

# APPENDIX

## **F** SPECIALIST STUDIES



## APPENDIX

# ***F-1*** AVIFAUNA

# AVIFAUNAL IMPACT ASSESSMENT

Impumelelo Wind Energy Facility Grid Connection up to 132kV,  
Mpumalanga Province



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# EXECUTIVE SUMMARY

## 1 Background

Impumelelo Wind (Pty) Ltd proposes to develop the Impumelelo Wind Energy Facility (of up to 200 MW) and its associated infrastructure near Greylingstad in Mpumalanga. Associated with the Impumelelo WEF development is an on-site substation, an overhead grid connection of 132 kV, and a step-down substation at Zandfontein. These associated components are referred to as the 'Impumelelo Grid Connection' in this report.

This report has been prepared in terms of the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted 'Procedures for the assessment and minimum criteria for reporting on identified environmental themes (Government Gazette 43110, No. 320, 20 March 2020 and Government Gazette 43855, No. 1150, 30 October 2020) (NEMA 2020a, 2020b). Note that these protocols replace the requirements of Appendix 6 of the 2014 NEMA EIA Regulations. The approach, methodology and regulatory framework is explained in Chapters 2-5 of

## 2 Avifauna

A total of 289 bird species could potentially occur within the broader area where the project site is located. Eighty-three (83) of these bird species are classified as powerline sensitive species, of which sixty (60) are considered to regularly occur in the development PAOI, with fifty (50) such species having been recorded during the field surveys.

## 3 Summary and conclusion

The proposed Impumelelo Grid Connection could have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Collisions with the 132kV HV overhead lines in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

### 3.1 Displacement of priority species due to habitat transformation in the construction phase

The loss of habitat for powerline sensitive species due to direct habitat transformation associated with the construction of the proposed Impumelelo Grid Connection is likely to be moderate due to the small size of the footprint, but ideally high-quality grassland should be avoided if possible. In summary, the powerline priority bird



species which may regularly occur at the development area could be impacted by habitat transformation associated with the development of the grid infrastructure: Blue Crane, Blue Korhaan, Denham's Bustard, Marsh Owl, Northern Black Korhaan, and Secretarybird. The impact is rated as **moderate** pre-mitigation and **low** post-mitigation.

### 3.2 Displacement of priority species due to disturbance linked to the construction activities in the construction phase

It is inevitable that a measure of displacement will take place at the Impumelelo Grid Connection development area for the priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species in the remaining high-quality grassland, wetlands and wetland fringes the most, as this could temporarily disrupt their reproductive cycle. Some species might be able to recolonise the area after the completion of the construction phase, but for some species, this might only be partially the case, resulting in lower densities than before. In summary, the powerline priority bird species which may regularly occur at the development area that could be impacted by disturbances during the construction phase are the following: African Fish Eagle, African Harrier-Hawk, African Marsh Harrier, Black Sparrowhawk, Black-chested Snake Eagle, Black-winged Kite, Blue Crane, Blue Korhaan, Denham's Bustard, Greater Kestrel, Jackal Buzzard, Lanner Falcon, Marsh Owl, Northern Black Korhaan, Secretarybird, and Spotted Eagle-Owl. The impact is rated as **moderate** pre-mitigation and **low** post-mitigation.

### 3.3 Electrocuting of priority species in the onsite substation in the operational phase

Electrocutions within the proposed on-site substation yard are possible but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls, and certain species of waterbirds. In summary, the following powerline priority bird species which may regularly occur at the development area are vulnerable to electrocution in this manner: African Fish Eagle, African Harrier-Hawk, African Marsh Harrier, African Sacred Ibis, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Cape Crow, Common Buzzard, Egyptian Goose, Greater Kestrel, Hadada Ibis, Hamerkop, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Marsh Owl, Pied Crow, Rock Kestrel, Spotted Eagle-Owl, Western Barn Owl, and Western Cattle Egret. The impact is rated as **moderate** pre-mitigation and **very low** post-mitigation.

### 3.4 Collisions of priority species with the overhead 132kV powerlines in the operational phase

Collisions are arguably the biggest threat posed by transmission lines to birds in southern Africa. Most heavily impacted upon are bustards, storks, cranes, and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to

take the necessary evasive action to avoid colliding with transmission lines. In summary, the following powerline priority bird species which may regularly occur at the development area are particularly vulnerable to risk of collisions with the overhead 132kV powerlines: African Black Duck, African Darter, African Sacred Ibis, African Spoonbill, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Cape Shoveler, Cape Teal, Denham's Bustard, Egyptian Goose, Glossy Ibis, Goliath Heron, Great Crested Grebe, Great Egret, Greater Flamingo, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Maccoa Duck, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-breasted Cormorant, White-faced Whistling Duck, and Yellow-billed Duck. The impact is rated as **high** pre-mitigation and **low** post-mitigation.

### 3.5 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed Grid Connection. The impact is rated as **moderate** pre-mitigation and **low** post-mitigation.

### 3.6 Cumulative impacts

The total length of overhead 132kV powerlines for proposed Impumelelo Grid Connection is approximately 34 km. There is a total length of approximately 3352 km of overhead high voltage powerlines in a 55 km radius of the development area, although for the purpose of this avifaunal risk assessment, this can be reduced to a functional length approximately 1785 km, given that several overhead powerlines run parallel for part of their respective lengths. The Impumelelo Grid Connection therefore represents a comparatively **Low** contribution towards the total length of high voltage power lines within a 55 km radius. However, this project will increase the density of planned and existing high voltage lines within a 55 km radius, and this cumulative effect represents a potentially **Moderate** impact risk to priority avifauna.

## 4 Conclusion and impact statement

The proposed Impumelelo Grid Connection could have a **moderate to high** impact on avifauna which, in most instances, could be reduced to **low** through appropriate mitigation, although some moderate residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed Grid Connection development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

## 5 Environmental sensitivities

The following specific environmental sensitivities were identified from an avifaunal perspective:

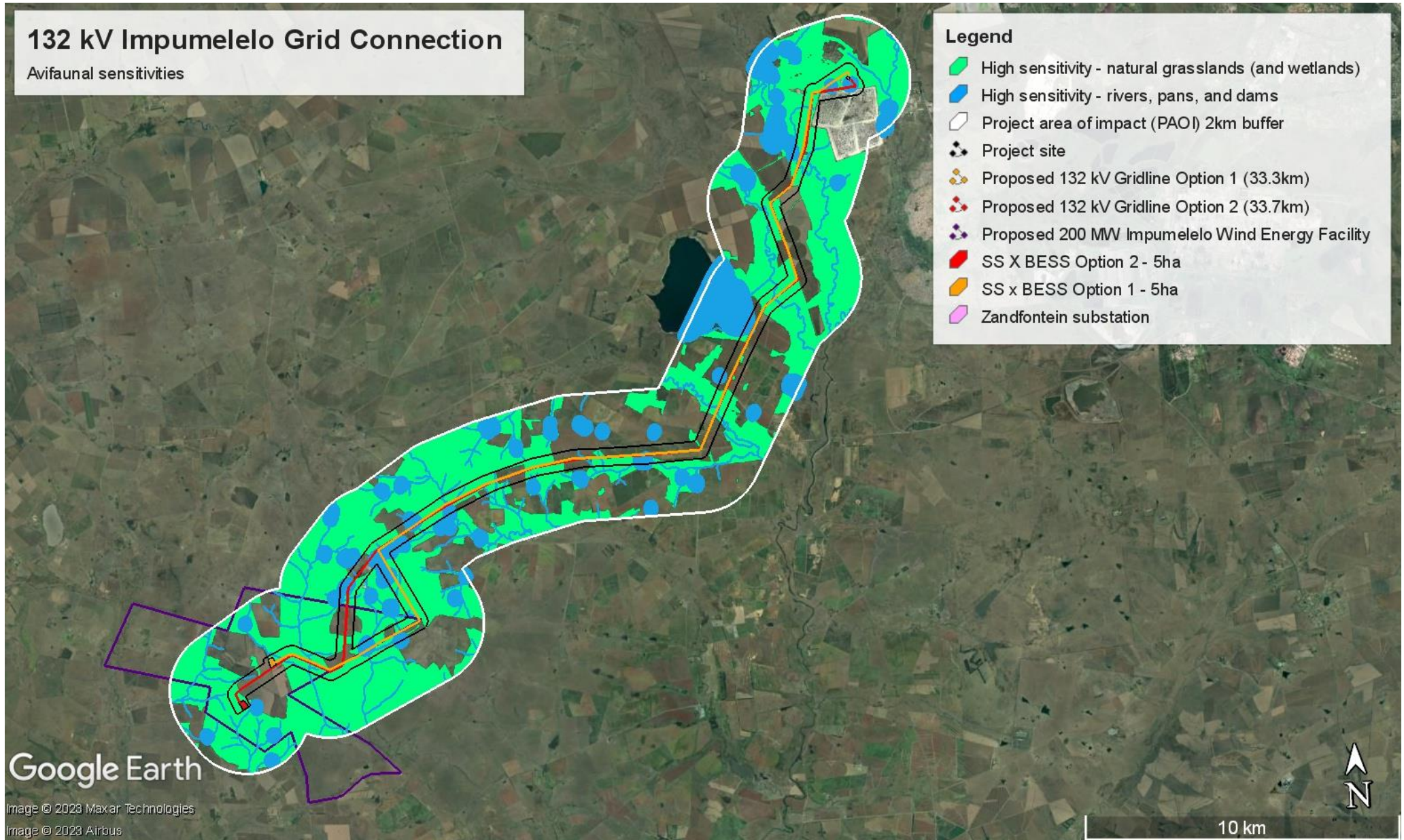
- **Drainage lines, dams, pans, and associated wetlands.** These habitat features are important attractions for many power line sensitive species, particularly waterbirds, including Red List species expected to regularly occur in the development area: African Marsh Harrier, Blue Crane, Greater Flamingo, Lesser Flamingo, Maccoa Duck, and Lanner Falcon. Birds commuting between these areas will be at risk of collision with the earthwire if they must cross over the grid connection. Spans crossing these areas, or situated between two or more such areas, must be identified during the walk-through inspection once the final tower positions have been determined and marked with Bird Flight Diverters, and/or LED bird flappers in specific instances (Leeupan) to reduce the risk of nocturnal bird collisions.
- **Natural grassland.** The natural grassland is vital breeding, roosting and foraging habitat for a variety of powerline sensitive species and will therefore be associated with significant flight activity. These include Red List species expected to regularly occur in the development area: African Marsh Harrier, Blue Crane, Denham's Bustard, Blue Korhaan, Lanner Falcon, and Secretarybird. Spans crossing these areas, or situated between two or more such areas, must be identified during the walk-through inspection once the final tower positions have been determined and marked with Bird Flight Diverters.

See Figure (i) for the avifaunal sensitivities identified from a powerline perspective.



# 132 kV Impumelelo Grid Connection

Avifaunal sensitivities



**Figure (i): Avifaunal sensitivities within the Impumelelo Grid Connection project area of impact. High sensitivity areas include natural undisturbed grassland (shaded green), and wetlands, rivers/streams, pans and dams (shaded blue).**



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## Glossary of Terms

<b>Definitions</b>	
Powerline sensitive species	Powerline sensitive species are defined as species which could potentially be impacted by powerline collisions or electrocutions, based on their morphology. Larger birds, particularly raptors and vultures, are more vulnerable to electrocution as they are more likely to bridge the clearances between electrical components than smaller birds. Large terrestrial species and certain waterbirds with high wing loading are less maneuverable than smaller species and are therefore more likely to collide with overhead lines.
Project area of impact (PAOI)	A 2km zone around the proposed on-site substation and 132kV overhead power line.
Project site	A 500m wide corridor within which the proposed grid connection will be constructed (250m on either side of the development).
Pentad	A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'x 5'). Each pentad is approximately 8 x 7.6 km.
Broader area	A consolidated data set for a total of 6 pentads where the application sites are located.

# DETAILS OF THE SPECIALIST

## **Chris van Rooyen (Bird Specialist)**

Chris has 25 years' experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (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 worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico, and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in numerous power line and wind generation projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in Southern Africa, which is the accepted industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

## **Jake Mulvaney**

Jake holds PhD in Zoology from Stellenbosch University and is the author of four academic papers involving bird population assessments and GIS modelling.

