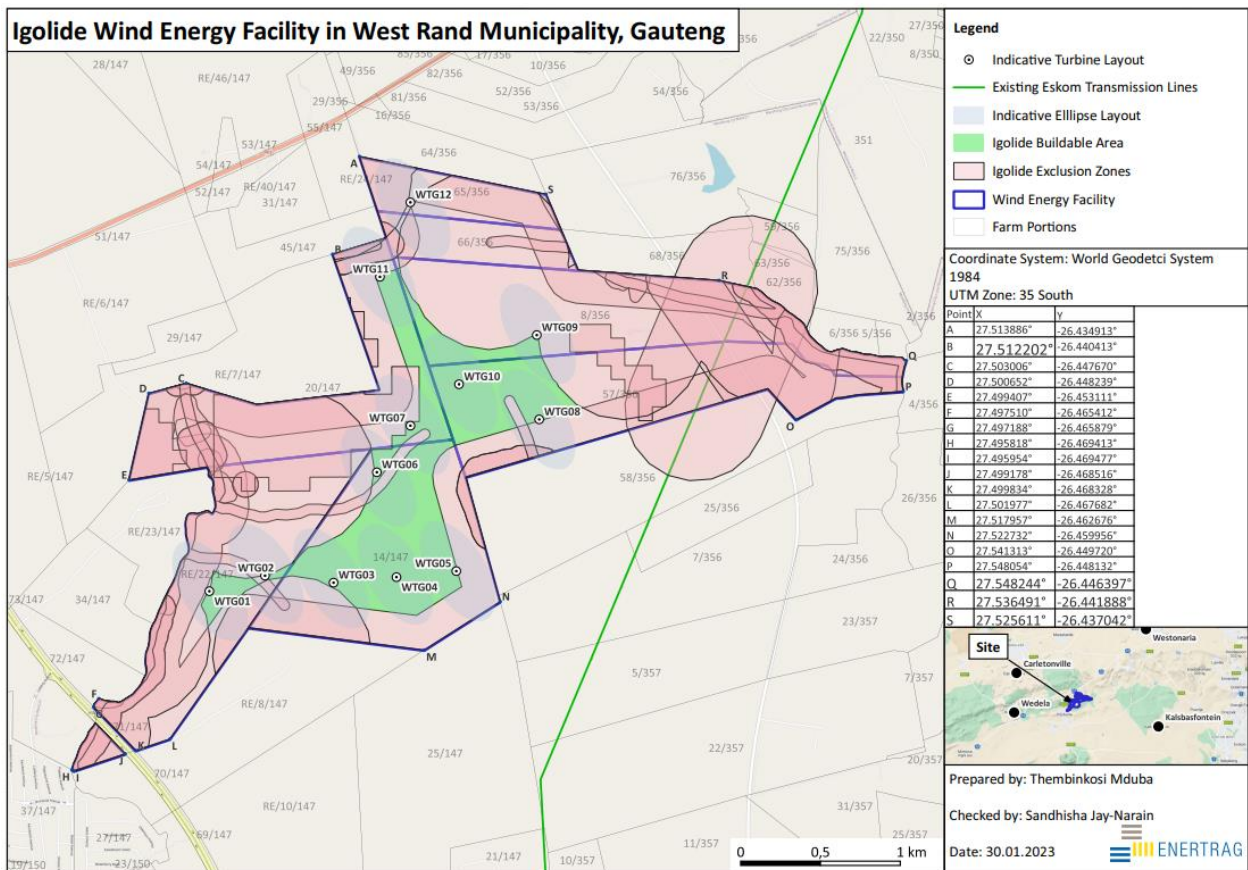


Figure 1: Igolide WEF Locality Map.

The proposed WEF will be constructed on the following farm portions:

- Portion 14 of Farm 147 Kraalkop
- Portion 20 of Farm 147 Kraalkop
- Portion RE/22 of Farm 147 Kraalkop
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This report serves as the Avifaunal Specialist Scoping Report input that was prepared as part of the Scoping and Environmental Impact Assessment (S&EIA) for the proposed Project.

The key project details for the Igolide WEF and associated infrastructure are in Table 2 below:

Table 2: Key project details for the Igolide WEF and associated infrastructure

Facility Name:	Igolide Wind Energy Facility (WEF)
Applicant:	Igolide Wind (Pty) Ltd
Municipalities:	Merafong City Local Municipality in the Gauteng Province of South Africa
Extent:	680ha
Capacity:	Up to 100MW
No. of turbines:	12
Turbine hub height:	Up to 200m
Rotor Diameter:	Up to 200m
Tip Height:	Up to 300m
Foundation:	Approximately 25m diameter x 3m deep – 500 m ³ – 650m ³ concrete. Excavation approximately 2200m ³ , in sandy soils due to access requirements and safe slope stability requirements.
Turbine Hardstand:	Hardstand does not require concrete. Area needed will be approximately 1ha per turbine.
Tower Type	Steel or concrete towers can be utilised at the site. Alternatively, the towers can be of a hybrid nature, comprising concrete towers and top steel sections.
On-site IPP substation and battery energy storage system (BESS):	<p>Total footprint will be up to 4ha in extent. The on-site IPP portion substation will have a footprint of approximately 2ha. The substation will consist of a high voltage substation yard to allow for multiple up to 132kV feeder bays and transformers, control building, telecommunication infrastructure, and other substation components, as required. A 500m buffer around the on-site IPP substation has been identified to ensure flexibility in routing the powerline.</p> <p>The Battery Energy Storage System (BESS) footprint will be up to 2ha. The BESS storage capacity will be up to 80MW/320 megawatt-hour (MWh) with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology; however, the specific technology will only be determined following Engineering, Procurement, and Construction (“EPC”) procurement. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers. The BESS components will arrive on site pre-assembled.</p>

<p>Grid (to form part of a separate application for Environmental Authirisation)</p>	<p>A single or double circuit 132kV overhead powerline and 132kV switching station (adjacent to the on-site IPP substation) to feed the electricity generated by the proposed WEF into Eskom’s Midas Main Transmission Substation via a 11km overhead line.</p> <p>A corridor of up to 250m in width (125m on either side of the centre line) has been identified for the placement of the up to 132kV single or double circuit power line to allow flexibility in the design of the final powerline route, and for the avoidance of sensitive environmental features (where possible).</p>
<p>Cables:</p>	<p>The medium voltage collector system will comprise cables up to and including 33kV that run underground, except where a technical assessment suggests that overhead lines are required, connecting the turbines to the on-site IPP.</p>
<p>Operations and Maintenance (O&M) building footprint:</p>	<p>Operations and Maintenance (“O&M”) building footprint to be located near the on-site substation. Typical areas include: Conservancy tanks with portable toilets. Typical areas include:</p> <ul style="list-style-type: none"> - Operations building – 20m x 10m = 200m² - Workshop and stores area – of ~300m² - Refuse area for temporary waste storage and conservancy tanks to service ablution facility. <p>The total combined area of the buildings will not exceed 5 000m².</p>
<p>Construction camps:</p>	<p>Typical area of 0.5ha. Sewage typically septic tanks and portable toilets.</p>
<p>Temporary laydown or staging areas:</p>	<p>Typical area of 2ha. Could increase to 3ha for concrete towers, should they be required. Will include diesel, cement and chemical storage, as well as a small workshop area.</p>
<p>Access and Internal Roads:</p>	<p>Internal roads will have a width of 8 - 10m, increasing up to 15m for turning circle/bypass areas to allow for larger component transport.</p> <p>Existing access roads will be used to minimise impact. Where required, the width of the existing roads will be widened to ensure the passage of vehicles.</p>
<p>Supporting Infrastructure:</p>	<ul style="list-style-type: none"> - Fencing; - Lighting; - Lightning protection; - Telecommunication infrastructure; - Stormwater channels; - Water pipelines; - Offices; - Operational control centre; - Warehouse; - Ablution facilities; - Gatehouse; - Security building; - Visitor’s centre; and - Substation building.

Site coordinates (centre point)	26°27'2.44"S / 27°30'58.82"E
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2. Legislative Context

2.1. Agreements and Conventions

Table 3: below lists agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna²

Convention Name	Description	Geographic Scope
African-Eurasian Waterbird Agreement (AEWA)	<p>The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (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.</p> <p>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 to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.</p>	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	<p>The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives:</p> <ul style="list-style-type: none"> The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources. 	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	<p>As an environmental treaty under the aegis of the United Nations Environment Programme, 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.</p>	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	<p>CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) 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.</p>	Global

² (BirdLife International (2021) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa.

Convention Name	Description	Geographic Scope
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

2.3. National Legislation

2.3.1. 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
 - (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

2.3.2. The National Environmental Management Act 107 of 1998, as amended (NEMA)

The National Environmental Management Act 107 of 1998, as amended, (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out several guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (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, which may significantly affect the environment, may be performed only after an environmental impact assessment or basic assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed

for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

The Protocol for the specialist assessment and minimum report content requirements for environmental impacts avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020) is applicable in the case of wind developments.

2.3.3. The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations)

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act 10 of 2004 (as amended) (NEMBA) 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. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

2.3.4. Provincial Legislation

The current legislation applicable to the conservation of fauna and flora in Gauteng is the Gauteng Nature Conservation Bill, 2014. The purpose of the Bill is to provide for the sustainable utilization and protection of biodiversity within Gauteng; to provide for the protection of wild and the management of alien animals; protected plants; aquatic biota and aquatic systems; to provide for the protection of invertebrates and the management of alien invertebrates; to provide for professional hunters, hunting outfitters and trainers; to provide for the preservation of caves, cave formations, cave biota and karst systems; to provide for the establishment of zoos; to provide for the powers and establishment of Nature Conservators; to provide for administrative matters and general powers; and to provide for matters connected therewith.

3. Assumptions and Limitations

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

- The SABAP2 data is regarded as an adequate indicator of the avifauna which could occur at the PAOI, and it was further supplemented by data collected during the on-site surveys.
- The focus of the study was on the potential impacts of the proposed WEF on wind energy priority species.

- Priority species for wind developments were identified from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Ralston-Paton et al., 2017; Retief et al., 2012).
- Despite the growing body of peer reviewed literature investigating the collision risks of birds with wind turbines and overhead powerlines in South Africa (Section 6), relevant information for many individual species remains limited. The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: “to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation.”
- The assessment of impacts is based on the baseline environment as it currently exists at the PAOI.
- Conclusions drawn in this study are based on experience of the specialists on the species found on site and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The **Broader Area** is defined as the area encompassed by the four pentads where the project is located (**Figure 2**).
- The **Project Area of Impact** (PAOI) is defined as the area where the primary impacts on avifauna are expected.
- The **Project Site** is the where the actual development will be located, i.e., the footprint containing the wind turbines and associated infrastructure.

4. Description of Methodology

4.1. Scope and objectives of this specialist input to the scoping report

The purpose of the report is to determine the main issues and potential impacts of the proposed project/s on avifauna at a high (scoping) level, through a combination of desktop analysis and field work. The report was prepared to provide inputs to the Draft Scoping Report for the projects as required by the EIA Regulations promulgated in terms of the National Environmental Management Act 107 of 1998, as amended, (NEMA).

4.2. Details of Specialists

This specialist assessment has been undertaken by Chris van Rooyen, Albert Froneman and Megan Loftie-Eaton of Chris van Rooyen Consulting. Chris van Rooyen works in association with, and under the supervision of, Albert Froneman, who is registered with the South African Council for Natural and Scientific Professions

(SACNASP), with Registration Number 400177/09 in the field of Zoological Science. Megan Loftie-Eaton is also registered with SACNASP in the field of Ecology (Registration Number 135161). Curriculum Vitae are included in Appendix A of this specialist input report.

4.3. Terms of Reference

The terms of reference for this scoping level report are as follows:

- Describe the affected environment from an avifaunal perspective
- Discuss gaps in baseline data and other limitations and describe the expected impacts associated with the solar facilities and associated infrastructure
- Identify potential sensitive environments and receptors that may be impacted on by the proposed facility
- Determine the nature and extent of potential impacts
- Identify 'No-Go' areas, where applicable
- Summarise the potential impacts that will be considered further in the EIA Phase through specialist assessments; and
- Recommend mitigation measures to reduce the impact of the expected impacts.

4.4. Approach and Methodology

The following methods were used to compile this report:

- Bird distribution data of the Second Southern African Bird Atlas (SABAP2) was obtained from the University of Cape Town, to ascertain which species occur within the Broader Area of four pentad grid cells within which the proposed Project is located (**Figure 2**). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 9 km. From 2007–present, a total of 551 full protocol lists (i.e., surveys of at least two hours each) have been completed for this area. In addition, 133 *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) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (<http://www.iucnredlist.org/>).
- A classification of the habitat in the PAOI was obtained from the First Atlas of Southern African Birds (SABAP1) (Harrison et al., 1997a, 1997b) and the National Vegetation Map (2018) from the South African National Biodiversity Institute (SANBI) BGIS map viewer (<http://bgisviewer.sanbi.org/>) (Mucina & Rutherford, 2006; SANBI, 2018). The PAOI is the area where the primary impacts on avifauna are expected.

- The Important Bird Areas of Southern Africa (Marnewick et al., 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2023) was used to view the PAOI and Broader Area on a landscape level and to help identify sensitive bird habitat.
- Priority species for wind development were identified from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Ralston-Paton et al., 2017; Retief et al., 2012).
- The 2022 South Africa Protected Areas Database compiled by the Department of Environment, Forestry and Fisheries (DFFE) was used to identify Nationally Protected Areas, National Protected Areas Expansion Strategy (NPAES) near the PAOI (DFFE, 2022).
- The Department of Forestry, Fisheries, and the Environment (DFFE) National Screening Tool was used to determine the assigned avian sensitivity of the PAOI.
- Data collected during previous site visits to the Broader Area was also considered as far as habitat classes and the occurrence of priority species are concerned.
- The following sources were used to determine the investigation protocol that is required for the site:
 - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).
 - BirdLife South Africa’s (BLSA) ‘Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa’ (Jenkins et al., 2015) – hereafter referred to as the ‘Windfarm Guidelines’ – were consulted to determine the level of survey effort that is required.
- The main source of information on the avifaunal diversity and abundance at the PAOI and Broader Area is an integrated pre-construction monitoring programme which was implemented at the Project Site during 2020 – 2022 over a period of four seasons. Four sets of surveys have been conducted.

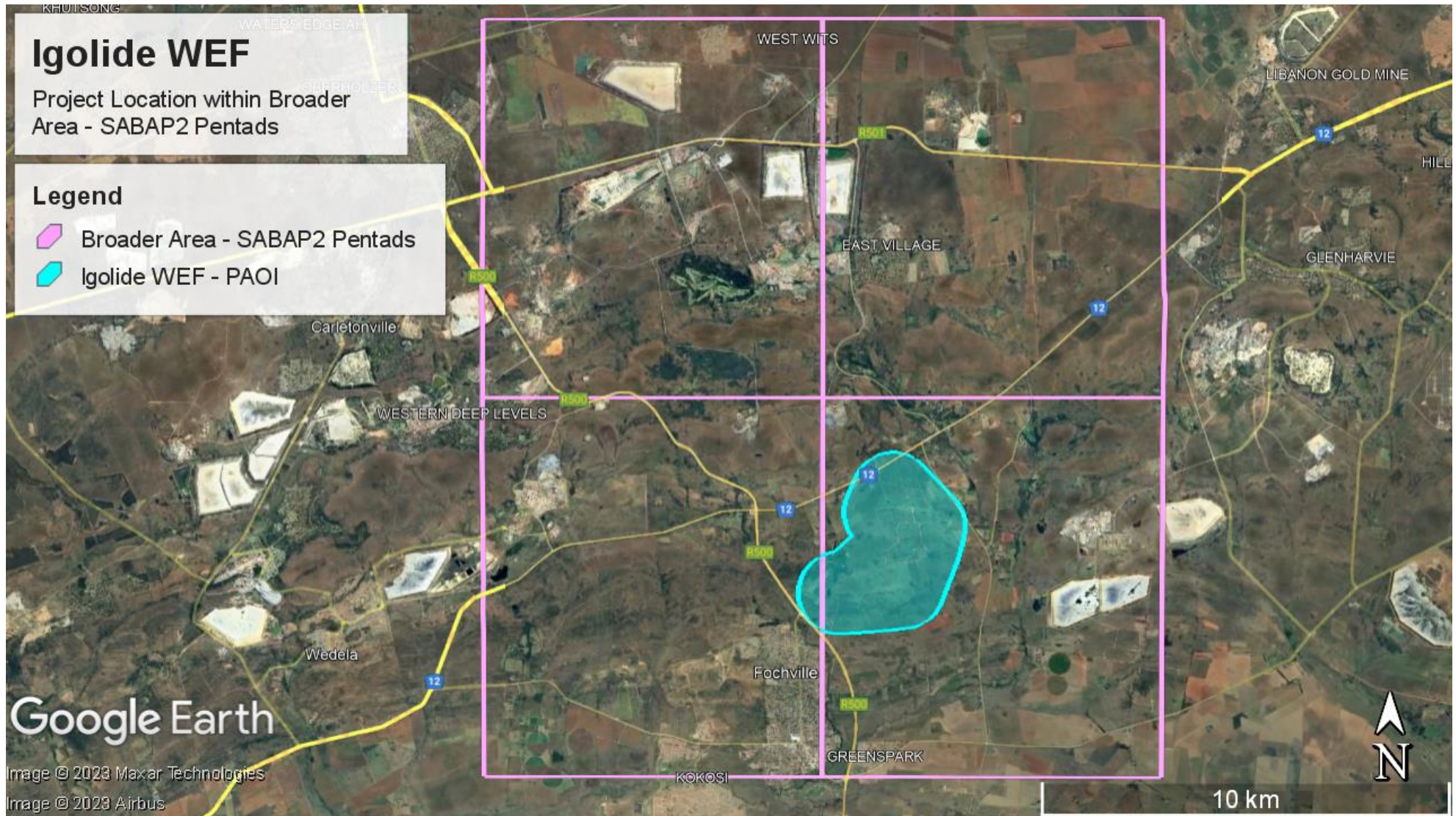


Figure 2: Project location within the Broader Area of four SABAP2 pentads.