## **Albert Froneman (Bird and GIS Specialist)**

Albert has an M. Sc. in Conservation Biology from the University of Cape Town and started his career in the natural sciences as a Geographic Information Systems (GIS) specialist at Council for Scientific and Industrial Research (CSIR). In 1998, he joined the Endangered Wildlife Trust where he headed up the Airports Company South Africa – EWT Strategic Partnership, a position he held until he resigned in 2008 to work as a private ornithological consultant. Albert's specialist field is the management of wildlife, especially bird related hazards at airports. His expertise is recognized internationally; in 2005 he was elected as Vice Chairman of the International Bird Strike Committee. Since 2010, Albert has worked closely with Chris van Rooyen in developing a protocol for pre-construction monitoring at wind energy facilities, and he is currently jointly coordinating pre- and post-construction monitoring programmes at several wind farm facilities. Albert also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

# 1. INTRODUCTION

Impumelelo Wind (Pty) Ltd proposes to develop the Impumelelo Wind Energy Facility (of up to 200 MW) and its associated infrastructure near Greylingstad in Mpumalanga. Associated with the Impumelelo WEF development is an on-site substation, an overhead grid connection of 132 kV, and a step-down substation at Zandfontein. These associated components are hereafter referred to as the ‘Impumelelo Grid Connection’.

Within this project area the extent of the buildable area is subject to a Basic Assessment process in terms of the 2014 NEMA EIA Regulations, as amended.

The Impumelelo Grid Connection falls within the Gert Sibande District Municipality and the Dipaleseng Local Municipality as well as the Govan Mbeki Local Municipality in the Mpumalanga province, with the Impumelelo onsite substation located at 26°39'05.8" S; 28°52'53.4"E. The Impumelelo Grid Connection spans approximately 34 km to the Zandfontein substation in the northeast, transecting four farm properties (see **Table 1**). This grid connection infrastructure follows the Impumelelo mine conveyor belt eastwards up to the R547 then northwards to link up with the R50, then north-eastward along the R547 before finally turning eastward to link to the Zandfontein substation.

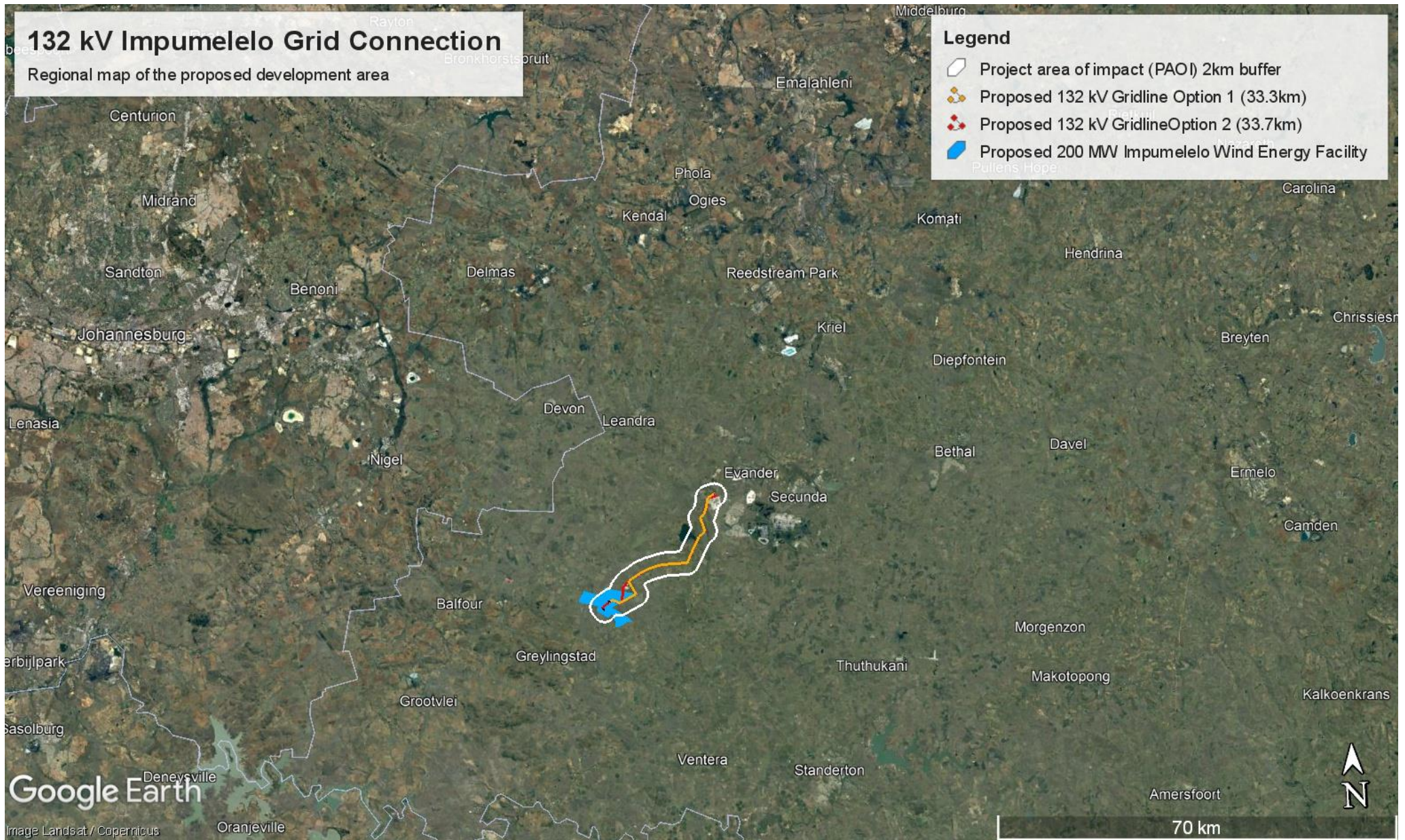
**Table 1: Key technical details of the Impumelelo Grid Connection development**

Component	Description / Dimensions
Facility Name	Impumelelo Wind Energy Facility
Applicant	Impumelelo Wind (Pty) Ltd (Registration Number: 2022/601923/07)
Municipalities	The project is located in the Dipaleseng local Municipality of the Gert Sibande District Municipality
Affected Farms	Zandfontein 130 (0, 2, 3, 4, 8, 9) Sprinbokdraai 277 (2, 3, 5, 8) De Bank of Vaalbank 280 (1, 2, 4, 6) Roodebank 323 (16, 20) Kaalspruit 528 (2, 3, 6, 7, 9) Farm 529 (0) Farm 532 (16) Wolvenfontein 534 (1, 18, 19, 20) Holgatsfontein 535 (3, 4, 14, 15, 16, 17, 18, 19, 20) Farm 542 (0) Platkop 543 (2, 4, 5, 9) Mahemsfontein 544 (0, 6, 7, 8, 25)
Powerline corridor length	Approximately 34km (To be confirmed prior to construction)
Powerline assessment corridors width	500m (250m either side of center line)
Powerline servitude	32m per 132kV powerline Option 1: ~33km Option 2: ~34km
Powerline pylons:	Monopole or Lattice pylons, or a combination of both where required
Powerline pylon height:	Maximum 40m height
Temporary laydown or staging area:	Typical area 220m x 100m = 22000m <sup>2</sup> . Laydown area could increase to 30000m <sup>2</sup> for concrete towers, should they be required.
Site access	R547 and R23

Height of substation fencing	Up to 3 m high Galvanised steel
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See Error! Reference source not found. for the regional context of the development area, and **Figure 2** for the map of the proposed layout for the proposed Impumelelo Grid Connection.





**Figure 1: Regional contextualisation map of the proposed Impumelelo Grid Connection in Mpumalanga, showing the project area of impact (PAOI)**



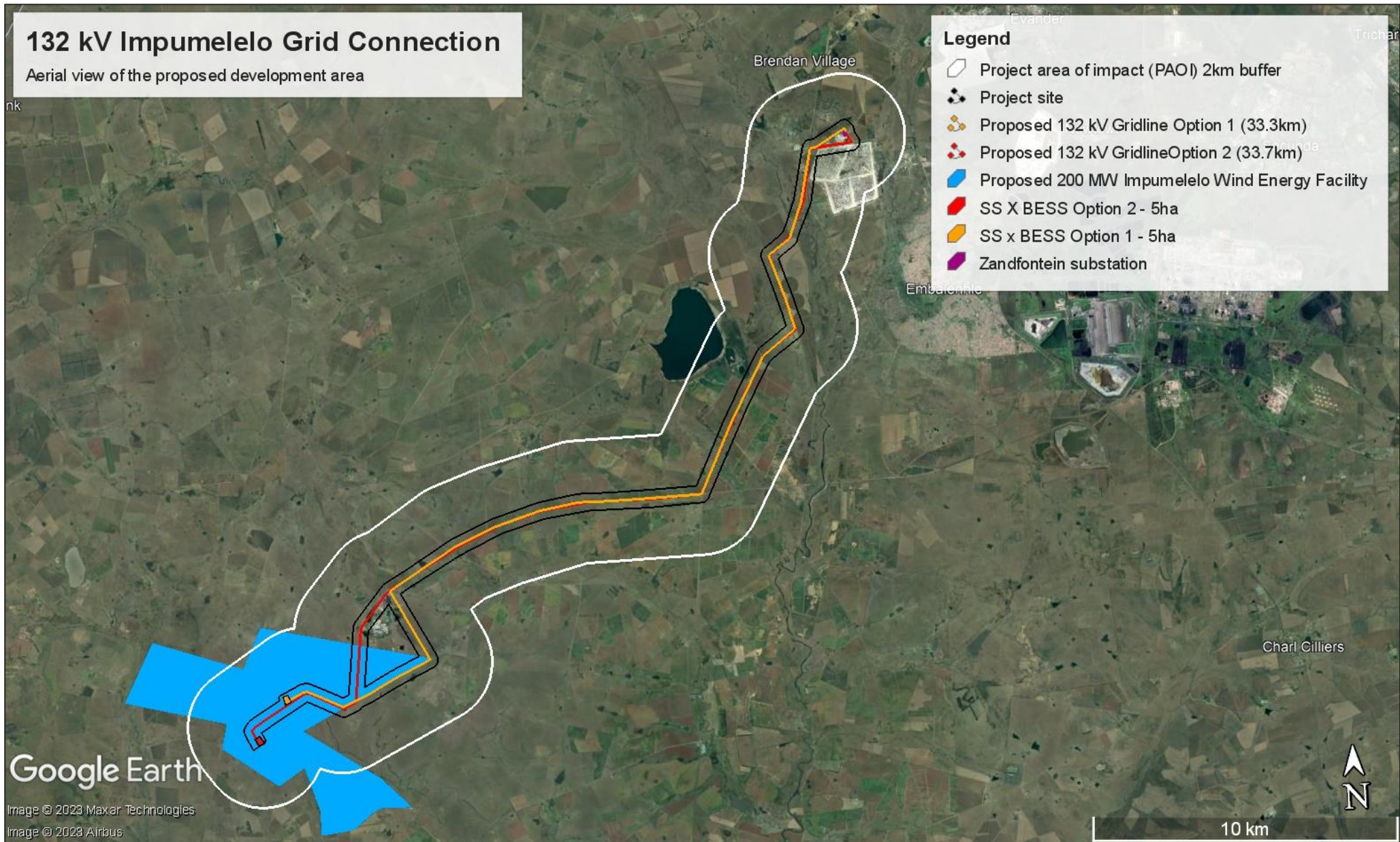


Figure 2: Aerial view of the proposed Impumelelo 132kV Grid Connection, showing project area of impact (PAOI – white delineation).

## 2. TERMS OF REFERENCE

The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020) is applicable. The purpose of the specialist report is to determine the main issues and potential impacts of the proposed project based by the on existing information and field assessments, according to the said protocol. In summary, the protocol requires the following:

- Describe the affected environment from an avifaunal perspective.
- Discuss gaps in baseline data and other limitations and describe the expected impacts associated with the Project.
- Identify potential sensitive environments and receptors that may be impacted on by the proposed Project and the types of impacts (i.e. direct, indirect and cumulative) that are most likely to occur.
- Determine the nature and extent of potential impacts during the construction and operational phases.
- Identify 'No-Go' areas, where applicable.
- Recommend mitigation measures to reduce the impact of the expected impacts.
- Provide an impact statement on whether the project should be approved or not.

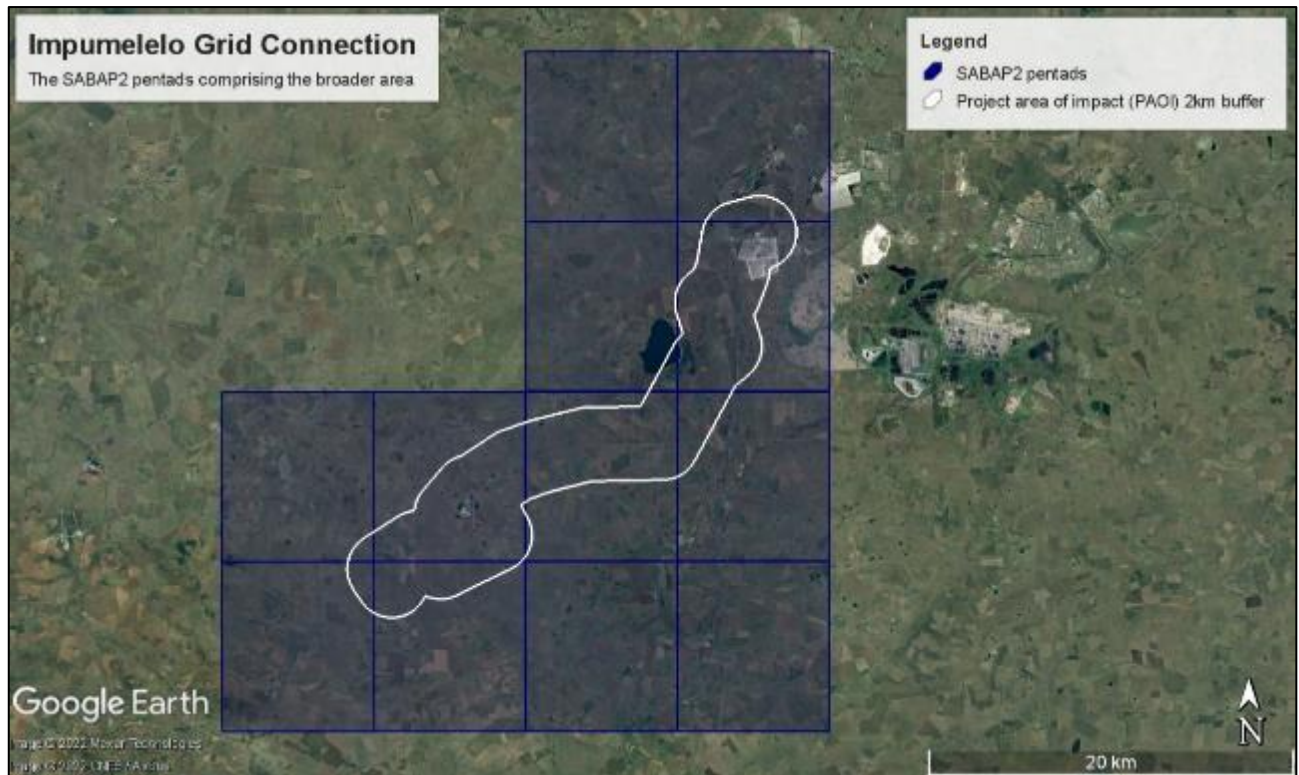
## 3. OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following information sources were consulted to conduct this study:

- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town, to ascertain which species occurs within the broader area i.e., within a block consisting of the twelve pentad grid cells each within which the proposed projects are situated (see **Figure 3**). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'x 5'). Each pentad is approximately 8 x 7.6 km. To date, a total of 830 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 800 *ad hoc* protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed. The SABAP2 data was therefore regarded as a reliable reflection of the avifauna which occurs in the area, but the data was also supplemented by data collected during the site surveys and general knowledge of the area.
- 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 powerline sensitive species was determined by consulting the (2022.1) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (<http://www.iucnredlist.org/>).

- The project area of impact (PAOI) was defined as a 2km buffer zone around the proposed 132kV powerline infrastructure.
- A classification of the habitat in the PAOI was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (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 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 ©2022) was used to view the PAOI and broader area on a landscape level and to help identify sensitive bird habitat.
- Powerline sensitive species are defined as species which could potentially be impacted by powerline collisions or electrocutions, based on their morphology. Larger birds, particularly raptors and vultures, are more vulnerable to electrocution as they are more likely to bridge the clearances between electrical components than smaller birds. Large terrestrial species and certain waterbirds with high wing loading are less manoeuvrable than smaller species and are therefore more likely to collide with overhead lines.
- 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:
  - 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)
  - The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020).
- The 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 from 2021 – 2022 over a period of four seasons for the proposed Impumelelo WEF, which is also relevant for the proposed grid connection.





**Figure 3: The SABAP2 pentads (dark blue shaded grid cells) comprising the broader area wherein the proposed Impumelelo Wind Energy facility is located (project area of impact – white delineation).**

## 4. ASSUMPTIONS AND LIMITATIONS

This study made the basic assumption that the sources of information used are reliable and accurate. The following must be noted:

- The focus of the study was primarily on the potential impacts of the proposed on-site substation and 132kV overhead power line on powerline sensitive species.
- Powerline sensitive species were defined as species which could potentially be impacted by powerline collisions or electrocutions, based on their morphology. Larger birds, particularly raptors and vultures, are more vulnerable to electrocution as they are more likely to bridge the clearances between electrical components than smaller birds. Large terrestrial species and certain waterbirds with high wing loading are less manoeuvrable than smaller species and are therefore more likely to collide with overhead lines.
- The assessment of impacts is based on the baseline environment as it currently exists in the PAOI, as well as the broader area comprising the six SABAP2 pentads associated with the Impumelelo Grid Connection project site (see **Figure 3**).
- The SABAP2 dataset is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna that could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, and the results of the pre-construction monitoring for the associated WEF which was conducted over 12 months.

- Conclusions in this study are based on experience of these 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.
- Information on the proposed grid connections of renewable energy projects within a 30km radius around the project was sourced from public documents available on the internet. In some instances, information was not readily available, or specifications may have changed, therefore the confidence in the information is moderate.
- 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.

## 5. LEGISLATIVE CONTEXT

### 5.1. Agreements and conventions

**Table 2** below lists agreements and conventions which South Africa is party to, and which are relevant to the conservation of avifauna<sup>1</sup>.

**Table 2: Agreements and conventions which South Africa is party to and which are relevant to the conservation of avifauna.**

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

<sup>1</sup> (BirdLife International (2021) Country profile: South Africa. Available from: [http://www.birdlife.org/datazone/country/south\\_africa](http://www.birdlife.org/datazone/country/south_africa). Checked: 2021-09-20).

Convention name	Description	Geographic scope
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> <p>The conservation of biological diversity</p> <p>The sustainable use of the components of biological diversity</p> <p>The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.</p>	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
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	<p>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.</p>	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	<p>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.</p>	Regional

## 5.2. National legislation

### 5.2.1. Constitution of the Republic of South Africa, 1996

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

- a) to an environment that is not harmful to their health or well-being; and

- b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
  - i. prevent pollution and ecological degradation;
  - ii. promote conservation; and
  - iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

### 5.2.2. The National Environmental Management Act 107 of 1998 (NEMA)

The National Environmental Management Act 107 of 1998 (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 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.

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

### 5.2.3. 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 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.



## 5.3. Provincial Legislation

The current legislation applicable to the conservation of fauna and flora in Mpumalanga is the Mpumalanga Nature Conservation Act 10 of 1998. It consolidated and amended the laws relating to nature conservation within the province and provides for matters connected therewith. All birds are classified as Protected Game (Section 4 (1) (b)), except those listed in Schedule 3, which are classified as Ordinary Game (Section 4 (1)(c)).

# 6. BASELINE ASSESSMENT

## 6.1. Important Bird Areas (IBAs)

The Devon Grasslands IBA (IBA SA130) (Marnewick et al., 2015) is 3.6km west of the southern extent of the Impumelelo Grid Connection's PAOI. The Devon Grassland IBA was established in 2014 for the protection of several threatened grassland/wetland species, several of which regularly occur within the broader area of PAOI (see Section 7): Blue Crane (Globally Vulnerable, Regionally Near Threatened), Greater Flamingo (Globally Least Concern, Regionally Near Threatened), Blue Korhaan (Globally Vulnerable, Regionally Least Concern), African Marsh Harrier (Globally Least Concern, Regionally Endangered), and Secretarybird (Globally Endangered, Regionally Vulnerable). The Devon's Grassland IBA additionally serves to protect Black Harrier (Globally Endangered, Regionally Endangered), another powerline sensitive species which irregularly occurs within the broader area of the PAOI.

As of 2015, 250-300 Blue Cranes and 20-25 breeding Secretarybirds were present within the Devon's Grassland IBA. The PAOI shares highly similar habitat conditions with the Devon Grassland IBA, and it is anticipated that some of these Red List species from this IBA will utilize, the grasslands and wetlands within the PAOI, and so would be vulnerable to the potential impacts of the Impumelelo Grid Connection development.

Two additional IBAs occur within 60 km of the PAOI: Blesbokspruit (IBA SA021) (46 km northwest) and Suikerbosrand (IBA SA022) (56 km west). However, it is not envisaged that the proposed grid connection will significantly impact on avifauna in these IBAs due to the distance from the PAOI.

## 6.2. DFFE National Screening Tool

The PAOI is classified as **Low, Medium and High Sensitivity** for terrestrial animals according to the Terrestrial Animal Species Theme. The **high sensitivity** classification is linked to the potential occurrence of African Marsh Harrier (Globally Least Concern, Regionally Endangered), Caspian Tern (Globally Least Concern, Regionally Vulnerable), White-bellied Bustard (Globally Least Concern, Regionally Vulnerable), Martial Eagle (Globally Endangered, Regionally Endangered), and Secretarybird (Globally Endangered, Regionally Vulnerable) (Error! Reference source not found.3). Additionally, **medium sensitivity** classifications are linked to most of the above species, as well as African Grass Owl (Globally Least Concern, Regionally Vulnerable)

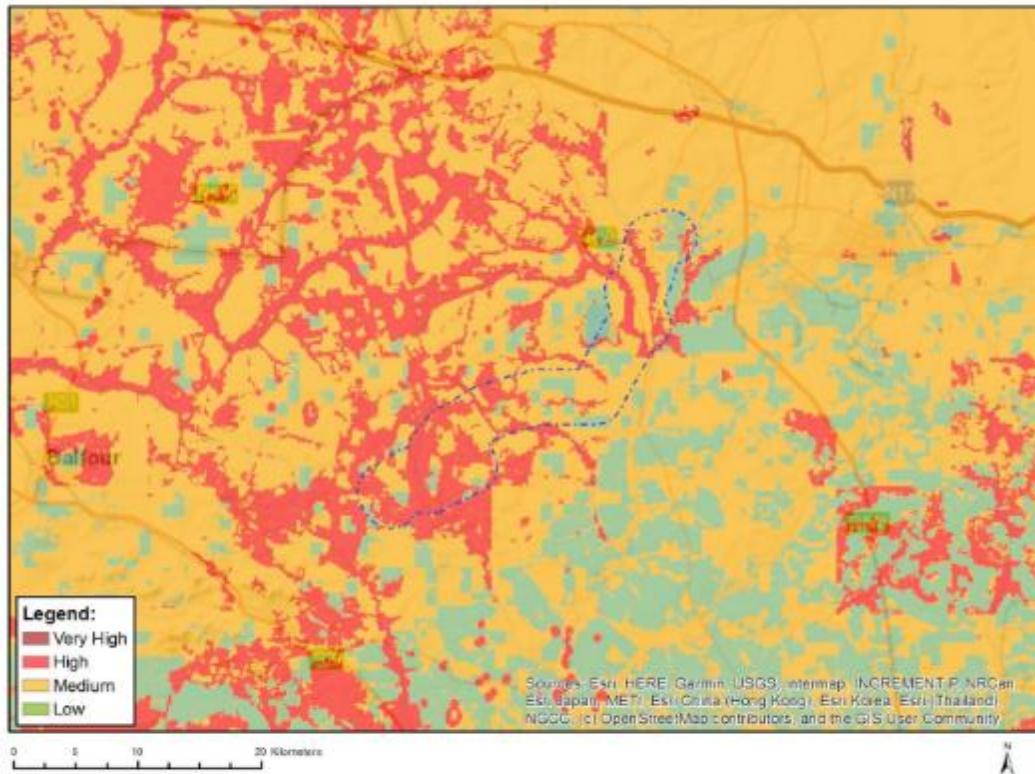
The project site and PAOI contain confirmed habitat for these species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental

impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020), namely listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered, Vulnerable, Near Threatened, and Data Deficient species.