4.5. Information Sources

The following data sources were used to compile this report:

Table 4: Data sources employed in the scoping report for the proposed Igolide WEF

Data / Information	Source	Date	Type	Description
South African Protected Areas Database (SAPAD)	Department of Forestry, Fisheries, and the Environment (DFFE)	2022, Q3	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
First Atlas of Southern African Birds (SABAP1)	University of Cape Town	1987-1991	Spatial, reference	SABAP1, which took place from 1987-1991.
Southern African Bird Atlas Project 2 (SABAP2)	University of Cape Town	May 2023	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 (2022.1)	IUCN	2022.1	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.

Data / Information	Source	Date	Type	Description
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 standardized, 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: CSIR/CAS/EMS/ER/2015 /0001/B. Stellenbosch.	2015	SEA	The SEA identifies areas where large scale wind and solar energy facilities can be developed in terms of Strategic Infrastructure Project (SIP) 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).
The National Screening Tool	Department of Forestry, Fisheries and Environment	May 2023	Spatial	The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to apply for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity.
National Protected Areas and National Protected Areas Expansion Strategy (NPAES)	DFFE	2016	Spatial	The goal of NPAES is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the

Data / Information	Source	Date	Type	Description
				most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion.
<p>Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).</p>	<p>NEMA</p>	<p>2020</p>	<p>Legislation</p>	<p>This protocol provides the criteria for the specialist assessment and minimum report content requirements for impacts on avifaunal species associated with the development of onshore wind energy generation facilities, where the electricity output is 20 megawatts or more, which require environmental authorisation. This protocol replaces the requirements of Appendix 6 of the Environmental Impact Assessment Regulations⁸</p>
<p>Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa (2015). Jenkins, A., van Rooyen, C. S., Smallie, J. J., Anderson, M. D., & Smit, A. H.</p>	<p>BirdLife South Africa</p>	<p>2015</p>	<p>Guidelines</p>	<p>These guidelines were developed to ensure that any negative impacts on threatened, or potentially threatened bird species are identified and effectively mitigated using structured, methodical. and scientific methods. The guidelines prescribe the best practice approach to gathering bird data at proposed utility-scale wind energy plants, primarily for the purposes of accurate and effective impact assessment.</p>
<p>Guidelines for the Implementation of the Terrestrial Flora & Terrestrial Fauna Species Protocols for EIAs in South Africa produced by the South African National Biodiversity Institute on behalf of the Department of</p>	<p>South African National Biodiversity Institute (SANBI) (BGIS)</p>	<p>2022.v3.1</p>	<p>Guidelines</p>	<p>The purpose of the Species Environmental Assessment Guideline is to provide background and context to the assessment and minimum reporting criteria contained within the Terrestrial Animal and Plant Species Protocols; as well as to provide guidance on sampling and data collection methodologies for the different</p>

Data / Information	Source	Date	Type	Description
Environment, Forestry and Fisheries (2020)				taxonomic groups that are represented in the respective protocols. This guideline is intended for specialist studies undertaken for activities that have triggered a listed and specified activity in terms of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as identified by the EIA Regulations, 2014 (as amended) and Listing Notices 1-3.
Results of the pre-construction monitoring according to the best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa. Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015.	Chris van Rooyen Consulting	June 2020 - January 2022.		The data set consists of the results of the pre-construction monitoring conducted over four seasons between June 2020 and January 2022. Data was collected by means of transect counts, vantage point watches and focal point inspections

5. Description of Baseline Environment – including Sensitivity Mapping

5.1. Biomes and Vegetation Types

The PAOI is situated along an ecotone between the Savanna and Grassland Biomes but falls mainly within the Grassland Biome (Mucina & Rutherford 2006) (**Figure 3**). According to the 2018 SANBI Vegetation Map the PAOI falls within the Central Bushveld Bioregion (northern half of PAOI) and the Mesic Highveld Grassland

Bioregion (southern half of PAOI) (**Figure 4**). The natural vegetation at the PAOI consists predominantly of Gauteng Shale Mountain Bushveld and Rand Highveld Grassland.

The typical landscape associated with Rand Highveld Grassland is highly variable, containing extensive sloping plains and a series of ridges slightly elevated over undulating surrounding plains. The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrubland on rocky outcrops and steeper slopes. Most of the grasses on the plains belong to the genera *Themeda*, *Eragrostis*, *Heteropogon* and *Elionurus*. A high diversity of herbs, many of which belong to the Asteraceae, is also a typical feature. Rocky hills and ridges consist of open woodlands with *Protea caffra* subsp. *caffra*, *Protea welwitschii*, *Senegalia caffra* and *Celtis africana*, accompanied by a rich suite of shrubs among which the genus *Searsia* is most prominent (Mucina and Rutherford 2006). The Gauteng Shale Mountain Bushveld is represented by woody vegetation and a grass dominated herbaceous layer. Depending on local conditions, trees form semi-open to closed thickets or woodlands, and can range from short deciduous bush cover to a medium-tall +5m tree cover of mostly *Senegalia sp.* and *Vachellia sp.* trees.

Fochville, which is the closest town to the PAOI has a temperate climate. Summers are warm and winters are cold and dry. The mean annual rainfall is around 600–800 mm, most of which falls in the summer months. The mean annual temperature is around 20C° (Schulze, 2009).

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

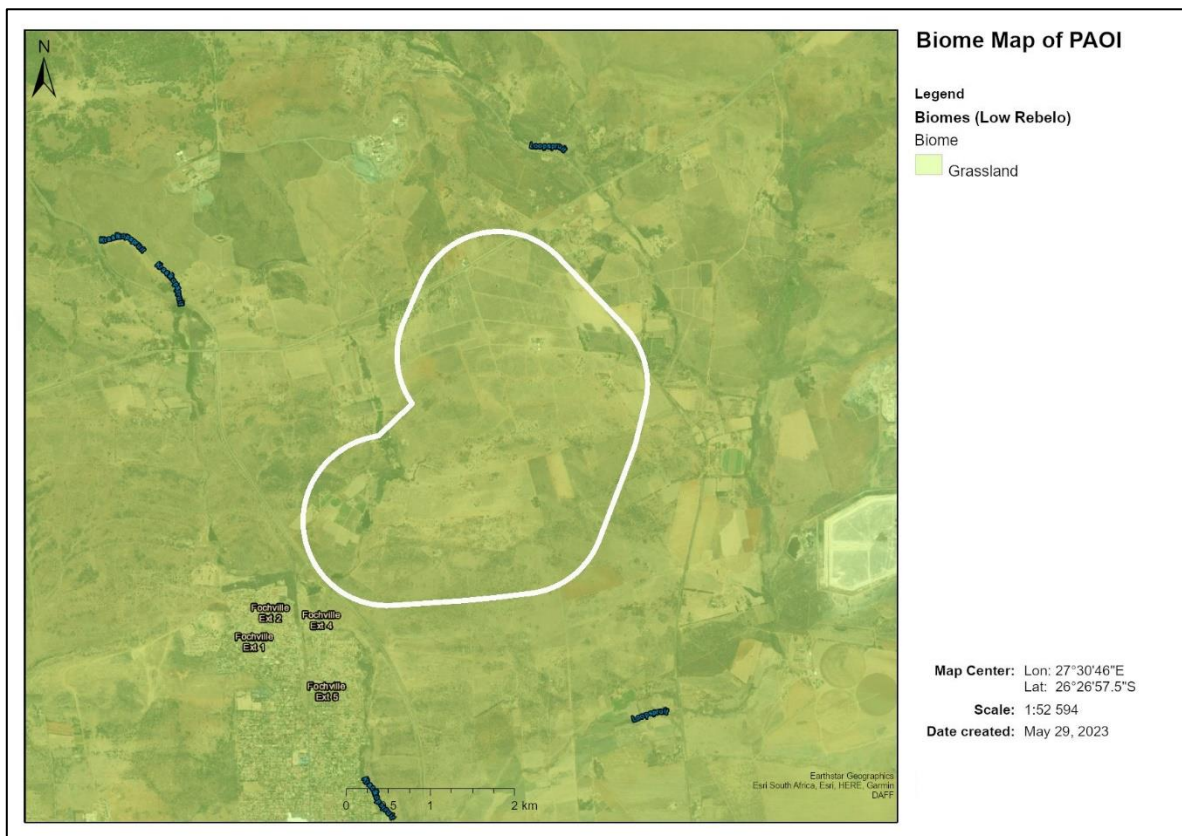


Figure 3: The Igolide WEF PAOI (outlined in white) falls within the Grassland Biome.

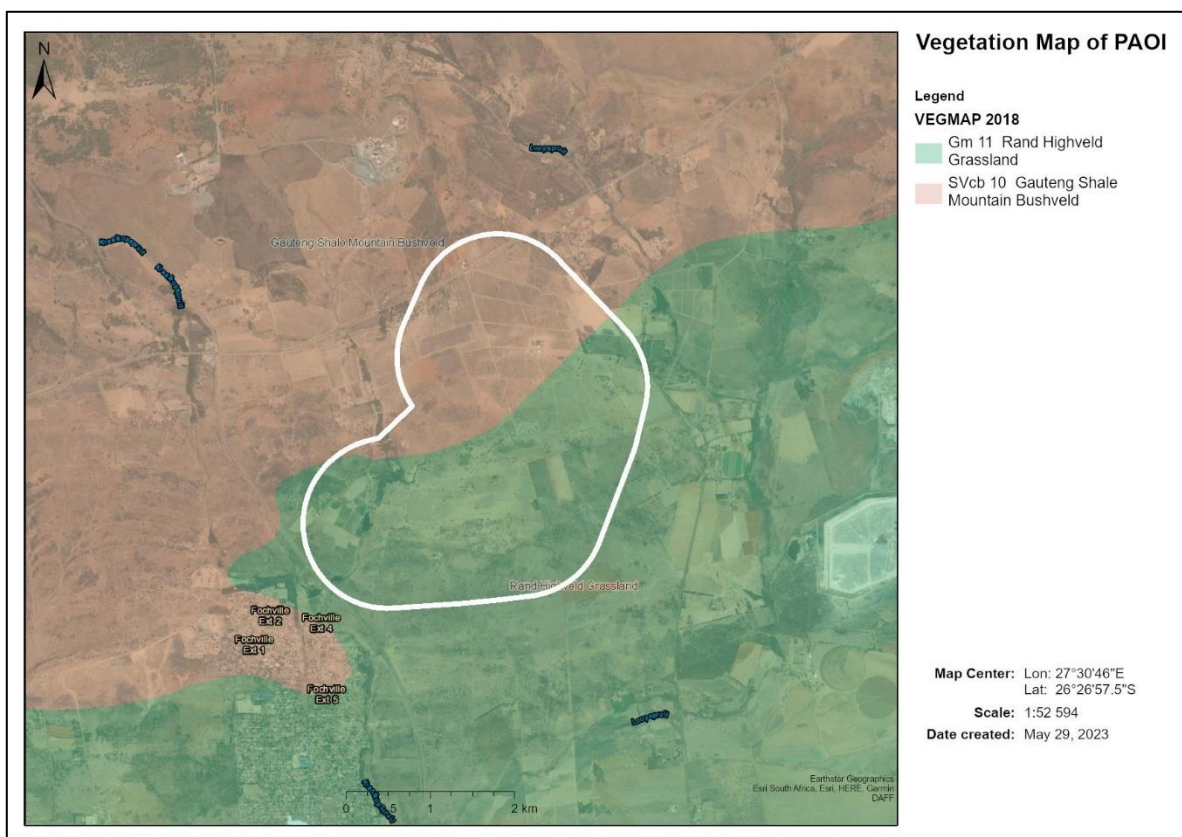


Figure 4: Vegetation Map of the Igolide WEF PAOI (outlined in white).

5.2. Habitat Classes and Land-use within the PAOI

The proposed Igolide WEF PAOI is situated within gently undulating plains of the Gauteng Highveld countryside. The avian habitat features in the Igolide WEF were identified as:

- (i) Natural Grassland
- (ii) Disturbed Grassland (including fallow agriculture fields)
- (iii) Open Woodland
- (iv) Drainage Lines and Wetlands
- (v) Dams
- (vi) Agriculture
- (vii) High Voltage Powerlines

5.2.1. Natural Grassland

This habitat feature is described above under Section 5.1 (Figure 5).



Figure 5: Natural grassland habitat at the PAOI.

Priority species that could utilise this habitat are listed in Table 5.

5.2.2. Disturbed Grassland

The PAOI contains fallow land and old agricultural fields that have converted back to grassland. Vegetative composition is generally characterised by lower cover and is comprised of pioneer grass, forbs, and other herbaceous plant species. Avian use is generally limited to habitat generalist species.



Figure 6: Disturbed grassland habitat at the PAOI.

Priority species that could utilise this habitat are listed in Table 5.

5.2.3. Open Woodland

The PAOI contains Gauteng Shale Mountain Bushveld which is represented by woody vegetation (trees and shrubs) and a grass dominated herbaceous layer (**Figure 7**). Depending on local conditions, trees form semi-open to closed thickets or woodlands, and can range from short deciduous bush cover to a medium-tall *Senegalia sp.* and *Vachellia sp.* trees.



Figure 7: Open woodland habitat within the PAOI.

Priority species that could utilise this habitat are listed in Table 5.

5.2.4. Drainage Lines and Wetlands

Drainage lines and wetlands are important habitats, especially for several priority species. Raptors may also use these areas to hunt other bird species and African Grass Owl could potentially be attracted to some of the wetland areas. There are drainage lines with associated wetlands and farm dams that transect the PAOI. The Broader Area also contains several drainage lines, seeps, and wetlands (**Figure 8**).



Figure 8: Drainage line within the PAOI.

Priority species that could utilise this habitat are listed in Table 5.

5.2.5. Dams

Surface water is important to several avifauna for drinking, bathing and foraging. There are six dams located within the PAOI (**Figure 9**).



Figure 9: Large dam within the PAOI.

Priority species that could utilise this habitat are listed in Table 5.

5.2.6. Agriculture

Agricultural activity present within the PAOI comprises cultivated commercial annuals crops (DEA & DALRRD, 2020), predominately dedicated towards planted pastures (**Figure 10**). Avian species richness in these areas is likely to be low. However, periods of ploughing, seeding, and harvesting are likely to create foraging opportunities for certain avian species.



Figure 10: Agricultural activities, cultivated land, within the PAOI.

Priority species that could utilise this habitat are listed in Table 5.

5.2.7 High Voltage Powerlines

High voltage powerlines are present along the eastern border of the PAOI (**Figure 11**). Birds often use HV powerlines as perching and/or roosting sites, and some birds even construct their nests on HV powerline structures (e.g., Pied Crow).



Figure 11: High voltage overhead powerline within the PAOI.

Priority species that could utilise this habitat are listed in Table 5.

5.3. Protected areas in/around the PAOI

5.3.1. Important Bird Areas (IBAs)

The PAOI does not fall within an Important Bird Area (IBA). The closest IBA, the Suikerbosrand Nature Reserve (SA022), lies 63km east of the Igolide WEF PAOI. It is not expected that the avifauna in the Suikerbosrand Nature Reserve (SA022) will be impacted by the development due to the distance from the PAOI.

5.3.2. National Protected Areas and National Protected Areas Expansion Strategy (NPAES) Focus Areas

The PAOI does not fall within a protected area or an NPAES focus area.

5.3.3. The Renewable Energy Development Zones (REDZ)

The PAOI is not located in a REDZ.

5.4. Avifauna present within the PAOI

A total of 307 species could potentially occur within the Broader Area where the Project Site is located (see **Appendix E**). Of these, 32 are classified as priority species for wind energy developments. Of these 32 priority species, 11 have a medium to very high probability of occurring regularly in the PAOI. Of these 32 priority species, 12 were recorded during the on-site field surveys. Ten (10) of the priority species recorded in the Broader Area are also Species of Conservation Concern (SCC). Two (2) SCC were recorded during the on-site surveys thus far, namely Secretarybird (Globally Endangered and Regionally Vulnerable) and Lanner Falcon (Regionally Vulnerable). There is also confirmed habitat for African Grass Owl (Regionally Vulnerable) within the PAOI.