The occurrence of Secretarybird (Globally Endangered, Regionally Vulnerable) and additional SCC was confirmed in the PAOI during the surveys i.e., Blue Crane (Globally, Vulnerable, Regionally Near Threatened), Denham's Bustard (Globally Near Threatened, Regionally Vulnerable), Blue Korhaan (Globally, Vulnerable, Regionally Least Concern), Greater Flamingo (Globally Least Concern, Regionally Near Threatened), Lanner Falcon (Globally Least Concern, Regionally Vulnerable), and Maccoa Duck (Globally Endangered, Regionally Near Threatened).

In summary, based on the Site Sensitivity Verification field surveys conducted and subsequent pre-construction monitoring at the WEF, habitat within the PAOI is suitable for Blue Crane, Denham's Bustard, Blue Korhaan, Greater Flamingo, Lanner Falcon, Maccoa Duck, and Secretarybird. Therefore, a classification of **High Sensitivity** for avifauna for the Terrestrial Animal Species theme is suggested for the PAOI.

## MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

### Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Circus ranivorus
High	Aves-Hydroprogne caspia
High	Aves-Eupodotis senegalensis
High	Aves-Polemaetus bellicosus
High	Aves-Sagittarius serpentarius
Low	Subject to confirmation
Medium	Aves-Circus ranivorus
Medium	Aves-Eupodotis senegalensis
Medium	Aves-Hydroprogne caspia
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Tyto capensis

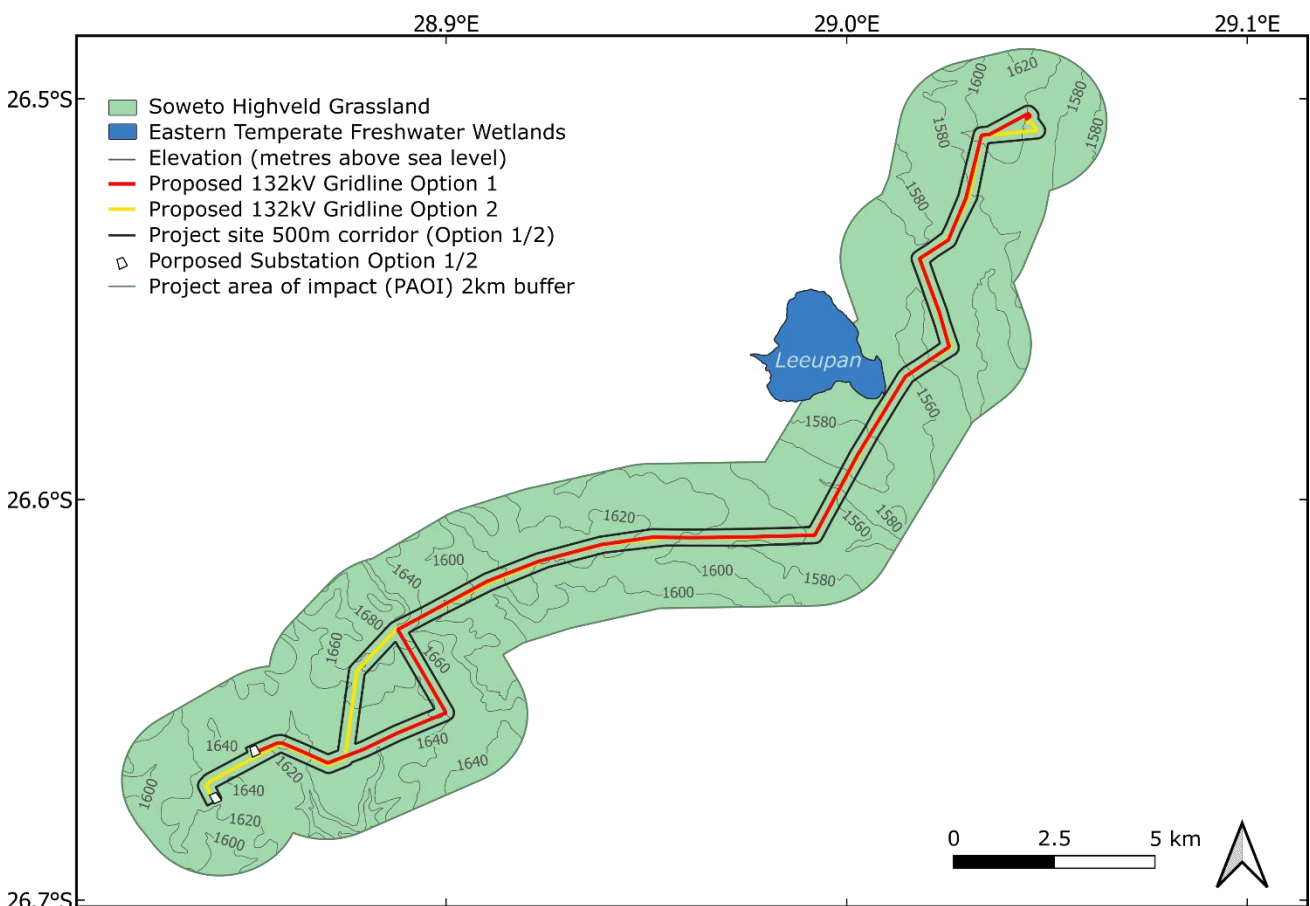
Figure 4: The national web-based environmental screening tool map of the project site, indicating sensitivities for the terrestrial animal species theme. The high sensitivity classification is linked to African Marsh Harrier (*Circus ranivorus*), Caspian Tern (*Hydroprogne caspia*), White-bellied Bustard (*Eupodotis senegalensis*), Martial Eagle (*Polemaetus bellicosus*), and Secretarybird (*Sagittarius serpentarius*). Medium sensitivity classification is linked to African Marsh Harrier, Caspian tern, White-bellied Bustard, Secretarybird, and African Grass Owl (*Tyto capensis*).

### 6.3. Protected Areas

According to the South African Protected Areas database (SAPAD), the closest protected area is the Devon Protected Area, which is located approximately 18km north-west of the proposed development area. No further information could be obtained about the nature reserve. However, from an avifaunal perspective, the state of the habitat and land use at the development area is more important than the legal status.

### 6.4. Biomes and vegetation types

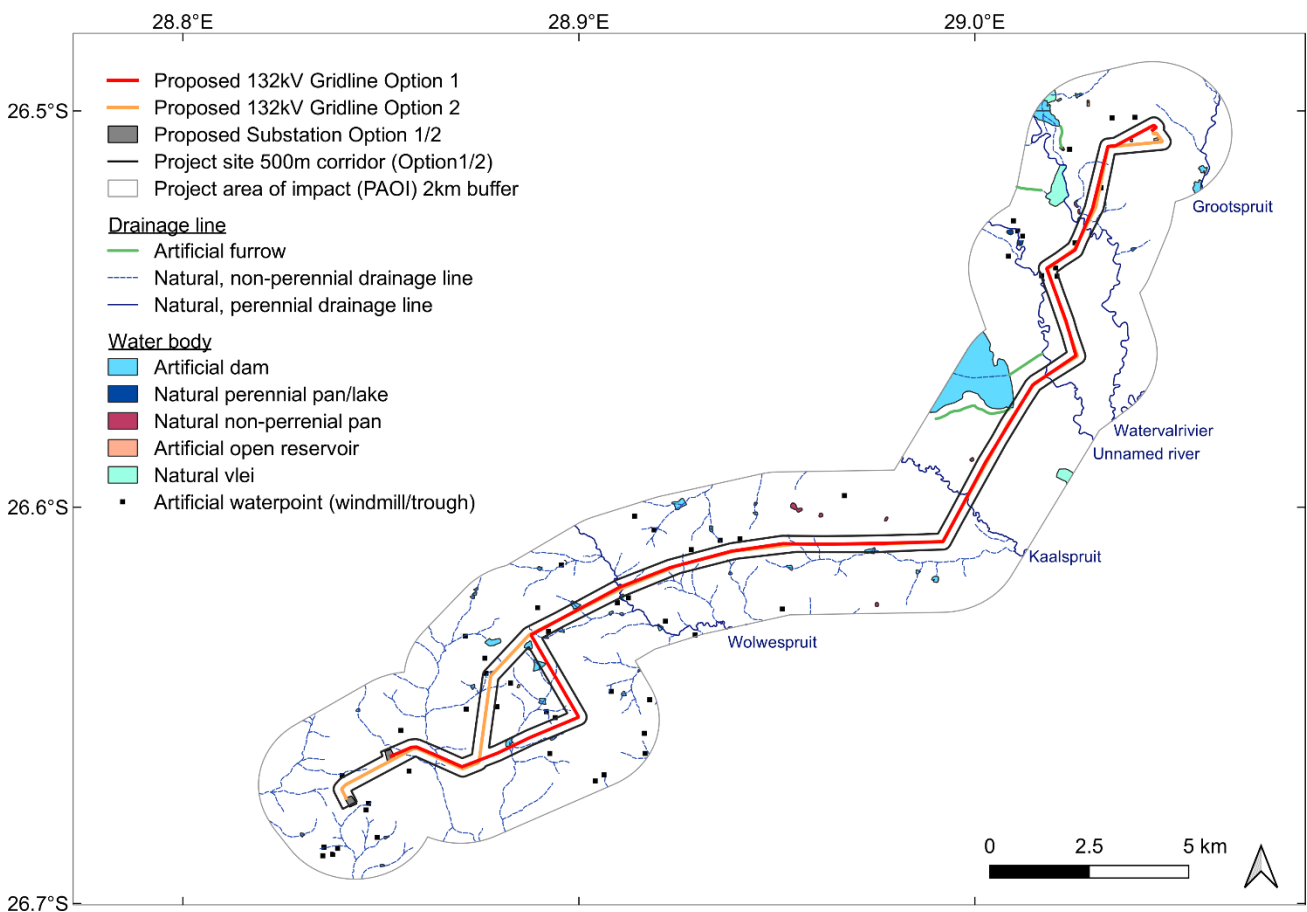
The PAOI of the Impumelelo Grid Connection is situated over gently undulating, and occasionally hilly terrain Soweto Highveld Grassland (Gm8) vegetation ecotype of Mesic Highveld Grassland Bioregion (SANBI, 2018) (**Figure 5**). Soweto Highveld Grassland covers 14 513 km<sup>2</sup> of Mpumalanga and Gauteng (and to a very small extent also in the neighbouring Free State and North-West provinces) and occurs from 1420-1760 m above sea level (Mucina et al., 2006). This grassland ecotype is characterised by a high prevalence of *Themeda triandra*, alongside other grass species, and includes a notable herbaceous forb component.



**Figure 5: The vegetation ecotypes (SANBI, 2018) and topography (Chief Directorate: National GeoSpatial Information, 2017) within the project area of impact (PAOI, black delineation) and project site (red delineation).**

Soweto Highveld Grassland is a summer rainfall vegetation (662 mm per annum, mostly September to April), which experiences a cool-temperate climate (mean annual temperature 14.8°C) with thermic continentality. Temperature ranges between 28°C (January) to -0.6°C (July). Frost and frequent grass fires during winter play an important role in limiting the occurrence of trees and shrubs in the region (Mucina et al., 2006). In places which have not been disturbed, scattered wetlands, narrow stream alluvia, pans and occasional ridges interrupt the grassland cover (as is observed within the PAOI).

Embedded within the dominant grassland matrix are natural pans representing pockets of the Eastern Temperate Freshwater Wetland ecotype, the most prominent of which being *Leeupan* which extends into the PAOI (SANBI, 2018) (Figure 5 and Figure 6). There are numerous drainage lines which intersect the PAOI, including five natural perennial streams/rivers, of which four flow through the project site itself (Figure 6): Watervalrivier, Kaalspruit, Wolwespruit, and an unnamed river; the fifth river, Grootspuit, flows adjacent to the north-eastern boundary of the project site. These perennial streams varyingly flow southwards or eastwards, occasionally feeding into small lakes (open waterbodies) and vleis (reedbed-covered waterbodies) (Figure 6). Artificial dams have also been constructed along these drainage lines, although these are most prevalent along the seasonal/non-perennial drainage lines (Figure 6).