See **Appendix E** for a list of species potentially occurring within the Broader Area. The possibility of priority species occurring in the PAOI, habitat classes, and potential long-term impacts of the proposed WEF are listed in **Table 5** below.

Table 5: Priority species which could occur at the PAOI, habitat classes within the PAOI, and the potential impacts of the Igolide WEF on avifauna.

Global and Regional (South African) Red List status: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least concern

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded during monitoring	Likelihood of regular occurrence at PAOI	Primary grassland	Secondary grassland	Open woodland	Drainage lines and wetlands	Dams	Agriculture	HV lines	Collision with turbines	Displacement - habitat transformation	Displacement - disturbance (breeding)	Electrocution MV lines	Collision powerlines
		Full protocol	Ad hoc protocol																
African Fish Eagle	<i>Haliaeetus vocifer</i>	1,45	0,75	-	-		M				x	x			x			x	
African Grass Owl	<i>Tyto capensis</i>	0,00	0,75	-	VU		L	x			x				x	x	x	x	x
African Harrier-Hawk	<i>Polyboroides typus</i>	0,73	0,75	-	-		L			x		x			x	x	x	x	
African Hawk-eagle	<i>Aquila spilogaster</i>	0,36	0,00	-	-		L			x		x			x	x		x	
Amur Falcon	<i>Falco amurensis</i>	1,63	2,26	-	-	x	M	x	x				x	x	x	x		x	
Black Harrier	<i>Circus maurus</i>	0,18	0,00	EN	EN		L	x							x	x		x	
Black Kite	<i>Milvus migrans</i>	0,00	0,75	-	-		L			x		x	x		x	x	x	x	
Black Sparrowhawk	<i>Accipiter melanoleucus</i>	1,45	0,00	-	-	x	M			x					x	x	x	x	
Black-chested Snake Eagle	<i>Circaetus pectoralis</i>	0,18	0,00	-	-		L	x	x	x		x	x	x	x	x	x	x	
Black-winged Kite	<i>Elanus caeruleus</i>	47,19	13,53	-	-	x	H	x	x	x			x	x	x	x	x	x	
Black-winged Pratincole	<i>Glareola nordmanni</i>	0,18	0,00	NT	NT		L	x	x		x				x				
Booted Eagle	<i>Hieraaetus pennatus</i>	0,36	0,75	-	-		L	x	x	x		x		x	x	x		x	
Cape Vulture	<i>Gyps coprotheres</i>	0,18	0,00	VU	EN		L	x	x	x		x		x	x	x		x	x
Common Buzzard	<i>Buteo buteo</i>	7,80	2,26	-	-	x	M	x	x	x		x	x	x	x	x		x	
Greater Flamingo	<i>Phoenicopterus roseus</i>	0,00	0,75	-	NT		L					x			x				x
Greater Kestrel	<i>Falco rupicoloides</i>	1,09	0,75	-	-		L	x	x					x	x	x	x	x	
Jackal Buzzard	<i>Buteo rufofuscus</i>	0,54	0,75	-	-		L	x	x	x		x	x	x	x	x	x	x	
Lanner Falcon	<i>Falco biarmicus</i>	0,36	0,75	-	VU	x	M	x	x	x		x	x	x	x	x	x	x	
Lesser Kestrel	<i>Falco naumanni</i>	1,27	0,00	-	-		L	x	x				x	x	x	x		x	
Long-crested Eagle	<i>Lophaetus occipitalis</i>	0,73	0,75	-	-		L	x		x		x		x	x	x	x	x	
Marsh Owl	<i>Asio capensis</i>	1,27	1,50	-	-	x	M	x			x				x	x	x	x	x

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status	Recorded during monitoring	Likelihood of regular occurrence at PAOI	Primary grassland	Secondary grassland	Open woodland	Drainage lines and wetlands	Dams	Agriculture	HV lines	Collision with turbines	Displacement - habitat transformation	Displacement - disturbance (breeding)	Electrocution MV lines	Collision powerlines
		Full protocol	Ad hoc protocol																
Martial Eagle	<i>Polemaetus bellicosus</i>	0,00	0,75	EN	EN		L	x	x	x		x		x	x	x		x	
Melodious Lark	<i>Mirafrja cheniana</i>	0,18	0,75	-	-	x	L	x	x						x	x	x		
Northern Black Korhaan	<i>Afrotis afraoides</i>	54,08	4,51	-	-	x	H	x	x						x	x	x		x
Pale Chanting Goshawk	<i>Melierax canorus</i>	3,81	0,75	-	-	x	M	x	x	x		x		x	x	x	x	x	
Secretarybird	<i>Sagittarius serpentarius</i>	0,18	0,00	EN	VU	x	L	x	x	x		x		x	x	x	x		x
Spotted Eagle-Owl	<i>Bubo africanus</i>	11,98	0,75	-	-	x	H	x	x	x		x	x		x	x	x	x	x
Verreaux's Eagle	<i>Aquila verreauxii</i>	3,09	2,26	-	VU		L	x	x	x		x		x	x	x		x	
Verreaux's Eagle-Owl	<i>Bubo lacteus</i>	0,00	0,75	-	-		L			x		x		x	x	x		x	
Western Osprey	<i>Pandion haliaetus</i>	0,18	0,75	-	-		L					x			x			x	
White Stork	<i>Ciconia ciconia</i>	1,63	1,50	-	-	x	M	x	x				x		x	x			x
Yellow-billed Stork	<i>Mycteria ibis</i>	0,00	0,75	-	EN		L				x	x			x				x

5.5. Identification of Environmental Sensitivities

The PAOI and immediate environment is classified as **Medium sensitivity** for bird species according to the Terrestrial Animal Species Theme (**Figure 11**). The Medium sensitivity classification is linked to the potential occurrence of African Grass Owl *Tyto capensis* (Regionally Vulnerable), White-bellied Bustard *Eupodotis senegalensis* (Regionally Vulnerable), and Caspian Tern *Hydroprogne caspia* (Regionally Vulnerable).

The PAOI contains confirmed habitat for Species of Conservation Concern (SCC), namely African Grass Owl and Secretarybird (Globally Endangered and Regionally Vulnerable), 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). During the on-site surveys, two SCC were also recorded. These SCC were: Lanner Falcon (Regionally Vulnerable), and Secretarybird (Globally Endangered and Regionally Vulnerable).

Based on the Site Sensitivity Verification survey and the integrated pre-construction monitoring conducted at the PAOI, the classification of **High sensitivity** for avifauna is suggested for the Igolide WEF.

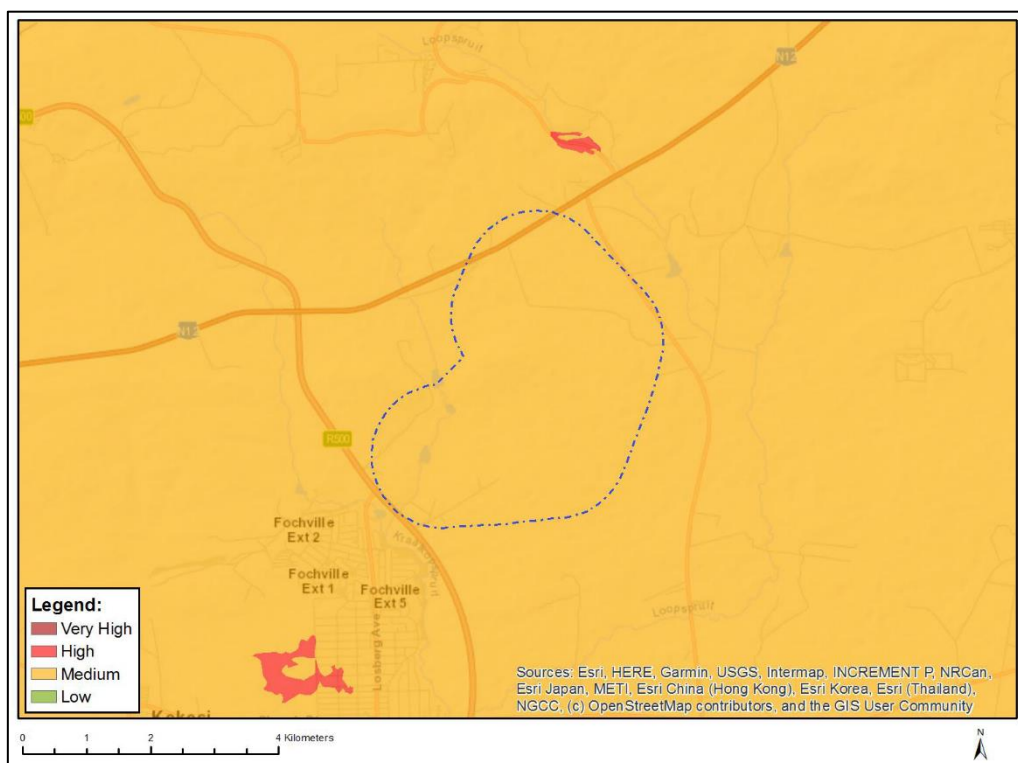


Figure 12: The National Web-Based Environmental Screening Tool map of the PAOI, indicating sensitivities for the Terrestrial Animal Species theme. The Medium sensitivity classification is linked to African Grass Owl *Tyto capensis*, White-bellied Bustard *Eupodotis senegalensis*, and Caspian Tern *Hydroprogne caspia*.

5.6. Specialist Sensitivity Analyses and Verification

5.6.1. Very high sensitivity: Turbine exclusion zone

Drainage lines, wetlands, dams: A wind turbine exclusion zone (including the rotor swept area) should be implemented within a 50m buffer around the centre line of the drainage lines, wetlands, dams and in all African Grass Owl breeding habitat³. Wetlands (including dam margins) are important breeding, roosting and foraging habitat for a variety of Species of Conservation Concern (SCC), most notably for African Grass Owl (Regionally Vulnerable), Greater Flamingo (Regionally Near Threatened), Maccoa Duck (Globally Vulnerable, Regionally Near Threatened), and Yellow-billed Stork (Regionally Endangered). These SCC have all been recorded in the Broader Area through the Southern African Bird Atlas Project (SABAP2). It should also be noted that any road and/or grid line crossings across these features should be restricted to what is unavoidable.

5.6.2. High sensitivity: Limited infrastructure zone

High sensitivity grassland: Natural grassland. Development in the remaining natural grassland in the PAOI must be limited as far as possible. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads. The grassland is potential breeding, roosting and foraging habitat for a variety of SCC. These include African Grass Owl (Globally Least Concern, Regionally Vulnerable), and Secretarybird (Globally Endangered, Regionally Vulnerable).

Figure 13 below is a preliminary sensitivity map, indicating sensitivity areas identified for development.

³ The extent of the African Grass Owl breeding habitat will be refined during the EIA phase.

Igolide WEF

Preliminary Avifaunal Sensitivities map

Legend

- Limited development: Natural grassland
- Turbine exclusion zone: Wetlands
- Wind turbine

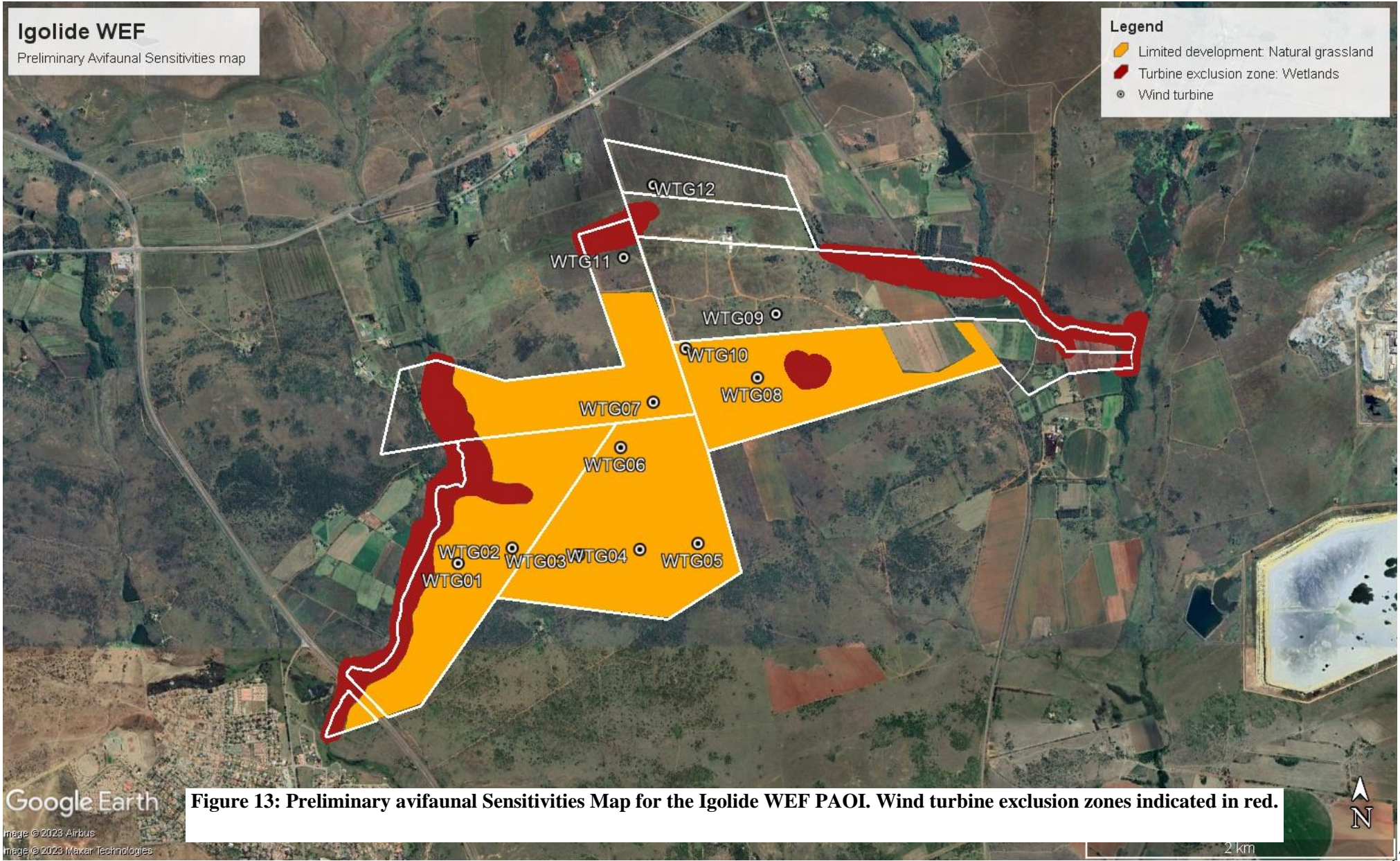


Figure 13: Preliminary avifaunal Sensitivities Map for the Igolide WEF PAOI. Wind turbine exclusion zones indicated in red.

5.7. Sensitivity Analysis Summary Statement

Based on the Site Sensitivity Verification survey and the integrated pre-construction monitoring conducted at the PAOI, the classification of **High sensitivity** for avifauna is suggested for the Igolide WEF.

6. Identification and high-level screening of impacts

6.1. Identification of Potential Impacts/Risks

The potential impacts identified during the study (i.e., Scoping Phase) are listed below.

6.1.1. Construction Phase

- Total or partial displacement due to noise disturbance and habitat transformation associated with the construction of the wind turbines and associated infrastructure.

6.1.2. Operational Phase

- Total or partial displacement due to habitat transformation associated with the presence of the wind turbines and associated infrastructure.
- Collisions with the wind turbines.
- Electrocutions in the onsite substations and internal 33kV network.
- Collisions with the internal 33kV network.

6.1.3. Decommissioning Phase

- Total or displacement due to disturbance associated with the decommissioning of the wind turbines and associated infrastructure.

6.1.4. Cumulative Impacts

- Total or partial displacement due to disturbance and habitat transformation associated with the construction and decommissioning of the WEF and associated infrastructure.
- Total or partial displacement due to habitat transformation associated with the operation of the wind turbines.
- Collisions with the wind turbines.
- Electrocutions and collisions with the onsite substations and internal 33kV network.

6.2. Scoping Level – Impact Assessment

The impacts wind farms have on bird populations are dependent upon a range of factors, including the specification of the development, the local/regional topography, the habitats affected, the abundance, species diversity, and characteristics of birds present.

Potential impacts can be:

- discrete – acting in isolation of other impacts (i.e., priority species response to wind farms are idiosyncratic).
- cumulative – exacerbating other the severity of other impacts (i.e., wind turbines and overhead powerlines may pose similar collision risks to a given bird population).
- counter-active – reducing the severity of other impacts (i.e., bird population reduction through habitat loss lowers collision mortality rates)

The multi-faceted impacts that wind farms have on bird populations necessitates that new developments should be assessed on a case-by-case basis. The major concerns surrounding the impacts of wind farms on birds are detailed below:

- Mortality due to collisions with the wind turbines
- Displacement due to disturbance during construction and operation of the wind farm
- Displacement due to habitat change and loss at the wind farm
- Mortality due to electrocution and collisions with the medium voltage overhead lines

It should be noted that environmental impact assessments are localised to the present-day pre-construction conditions of a given development site. Impacts to the regional landscape are not considered as the extent and nature of future developments (not only wind energy development) are unknown at this stage. It is, however, highly unlikely that the land use will change in the foreseeable future due to climatic limitations.

6.3. Construction phase - displacement due to disturbance associated with the construction of the wind turbines and associated infrastructure.

The scale of permanent habitat loss resulting from the construction of a wind farm and associated infrastructure depends on the size of the project but, in general, it is likely to be small per turbine base. Typically, actual habitat loss amounts to 2–5% of the total development site [Fox et al. (2006) as cited by Drewitt & Langston (2006)], with a further 3-14% of airspace altered by turbines (Marques et al., 2020) (see Section 6.5). The effects of habitat loss could be more widespread where developments interfere with hydrological patterns or flows on wetland or peatland sites (unpublished data). Some changes could also be beneficial. For example, habitat transformation following the development of the Altamont Pass Wind Farm in California led to increased mammal prey availability for some species of raptor, such as higher abundance of Pocket Gophers *Thomomys bottae* burrows around turbine bases), although this may also have increased collision risk [Thelander et al., (2003) as cited by Drewitt & Langston (2006)].

Despite overall habitat loss resulting from wind farm development being limited, the associated infrastructure such as roads and powerlines fragment previously continuous tracts of habitat. Beyond the increased mortality risks to local bird populations posed by such infrastructure, the resulting habitat fragmentation can degrade adjacent habitats, potentially changing the way birds interact within the immediate environment (Fletcher et al., 2018). It remains disputed whether habitat fragmentation is always an environmental detriment (Fahrig et al., 2019), yet the effects of this landscape change have been observed in bird species vulnerable to wind farms. Lane et al. (2001) noted that Great Bustard *Otis tarda* flocks in Spain were significantly larger further from power lines than at control points. Shaw (2013) found that Ludwig's Bustard *Neotis ludwigii* in South Africa generally avoid the immediate proximity of roads within a 500m buffer. Bidwell (2004) found that Blue Cranes in South Africa select nesting sites away from roads.

The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab et al., 2011). It has been shown that fragmentation of natural grassland in Gauteng (in that case by afforestation) has had a detrimental impact on the densities and diversity of grassland species (Allan et al., 1997).

The species that could be most affected by this impact are listed in Table 5. The recommended mitigation measures are detailed in in **Table 7** in Section 6.9 below.

6.4. Operation phase – total or partial displacement of avifauna due to habitat transformation associated with the operation of the wind turbines and associated infrastructure.

This impact relates to the total or partial displacement of avifauna due to habitat transformation associated with the presence of the horizontal-axis wind turbines and associated infrastructure. This impact is rated as negative, with a site-specific spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years).

The displacement of birds away from areas in and around wind farms due to visual intrusion and airspace disturbance can be considered functional habitat loss. These disturbances can be detrimental to migratory bird population if wind farms disrupt migration routes (Marques et al., 2020, 2021), or if they impact the breeding productivity and population sizes of species which avoid the behaviour of wind farms.

The population displacement effect of wind turbines is observable across avian taxonomic orders, and has been better studied in raptors (Accipitriformes and Falconiformes), landfowl (Galliformes), shorebirds (Charadriiformes), waterfowl (Anseriformes), and songbirds (Passeriformes) (Marques et al., 2021).

Three types of avoidance have been described (Cook et al., 2018; May, 2015):

- ‘Macro-avoidance’ or displacement, whereby the density of birds is reduced around a wind farm due to long-term disturbance (Desholm & Kahlert, 2005; Furness et al., 2013; Plonczkier & Simms, 2012; Villegas-Patracca et al., 2014; Walker et al., 2005).
- ‘Meso-avoidance’ or anticipatory/impulsive evasion, whereby flying birds anticipate a perceived threat from a wind farm, or segments thereof and alter their flight paths to avoid these threats (Desholm & Kahlert, 2005; Healy & Braithwaite, 2010; Mueller & Fagan, 2008)
- ‘Micro-avoidance’ or escape, whereby birds in close proximity to the rotor swept zone perform last-second evasion maneuvers, possibly reflexively, away from the rotors (Everaert, 2014; Frid & Dill, 2002; Mueller & Fagan, 2008).

This may differ between species and may have a significant impact on the size of the risk associated with a specific species. It is generally assumed that 95-98% of birds will successfully avoid the turbines (Scottish Natural Heritage, 2010).

Displacement may occur during both the construction and operation phases of wind farms, manifesting from turbines themselves through visual, noise and vibration impacts, as well as vehicle and personnel movements related to site construction and maintenance (Campedelli et al., 2014; May, 2015). Disturbance magnitude varies across sites and species, necessitating assessments on a site-by-site basis (Dohm et al., 2019; Drewitt & Langston, 2006). A recent meta-analysis study found that of long-term studies into avian displacement around

wind farms found that half ~50% of studies reported limited displacement from wind turbines, 46% reported a decrease in some bird populations, and 7.7% found an increased abundance of certain species around wind farms (Marques et al., 2021). Unfortunately, few studies provide comprehensive before- and-after and control-impact (BACI) assessments, limiting current insights.

The operational phase is thought to impose the greatest displacement threat to bird populations, although these impacts may be temporary (Dohm et al., 2019; Pearce-Higgins et al., 2012). Local raptor populations around wind farms may rebound within 7-8 years post-construction (Dohm et al., 2019). Bustards may retain high affinity for historic lek sites (courtship display areas) on wind farms, as has been documented in Great Bustard in Spain (A. Camiña, *personal communications*, 17 November 2012) and Denham's Bustard in South Africa (Ralston-Paton et al., 2017). It should be noted that Great Bustard elsewhere in Europe can be displaced by 0.6km [Wurm & Kollar (2000), as quoted by Raab et al. (2009)] to 1km (Langgemach, 2008) of an operational wind farm, although Denham's Bustard populations do not appear to be displaced by wind farms in South Africa (Ralston-Paton et al., 2017). It should be noted that for raptors and large terrestrial species, site-fidelity and species longevity may mask short- and medium-term impacts that wind farms may have on these species, and that the true impact severity may only manifest in the long-term – such as through diminishing recruitment of new individuals over the course of multiple generations (Ferrer et al., 2012; Santos et al., 2020).

The limited research into shorter-lived bird species around wind farms may offer insights into the long-term response of birds more generally. Leddy et al., (1999) reported increased densities of breeding grassland passerines with increased distance (>80m) from wind turbines, and review study by (Hötker et al. (2006) found that the minimum avoidance distances of eleven breeding passerines species ranged 14–93m of wind turbines. However, Hale et al. (2014) and Stevens et al. (2013) found limited evidence for permanent displacement of grassland passerines in North America. Passerine resilience to wind farms is further observed in the UK in species such as Skylark (despite some evidence of turbine avoidance) (Pearce-Higgins et al., 2012), and Thekla Lark populations in Southern Spain (Farfán et al., 2009). Across nine wind farms in Scotland, seven out of twelve bird species across a range of taxa exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with demonstrable turbine avoidance behaviour in a further two species (Pearce-Higgins et al., 2009). No species preferentially occurred close to the turbines, and breeding pair densities decreased 15-53% within 500m of wind turbines for several species. Follow-up monitoring reported breeding densities of certain species (such as Red Grouse) recovered post-construction, whereas others (such as Snipe and Curlew) did not. Conversely, breeding densities of certain species (such as Skylark and Stonechat) increased on wind farms during construction.

Species response to wind farm construction and operation appears highly idiosyncratic, and although the local populations of many bird species may recover, the long-term impacts of wind farms on bird populations remains to be better elucidated.

The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and very likely probability, which will render the impact significance as high without the implementation of mitigation measures. With the implementation of mitigation measures, the significance of the impact is reduced to moderate.

The species that could be most affected by this impact are listed in Table 5. The recommended mitigation measures are detailed in in Table 7 in Section 6.9 below.

6.5. Operation phase – bird mortality and injury from collisions with the wind turbines⁴

This impact relates to the bird mortalities because of potential collisions with the wind turbines. This impact is rated as negative, with a site-specific spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years).

Wind energy generation has experienced rapid worldwide development over recent decades as its environmental impacts are considered to be relatively lower than those caused by traditional energy sources, with reduced environmental pollution and water consumption (Saidur et al., 2011). However, bird fatalities due to collisions with wind turbines have been consistently identified as a major ecological drawback to wind energy (Drewitt & Langston, 2006).

Collisions with wind turbines kill fewer birds than collisions with other man-made infrastructure, such as power lines, buildings or even traffic (Erickson et al., 2005). Nevertheless, estimates of bird deaths from collisions with wind turbines worldwide range from 0-40 deaths per turbine per year (Sovacool, 2013). Bird mortality rates vary across sites, as do the number of sensitive bird species impacted (Hull et al., 2013; May, 2015). Estimated mortalities are likely lower than true number of bird deaths from wind farm infrastructure, given that studies may fail to account for detection biases caused by scavenging, search efficiency and search radius (Bernardino et al., 2013; Erickson et al., 2005; Huso et al., 2015, 2021). Additionally, even for low mortality rates, collisions with wind turbines may disproportionately affect certain species. For long-lived species with low reproductivity and slow maturation rates (e.g. raptors), even low mortality rates can have a significant impact at the population level (Carrete et al., 2009; De Lucas et al., 2008; Drewitt & Langston,

⁴ This section is based largely on a (2014) review paper by Ana Teresa Marques, Helena Batalha, Sandra Rodrigues, Hugo Costa, Maria João Ramos Pereira, Carlos Fonseca, Miguel Mascarenhas, Joana Bernardino. *Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies*. *Biological Conservation* 179 (2014) 40– 52.

2006). The situation is even more critical for species of conservation concern and those with restricted distributions, which sometimes are most at risk (Osborn et al., 1998).

High bird mortality rates at several wind farms have raised concerns among the industry and scientific community. High profile examples include the Altamont Pass Wind Resource Area (APWRA) in California because of high fatality of Golden eagles *Aquila chrysaetos*, Tarifa in Southern Spain for Griffon vultures *Gyps fulvus*, Smøla in Norway for White-tailed eagles *Haliaeetus albicilla*, and the port of Zeebrugge in Belgium for *Larus* gulls and *Sterna* terns (Barrios & Rodríguez, 2004; Drewitt & Langston, 2006; Huso et al., 2015; Stienen et al., 2008; Thelander et al., 2003). Due to their specific features and location, and characteristics of their bird communities, these wind farms have been responsible for many fatalities that culminated in the deployment of additional measures to minimize or compensate for bird collisions. However, currently, no simple formula can be applied to all sites; in fact, mitigation measures must inevitably be defined according to the characteristics of each wind farm and the diversity of species occurring there (Hull et al., 2013; Marques et al., 2014). An understanding of the factors that explain bird collision risk and how they interact with one another is therefore crucial to proposing and implementing valid mitigation measures. In southern Africa, vultures – followed by larger eagle species – are highlighted as being especially susceptible to collisions with wind turbines (McClure et al., 2021).

The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence and very likely probability, which will render the impact significance as high without the implementation of mitigation measures. The impact will be reduced to low with the implementation of mitigation measures. The severity of impact for this risk will vary according to species- and site-specific factors, as detailed in Sections 6.5.1 and Sections 6.5.2.

The species that could be most affected by this impact are listed in Table 5. The recommended mitigation measures are detailed in in Table 7 in Section 6.9 below.

6.5.1. Species-specific factors

6.5.1.1. Morphological features

Certain morphological traits of birds, especially those related to size, are known to influence collision risk with structures such as power lines and wind turbines. Janss (2000) identified weight, wing length, tail length and total bird length as being collision risk determinant. Wing loading (ratio of body weight to wing area) and aspect ratio (ratio of wing span squared to wing area) are particularly relevant, as they influence flight type and thus collision risk (Bevanger, 1994; De Lucas et al., 2008; Herrera-Alsina et al., 2013; Janss, 2000). Birds with high wing loading, such as the Griffon Vulture *Gyps fulvus*, seem to collide more frequently with wind

turbines at the same sites than birds with lower wing loadings, such as Common Buzzards *Buteo buteo* and Short-toed Eagles *Circaetus gallicus*, and this pattern is not related with their local abundance (Barrios & Rodríguez, 2004; De Lucas et al., 2008). High wing-loading is associated with low flight maneuverability (De Lucas et al., 2008), which determines whether a bird can escape an encountered object fast enough to avoid collision.

Information on the wing loading of the priority species potentially occurring regularly at the Igolide Wind Energy Facility was not available at the time of writing. However, based on general observations, and research on related species, it can be confidently assumed that regularly occurring priority species that could potentially be vulnerable to wind turbine collisions due to morphological features (high wing loading) are korhaans, making them less maneuverable (Keskin et al., 2019).

6.5.1.2. Sensorial perception

Birds are assumed to have excellent visual acuity, but this assumption is contradicted by the large numbers of birds killed by collisions with man-made structures (Drewitt & Langston, 2006; Erickson et al., 2005). A common explanation is that birds collide more often with these structures in conditions of low visibility, but recent studies have shown that this is not always the case (Guichard, 2017; Krijgsveld et al., 2009; May et al., 2015; Mitkus et al., 2018). The visual acuity of birds seems to be slightly superior to that of other vertebrates (Martin et al., 2010; McIsaac, 2001; Mitkus et al., 2018). Unlike humans, who have a broad horizontal binocular field of 120°, some birds have two high acuity areas that overlap in a very narrow horizontal binocular field (Martin et al., 2010, 2012; Mitkus et al., 2018). Relatively small frontal binocular fields have been described for several species that are particularly vulnerable to power line collisions, such as vultures (*Gyps* spp.) cranes and bustards (Martin, 2011; Martin et al., 2010, 2012; Martin & Katzir, 1999). Furthermore, for some species, their high resolution vision areas are often found in the lateral fields of view, rather than frontally (Martin, 2011; Martin et al., 2010, 2012; O'Rourke et al., 2010; Päckert et al., 2012). Finally, some birds tend to look downwards when in flight, searching for conspecifics or food, which puts the direction of flight completely inside the blind zone of some species (Martin et al., 2010).

Some of the regularly occurring priority species at the Project Site have high resolution vision areas found in the lateral fields of view, rather than frontally, e.g., the korhaans and storks. The exceptions to this are the priority raptors which all have wider binocular fields, although as pointed out by Martin et al. (2010), this does not necessarily result in these species being able to avoid obstacles better.

6.5.1.3. Phenology

Turbine collision mortalities within raptors may be higher for resident than for migratory birds of the same species/taxon group. This disparity is possible due to resident birds frequenting areas occupied by wind farms more readily than migratory birds, which typically cross these wind farms *en route* to destinations further afield (Krijgsveld et al., 2009). However, factors like bird behaviour remain relevant. Katzner et al. (2012) showed that Golden Eagles performing local movements fly at lower altitudes, putting them at a greater risk of collision than migratory eagles. Resident eagles flew more frequently over cliffs and steep slopes, using low altitude slope updrafts, while migratory eagles flew more frequently over flat areas and gentle slopes where thermals are generated, enabling the birds to use them to gain lift and fly at higher altitudes.

South Africa is at the end of the migration path for summer migrants; therefore, the phenomenon of migratory flyways where birds are concentrated in large numbers for a limited period of time (Martín et al., 2018), such as the African Rift Valley or Mediterranean Red Sea flyways, is not a feature of the landscape. The migratory priority species which could occur regularly at the PAOI with some regularity (e.g., Amur Falcon, Common Buzzard, White Stork) will behave much the same as the resident birds once they arrive in the area.

6.5.1.4. Bird behaviour

Flight type seems to play an important role in collision risk, especially when associated with hunting and foraging strategies. Kiting flight (hanging in the wind with almost motionless wings), which is used in strong winds and occurs in rotor swept zones, has been highlighted as a factor explaining the high collision rate of Red-tailed Hawks *Buteo jamaicensis* at APWRA, California (Hoover & Morrison, 2005), and could also be a factor in contributing to the high collision rate for Jackal Buzzards in South Africa (Ralston-Patton & Camagu, 2019). The hovering behaviour exhibited by Common Kestrels *Falco tinnunculus* when hunting may also explain the fatality levels of this species at wind farms in the Strait of Gibraltar (Barrios & Rodríguez, 2004). This may also explain the high mortality rate of Rock Kestrels *Falco rupicolus* at wind farms in South Africa (Ralston-Patton & Camagu, 2019). Kiting and hovering are associated with strong winds, which often produce unpredictable gusts that may suddenly change a bird's position (Hoover & Morrison, 2005). Additionally, while birds are hunting and focused on prey, they might lose track of wind turbine positions (Krijgsveld et al., 2009; Smallwood et al., 2009). In the case of raptors, aggressive interactions may play an important role in turbine fatalities, in that birds involved in these interactions are momentarily distracted, putting them at risk. At least one eye-witness account of a Martial Eagle getting killed by a turbine in South Africa in this fashion is on record (Simmons & Martins, 2016).