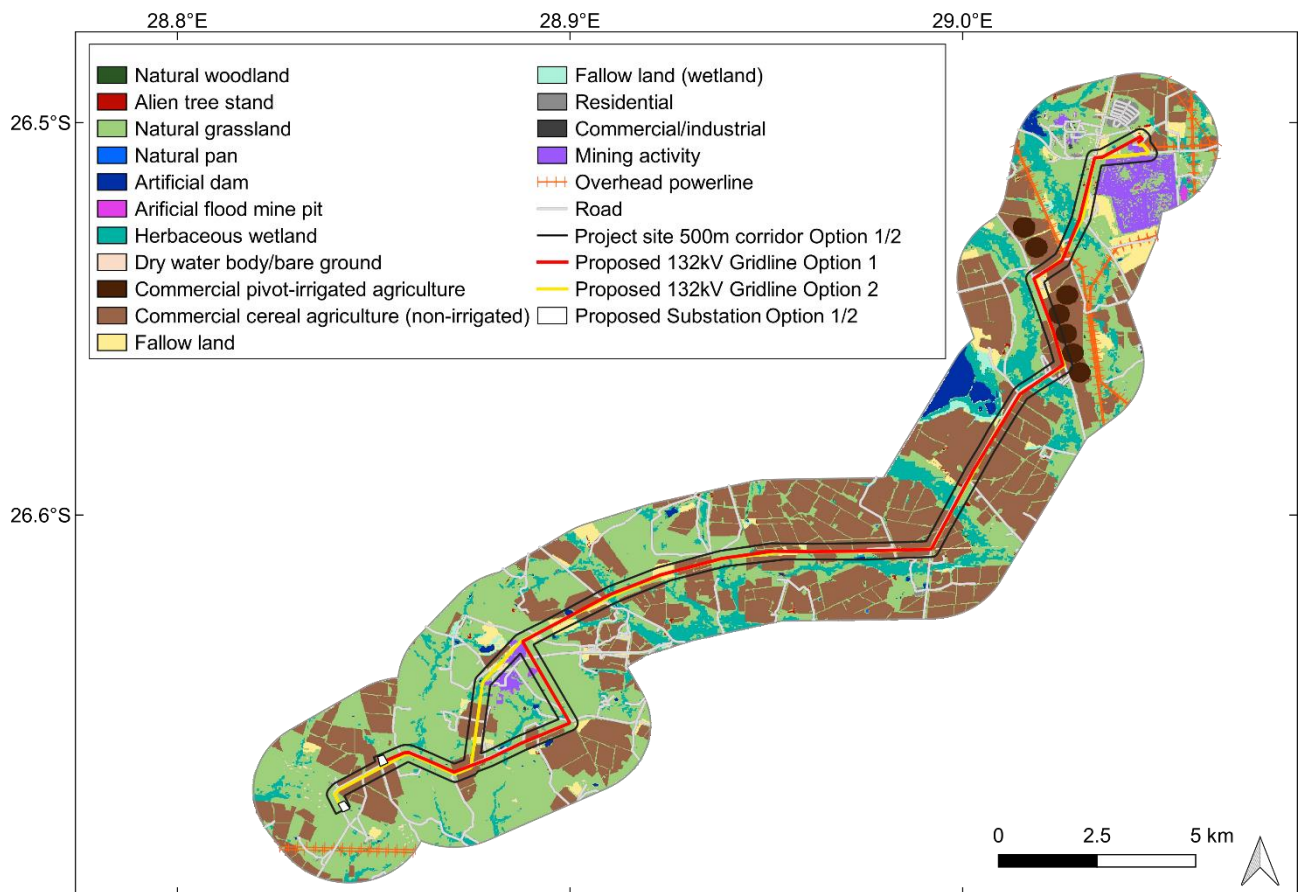
**Figure 6: The natural and artificial waterbodies present within the project area of impact (PAOI, grey delineation) and project site (black delineation) (Chief Directorate: National GeoSpatial Information, 2017).**



The conservation status of this vegetation type was listed as “Endangered” by (Mucina & Rutherford (2006). Very few statutorily conserved areas occur in this vegetation type and almost half has been transformed mostly by cultivation, plantations, mining, and urbanisation. The PAOI does not fall within any Centre of Endemism (Van Wyk & Smith, 2001).

## 6.5. Bird habitat

Whilst much of the distribution and abundance of the bird species in the development areas can be explained by the dominant biomes and vegetation types, it is also important to examine the modifications which have changed the natural landscape, and which may influence the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types and are determined by a host of factors such as topography, land use and man-made infrastructure.



**Figure 7: Land-cover and land-use within the project area of impact (PAOI, 2km buffer - grey delineation) and project site (black delineation) according to the 2018 national land-cover surveys (DEA & DALRRD, 2019)**

The following bird habitat classes were identified in the development areas (see

**APPENDIX 2: HABITAT FEATURES AT THE PROPOSED DEVELOPMENT AREA** for photographic examples of the habitat classes within the PAOI):

### 6.5.1. Grassland

There are significant tracts of natural undisturbed grassland in the PAOI, particularly in the southern portions (**Figure 7**), as well as tracts of disturbed, overgrazed grassland and fallow fields interspersed throughout the PAOI. The grassland characteristics are detailed in Section 6.4. The local grassland conditions range from dense stands of relatively high grass to areas of heavily grazed short grass (see

**APPENDIX 1: SPECIES LIST FOR THE BROADER AREA).** Several powerline sensitive species, including those of conservation concern, are highly dependent on both disturbed and undisturbed tracts of natural grasslands for breeding, roosting, and foraging. The powerline sensitive species which could have the potential to use the natural grassland within the PAOI are listed in **Table 3** below.

**Table 3: Powerline sensitive species which may use the natural grasslands in the development area. Red List species are highlighted in red.**

<b>Species Common Name</b>	<b>Global Status</b>	<b>Regional Status</b>	<b>Occurrence Likelihood</b>
African Marsh Harrier	Least Concern	Endangered	Medium
Amur Falcon	Least Concern	Least Concern	High
Black-Chested Snake Eagle	Least Concern	Least Concern	Medium
Black-Headed Heron	Least Concern	Least Concern	High
Black-Winged Kite	Least Concern	Least Concern	High
Blue Crane	Vulnerable	Near Threatened	High
Blue Korhaan	Near Threatened	Least Concern	High
Cape Crow	Least Concern	Least Concern	High
Common Buzzard	Least Concern	Least Concern	High
Denham's Bustard	Near Threatened	Vulnerable	Medium
Egyptian Goose	Least Concern	Least Concern	High
Greater Kestrel	Least Concern	Least Concern	High
Hadada Ibis	Least Concern	Least Concern	High
Helmeted Guineafowl	Least Concern	Least Concern	High
Jackal Buzzard	Least Concern	Least Concern	Medium
Lanner Falcon	Least Concern	Vulnerable	Medium
Marsh Owl	Least Concern	Least Concern	High
Northern Black Korhaan	Least Concern	Least Concern	High
Pied Crow	Least Concern	Least Concern	High
Rock Kestrel	Least Concern	Least Concern	Medium
Secretarybird	Endangered	Vulnerable	Medium
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Spur-Winged Goose	Least Concern	Least Concern	High
Western Barn Owl	Least Concern	Least Concern	Medium
Western Cattle Egret	Least Concern	Least Concern	High
White Stork	Least Concern	Least Concern	Medium
Black Harrier	Endangered	Endangered	Low
Booted Eagle	Least Concern	Least Concern	Low
Brown Snake Eagle	Least Concern	Least Concern	Low
Long-Crested Eagle	Least Concern	Least Concern	Low
Martial Eagle	Endangered	Endangered	Low
Montagu's Harrier	Least Concern	Least Concern	Low
Pallid Harrier	Near Threatened	Near Threatened	Low
Red-Footed Falcon	Vulnerable	Near Threatened	Low
Southern Bald Ibis	Vulnerable	Vulnerable	Low
Wattled Crane	Vulnerable	Critically Endangered	Low
White-Bellied Bustard	Least Concern	Vulnerable	Low
Yellow-Billed Kite	Least Concern	Least Concern	Low

### 6.5.2. Drainage lines and wetlands

There are five perennial streams/rivers which drain south- or eastwardly through the PAOI: Watervalrivier, Kaalspruit, Wolwespruit, and an unnamed river, and Grootsspruit (**Figure 7**). The first four of these rivers also intersect the project site (**Figure 7**). Additionally, there are numerous non-perennial streams within the PAOI.

The perennial rivers occasionally flow into small lakes (exposed water bodies) and vleis (reedbed-covered waterbodies) (**Figure 7** and **Figure 7**). Artificial dams have also been constructed on these drainage-lines, particularly along the non-perennial streams (see **Section 6.5.3**). Associated with these drainage line and riparian waterbodies are herbaceous wetlands comprising extensive reedbed marshlands and riparian grassland, including seasonal floodplains of inundated grassland (**Figure 7**). Surface rocks are present in some places along the streams. The alluvial soils are mostly deep dark brown to black clayey soils. Riparian wetlands comprising extensive herbaceous reedbed-grassland intergradations provide important foraging, roosting, and breeding opportunities for many power line sensitive species. Additionally, drainage lines provide navigational passageways for many power line sensitive species, and so these landscape features are generally areas of heightened flight activity; certain powerline sensitive species are also ecologically dependent on stream/rivers. The powerline sensitive species which could have the potential to use the drainage lines and wetlands in the development are listed in **Table 4**.

**Table 4: Powerline sensitive species which may use the drainage lines and wetlands in the development area. Red List species are highlighted in red.**

Species Name	Global Status	Regional Status	Occurrence likelihood
African Black Duck	Least Concern	Least Concern	Medium
African Darter	Least Concern	Least Concern	High
African Fish Eagle	Least Concern	Least Concern	Medium
African Marsh Harrier	Least Concern	Endangered	Medium
African Sacred Ibis	Least Concern	Least Concern	High
African Spoonbill	Least Concern	Least Concern	High
Blue Crane	Vulnerable	Near Threatened	High
Cape Shoveler	Least Concern	Least Concern	High
Cape Teal	Least Concern	Least Concern	High
Common Moorhen	Least Concern	Least Concern	High
Egyptian Goose	Least Concern	Least Concern	High
Glossy Ibis	Least Concern	Least Concern	High
Goliath Heron	Least Concern	Least Concern	Medium
Great Crested Grebe	Least Concern	Least Concern	Medium
Great Egret	Least Concern	Least Concern	Medium
Grey Heron	Least Concern	Least Concern	High
Hadada Ibis	Least Concern	Least Concern	High
Hamerkop	Least Concern	Least Concern	Medium
Intermediate Egret	Least Concern	Least Concern	High
Little Egret	Least Concern	Least Concern	High
Maccoa Duck	Endangered	Near Threatened	High
Marsh Owl	Least Concern	Least Concern	High
Pied Crow	Least Concern	Least Concern	High
Purple Heron	Least Concern	Least Concern	Medium
Red-billed Teal	Least Concern	Least Concern	High
Reed Cormorant	Least Concern	Least Concern	High
South African Shelduck	Least Concern	Least Concern	High
Southern Pochard	Least Concern	Least Concern	High
Spur-winged Goose	Least Concern	Least Concern	High
Squacco Heron	Least Concern	Least Concern	Medium
White-backed Duck	Least Concern	Least Concern	Medium
White-breasted Cormorant	Least Concern	Least Concern	High
White-faced Whistling Duck	Least Concern	Least Concern	Medium
Yellow-billed Duck	Least Concern	Least Concern	High
African Openbill	Least Concern	Least Concern	Low
African Swampphen	Least Concern	Least Concern	Low

Species Name	Global Status	Regional Status	Occurrence likelihood
Black Heron	Least Concern	Least Concern	Low
Black-crowned Night Heron	Least Concern	Least Concern	Low
Blue-billed Teal	Least Concern	Least Concern	Low
Fulvous Whistling Duck	Least Concern	Least Concern	Low
Knob-billed Duck	Least Concern	Least Concern	Low
Long-crested Eagle	Least Concern	Least Concern	Low
Southern Bald Ibis	Vulnerable	Vulnerable	Low
Wattled Crane	Vulnerable	Critically Endangered	Low
Yellow-billed Stork	Least Concern	Endangered	Low

### 6.5.3. Dams and pans

The PAOI includes several natural pans and artificial dams (**Figure 7** and **Figure 7**), the most prominent of which being Leeupan which partly extends into the west-central portion of the PAIO (**Figure 5** and **Figure 7**). These exposed waterbodies provide foraging, roosting, breeding opportunities for several powerline sensitive species. Leeupan, in particular, is an important habitat for several powerline sensitive species of conservation concern, and 179 bird species currently have been observed in or near this waterbody, according to the ebird avifaunal repository (<https://ebird.org/hotspot/L6221281>). In addition to the artificial dams associated with local drainage lines, the PAOI includes artificial waterpoints (windmills, troughs, reservoirs, etc.) (**Figure 7**). Collectively, these waterbodies are focal points of attraction for many powerline sensitive species (including those not typically associated with dams and pans), as these provide accessible opportunities for drinking water. The powerline sensitive species which could have the potential to use the dams and pans in the development are listed in **Table 5**.