Social behaviour may also result in a greater collision risk with wind turbines due to a decreased awareness of the surroundings. Several authors have reported that flocking behaviour increases collision risk with power lines as opposed to solitary flights (Carrete et al., 2012; Janss, 2000), and territoriality and courtship displays

may override aversion to wind turbines (Walker et al., 2005). However, caution must be exercised when comparing the particularities of wind farms with power lines, as some species appear to be vulnerable to collisions with power lines but not with wind turbines, e.g. indications are that bustards, which are highly vulnerable to power line collisions, are not prone to wind turbine collisions – a Spanish database of over 7000 recorded turbine collisions contains no Great Bustards *Otis tarda* (A. Camiña, personal communications, 12 April 2012). Similarly, in South Africa, very few bustard collisions with wind turbines have been reported to date, all Ludwig's Bustards (Ralston-Patton & Camagu, 2019). No Denham's Bustards *Neotis denhami* turbine fatalities have been reported to date, despite the species occurring at several wind farm sites.

Relative to this wind farm, flocking behavior (Amur Falcon) and display activity (Northern Black Korhaan) could place these species at risk of turbine collisions.

6.5.1.5. Avoidance behaviour

See Section 6.4. for further details on avoidance behaviour.

It is anticipated that most birds at the PAOI will avoid the wind turbines, as is generally the case at all wind farms (Scottish Natural Heritage, 2010). Exceptions already mentioned are raptors that engage in hunting behaviour which may serve to distract them and place them at risk of collision, birds engaged in display behaviour or inter- and intraspecific aggressive interaction. It is unlikely that the entire regional/local population of each priority species present around the proposed WEF will engage in complete meso- and macro-avoidance strategies of the wind energy infrastructure.

6.5.1.6. Bird abundance

Some authors suggest that fatality rates are related to bird abundance, density or site utilization rates (Carrete et al., 2012; Kitano & Shiraki, 2013; Smallwood & Karas, 2009), while others highlight as birds utilize territories in non-random ways, and so mortality rates do not depend on bird abundance alone (Ferrer et al., 2012; Hull et al., 2013). Instead, fatality rates depend on other factors such as discriminatory use of specific areas within a wind farm (De Lucas et al., 2008). For example, at Smøla, Norway, White-tailed Eagle flight activity is correlated with collision fatalities (Dahl et al., 2013). In the APWRA, California, Golden Eagles, Red-tailed Hawks and American Kestrels *Falco sparverius* have higher collision fatality rates than Turkey Vultures *Cathartes aura* and Common Raven *Corvus corax*, even though the latter are more abundant in the area (Smallwood et al., 2009), indicating that fatalities are more influenced by each species' flight behaviour and turbine perception. Also, in southern Spain, bird fatality was higher in the winter, even though bird abundance was higher during the pre-breeding season (De Lucas et al., 2008). Should there be good rainfall at the site, flocks of Amur Falcon could be expected at the site, which may heighten the risk of collisions.

6.5.2. Site-specific Factors

6.5.2.1. Landscape features

Susceptibility to collision can also heavily depend on landscape features at a wind farm site, particularly for soaring birds that predominantly rely on wind updrafts to fly. Some landforms such as ridges, steep slopes and valleys may be more frequently used by some birds, for example for hunting or during migration (Barrios & Rodríguez, 2004; Drewitt & Langston, 2008; Healy & Braithwaite, 2010; Katzner et al., 2012; Thelander et al., 2003). In South Africa, Verreaux's Eagle *Aquila verreauxii* is expected to incur higher fatality rates from at higher elevations and along steeper slopes (Murgatroyd et al., 2021). In Lesotho, Bearded Vultures *Gypaetus barbatus* preferentially forage upper mountain slopes and high ridges which are favourable sites for wind turbine construction (Rushworth & Krüger, 2014).

In APWRA, California, Red-tailed Hawk fatalities occur more frequently than expected by chance at wind turbines located on ridge tops and swales, whereas Golden Eagle fatalities are higher at wind turbines located on slopes (Thelander et al., 2003). Other birds may follow other landscape features, such as peninsulas and shorelines, during dispersal and migration periods. Kitano & Shiraki (2013) found that the collision rate of White-tailed Eagles along a coastal cliff was extremely high, suggesting an effect of these landscape features on fatality rates.

Landscape features are unlikely to play a major role at the Igolide WEF site as the proposed development is located on a flat area.

6.5.2.2. Flight paths

The foraging behaviour of breeding, or otherwise territorial, raptors is often constrained to the vicinity nearest to the nest/home range (Watson et al., 2018). For example, in Scotland 98% of Golden Eagle *Aquila chrysaetos* movements were registered at ranges less than 6 km from the nest, and the core areas were located within a 2-3 km radius (McGrady et al., 2002). These results, combined with the terrain features selected by Golden Eagles to forage such as areas close to ridges, can be used to predict the areas used by the species to forage (McLeod et al., 2002), and therefore provide a sensitivity map and guidance to the development of new wind farms (Bright et al., 2006, 2008).

There are relatively few telemetry studies the foraging behaviour of breeding raptors in South Africa. Breeding Verreaux's Eagles largely forage within 3.7km of their nest (Brink, 2020), with turbine collision risk potential falling substantially further away from the nest, becoming a negligible concern after 8km (Murgatroyd et al., 2021). Breeding African Crowned Eagles demonstrate more restrictive foraging behaviour largely confined to 1.62km of their nest, whereas breeding Martial Eagle *Polemaetus bellicosus* forage generally forage within 5.39km of their nests (Brink, 2020). Male Black Sparrowhawks *Accipiter melanoleucus* have been observed

to display year-round territoriality, mostly foraging within 2.27 (breeding) and 2.43km (non-breeding) of the nest (Brink, 2020; Sumasgutner et al., 2016). The home range size for foraging female Long-crested Eagles *Lophaetus occipitalis* in KwaZulu-Natal undergo substantial contractions to within a close vicinity of the nest (<25ha for one observed female) during the breeding season (Maphalala et al., 2020). Breeding Black Harrier *Circus maurus* pairs forage further afield (within 7.1–33.4km of their nests) (Garcia-Heras et al., 2019), as do Bearded Vultures (10km of their nests), and especially Lappet-faced Vultures (110.98km of their nest) (Brink, 2020).

No raptor nests have been recorded prior to, or during Site Sensitivity Verification field surveys. The most likely flight concentration of priority species at the proposed WEF site would be associated with drainage lines, wetlands, and dams.

6.5.2.3. Food availability

Factors that increase the use of a certain area or that attract birds, like food availability; also play a role in collision risk. For example, the high density of raptors at the APWRA, California, and the high collision fatality due to collision with turbines is thought to result, at least in part, from high prey availability in certain areas (Hoover & Morrison, 2005; Smallwood et al., 2009). This may be particularly relevant for birds that are less aware of obstructions such as wind turbines while foraging (Krijgsveld et al., 2009; Smallwood et al., 2009). It is suggested that the mortality of three Verreaux's Eagles in 2015 at a wind farm site in South Africa may have been linked to the availability of food (Smallie, 2015).

Depending on the availability of insect prey in the natural grassland at the proposed Igolide WEF site, flocks of Amur Falcons and White Stork of varying sizes might be present in the summer months.

6.6. Operation phase – electrocution of priority species in the onsite substations and internal 33kV network

This impact deals with the potential electrocution of priority species in the onsite substations and any overhead sections of the 33kV powerlines. This impact is rated as negative, with a local spatial extent and a long-term duration due to the extended timeframe of the operational phase (lifetime estimated at 20 years).

Electrocution refers to instances where birds perch, or attempt to perch, upon electrical structure in a manner that physically bridges the air gap between live components and/or live and earthed components, causing a fatal electrical short circuit through the birds (Bevanger, 1994; van Rooyen, 2000). The electrocution risk is largely determined by the design of the electrical hardware, with medium voltage electricity poles posing a potential electrocution risk to raptors (Cole & Dahl, 2013; Haas et al., 2006; Loss et al., 2014).

The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence but unlikely probability, which will result in an impact significance of moderate, without the implementation of mitigation measures. With the implementation of mitigation measures (i.e., reactive insulation of electrical hardware), the significance of the impact is reduced to very low.

The raptors that could be most affected by this impact are listed in Table 5. The recommended mitigation measures are detailed in in Table 7 in Section 6.9 below.

6.7. Operation phase – collision of priority species with the internal 33kV network

A related concern to that addressed in Section 6.6 is bird collisions with medium voltage overhead powerlines. Overhead line collisions are arguably the greatest threat posed by overhead lines to birds in southern Africa (van Rooyen, 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures (Shaw et al., 2010; van Rooyen, 2004). These species are mostly heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (van Rooyen, 2004).

Power line collisions are generally accepted as a key threat to bustards (Barrientos et al., 2012; Jenkins et al., 2010; Raab et al., 2009, 2011; Shaw, 2013). In one study, carcass surveys were performed under high voltage transmission lines in the Karoo for two years, and low voltage distribution lines for one year (Shaw, 2013). Ludwig's Bustard *Neotis ludwigii* was the most common collision victim (69% of carcasses), with bustards generally comprising 87% of mortalities recovered. Total annual mortality was estimated at 41% of the Ludwig's Bustard population, with Kori Bustards *Ardeotis kori* also dying in large numbers (at least 14% of the South African population killed in the Karoo alone). Karoo Korhaan *Eupodotis vigorsii* was also recorded, but to a much lesser extent than Ludwig's Bustard. The reasons for the relatively low collision risk of this species probably include their smaller size (and hence greater agility in flight) as well as their more sedentary lifestyles, as local birds are familiar with their territory and are less likely to collide with power lines (Shaw, 2013).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the 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 (Shaw et al., 2018). Marking was highly effective for Blue Cranes *Grus paradisea*, with a 92% reduction in mortality, and large birds in general with a 56% reduction in mortality, but not for bustards, including the endangered Ludwig's Bustard. The two different marking devices were approximately equally effective, namely spirals

and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw et al., 2018).

The impact is rated with a high reversibility (meaning that the potential impact is highly reversible at end of the project life); and low irreplaceability (meaning there is a low irreplaceability of avifaunal species). The potential impact is allocated a severe consequence but unlikely probability, which will result in an impact significance of moderate, without the implementation of mitigation measures. With the implementation of mitigation measures (i.e., marking of line with bird flight diverters), the significance of the impact is reduced to low.

The species that could be most affected by this impact are listed in **Table 5**. The recommended mitigation measures are detailed in in **Table 7** in Section 6.9 below.

6.8. Decommissioning phase - displacement due to disturbance associated with the decommissioning of the wind turbines and associated infrastructure.

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

The species that could be most affected by this impact are listed in **Table 5**. The recommended mitigation measures are detailed in in **Table 7** in Section 6.9 below.

6.9. Scoping level assessment of environmental impact scores and impact mitigation recommendations

Assessment scores of expected environmental impacts from the proposed Igolide WEF within the PAOI are detailed below in **Table 6**.

Mitigation recommendations for each expected environmental impact are detailed below in **Table 7**.

Table 6: Scoping level assessment of pre-mitigation environmental impacts of the Igolide WEF during construction, operation, and decommissioning phases

Phase	Impact	Consequence	Status	Impact Magnitude (M)	Impact Extent (E)	Impact Reversibility (R)	Impact Duration (D)	Occurrence Probability (P)	Impact Significance (S)
Construction	Noise pollution and environmental disruption from construction activity	Displacement of priority species from breeding/feeding/roosting areas	Negative (-ve)	High (4)	Site only (1)	Recoverable (3)	Short-term 0-5 years (2)	Definite (5)	Moderate (50)
Operation	Habitat transformation resulting from the wind turbines and associated infrastructure	Displacement of priority species from breeding/feeding/roosting areas	Negative (-ve)	Medium (3)	Local (2)	Reversible (1)	Long term Project life (4)	Highly probable (4)	Moderate (40)
Operation	Bird mortality and injury resulting from collisions with the wind turbines.	Population reduction of priority species	Negative (-ve)	Medium (3)	International (migrants) (5)	Reversible (1)	Long term Project life (4)	Highly probable (4)	Moderate (52)
Operation	Electrocution of priority species on the onsite sub-stations and internal 33kV network.	Population reduction of priority species	Negative (-ve)	Medium (3)	International (migrants) (5)	Reversible (1)	Long term Project life (4)	Highly probable (4)	Moderate (52)
Operation	Collisions of priority species with the internal 33kV network.	Population reduction of priority species	Negative (-ve)	Medium (3)	International (migrants) (5)	Reversible (1)	Long term Project life (4)	Highly probable (4)	Moderate (52)
Decommission	Noise pollution and environmental disruption during the	Total/partial displacement of priority species from breeding/feeding/roosting areas	Negative (-ve)	High (4)	Site only (1)	Recoverable (3)	Short-term 0-5 years (2)	Definite (5)	Moderate (50)

Phase	Impact	Consequence	Status	Impact Magnitude (M)	Impact Extent (E)	Impact Reversibility (R)	Impact Duration (D)	Occurrence Probability (P)	Impact Significance (S)
	decommissioning phase.								

Table 7: Proposed mitigation measures for the environmental disturbances identified in Table 6.

Phase	Impact	Consequence	Initial impact score	Post-mitigation impact score	Mitigation Measures	Confidence level
Construction	Noise pollution and habitat loss during construction	Total/partial displacement of priority species from breeding/feeding/roosting areas	Moderate	Low	<p>No turbines should be constructed in the turbine exclusion buffer zones as indicated in the sensitivity map in Figure 13.⁵</p> <p>Restrict construction to the immediate infrastructural footprint. Access to remaining areas should be strictly controlled to minimise disturbance of priority species. This recommendation especially applies within the very high and high sensitivity areas depicted in the sensitivity map in Figure 13.</p> <p>Minimise removal of natural vegetation, and rehabilitate natural vegetation post-construction where possible.</p> <p>Prioritise upgrading existing roads (where the requisite roads authority permission has been issued) over constructing new roads</p> <p>Apply noise and dust control measures according to best practice in the industry</p>	High

⁵ The extent of the African Grass Owl breeding habitat will be refined during the EIA phase.

Phase	Impact	Consequence	Initial impact score	Post-mitigation impact score	Mitigation Measures	Confidence level
					Strictly implement the recommendations of ecological specialists to reduce the level of habitat loss.	
Operation	Habitat transformation resulting from the wind turbines and associated infrastructure	Total/partial displacement of priority species from breeding/feeding/roosting areas	Moderate	Low	<p>No turbines should be constructed in the turbine exclusion buffer zones as indicated in the sensitivity map in Figure 13.⁶</p> <p>Restrict construction to the immediate infrastructural footprint where possible. Access to remaining areas should be strictly controlled to minimise disturbance of priority species. This recommendation especially applies within the very high and high sensitivity areas depicted in the sensitivity map in Figure 13.</p> <p>Once operational, vehicle and pedestrian access to the site should be controlled and restricted to the facility footprint as much as possible to prevent unnecessary destruction of vegetation.</p> <p>Formal live-bird monitoring should commence following initial turbine operation, as per the Best Practice Guidelines (Jenkins et al. 2015), to determine the extent to which priority species displacement has occurred. Operational monitoring should be undertaken for the first two (preferably three) years of operation, and then repeated every five years thereafter for the operational lifetime of the facility.</p>	High

⁶ The extent of the African Grass Owl breeding habitat will be refined during the EIA phase.

Phase	Impact	Consequence	Initial impact score	Post-mitigation impact score	Mitigation Measures	Confidence level
Operation	Bird mortality and injury resulting from collisions with the wind turbines.	Population reduction of priority species	Moderate	Low	No turbines should be constructed in the turbine exclusion buffer zones as indicated in the sensitivity map in Figure 13 . ⁷	High
					Formal live-bird monitoring and carcass searches should be conducted in the operational phase, as per the Best Practice Guidelines at the time (Jenkins et al. 2015) to assess collision rates.	
					If estimated annual collision rates indicate unacceptable mortality levels of priority species exceeding mortality thresholds as determined by the avifaunal specialist in consultation with other experts (e.g., BLSA), additional measures must be implemented, such as shut down on demand or other proven measures (if available at the time).	
Operation	Electrocution of priority species on the onsite sub-stations and internal 33kV network.	Population reduction of priority species	Moderate	Low	Use underground cabling as much as is practically possible.	High
					Where the use of overhead lines is unavoidable, raptor-friendly pole design should be used, with appropriate mitigation measures for complicated pole structures (e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformer), as recommended by the Avifaunal Specialist.	
					Apply insulation reactively in the substation if significant electrocutions of SCC are recorded.	

⁷ The extent of the African Grass Owl breeding habitat will be refined during the EIA phase.