**Table 5: Powerline sensitive species which may use the dams and pans in the PAOI. Red List species are highlighted in red.**

Species Name	Global Status	Regional Status	Occurrence likelihood
African Darter	Least Concern	Least Concern	High
African Fish Eagle	Least Concern	Least Concern	Medium
African Marsh Harrier	Least Concern	Endangered	Medium
African Sacred Ibis	Least Concern	Least Concern	High
African Spoonbill	Least Concern	Least Concern	High
Black-chested Snake Eagle	Least Concern	Least Concern	Medium
Black-necked Grebe	Least Concern	Least Concern	High
Blue Crane	Vulnerable	Near Threatened	High
Cape Shoveler	Least Concern	Least Concern	High
Cape Teal	Least Concern	Least Concern	High
Egyptian Goose	Least Concern	Least Concern	High
Glossy Ibis	Least Concern	Least Concern	High
Goliath Heron	Least Concern	Least Concern	Medium
Great Crested Grebe	Least Concern	Least Concern	Medium
Great Egret	Least Concern	Least Concern	Medium
Greater Flamingo	Least Concern	Near Threatened	High
Grey Heron	Least Concern	Least Concern	High
Hamerkop	Least Concern	Least Concern	Medium
Intermediate Egret	Least Concern	Least Concern	High
Lanner Falcon	Least Concern	Vulnerable	Medium
Lesser Flamingo	Near Threatened	Near Threatened	Medium
Little Egret	Least Concern	Least Concern	High

Species Name	Global Status	Regional Status	Occurrence likelihood
Little Grebe	Least Concern	Least Concern	High
Maccoa Duck	Endangered	Near Threatened	High
Pied Crow	Least Concern	Least Concern	High
Purple Heron	Least Concern	Least Concern	Medium
Red-billed Teal	Least Concern	Least Concern	High
Red-knobbed Coot	Least Concern	Least Concern	High
Reed Cormorant	Least Concern	Least Concern	High
South African Shelduck	Least Concern	Least Concern	High
Southern Pochard	Least Concern	Least Concern	High
Spur-winged Goose	Least Concern	Least Concern	High
White-backed Duck	Least Concern	Least Concern	Medium
White-breasted Cormorant	Least Concern	Least Concern	High
White-faced Whistling Duck	Least Concern	Least Concern	Medium
Yellow-billed Duck	Least Concern	Least Concern	High
African Openbill	Least Concern	Least Concern	Low
Blue-billed Teal	Least Concern	Least Concern	Low
Fulvous Whistling Duck	Least Concern	Least Concern	Low
Great White Pelican	Least Concern	Vulnerable	Low
Knob-billed Duck	Least Concern	Least Concern	Low
Martial Eagle	Endangered	Endangered	Low
Yellow-billed Stork	Least Concern	Endangered	Low

#### 6.5.4. Agriculture

Within the PAOI are extensive areas of non-irrigated commercial cereal agriculture (**Figure 7**) predominately dedicated towards maize production (see



**APPENDIX 2: HABITAT FEATURES AT THE PROPOSED DEVELOPMENT AREA**), as well as tracts of pivot-irrigated cropland (**Figure 7**). Additionally, livestock (cattle) farming is also practiced on lands not dedicated to cereal agriculture, including fallow land. Some fields are lying fallow or are in the process of being re-vegetated by grass. Cereal monocultures generally have far lower bird diversity and abundance compared to the natural grasslands which these replace. However, recently sown and/or ploughed fields can become focal foraging areas for many powerline sensitive species, and fallow lands can fulfil many ecological requirements for such species utilising/dependent upon grasslands. The powerline sensitive species which could have the potential to use the agricultural habitats in the development are listed in **Table 6**.

**Table 6: Powerline sensitive species which may use the agricultural habitats in the PAOI. Red List species are highlighted in Red**

Species Name	Global Status	Regional Status	Occurrence likelihood
African Sacred Ibis	Least Concern	Least Concern	High
Amur Falcon	Least Concern	Least Concern	High
Black-chested Snake Eagle	Least Concern	Least Concern	Medium
Black-headed Heron	Least Concern	Least Concern	High
Black-winged Kite	Least Concern	Least Concern	High
Blue Crane	Vulnerable	Near Threatened	High
Cape Crow	Least Concern	Least Concern	High
Common Buzzard	Least Concern	Least Concern	High
Egyptian Goose	Least Concern	Least Concern	High
Hadada Ibis	Least Concern	Least Concern	High
Helmeted Guineafowl	Least Concern	Least Concern	High
Jackal Buzzard	Least Concern	Least Concern	Medium
Lanner Falcon	Least Concern	Vulnerable	Medium
Marsh Owl	Least Concern	Least Concern	High
Pied Crow	Least Concern	Least Concern	High
Rock Kestrel	Least Concern	Least Concern	Medium
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Spur-winged Goose	Least Concern	Least Concern	High
Western Barn Owl	Least Concern	Least Concern	Medium
Western Cattle Egret	Least Concern	Least Concern	High
White Stork	Least Concern	Least Concern	Medium
Lesser Kestrel	Least Concern	Least Concern	Low
Martial Eagle	Endangered	Endangered	Low
Montagu's Harrier	Least Concern	Least Concern	Low
Pallid Harrier	Near Threatened	Near Threatened	Low
Red-footed Falcon	Vulnerable	Near Threatened	Low
Southern Bald Ibis	Vulnerable	Vulnerable	Low
Yellow-billed Kite	Least Concern	Least Concern	Low

### 6.5.5. Alien trees

The PAOI, being situated in a natural grassland-cereal agriculture mosaic, supports few trees. Minor pockets of natural woodland are present (**Figure 7**), although more prevalent are alien trees stands – particularly Eucalyptus, Australian Acacia (Wattle), and Salix (Willow) species (see

**APPENDIX 2: HABITAT FEATURES AT THE PROPOSED DEVELOPMENT AREA).** These alien trees are often planted as wind breaks next to agricultural lands and artificial dams, as well as around homesteads and residential areas. Some of the drainage lines also have alien trees growing alongside them. In tree-deficient environments, such as those within the PAOI, alien trees can provide roosting and breeding habitat for several powerline sensitive species, especially raptors. The powerline sensitive species which could have the potential to use the alien trees in the development are listed in **Table 7**.

**Table 7: Powerline sensitive species which may use the alien trees in development area. Red list species are highlighted in red.**

<b>Species Name</b>	<b>Global Status</b>	<b>Regional Status</b>	<b>Occurrence likelihood</b>
African Fish Eagle	Least Concern	Least Concern	Medium
African Harrier-Hawk	Least Concern	Least Concern	Medium
African Sacred Ibis	Least Concern	Least Concern	High
African Spoonbill	Least Concern	Least Concern	High
Amur Falcon	Least Concern	Least Concern	High
Black Sparrowhawk	Least Concern	Least Concern	Medium
Black-chested Snake Eagle	Least Concern	Least Concern	Medium
Black-headed Heron	Least Concern	Least Concern	High
Black-winged Kite	Least Concern	Least Concern	High
Cape Crow	Least Concern	Least Concern	High
Common Buzzard	Least Concern	Least Concern	High
Egyptian Goose	Least Concern	Least Concern	High
Greater Kestrel	Least Concern	Least Concern	High
Grey Heron	Least Concern	Least Concern	High
Hadada Ibis	Least Concern	Least Concern	High
Hamerkop	Least Concern	Least Concern	Medium
Helmeted Guineafowl	Least Concern	Least Concern	High
Jackal Buzzard	Least Concern	Least Concern	Medium
Lanner Falcon	Least Concern	Vulnerable	Medium
Pied Crow	Least Concern	Least Concern	High
Rock Kestrel	Least Concern	Least Concern	Medium
Secretarybird	Endangered	Vulnerable	Medium
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Spur-winged Goose	Least Concern	Least Concern	High
Western Barn Owl	Least Concern	Least Concern	Medium
Western Cattle Egret	Least Concern	Least Concern	High
White Stork	Least Concern	Least Concern	Medium
White-breasted Cormorant	Least Concern	Least Concern	High
Booted Eagle	Least Concern	Least Concern	Low
Brown Snake Eagle	Least Concern	Least Concern	Low
European Honey-buzzard	Least Concern	Least Concern	Low
Lesser Kestrel	Least Concern	Least Concern	Low
Long-crested Eagle	Least Concern	Least Concern	Low
Martial Eagle	Endangered	Endangered	Low
Red-footed Falcon	Vulnerable	Near Threatened	Low
Southern Bald Ibis	Vulnerable	Vulnerable	Low
Yellow-billed Kite	Least Concern	Least Concern	Low

See

**APPENDIX 2: HABITAT FEATURES AT THE PROPOSED DEVELOPMENT AREA** for photographic record of habitat features in the development area and immediate surroundings.

## 7. AVIFAUNA

### 7.1. South African Bird Atlas Project 2

A total of 289 bird species could potentially occur within the broader area where the project site is located (see

**APPENDIX 1: SPECIES LIST FOR THE BROADER AREA).** Eighty-three (83) of these bird species are classified as powerline sensitive species, of which sixty (60) are considered to regularly occur in the development PAOI, with fifty (50) such species having been recorded during the field surveys.

Eighteen (18) Red Data List species are associated with the broader area. Nine (9) Red List species have a medium-to-high probability of occurring within the PAOI: African Marsh Harrier, Blue Crane, Blue Korhaan, Denham's Bustard, Greater Flamingo, Lanner Falcon, Lesser Flamingo, Maccoa Duck, and Secretarybird (**Table 8**). The other nine (9) Red List species only have a low occurrence probability within the broader area of the PAOI, and are therefore at lower risk from this development: Black Harrier, Great White Pelican, Martial Eagle, Pallid Harrier, Red-footed Falcon, Southern Bald Ibis, Wattled Crane, White-bellied Bustard, and Yellow-billed Stork (**Table 9**).

See

**APPENDIX 1: SPECIES LIST FOR THE BROADER AREA** for a list of species potentially occurring in the broader area. The potential long-term impacts that the Impumelelo Grid Connection development may have on powerline priority bird species are detailed in Table 8 for regularly occurring species within the PAOI, and in **Table 9** for those less likely to occur.