Phase	Impact	Consequence	Initial impact score	Post-mitigation impact score	Mitigation Measures	Confidence level
Operation	Collisions of priority species with the internal 33kV network.	Population reduction of priority species	Moderate	Low	Use underground cabling as much as is practically possible.	High
					All above-ground internal medium voltage lines must be marked with Eskom approved Bird Flight Diverters according to the applicable Eskom standard.	
Decommission	Noise pollution and environmental disruption during the decommissioning phase.	Total/partial displacement of priority species from breeding/feeding/roosting areas	Moderate	Low	Restrict dismantling to the immediate infrastructural footprint where possible. Access to remaining areas should be strictly controlled to minimise disturbance of priority species. This recommendation especially applies within the very high and high sensitivity areas depicted in the sensitivity map in Figure 13 .	High
					Apply noise and dust control measures according to best practice in the industry	
					Prioritise use of existing access roads during the decommissioning phase and avoid construction of new roads where feasible.	
					The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned	

6.10. Impact Statement

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

Table 8: Summary of avifaunal impact significances anticipated for the proposed Igolide WEF

Phase	Overall Impact Significance (Pre-Mitigation)	Overall Impact Significance (Post Mitigation)
Construction	Moderate	Low
Operational	Moderate	Low
Decommissioning	Moderate	Low

6.11. Plan of study for the EIA

The following are proposed for the EIA Phase:

- The implementation of four avifaunal surveys, utilising transects, vantage point watches, focal points and incidental counts, to inform the assessment of the potential impacts of the planned infrastructure within the development footprint.⁸ The monitoring protocol is guided by the following:
 - Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020)
 - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).
 - Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa. Hereafter referred to as the wind guidelines.
- Site specific modelling of the African Grass Owl habitat spanning multiple years will be undertaken to identify any potential breeding habitat.
- The avifaunal specialists report will be structured around the following terms of reference:
 - Description of the affected environment from an avifaunal perspective.
 - Discussion of gaps in baseline data and other limitations.
 - Description of the methodology that was used for the field surveys.

⁸ This has been completed. Details and results will be presented in the Avifaunal Specialist Impact Report.

- Comparison of the site sensitivity recorded in the field with the sensitivity classification in the DFFE National Screening Tool and adjustment if necessary.
- Provision of an overview of all applicable legislation.
- Provision of an overview of assessment methodology.
- Identification and assessment of the potential impacts of the proposed development on avifauna including cumulative impacts.
- Provision of sufficient mitigation measures to include in the Environmental Management Programme (EMPr).
- Conclusion with an impact statement whether the wind energy facility is fatally flawed or may be authorised.

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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	:	27 years

Key experience

Chris van Rooyen has decades of 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 Noupoot 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. Noupoot Wind Energy Facility 24-months post-construction monitoring (Mainstream)
44. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
45. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
46. Dassieklip Wind Energy Facility 3 years post-construction monitoring (Biotherm)
47. Loeriesfontein 2 Wind Energy Facility 2 years post-construction monitoring (Mainstream)
48. Khobab Wind Energy Facility 2 years post-construction monitoring (Mainstream)
49. Excelsior Wind Energy Facility 18 months construction phase monitoring (Biotherm)
50. Boesmansberg Wind Energy Facility 12-months pre-construction bird monitoring (juwi)
51. Mañhica Wind Energy Facility, Mozambique, 12-months pre-construction monitoring (Windlab)
52. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
53. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO).
54. Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
55. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
56. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).

57. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
58. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
59. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
60. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
61. Gauteng & 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 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 Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos project, Copperton, Northern Cape
4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla Project, Aggeneys, Northern Cape
8. Biotherm Sendawo Project, Vryburg, North-West
9. Biotherm Tlisitseng 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 Project, Vryburg, North-West
14. NamPower CSP Facility near Arandis, Namibia
15. Dayson Klip Facility near Upington, Northern Cape
16. Geelkop Facility near Upington, Northern Cape
17. Oya Facility, Ceres, Western Cape
18. Vrede and Rondawel Facilities, Free State
19. Kolkies & Sadawa Facilities, Western Cape
20. Leeuwbosch 1 and 2 and Wildebeeskuil 1 and 2 Facilities, North-West
21. Kenhardt 3,4 and 5, Northern Cape
22. Wittewal , Grootfontein and Hoekdoornen Facilities, Touws River, Western Cape

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-Overysse 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. Liphobong-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 Booyendal 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. Benfiosa 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. Booyesdal 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, Gauteng
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Gauteng
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 affiliation

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 : 25 years

Key Qualifications

Albert Froneman (Pr.Sci.Nat) has more than 18 years' experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee and has presented various papers at international conferences and workshops. At present he is consulting to ACSA with wildlife hazard management on all their airports. He also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies. He has co-authored many avifaunal specialist studies and pre-construction monitoring reports for proposed renewable energy developments across South Africa. He also has vast experience in using Geographic Information Systems to analyse and interpret avifaunal data spatially and derive meaningful conclusions. Since 2009 Albert has been a registered Professional Natural Scientist (reg. nr 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

Key Project Experience

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

1. Jeffrey's Bay Wind Farm – 12-months preconstruction avifaunal monitoring project
2. Oysterbay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
3. Ubuntu Wind Energy Project near Jeffrey's Bay – 12-months preconstruction avifaunal monitoring project
4. Bana-ba-Pifu Wind Energy Project near Humansdorp – 12-months preconstruction avifaunal monitoring project
5. Excelsior Wind Energy Project near Caledon – 12-months preconstruction avifaunal monitoring project

6. Laingsburg Spitskolakke 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. Noupoot 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 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. Noupoot Wind Energy Facility 24-months post-construction monitoring (Mainstream)
30. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
31. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
32. Mañhica Wind Energy Facility 12-month bird monitoring & EIA specialist study (Windlab)
33. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)

34. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO). Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
35. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
36. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
37. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
38. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
39. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
40. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
41. Gauteng & 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, Gauteng
15. Avian biodiversity assessment for the Mafube Colliery Coal mine near Middelburg Gauteng
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 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, Gauteng
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 Benficsosa 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 Lephalele 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.

Curriculum Vitae: Megan Loftie-Eaton

FORMAL EDUCATION

UNIVERSITY OF CAPE TOWN – (PhD – Biological Sciences)

- Completed PhD in Biological Sciences, Animal Demography Unit, Department of Biological Sciences, UCT (December 2018) Thesis: The impacts of bush encroachment on bird distributions in the Savanna Biome of South Africa

UNIVERSITY OF CAPE TOWN – (MSc - Zoology)

- Completed MSc in Zoology, Animal Demography Unit, Department of Biological Sciences, UCT (June 2014)

UNIVERSITY OF ALBERTA – (BSc in Environmental and Conservation Sciences)

- Completed with Distinction. June 2011

PROFESSIONAL REGISTRATIONS AND INDUSTRY AFFILIATIONS

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

EXPERIENCE AND QUALIFICATIONS

2022-2023:

- Environmental Assessment Practitioner for Resource Management Services, Durbanville
- Avifaunal Impact Assessment assistant with Chris van Rooyen Consulting
- Citizen Science Projects Coordinator and Social Media Manager at The Biodiversity and Development Institute

2021:

- Environmental Assessment Practitioner for Resource Management Services, Durbanville (Part-time)
- Completed Avifaunal Impact Assessment for Robben Island Museum (Blue Stone Quarry Wall Restoration)
- Conducted avifaunal field work for proposed wind farms near Laingsburg, Karoo
- OdonataMAP (African Atlas of Odonata) Project Coordinator and Social Media Manager at The Biodiversity and Development Institute (contracted by the Freshwater Research Centre)
- Senior Environmental Consultant with Terramanzi Group Pty Ltd.
- SACNASP Registered Professional Natural Scientist in Ecology (Member #135161)

2020:

- Senior Environmental Consultant with Terramanzi Group Pty Ltd.
- Completed Global Environmental Management - an online course authorized by Technical University of Denmark (DTU) and offered through Coursera
- Ecologist and Researcher (contracted by Hoedspruit Hub) for Kruger To Canyons Biosphere Reserve, conducting sustainable agriculture research in the village of Phiring, Limpopo as part of the "Agroecology as a Climate Change Adaptation Strategy" output of the Dinkwanyane Water Stewardship Project

2019:

- Participated in the Karkloof 50 Miler trail run, where I placed third, and raised funds (R30,000) for ReWild NPC (a wildlife rehabilitation and conservation organization)
- OdonataMAP (African Atlas of Odonata) Project Coordinator at The Biodiversity and Development Institute (contracted by the Freshwater Research Centre)
- Ecologist and Researcher and Social Media Manager at Hoedspruit Hub
- Communications, Social Media, and Citizen Science Project Coordinator at The Biodiversity & Development Institute - ongoing
- Organized, planned, and orchestrated the Hoedspruit Hub's Open Day event
- Obtained qualification for NQF Level 5, Unit Standard 115753, Conduct Outcomes-based Assessment through Ndzalama Training (PtY) Ltd

2017-2018:

- Completed contract projects for the Hoedspruit Hub's Agroecology Division in partnership with Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ). I built, installed, and provided training materials for pollinator stations, artificial bat roosts and earthworm composting bins
- Awarded PhD in Biological Sciences, University of Cape Town (December 2018)
- Ecologist for WildArk on Pridelands Conservancy (Hoedspruit, Limpopo), conducting biodiversity surveys and ecological monitoring, as well as creating content for WildArk's social media
- Project coordinator and communications officer of the Atlas of African Odonata (OdonataMAP), Animal Demography Unit (funded by JRS Biodiversity Foundation).
- Facilitated and assessed a four-day Ecology Course for students at Tsakane Conservation in Balule Nature Reserve (Limpopo Province, South Africa) as part of the EcoLife student programme (University of Pretoria)
- Presented several biodiversity mapping and bird atlasing workshops (SABAP2, Southern African Bird Atlas Project) across South Africa, Nigeria, Tanzania, and Europe (Poland, Finland, Germany)

2016-2018:

- Presented and assessed bird atlasing (<http://sabap2.adu.org.za/>) and BioMAPping (<http://vmus.adu.org.za>) workshops to field guide students at Bushwise Field Guide Training Academy, Limpopo Province, South Africa
- Attended a Snake Awareness and Venomous Snake Handling Course as well as an Introductory Course to Scorpions (accredited by FGASA and HPCSA), hosted by the African Snakebite Institute in Hoedspruit (12-13 November 2016)

2014-2018:

- Completed doctoral (PhD) studies in Biological Sciences at the University of Cape Town (Animal Demography Unit). Research title: The impacts of bush encroachment on bird distributions in the savanna biome of South Africa
- Project coordinator and communications officer of the Atlas of African Lepidoptera (LepiMAP): LepiMAP is a project aimed at determining the distribution and conservation priorities of butterflies and moths on the African continent. It is a joint project of the Animal Demography Unit (Department of Biological Sciences, University of Cape Town) and LepSoc, The Lepidopterists' Society of Africa

- BirdMAP Assistant: helping with the Animal Demography Unit's bird atlas project in African countries north of South Africa, assisting the project teams in Kenya, Nigeria, Zimbabwe, Namibia, Zambia and Rwanda with everything from observer queries to social media aspects

2014:

- Obtained MSc in Zoology through the Department of Biological Sciences, University of Cape Town. Thesis title: Geographic Range Dynamics of South Africa's Bird Species. PDF of thesis: http://adu.org.za/pdf/Loftie-Eaton_M_2014_MSc_thesis.pdf.
- Attended an International Wildlife Trapping Course in Hoedspruit, South Africa to learn about humane live capture methods of mammals for research purposes

2013:

- Started coordinating LepiMAP, The Atlas of African Lepidoptera
- Obtained FGASA (Field Guides Association of Southern Africa) Level One Nature Guide qualification (membership number 18574) through Ulovane Environmental Training in South Africa. Obtained First Aid Level One qualification

2011–2018:

- Social Media Manager for the Animal Demography Unit
- Data technician for the ADU's Virtual Museum. I am on the Expert Panel for the MammalMAP, FrogMAP, ReptileMAP, and BirdPix citizen science projects. The Expert Panel has the important task of identifying the records submitted to the Virtual Museum

2011:

- Assistant Researcher on the African Penguin EarthWatch Research Team on Robben Island, South Africa. Conducted population surveys on penguins and other seabirds to determine their breeding success and survival - <http://earthwatch.org/expeditions/south-african-penguins>
- Obtained BSc in Environmental and Conservation Sciences, with Distinction, through the Faculty of Agriculture, Life and Environmental Sciences, University of Alberta, Edmonton, Canada. Major: Conservation Biology.

Appendix B – Specialist Statement of Independence

Appendix C – Site Sensitivity Verification

Prior to commencing with the specialist assessment in accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a site sensitivity verification was undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool). The Protocol for the specialist assessment and minimum report content requirements for environmental impacts avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020) is applicable in the case of wind developments.

The details of the site sensitivity verification (SSV) are noted below:

Date of Site Visits	11 – 14 January 2022 05 – 09 July 2021 06 – 08 December 2020 22 – 23 June 2020
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

C1. Methodology

The following methods were used to compile this report:

- Bird distribution data of the Second Southern African Bird Atlas (SABAP2) was obtained from the University of Cape Town, to ascertain which species occur within the Broader Area of four pentad grid cells within which the proposed Project is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 9 km. From 2007–present, a total of 551 full protocol lists (i.e., surveys of at least two hours each) have been completed for this area. In addition, 133 *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) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (<http://www.iucnredlist.org/>).
- A classification of the habitat in the PAOI was obtained from the First Atlas of Southern African Birds (SABAP1) (Harrison et al., 1997a, 1997b) and the National Vegetation Map (2018) from the South African National Biodiversity Institute (SANBI) BGIS map viewer (<http://bgisviewer.sanbi.org/>) (Mucina

& Rutherford, 2006; SANBI, 2018). The PAOI is the area where the primary impacts on avifauna are expected and includes the land parcels where the Project will be located.

- The Important Bird Areas of Southern Africa (Marnewick et al., 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2023) was used to view the PAOI and Broader Area on a landscape level and to help identify sensitive bird habitat.
- Priority species for wind development were identified from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Ralston-Paton et al., 2017; Retief et al., 2012).
- The 2022 South Africa Protected Areas Database compiled by the Department of Environment, Forestry and Fisheries (DFFE) was used to identify Nationally Protected Areas, National Protected Areas Expansion Strategy (NPAES) near the PAOI (DFFE, 2022).
- The Department of Forestry, Fisheries, and the Environment (DFFE) National Screening Tool was used to determine the assigned avian sensitivity of the PAOI.
- Data collected during previous site visits to the Broader Area was also considered as far as habitat classes and the occurrence of priority species are concerned.
- The following sources were used to determine the investigation protocol that is required for the site:
 - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).
 - BirdLife South Africa’s (BLSA) ‘Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa’ (Jenkins et al., 2015) – hereafter referred to as the ‘Windfarm Guidelines’ – were consulted to determine the level of survey effort that is required.
- The main source of information on the avifaunal diversity and abundance at the PAOI and Broader Area is an integrated pre-construction monitoring programme which was implemented at the Project Site during 2020 – 2022 over a period of four seasons. Four sets of surveys have been conducted.

C2. Results of Site Assessment

The PAOI is situated along an ecotone between the Savanna and Grassland Biomes but falls mainly within the Grassland Biome (Mucina & Rutherford 2006). According to the 2018 SANBI Vegetation Map the PAOI falls within the Central Bushveld Bioregion (northern half of PAOI) and the Mesic Highveld Grassland Bioregion (southern half of PAOI). The natural vegetation at the PAOI consists predominantly of Gauteng Shale Mountain Bushveld and Rand Highveld Grassland.

The typical landscape associated with Rand Highveld Grassland is highly variable, containing extensive sloping plains and a series of ridges slightly elevated over undulating surrounding plains. The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrubland on rocky outcrops and steeper slopes. Most of the grasses on the plains belong to the genera *Themeda*, *Eragrostis*, *Heteropogon* and *Elionurus*. A high diversity of herbs, many of which belong to the Asteraceae, is also a typical feature. Rocky hills and ridges consist of open woodlands with *Protea caffra* subsp. *caffra*, *Protea welwitschii*, *Senegalia caffra* and *Celtis africana*, accompanied by a rich suite of shrubs among which the genus *Searsia* is most prominent (Mucina and Rutherford (2006). The Gauteng Shale Mountain Bushveld is represented by woody vegetation and a grass dominated herbaceous layer. Depending on local conditions, trees form semi-open to closed thickets or woodlands, and can range from short deciduous bush cover to a medium-tall +5m tree cover of mostly *Senegalia sp.* and *Vachellia sp.* trees.

Fochville, which is the closest town to the PAOI has a temperate climate. Summers are warm and winters are cold and dry. The mean annual rainfall is around 600–800 mm, most of which falls in the summer months. The mean annual temperature is around 20C° (Schulze, 2009).

The proposed Igolide WEF PAOI is situated within gently undulating plains of the Gauteng Highveld countryside. The avian habitat types in the Igolide WEF were identified as:

- (i) Natural Grassland
- (ii) Disturbed Grassland
- (iii) Open Woodland
- (iv) Drainage Lines and Wetlands
- (v) Dams
- (vi) Agriculture
- (vii) High Voltage Powerlines

The PAOI and immediate environment is classified as **Medium** sensitivity for bird species according to the Terrestrial Animal Species Theme (**Figure C.1**). The Medium sensitivity classification is linked to the potential occurrence of African Grass Owl *Tyto capensis* (Regionally Vulnerable), White-bellied Bustard

Eupodotis senegalensis (Regionally Vulnerable), and Caspian Tern *Hydroprogne caspia* (Regionally Vulnerable).

The PAOI contains confirmed habitat for Species of Conservation Concern (SCC), namely African Grass Owl and Secretarybird (Globally Endangered and Regionally Vulnerable), 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). During the on-site surveys, two SCC were also recorded. These SCC were: Lanner Falcon (Regionally Vulnerable), and Secretarybird (Globally Endangered and Regionally Vulnerable) .