**Table 8: Powerline sensitive species with a medium-to-high occurrence within the broader area, and which are therefore more likely to occur within the PAOI**

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	Global status	Regional status	Full protocol	Ad hoc protocol	Recorded during monitoring	Grassland	Drainage lines and wetlands	Dams and pans	Agriculture	Alien trees	Grid - habitat transformation	Grid - disturbance (breeding)	Grid - substation electrocutions	Grid - Collision HV lines
African Black Duck	<i>Anas sparsa</i>	LC	LC	8.31	0.88			x							X
African Darter	<i>Anhinga rufa</i>	LC	LC	17.11	0.75	x		x	x						X
African Fish Eagle	<i>Haliaeetus vocifer</i>	LC	LC	5.06	0.75			x	x		x		x	x	
African Harrier-Hawk	<i>Polyboroides typus</i>	LC	LC	1.08	0.13	x					x		x	x	
African Marsh Harrier	<i>Circus ranivorus</i>	LC	EN	2.17	1.50		x	x	x				x	x	
African Sacred Ibis	<i>Threskiornis aethiopicus</i>	LC	LC	38.43	10.53	x		x	x	x	x			x	x
African Spoonbill	<i>Platalea alba</i>	LC	LC	31.20	6.39	x		x	x		x				x
Amur Falcon	<i>Falco amurensis</i>	LC	LC	16.51	4.76	x	x			x	x			x	
Black Sparrowhawk	<i>Accipiter melanoleucus</i>	LC	LC	3.61	0.00	x					x		x	x	
Black-chested Snake Eagle	<i>Circaetus pectoralis</i>	LC	LC	1.08	0.50	x	x		x	x	x		x	x	
Black-headed Heron	<i>Ardea melanocephala</i>	LC	LC	68.55	21.55	x	x			x	x			x	x
Black-necked Grebe	<i>Podiceps nigricollis</i>	LC	LC	20.96	4.76	x			x						x
Black-winged Kite	<i>Elanus caeruleus</i>	LC	LC	73.01	26.07	x	x			x	x		x	x	
Blue Crane	<i>Grus paradisea</i>	VU	NT	10.72	4.26	x	x	x	x	x		x	x		x
Blue Korhaan	<i>Eupodotis caerulescens</i>	NT	LC	27.71	12.41	x	x					x	x		x
Cape Crow	<i>Corvus capensis</i>	LC	LC	22.29	10.15	x	x			x	x			x	
Cape Shoveler	<i>Spatula smithii</i>	LC	LC	36.39	8.27	x		x	x						x
Cape Teal	<i>Anas capensis</i>	LC	LC	19.76	3.88	x		x	x						x
Common Buzzard	<i>Buteo buteo</i>	LC	LC	14.34	3.13		x			x	x			x	
Common Moorhen	<i>Gallinula chloropus</i>	LC	LC	14.22	0.75			x							
Denham's Bustard	<i>Neotis denhami</i>	NT	VU	0.00	0.00	x	x					x	x		x
Egyptian Goose	<i>Alopochen aegyptiaca</i>	LC	LC	80.84	29.07	x	x	x	x	x	x			x	x
Glossy Ibis	<i>Plegadis falcinellus</i>	LC	LC	22.89	5.76	x		x	x						x
Goliath Heron	<i>Ardea goliath</i>	LC	LC	6.87	2.01	x		x	x						x
Great Crested Grebe	<i>Podiceps cristatus</i>	LC	LC	8.92	1.50	x		x	x						x
Great Egret	<i>Ardea alba</i>	LC	LC	2.05	1.00	x		x	x						x
Greater Flamingo	<i>Phoenicopterus roseus</i>	LC	NT	31.08	9.27	x			x						x
Greater Kestrel	<i>Falco rupicoloides</i>	LC	LC	13.37	6.39	x	x				x		x	x	
Grey Heron	<i>Ardea cinerea</i>	LC	LC	29.04	7.02	x		x	x		x				x



Species name	Scientific name	Global status	Regional status	Full protocol	Ad hoc protocol	Recorded during monitoring	Grassland	Drainage lines and wetlands	Dams and pans	Agriculture	Alien trees	Grid - habitat transformation	Grid - disturbance (breeding)	Grid - substation electrocutions	Grid – Collision HV lines
Hadada Ibis	<i>Bostrychia hagedash</i>	LC	LC	85.66	31.08	x	x	x		x	x			x	x
Hamerkop	<i>Scopus umbretta</i>	LC	LC	9.76	2.76	x		x	x		x			x	x
Helmeted Guineafowl	<i>Numida meleagris</i>	LC	LC	60.96	13.28	x	x			x	x			x	
Intermediate Egret	<i>Ardea intermedia</i>	LC	LC	13.61	3.76	x		x	x						x
Jackal Buzzard	<i>Buteo rufofuscus</i>	LC	LC	8.92	2.63		x			x	x		x	x	
Lanner Falcon	<i>Falco biarmicus</i>	LC	VU	6.02	2.01	x	x		x	x	x		x	x	
Lesser Flamingo	<i>Phoeniconaias minor</i>	NT	NT	10.60	3.26				x						x
Little Egret	<i>Egretta garzetta</i>	LC	LC	13.25	1.75	x		x	x						x
Little Grebe	<i>Tachybaptus ruficollis</i>	LC	LC	63.37	17.92	x			x						x
Maccoa Duck	<i>Oxyura maccoa</i>	EN	NT	10.60	1.00	x		x	x						x
Marsh Owl	<i>Asio capensis</i>	LC	LC	12.17	2.88	x	x	x		x		x	x	x	x
Northern Black Korhaan	<i>Afrotis afraoides</i>	LC	LC	14.82	5.39	x	x					x	x		x
Pied Crow	<i>Corvus albus</i>	LC	LC	17.83	2.63	x	x	x	x	x	x			x	
Purple Heron	<i>Ardea purpurea</i>	LC	LC	5.90	1.25	x		x	x						x
Red-billed Teal	<i>Anas erythrorhyncha</i>	LC	LC	46.99	10.28	x		x	x						x
Red-knobbed Coot	<i>Fulica cristata</i>	LC	LC	81.20	26.32	x			x						x
Reed Cormorant	<i>Microcarbo africanus</i>	LC	LC	71.33	19.55	x		x	x						x
Rock Kestrel	<i>Falco rupicolus</i>	LC	LC	9.28	7.27	x	x			x	x			x	
Secretarybird	<i>Sagittarius serpentarius</i>	EN	VU	7.47	8.15	x	x				x	x	x		x
South African Shelduck	<i>Tadorna cana</i>	LC	LC	23.98	5.01	x		x	x						x
Southern Pochard	<i>Netta erythrophthalma</i>	LC	LC	25.18	5.51	x		x	x						x
Spotted Eagle-Owl	<i>Bubo africanus</i>	LC	LC	4.46	0.25	x	x			x	x		x	x	x
Spur-winged Goose	<i>Plectropterus gambensis</i>	LC	LC	27.95	7.02	x	x	x	x	x	x				x
Squacco Heron	<i>Ardeola ralloides</i>	LC	LC	3.25	2.51			x							x
Western Barn Owl	<i>Tyto alba</i>	LC	LC	3.61	0.25		x			x	x			x	x
Western Cattle Egret	<i>Bubulcus ibis</i>	LC	LC	48.43	13.91	x	x			x	x			x	x
White Stork	<i>Ciconia ciconia</i>	LC	LC	2.05	1.13		x			x	x				x
White-backed Duck	<i>Thalassornis leuconotus</i>	LC	LC	4.34	0.75	x		x	x						x
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>	LC	LC	21.81	5.51	x		x	x		x				x
White-faced Whistling Duck	<i>Dendrocygna viduata</i>	LC	LC	10.48	1.75	x		x	x						x
Yellow-billed Duck	<i>Anas undulata</i>	LC	LC	67.83	17.67	x		x	x						x

**Table 9: Powerline sensitive species with a low occurrence within the broader area, and which are therefore less likely to occur within the PAOI**

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	Global status	Regional status	Full protocol	Ad hoc protocol	Recorded during monitoring	Grassland	Drainage lines and wetlands	Dams and pans	Agriculture	Alien trees	Grid - habitat transformation	Grid - disturbance (breeding)	Grid - substation electrocutions	Grid - Collision HV lines
African Openbill	<i>Anastomus lamelligerus</i>	LC	LC	0.48	0.25			x	x						x
African Swamphen	<i>Porphyrio madagascariensis</i>	LC	LC	1.20	0.00			x							
Black Harrier	<i>Circus maurus</i>	EN	EN	0.24	0.63		x					x	x		
Black Heron	<i>Egretta ardesiaca</i>	LC	LC	0.00	0.25			x							x
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	LC	LC	1.57	0.00			x							x
Blue-billed Teal	<i>Spatula hottentota</i>	LC	LC	0.48	0.25			x	x						x
Booted Eagle	<i>Hieraaetus pennatus</i>	LC	LC	0.24	0.00		x				x	x	x		
Brown Snake Eagle	<i>Circaetus cinereus</i>	LC	LC	0.24	0.00		x				x	x	x		
European Honey-buzzard	<i>Pernis apivorus</i>	LC	LC	0.48	0.00						x			x	
Fulvous Whistling Duck	<i>Dendrocygna bicolor</i>	LC	LC	0.24	0.00			x	x						x
Great White Pelican	<i>Pelecanus onocrotalus</i>	LC	VU	0.24	0.00				x						x
Knob-billed Duck	<i>Sarkidiornis melanotos</i>	LC	LC	0.96	0.00			x	x						x
Lesser Kestrel	<i>Falco naumanni</i>	LC	LC	1.20	0.00					x	x			x	
Long-crested Eagle	<i>Lophaetus occipitalis</i>	LC	LC	0.48	0.00		x	x			x	x	x	x	
Martial Eagle	<i>Polemaetus bellicosus</i>	EN	EN	0.48	0.25		x		x	x	x	x	x	x	
Montagu's Harrier	<i>Circus pygargus</i>	LC	LC	1.69	1.00		x			x				x	
Pallid Harrier	<i>Circus macrourus</i>	NT	NT	1.20	0.00		x			x				x	
Red-footed Falcon	<i>Falco vespertinus</i>	VU	NT	0.36	0.25		x			x	x			x	
Southern Bald Ibis	<i>Geronticus calvus</i>	VU	VU	0.24	0.00		x	x		x	x		x	x	x
Wattled Crane	<i>Grus carunculata</i>	VU	CR	0.12	0.00		x	x				x	x		x
White-bellied Bustard	<i>Eupodotis senegalensis</i>	LC	VU	0.48	0.00		x					x	x		x
Yellow-billed Kite	<i>Milvus aegyptius</i>	LC	LC	0.48	0.25		x			x	x			x	
Yellow-billed Stork	<i>Mycteria ibis</i>	LC	EN	0.24	0.00			x	x						x

## 7.2. Field surveys

A total of 50 powerline sensitive species were observed during pre-construction monitoring at the proposed Impumelelo Wind Energy Facility and associated Impumelelo Grid Connection, which also included the grid PAOI (see **Table 10**). These species could potentially occur anywhere in the PAOI in suitable habitat.

**Table 10: Powerline sensitive species observed during preconstruction monitoring at the Impumelelo Wind Energy Facility development area, including the grid PAOI.**

Species name	Scientific name
African Darter	<i>Anhinga rufa</i>
African Harrier-Hawk	<i>Polyboroides typus</i>
African Sacred Ibis	<i>Threskiornis aethiopicus</i>
African Spoonbill	<i>Platalea alba</i>
Amur Falcon	<i>Falco amurensis</i>
Black Sparrowhawk	<i>Accipiter melanoleucus</i>
Black-chested Snake Eagle	<i>Circaetus pectoralis</i>
Black-headed Heron	<i>Ardea melanocephala</i>
Black-necked Grebe	<i>Podiceps nigricollis</i>
Black-winged Kite	<i>Elanus caeruleus</i>
Blue Crane	<i>Grus paradisea</i>
Blue Korhaan	<i>Eupodotis caerulescens</i>
Cape Crow	<i>Corvus capensis</i>
Cape Shoveler	<i>Spatula smithii</i>
Cape Teal	<i>Anas capensis</i>
Denham's Bustard	<i>Neotis denhami</i>
Egyptian Goose	<i>Alopochen aegyptiaca</i>
Glossy Ibis	<i>Plegadis falcinellus</i>
Goliath Heron	<i>Ardea goliath</i>
Great Crested Grebe	<i>Podiceps cristatus</i>
Great Egret	<i>Ardea alba</i>
Greater Flamingo	<i>Phoenicopterus roseus</i>
Greater Kestrel	<i>Falco rupicoloides</i>
Grey Heron	<i>Ardea cinerea</i>
Hadada Ibis	<i>Bostrychia hagedash</i>
Hamerkop	<i>Scopus umbretta</i>
Helmeted Guineafowl	<i>Numida meleagris</i>
Intermediate Egret	<i>Ardea intermedia</i>
Lanner Falcon	<i>Falco biarmicus</i>
Little Egret	<i>Egretta garzetta</i>
Little Grebe	<i>Tachybaptus ruficollis</i>
Maccoa Duck	<i>Oxyura maccoa</i>
Marsh Owl	<i>Asio capensis</i>
Northern Black Korhaan	<i>Afrotis afraoides</i>
Pied Crow	<i>Corvus albus</i>
Purple Heron	<i>Ardea purpurea</i>
Red-billed Teal	<i>Anas erythrorhyncha</i>
Red-knobbed Coot	<i>Fulica cristata</i>
Reed Cormorant	<i>Microcarbo africanus</i>
Rock Kestrel	<i>Falco rupicolus</i>
Secretarybird	<i>Sagittarius serpentarius</i>

Species name	Scientific name
South African Shelduck	<i>Tadorna cana</i>
Southern Pochard	<i>Netta erythrophthalma</i>
Spotted Eagle-Owl	<i>Bubo africanus</i>
Spur-winged Goose	<i>Plectropterus gambensis</i>
Western Cattle Egret	<i>Bubulcus ibis</i>
White-backed Duck	<i>Thalassornis leuconotus</i>
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>
White-faced Whistling Duck	<i>Dendrocygna viduata</i>
Yellow-billed Duck	<i>Anas undulata</i>

## 8. IMPACT ASSESSMENT

Negative impacts on avifauna by electricity infrastructure generally take two main forms namely electrocution and collisions (Hobbs & Ledger, 1986b, 1986a; Jenkins et al., 2010; Kruger, 1999; Kruger & Van Rooyen, 1998; Ledger, 1983, 1984; Ledger et al., 1992; Ledger & Annegarn, 1981; van Rooyen, 2004; Van Rooyen, 2000; van Rooyen, 2000; Van Rooyen & Taylor, 1999; Verdoorn, 1996). Displacement due to habitat destruction and disturbance associated with the construction of the electricity infrastructure are also impacts that could potentially affect avifauna.