Based on the Site Sensitivity Verification survey and the integrated pre-construction monitoring conducted at the PAOI, the classification of **High** sensitivity for avifauna is suggested for the Igolide WEF.

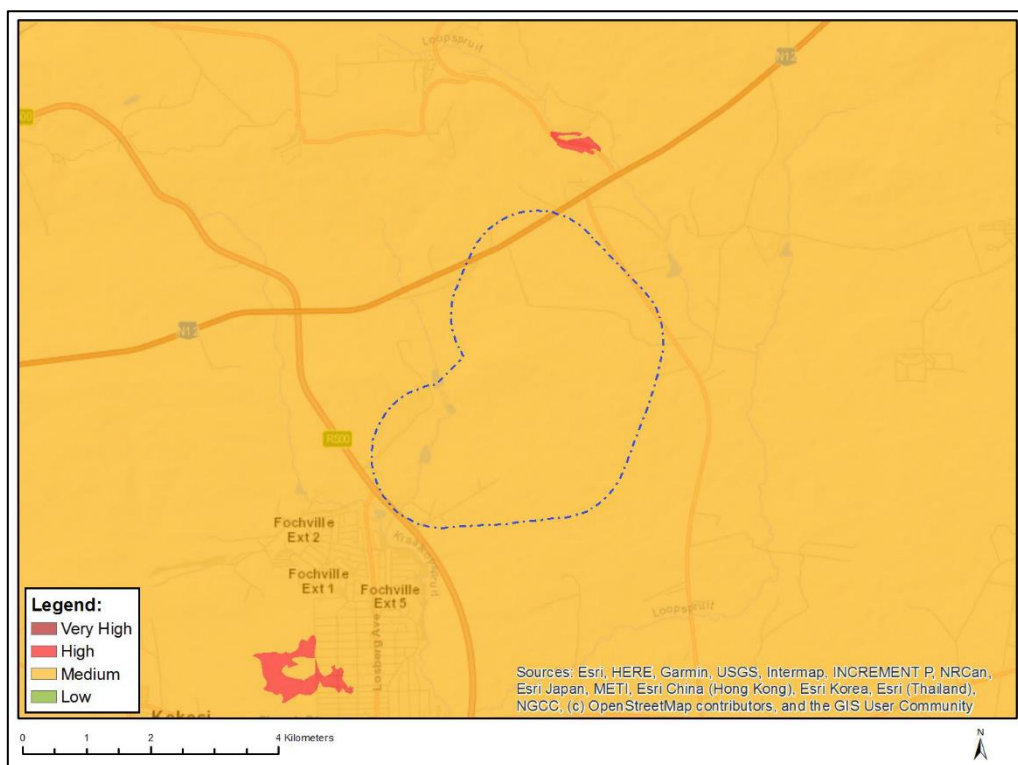


Figure C.1: The National Web-Based Environmental Screening Tool map of the PAOI, indicating sensitivities for the Terrestrial Animal Species theme. The Medium sensitivity classification is linked to African Grass Owl *Tyto capensis*, White-bellied Bustard *Eupodotis senegalensis*, and Caspian Tern *Hydroprogne caspia*.

Appendix D – Impact Assessment Methodology

Appendix 2 of GNR 982, as amended, requires the identification of the significance of potential impacts during scoping. To this end, an impact screening tool has been used in the scoping phase. The screening tool is based on two criteria, namely probability (Figure D1); and consequence (Figure D2), where the latter is based on general consideration to the intensity, extent, and duration.

SCORE	DESCRIPTOR
4	Definite: The impact will occur regardless of any prevention measures
3	Highly Probable: It is most likely that the impact will occur
2	Probable: There is a good possibility that the impact will occur
1	Improbable: The possibility of the impact occurring is very low

Figure D1: Probability scores and descriptors

SCORE	NEGATIVE	POSITIVE
4	Very severe: An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	Very beneficial: A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.
3	Severe: A long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming or some combination of these.	Beneficial: A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
2	Moderately severe: A medium to long term impacts on the affected system(s) or party (ies) that could be mitigated.	Moderately beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.
1	Negligible: A short to medium term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	Negligible: A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.

Figure D2: Consequence score descriptions

The impact assessment includes:

- Impact magnitude
- Impact extent
- Impact reversibility
- Impact duration
- Probability of impact occurrence
- Impact significance

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ <i>Significance = (Extent + Duration + Reversibility + Magnitude) × Probability</i>				
IMPACT SIGNIFICANCE RATING					
Total Score	4 to 15	16 to 30	31 to 60	61 to 80	81 to 100
Environmental Significance Rating (Negative (-))	Very low	Low	Moderate	High	Very High
Environmental Significance Rating (Positive (+))	Very low	Low	Moderate	High	Very High

Figure D3: Impact assessment scoring metric used in this scoping report.

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

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

The impact assessment methodology includes the following aspects:

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

- Impact status - whether the impact/risk on the overall environment will be:
 - Positive - environment overall will benefit from the impact/risk
 - Negative - environment overall will be adversely affected by the impact/risk; or
 - Neutral - environment overall not be affected.
- Impact spatial extent – The size of the area that will be affected by the impact/risk:
 - Site specific
 - Local (<10 km from site)
 - Regional (<100 km of site)
 - National; or
 - International (e.g. Greenhouse Gas emissions or migrant birds).
- Impact reversibility - the ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change:
 - Reversible (recovery without pro-active rehabilitation)
 - Recoverable (recovery with pro-active rehabilitation)
 - Irreversible (not possible despite action)
- Impact duration – the timeframe during which the impact/risk will be experienced:
 - Very short term (instantaneous);
 - Short term (0-5 year);
 - Medium term (5- 15 years);
 - Long term (the impact will cease after the operational life of the activity (i.e., the impact or risk will occur for the project duration)); or

- Permanent/indefinite (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e., the impact will occur beyond the project decommissioning)).
- Probability of impact occurrence:
 - Improbable (little to no chance of occurring)
 - Low Probability (<30% chance of occurring)
 - Probable (30-50% chance of occurring)
 - Highly Probability (51 – 90% chance of occurring); or
 - Definite (>90% chance of occurring regardless of prevention measures).
- Impact significance – the product of the impact occurrence probability with the sum of impact magnitude, extent, duration, and reversibility

Significance = (Extent + Duration + Reversibility + Magnitude) × Probability:

IMPACT SIGNIFICANCE RATING					
Total Score	4 to 15	16 to 30	31 to 60	61 to 80	81 to 100
Environmental Significance Rating (Negative (-))	Very low	Low	Moderate	High	Very High
Environmental Significance Rating (Positive (+))	Very low	Low	Moderate	High	Very High

Figure D4: Impact significance rating

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

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

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

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

- Low
- Medium
- High.

Appendix E – Species List for the Broader Area

Species name	Scientific name	SABAP2 Reporting Rate %		Global Conservation Status	Regional Conservation Status
		Full protocol	Ad hoc protocol		
Abdim's Stork	<i>Ciconia abdimii</i>	0,00	0,75	-	NT
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>	70,24	2,26	-	-
African Black Duck	<i>Anas sparsa</i>	21,60	1,50	-	-
African Crake	<i>Creccopsis egregia</i>	0,73	0,00	-	-
African Darter	<i>Anhinga rufa</i>	28,31	0,75	-	-
African Firefinch	<i>Lagonosticta rubricata</i>	6,35	0,75	-	-
African Fish Eagle	<i>Haliaeetus vocifer</i>	1,45	0,75	-	-
African Grass Owl	<i>Tyto capensis</i>	0,00	0,75	-	VU
African Green Pigeon	<i>Treron calvus</i>	0,54	0,00	-	-
African Grey Hornbill	<i>Lophoceros nasutus</i>	5,63	0,75	-	-
African Harrier-Hawk	<i>Polyboroides typus</i>	0,73	0,75	-	-
African Hawk-eagle	<i>Aquila spilogaster</i>	0,36	0,00	-	-
African Hoopoe	<i>Upupa africana</i>	84,57	6,77	-	-
African Olive Pigeon	<i>Columba arquatrix</i>	2,18	0,75	-	-
African Palm Swift	<i>Cypsiurus parvus</i>	81,67	5,26	-	-
African Paradise Flycatcher	<i>Terpsiphone viridis</i>	31,22	3,76	-	-
African Pipit	<i>Anthus cinnamomeus</i>	49,91	3,76	-	-
African Red-eyed Bulbul	<i>Pycnonotus nigricans</i>	90,38	9,02	-	-
African Reed Warbler	<i>Acrocephalus baeticatus</i>	13,61	0,75	-	-
African Sacred Ibis	<i>Threskiornis aethiopicus</i>	26,32	3,01	-	-
African Snipe	<i>Gallinago nigripennis</i>	23,59	0,00	-	-
African Spoonbill	<i>Platalea alba</i>	7,08	0,75	-	-
African Stonechat	<i>Saxicola torquatus</i>	79,31	5,26	-	-
African Swamphen	<i>Porphyrio madagascariensis</i>	6,72	1,50	-	-
African Wattled Lapwing	<i>Vanellus senegallus</i>	19,78	1,50	-	-
African Yellow Warbler	<i>Iduna natalensis</i>	0,18	0,00	-	-
Alpine Swift	<i>Tachymartus melba</i>	0,54	0,00	-	-
Amethyst Sunbird	<i>Chalcomitra amethystina</i>	64,79	3,76	-	-
Amur Falcon	<i>Falco amurensis</i>	1,63	2,26	-	-
Ant-eating Chat	<i>Myrmecocichla formicivora</i>	3,09	0,75	-	-
Arrow-marked Babbler	<i>Turdoides jardineii</i>	0,18	0,75	-	-
Ashy Tit	<i>Melaniparus cinerascens</i>	18,33	1,50	-	-
Banded Martin	<i>Riparia cincta</i>	0,73	0,00	-	-
Barn Swallow	<i>Hirundo rustica</i>	45,01	6,77	-	-
Bar-throated Apalis	<i>Apalis thoracica</i>	46,82	2,26	-	-
Black Crake	<i>Zapornia flavirostra</i>	9,80	0,75	-	-
Black Harrier	<i>Circus maurus</i>	0,18	0,00	EN	EN
Black Heron	<i>Egretta ardesiaca</i>	0,73	0,75	-	-
Black Kite	<i>Milvus migrans</i>	0,00	0,75	-	-
Black Sparrowhawk	<i>Accipiter melanoleucus</i>	1,45	0,00	-	-
Black-backed Puffback	<i>Dryoscopus cubla</i>	6,72	1,50	-	-

Black-chested Prinia	<i>Prinia flavicans</i>	90,38	5,26	-	-
Black-chested Snake Eagle	<i>Circaetus pectoralis</i>	0,18	0,00	-	-
Black-collared Barbet	<i>Lybius torquatus</i>	90,74	10,53	-	-
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	2,36	0,75	-	-
Black-crowned Tchagra	<i>Tchagra senegalus</i>	0,00	0,75	-	-
Black-faced Waxbill	<i>Brunhilda erythronotos</i>	25,41	0,00	-	-
Black-headed Heron	<i>Ardea melanocephala</i>	30,31	1,50	-	-
Black-headed Oriole	<i>Oriolus larvatus</i>	2,54	0,75	-	-
Blacksmith Lapwing	<i>Vanellus armatus</i>	93,10	11,28	-	-
Black-throated Canary	<i>Crithagra atrogularis</i>	88,75	5,26	-	-
Black-winged Kite	<i>Elanus caeruleus</i>	47,19	13,53	-	-
Black-winged Pratincole	<i>Glareola nordmanni</i>	0,18	0,00	NT	NT
Black-winged Stilt	<i>Himantopus himantopus</i>	0,91	0,75	-	-
Blue Waxbill	<i>Uraeginthus angolensis</i>	64,61	6,02	-	-
Blue-billed Teal	<i>Spatula hottentota</i>	0,18	0,00	-	-
Bokmakierie	<i>Telophorus zeylonus</i>	79,31	5,26	-	-
Booted Eagle	<i>Hieraaetus pennatus</i>	0,36	0,75	-	-
Bronze Mannikin	<i>Spermestes cucullata</i>	58,80	5,26	-	-
Brown-backed Honeybird	<i>Prodotiscus regulus</i>	14,88	0,00	-	-
Brown-crowned Tchagra	<i>Tchagra australis</i>	44,10	0,75	-	-
Brown-hooded Kingfisher	<i>Halcyon albiventris</i>	29,40	0,75	-	-
Brown-throated Martin	<i>Riparia paludicola</i>	9,07	0,75	-	-
Brubru	<i>Nilaus afer</i>	50,45	0,75	-	-
Buffy Pipit	<i>Anthus vaalensis</i>	11,62	0,75	-	-
Burchell's Coucal	<i>Centropus burchellii</i>	6,90	0,75	-	-
Cape Bunting	<i>Emberiza capensis</i>	26,86	0,00	-	-
Cape Grassbird	<i>Sphenoeacus afer</i>	0,18	0,00	-	-
Cape Longclaw	<i>Macronyx capensis</i>	60,44	4,51	-	-
Cape Penduline Tit	<i>Anthoscopus minutus</i>	0,91	0,00	-	-
Cape Robin-Chat	<i>Cossypha caffra</i>	92,56	8,27	-	-
Cape Shoveler	<i>Spatula smithii</i>	0,36	0,75	-	-
Cape Sparrow	<i>Passer melanurus</i>	95,46	9,77	-	-
Cape Starling	<i>Lamprotornis nitens</i>	90,56	14,29	-	-
Cape Teal	<i>Anas capensis</i>	0,00	0,75	-	-
Cape Turtle Dove	<i>Streptopelia capicola</i>	87,66	13,53	-	-
Cape Vulture	<i>Gyps coprotheres</i>	0,18	0,00	VU	EN
Cape Wagtail	<i>Motacilla capensis</i>	88,75	2,26	-	-
Cape Weaver	<i>Ploceus capensis</i>	11,25	0,75	-	-
Cape White-eye	<i>Zosterops virens</i>	92,38	8,27	-	-
Capped Wheatear	<i>Oenanthe pileata</i>	10,34	0,00	-	-
Cardinal Woodpecker	<i>Dendropicos fuscescens</i>	35,93	3,76	-	-
Chestnut-backed Sparrow-Lark	<i>Eremopterix leucotis</i>	0,54	0,00	-	-
Chestnut-vented Warbler	<i>Curruca subcoerulea</i>	73,50	0,75	-	-
Chin-spot Batis	<i>Batis molitor</i>	59,17	6,02	-	-
Cinnamon-breasted Bunting	<i>Emberiza tahapisi</i>	22,87	0,75	-	-
Cloud Cisticola	<i>Cisticola textrix</i>	17,06	0,00	-	-
Common Buttonquail	<i>Turnix sylvaticus</i>	1,81	0,75	-	-
Common Buzzard	<i>Buteo buteo</i>	7,80	2,26	-	-
Common Greenshank	<i>Tringa nebularia</i>	0,54	0,75	-	-
Common House Martin	<i>Delichon urbicum</i>	9,62	1,50	-	-
Common Moorhen	<i>Gallinula chloropus</i>	66,79	2,26	-	-
Common Myna	<i>Acridotheres tristis</i>	94,01	15,79	-	-
Common Ostrich	<i>Struthio camelus</i>	3,99	3,76	-	-
Common Quail	<i>Coturnix coturnix</i>	0,73	0,00	-	-
Common Sandpiper	<i>Actitis hypoleucos</i>	0,00	0,75	-	-
Common Scimitarbill	<i>Rhinopomastus cyanomelas</i>	28,68	1,50	-	-
Common Waxbill	<i>Estrilda astrild</i>	41,38	2,26	-	-
Common Whitethroat	<i>Curruca communis</i>	0,54	0,00	-	-
Coqui Francolin	<i>Peliperdix coqui</i>	9,26	0,75	-	-

Crested Barbet	Trachyphonus vaillantii	93,47	11,28	-	-
Crimson-breasted Shrike	Laniarius atrococcineus	44,10	0,75	-	-
Crowned Lapwing	Vanellus coronatus	96,55	12,78	-	-
Cuckoo Finch	Anomalospiza imberbis	0,91	0,00	-	-
Curlew Sandpiper	Calidris ferruginea	0,18	0,75	NT	LC
Cut-throat Finch	Amadina fasciata	0,18	0,75	-	-
Dark-capped Bulbul	Pycnonotus tricolor	81,67	6,77	-	-
Desert Cisticola	Cisticola aridulus	21,78	0,75	-	-
Diederik Cuckoo	Chrysococcyx caprius	38,29	1,50	-	-
Dusky Indigobird	Vidua funerea	0,36	0,00	-	-
Dusky Lark	Pinarocorys nigricans	0,00	0,75	-	-
Eastern Clapper Lark	Mirafraga fasciolata	11,43	0,75	-	-
Egyptian Goose	Alopochen aegyptiaca	51,36	4,51	-	-
European Bee-eater	Merops apiaster	37,93	4,51	-	-
European Honey-buzzard	Pernis apivorus	0,91	0,00	-	-
European Roller	Coracias garrulus	0,00	0,75	-	NT
Fairy Flycatcher	Stenostira scita	13,61	0,75	-	-
Familiar Chat	Oenanthe familiaris	13,79	2,26	-	-
Fiery-necked Nightjar	Caprimulgus pectoralis	0,00	0,75	-	-
Fiscal Flycatcher	Melaenornis silens	81,49	7,52	-	-
Gabar Goshawk	Micronisus gabar	5,99	0,00	-	-
Garden Warbler	Sylvia borin	2,54	0,00	-	-
Giant Kingfisher	Megaceryle maxima	1,81	0,75	-	-
Glossy Ibis	Plegadis falcinellus	22,69	1,50	-	-
Golden-breasted Bunting	Emberiza flaviventris	1,45	0,00	-	-
Golden-tailed Woodpecker	Campethera abingoni	21,05	0,00	-	-
Goliath Heron	Ardea goliath	0,36	0,75	-	-
Great Crested Grebe	Podiceps cristatus	0,00	0,75	-	-
Great Egret	Ardea alba	0,91	0,75	-	-
Great Reed Warbler	Acrocephalus arundinaceus	2,54	0,75	-	-
Great Spotted Cuckoo	Clamator glandarius	0,73	0,75	-	-
Greater Double-collared Sunbird	Cinnyris afer	2,72	0,75	-	-
Greater Flamingo	<i>Phoenicopterus roseus</i>	0,00	0,75	-	NT
Greater Honeyguide	Indicator indicator	5,44	1,50	-	-
Greater Kestrel	<i>Falco rupicoloides</i>	1,09	0,75	-	-
Greater Striped Swallow	Cecropis cucullata	68,60	8,27	-	-
Green Wood Hoopoe	Phoeniculus purpureus	82,76	8,27	-	-
Green-winged Pytilia	Pytilia melba	36,66	0,75	-	-
Grey Go-away-bird	Crinifer concolor	61,89	4,51	-	-
Grey Heron	Ardea cinerea	13,79	0,75	-	-
Grey-headed Bushshrike	Malaconotus blanchoti	18,15	3,01	-	-
Groundscraper Thrush	Turdus litsitsirupa	0,36	0,75	-	-
Hadada Ibis	Bostrychia hagedash	94,74	14,29	-	-
Hamerkop	Scopus umbretta	19,24	1,50	-	-
Helmeted Guineafowl	Numida meleagris	82,03	14,29	-	-
Horus Swift	Apus horus	0,36	0,75	-	-
House Sparrow	Passer domesticus	88,20	12,78	-	-
Hybrid Red-eyed/Dark-capped Bulbul	Pycnonotus nigricans/tricolor	2,00	0,00	-	-
Icterine Warbler	Hippolais icterina	1,63	0,75	-	-
Indian Peafowl	Pavo cristatus	0,36	1,50	-	-
Intermediate Egret	Ardea intermedia	0,18	0,75	-	-
Jackal Buzzard	<i>Buteo rufofuscus</i>	0,54	0,75	-	-
Jacobin Cuckoo	Clamator jacobinus	1,45	0,75	-	-
Jameson's Firefinch	Lagonosticta rhodopareia	20,15	1,50	-	-
Kalahari Scrub Robin	Cercotrichas paena	68,42	1,50	-	-
Karoo Thrush	Turdus smithi	88,93	11,28	-	-
Kittlitz's Plover	Charadrius pecuarius	0,00	0,75	-	-
Klaas's Cuckoo	Chrysococcyx klaas	5,26	1,50	-	-
Kurriehane Thrush	Turdus libonyana	6,53	2,26	-	-

Lanner Falcon	<i>Falco biarmicus</i>	0,36	0,75	-	VU
Lark-like Bunting	<i>Emberiza impetuani</i>	0,91	0,00	-	-
Laughing Dove	<i>Spilopelia senegalensis</i>	97,82	26,32	-	-
Lazy Cisticola	<i>Cisticola aberrans</i>	0,18	0,75	-	-
Lesser Grey Shrike	<i>Lanius minor</i>	3,27	0,75	-	-
Lesser Honeyguide	<i>Indicator minor</i>	17,60	1,50	-	-
Lesser Kestrel	<i>Falco naumanni</i>	1,27	0,00	-	-
Lesser Striped Swallow	<i>Cecropis abyssinica</i>	0,36	1,50	-	-
Lesser Swamp Warbler	<i>Acrocephalus gracilirostris</i>	60,62	0,75	-	-
Levaillant's Cisticola	<i>Cisticola tinniens</i>	69,15	3,76	-	-
Lilac-breasted Roller	<i>Coracias caudatus</i>	0,18	0,75	-	-
Little Bee-eater	<i>Merops pusillus</i>	12,70	0,75	-	-
Little Bittern	<i>Ixobrychus minutus</i>	2,72	0,00	-	-
Little Egret	<i>Egretta garzetta</i>	9,26	0,75	-	-
Little Grebe	<i>Tachybaptus ruficollis</i>	39,02	1,50	-	-
Little Rush Warbler	<i>Bradypterus baboecala</i>	23,05	0,00	-	-
Little Sparrowhawk	<i>Accipiter minullus</i>	1,45	0,75	-	-
Little Swift	<i>Apus affinis</i>	66,97	3,76	-	-
Long-billed Crombec	<i>Sylvietta rufescens</i>	5,08	0,00	-	-
Long-crested Eagle	<i>Lophaetus occipitalis</i>	0,73	0,75	-	-
Long-tailed Paradise Whydah	<i>Vidua paradisaea</i>	12,16	0,75	-	-
Long-tailed Widowbird	<i>Euplectes progne</i>	37,93	6,77	-	-
Maccoa Duck	<i>Oxyura maccoa</i>	0,00	0,75	EN	NT
Malachite Kingfisher	<i>Corythornis cristatus</i>	9,44	0,75	-	-
Malachite Sunbird	<i>Nectarinia famosa</i>	5,63	1,50	-	-
Mallard	<i>Anas platyrhynchos</i>	47,91	0,75	-	-
Marsh Owl	<i>Asio capensis</i>	1,27	1,50	-	-
Marsh Sandpiper	<i>Tringa stagnatilis</i>	0,18	0,75	-	-
Marsh Warbler	<i>Acrocephalus palustris</i>	0,36	0,00	-	-
Martial Eagle	<i>Polemaetus bellicosus</i>	0,00	0,75	EN	EN
Melodious Lark	<i>Mirafra cheniana</i>	0,18	0,75	-	-
Mocking Cliff Chat	<i>Thamnotlaea cinnamomeiventris</i>	2,54	1,50	-	-
Mountain Wheatear	<i>Myrmecocichla monticola</i>	44,28	2,26	-	-
Namaqua Dove	<i>Oena capensis</i>	5,99	2,26	-	-
Natal Spurfowl	<i>Pternistis natalensis</i>	6,35	0,00	-	-
Neddicky	<i>Cisticola fulvicapilla</i>	86,39	3,01	-	-
Nicholson's Pipit	<i>Anthus nicholsoni</i>	4,54	0,00	-	-
Northern Black Korhaan	<i>Afrotis afraoides</i>	54,08	4,51	-	-
Orange River Francolin	<i>Scleroptila gutturalis</i>	13,79	1,50	-	-
Orange River White-eye	<i>Zosterops pallidus</i>	14,70	0,75	-	-
Orange-breasted Bushshrike	<i>Chlorophoneus sulfureopectus</i>	0,73	0,75	-	-
Orange-breasted Waxbill	<i>Amandava subflava</i>	7,62	1,50	-	-
Ovambo Sparrowhawk	<i>Accipiter ovampensis</i>	1,81	0,75	-	-
Pale Chanting Goshawk	<i>Melierax canorus</i>	3,81	0,75	-	-
Pearl-breasted Swallow	<i>Hirundo dimidiata</i>	0,18	0,00	-	-
Pied Avocet	<i>Recurvirostra avosetta</i>	0,36	0,75	-	-
Pied Crow	<i>Corvus albus</i>	57,53	14,29	-	-
Pied Kingfisher	<i>Ceryle rudis</i>	14,70	0,75	-	-
Pied Starling	<i>Lamprotornis bicolor</i>	9,26	5,26	-	-
Pink-billed Lark	<i>Spizocorys conirostris</i>	0,91	0,00	-	-
Pin-tailed Whydah	<i>Vidua macroura</i>	64,79	7,52	-	-
Plain-backed Pipit	<i>Anthus leucophrys</i>	15,97	0,75	-	-
Purple Heron	<i>Ardea purpurea</i>	25,77	1,50	-	-
Purple Indigobird	<i>Vidua purpurascens</i>	5,81	0,00	-	-
Quailfinch	<i>Ortygospiza atricollis</i>	18,51	1,50	-	-
Rattling Cisticola	<i>Cisticola chiniana</i>	24,86	0,75	-	-
Red-backed Shrike	<i>Lanius collurio</i>	21,96	0,75	-	-
Red-billed Firefinch	<i>Lagonosticta senegala</i>	6,35	0,00	-	-
Red-billed Quelea	<i>Quelea quelea</i>	78,22	4,51	-	-

Red-billed Teal	<i>Anas erythrorhyncha</i>	21,42	1,50	-	-
Red-breasted Swallow	<i>Cecropis semirufa</i>	0,00	0,75	-	-
Red-capped Lark	<i>Calandrella cinerea</i>	17,24	4,51	-	-
Red-chested Cuckoo	<i>Cuculus solitarius</i>	19,78	0,75	-	-
Red-chested Flufftail	<i>Sarothrura rufa</i>	0,91	0,75	-	-
Red-collared Widowbird	<i>Euplectes ardens</i>	88,02	6,77	-	-
Red-eyed Dove	<i>Streptopelia semitorquata</i>	95,64	16,54	-	-
Red-faced Mousebird	<i>Urocolius indicus</i>	94,01	11,28	-	-
Red-headed Finch	<i>Amadina erythrocephala</i>	82,40	6,02	-	-
Red-knobbed Coot	<i>Fulica cristata</i>	69,33	3,01	-	-
Red-throated Wryneck	<i>Jynx ruficollis</i>	25,23	0,00	-	-
Red-winged Starling	<i>Onychognathus morio</i>	7,26	1,50	-	-
Reed Cormorant	<i>Microcarbo africanus</i>	66,79	3,76	-	-
Rock Dove	<i>Columba livia</i>	12,16	1,50	-	-
Rock Kestrel	<i>Falco rupicolus</i>	0,36	0,75	-	-
Rock Martin	<i>Ptyonoprogne fuligula</i>	51,72	4,51	-	-
Rose-ringed Parakeet	<i>Psittacula krameri</i>	0,18	0,00	-	-
Ruff	<i>Calidris pugnax</i>	0,18	0,75	-	-
Rufous-cheeked Nightjar	<i>Caprimulgus rufigena</i>	1,27	0,75	-	-
Rufous-naped Lark	<i>Mirafraga africana</i>	57,71	6,77	-	-
Sabota Lark	<i>Calendulauda sabota</i>	14,70	1,50	-	-
Scaly-feathered Weaver	<i>Sporopipes squamifrons</i>	6,35	0,75	-	-
Secretarybird	<i>Sagittarius serpentarius</i>	0,18	0,00	EN	VU
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>	0,36	0,75	-	-
Shaft-tailed Whydah	<i>Vidua regia</i>	4,17	0,00	-	-
Shikra	<i>Accipiter badius</i>	0,18	0,75	-	-
Short-toed Rock Thrush	<i>Monticola brevipes</i>	0,36	0,00	-	-
South African Cliff Swallow	<i>Petrochelidon spilodera</i>	7,80	0,00	-	-
South African Shelduck	<i>Tadorna cana</i>	4,54	0,75	-	-
Southern Boubou	<i>Laniarius ferrugineus</i>	7,80	1,50	-	-
Southern Fiscal	<i>Lanius collaris</i>	91,83	12,78	-	-
Southern Grey-headed Sparrow	<i>Passer diffusus</i>	80,76	4,51	-	-
Southern Masked Weaver	<i>Ploceus velatus</i>	98,37	18,05	-	-
Southern Pied Babbler	<i>Turdoides bicolor</i>	0,18	0,00	-	-
Southern Pochard	<i>Netta erythrophthalma</i>	0,36	0,75	-	-
Southern Red Bishop	<i>Euplectes orix</i>	94,74	17,29	-	-
Speckled Mousebird	<i>Colius striatus</i>	81,31	6,02	-	-
Speckled Pigeon	<i>Columba guinea</i>	93,28	16,54	-	-
Spike-heeled Lark	<i>Chersomanes albofasciata</i>	11,43	3,01	-	-
Spotted Eagle-Owl	<i>Bubo africanus</i>	11,98	0,75	-	-
Spotted Flycatcher	<i>Muscicapa striata</i>	21,23	0,00	-	-
Spotted Thick-knee	<i>Burhinus capensis</i>	58,80	2,26	-	-
Spur-winged Goose	<i>Plectropterus gambensis</i>	19,24	0,75	-	-
Squacco Heron	<i>Ardeola ralloides</i>	3,45	0,75	-	-
Streaky-headed Seedeater	<i>Crithagra gularis</i>	52,45	3,01	-	-
Striated Heron	<i>Butorides striata</i>	2,72	0,00	-	-
Striped Pipit	<i>Anthus lineiventris</i>	2,72	0,00	-	-
Swainson's Spurfowl	<i>Pternistis swainsonii</i>	67,33	4,51	-	-
Swallow-tailed Bee-eater	<i>Merops hirundineus</i>	0,54	0,00	-	-
Tawny-flanked Prinia	<i>Prinia subflava</i>	57,17	2,26	-	-
Temminck's Courser	<i>Cursorius temminckii</i>	0,73	0,75	-	-
Thick-billed Weaver	<i>Amblyospiza albifrons</i>	64,61	6,02	-	-
Three-banded Plover	<i>Charadrius tricollaris</i>	28,31	0,75	-	-
Verreaux's Eagle	<i>Aquila verreauxii</i>	3,09	2,26	-	VU
Verreaux's Eagle-Owl	<i>Bubo lacteus</i>	0,00	0,75	-	-
Village Indigobird	<i>Vidua chalybeata</i>	5,99	0,00	-	-
Village Weaver	<i>Ploceus cucullatus</i>	0,36	0,00	-	-
Violet-backed Starling	<i>Cinnyricinclus leucogaster</i>	2,00	0,75	-	-
Violet-eared Waxbill	<i>Granatina granatina</i>	6,90	0,75	-	-

Wailing Cisticola	<i>Cisticola lais</i>	37,75	0,75	-	-
Wattled Starling	<i>Creatophora cinerea</i>	55,72	2,26	-	-
Western Barn Owl	<i>Tyto alba</i>	9,80	0,75	-	-
Western Cattle Egret	<i>Bubulcus ibis</i>	61,71	9,02	-	-
Western Osprey	<i>Pandion haliaetus</i>	0,18	0,75	-	-
Whiskered Tern	<i>Chlidonias hybrida</i>	1,63	0,00	-	-
White Stork	<i>Ciconia ciconia</i>	1,63	1,50	-	-
White-backed Duck	<i>Thalassornis leuconotus</i>	0,00	0,75	-	-
White-backed Mousebird	<i>Colius colius</i>	39,93	3,76	-	-
White-bellied Sunbird	<i>Cinnyris talatala</i>	78,77	6,02	-	-
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>	6,53	0,75	-	-
White-browed Sparrow-Weaver	<i>Plocepasser mahali</i>	98,55	24,06	-	-
White-faced Whistling Duck	<i>Dendrocygna viduata</i>	8,35	2,26	-	-
White-fronted Bee-eater	<i>Merops bullockoides</i>	4,90	0,75	-	-
White-rumped Swift	<i>Apus caffer</i>	66,06	6,77	-	-
White-throated Robin-Chat	<i>Cossypha humeralis</i>	0,18	0,00	-	-
White-throated Swallow	<i>Hirundo albigularis</i>	52,81	2,26	-	-
White-winged Widowbird	<i>Euplectes albonotatus</i>	34,30	2,26	-	-
Willow Warbler	<i>Phylloscopus trochilus</i>	23,41	0,75	-	-
Wing-snapping Cisticola	<i>Cisticola ayresii</i>	1,63	0,75	-	-
Wood Sandpiper	<i>Tringa glareola</i>	0,91	0,00	-	-
Yellow Canary	<i>Crithagra flaviventris</i>	59,89	0,75	-	-
Yellow-bellied Eremomela	<i>Eremomela icteropygialis</i>	8,35	0,00	-	-
Yellow-billed Duck	<i>Anas undulata</i>	61,71	3,01	-	-
Yellow-billed Kite	<i>Milvus aegyptius</i>	0,18	0,75	-	-
Yellow-billed Stork	<i>Mycteria ibis</i>	0,00	0,75	-	EN
Yellow-crowned Bishop	<i>Euplectes afer</i>	21,78	3,01	-	-
Yellow-fronted Canary	<i>Crithagra mozambica</i>	0,73	0,75	-	-
Yellow-throated Bush Sparrow	<i>Gymnoris supercilialis</i>	0,18	0,00	-	-
Zitting Cisticola	<i>Cisticola juncidis</i>	17,24	2,26	-	-