### 8.1. Displacement due to habitat transformation

During the construction of power lines, service roads (jeep tracks) and substations, habitat destruction/transformation inevitably takes place. The construction activities will constitute the following:

- Site clearance and preparation
- Construction of the infrastructure (i.e., the on-site substation and overhead power line)
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site
- Removal of vegetation for the proposed on-site substation and overhead power line, stockpiling of topsoil and cleared vegetation
- Excavations for infrastructure

Beyond the increased mortality risks to local bird populations posed by such infrastructure, the resulting habitat loss and fragmentation can degrade adjacent habitats, causing either temporary or permanent displacement of bird species from breeding, roosting, and/or foraging habitats (Fletcher et al., 2018). It remains disputed whether habitat fragmentation is always an environmental detriment (Fahrig et al., 2019), yet the impacts of this landscape change are observable in birds. Lane et al. (2001) noted that Great Bustard flocks in Spain were significantly larger further from power lines than at control points. Shaw (2013) found that Ludwig's Bustard 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 Mpumalanga (in that case by afforestation) has had a detrimental impact on the densities and diversity of grassland species (Allan et al., 1997).

*The loss of habitat for powerline sensitive species due to direct habitat transformation associated with the construction of the proposed Impumelelo Grid Connection is likely to be moderate due to the small size of the footprint, but ideally high-quality grassland should be avoided if possible.*

**Table 11** presents the powerline sensitive species occurring in the development area are vulnerable to displacement due to habitat transformation associated with the construction of the grid infrastructure.

**Table 11: Powerline sensitive species which are vulnerable to displacement due to habitat transformation associated with the construction of the Impumelelo Grid Connection**

Species	Global status	Regional status	Occurrence likelihood
Blue Crane	Vulnerable	Near Threatened	High
Blue Korhaan	Near Threatened	Least Concern	High
Denham's Bustard	Near Threatened	Vulnerable	Medium
Marsh Owl	Least Concern	Least Concern	High
Northern Black Korhaan	Least Concern	Least Concern	High
Secretarybird	Endangered	Vulnerable	Medium
Wattled Crane	Vulnerable	Critically Endangered	Low
White-bellied Bustard	Least Concern	Vulnerable	Low

## 8.2. Displacement due to disturbance

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through **disturbance**; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities near breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Terrestrial species and owls are most likely to be affected by displacement due to disturbance in the PAOI.

**Table 12** presents the powerline sensitive species occurring in the development area which are vulnerable to displacement due to disturbances associated with construction and decommissioning of the Impumelelo Grid Connection.

**Table 12: Powerline sensitive species which are vulnerable to displacement due to disturbances associated with construction and decommissioning of the Grid Connection**

Species	Global status	Regional status	Occurrence likelihood
African Fish Eagle	Least Concern	Least Concern	Medium
African Harrier-Hawk	Least Concern	Least Concern	Medium
African Marsh Harrier	Least Concern	Endangered	Medium
Black Sparrowhawk	Least Concern	Least Concern	Medium
Black-chested Snake Eagle	Least Concern	Least Concern	Medium
Black-winged Kite	Least Concern	Least Concern	High
Blue Crane	Vulnerable	Near Threatened	High
Blue Korhaan	Near Threatened	Least Concern	High



Species	Global status	Regional status	Occurrence likelihood
Denham's Bustard	Near Threatened	Vulnerable	Medium
Greater Kestrel	Least Concern	Least Concern	High
Jackal Buzzard	Least Concern	Least Concern	Medium
Lanner Falcon	Least Concern	Vulnerable	Medium
Marsh Owl	Least Concern	Least Concern	High
Northern Black Korhaan	Least Concern	Least Concern	High
Secretarybird	Endangered	Vulnerable	Medium
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Black Harrier	Endangered	Endangered	Low
Booted Eagle	Least Concern	Least Concern	Low
Brown Snake Eagle	Least Concern	Least Concern	Low
Long-crested Eagle	Least Concern	Least Concern	Low
Martial Eagle	Endangered	Endangered	Low
Southern Bald Ibis	Vulnerable	Vulnerable	Low
Wattled Crane	Vulnerable	Critically Endangered	Low
White-bellied Bustard	Least Concern	Vulnerable	Low

### 8.3. Electrocution of priority species in substations in the operational phase

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen, 2004). The electrocution risk is largely determined by the pole/tower design. In the case of the proposed 132kV grid connection, the electrocution risk is envisaged to be negligible because of the clearance distances between the live and earthed components inherent in the design of such powerlines. The 132kV grid connection power line should not pose an electrocution threat to the powerline sensitive species which are likely to occur in the PAOI and immediate surrounding environment.

Electrocutions within the proposed on-site substation yard are possible but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls, and certain species of waterbirds.

**Table 132** presents the powerline sensitive species occurring in the development area which are more vulnerable to mortality risks resulting from electrocution on the Impumelelo Grid Connection.

**Table 13: Powerline sensitive species occurring in the development area which are vulnerable to mortality risks resulting from electrocution in the on-site substations**

Species	Global status	Regional status	Occurrence likelihood
African Fish Eagle	Least Concern	Least Concern	Medium
African Harrier-Hawk	Least Concern	Least Concern	Medium
African Marsh Harrier	Least Concern	Endangered	Medium
African Sacred Ibis	Least Concern	Least Concern	High
Amur Falcon	Least Concern	Least Concern	High
Black Sparrowhawk	Least Concern	Least Concern	Medium
Black-chested Snake Eagle	Least Concern	Least Concern	Medium

Species	Global status	Regional status	Occurrence likelihood
Black-headed Heron	Least Concern	Least Concern	High
Black-winged Kite	Least Concern	Least Concern	High
Cape Crow	Least Concern	Least Concern	High
Common Buzzard	Least Concern	Least Concern	High
Egyptian Goose	Least Concern	Least Concern	High
Greater Kestrel	Least Concern	Least Concern	High
Hadada Ibis	Least Concern	Least Concern	High
Hamerkop	Least Concern	Least Concern	Medium
Helmeted Guineafowl	Least Concern	Least Concern	High
Jackal Buzzard	Least Concern	Least Concern	Medium
Lanner Falcon	Least Concern	Vulnerable	Medium
Marsh Owl	Least Concern	Least Concern	High
Pied Crow	Least Concern	Least Concern	High
Rock Kestrel	Least Concern	Least Concern	Medium
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Western Barn Owl	Least Concern	Least Concern	Medium
Western Cattle Egret	Least Concern	Least Concern	High
Black Harrier	Endangered	Endangered	Low
Booted Eagle	Least Concern	Least Concern	Low
Brown Snake Eagle	Least Concern	Least Concern	Low
European Honey-buzzard	Least Concern	Least Concern	Low
Lesser Kestrel	Least Concern	Least Concern	Low
Long-crested Eagle	Least Concern	Least Concern	Low
Martial Eagle	Endangered	Endangered	Low
Montagu's Harrier	Least Concern	Least Concern	Low
Pallid Harrier	Near Threatened	Near Threatened	Low
Red-footed Falcon	Vulnerable	Near Threatened	Low
Southern Bald Ibis	Vulnerable	Vulnerable	Low
Yellow-billed Kite	Least Concern	Least Concern	Low

## 8.4. Collision mortality of priority species with the overhead 132kV powerlines

Collisions are arguably the biggest threat posed by transmission lines to birds in southern Africa (van Rooyen, 2004). Most heavily impacted upon are bustards, storks, cranes, and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (van Rooyen, 2004). In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with transmission lines:

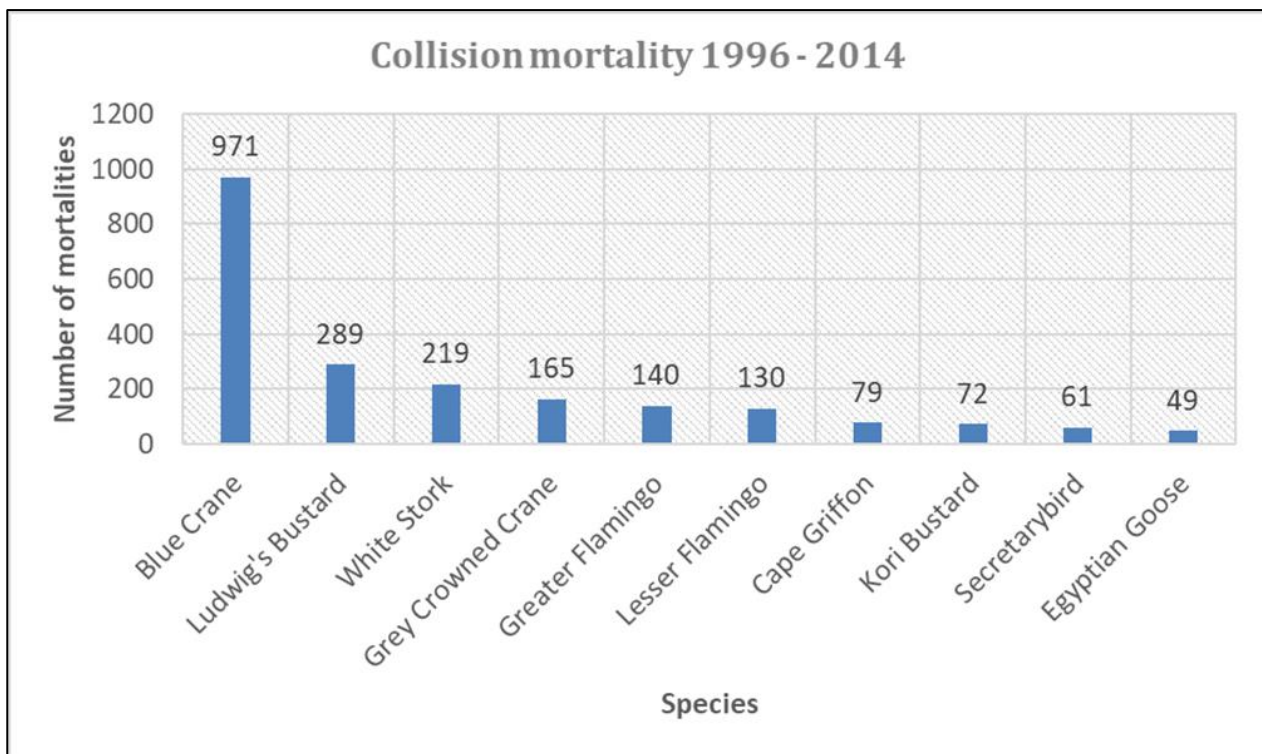
*“The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors described these factors in four main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

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

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

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

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa (see **Figure 8**).



**Figure 8: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust strategic partnership central incident register 1996 - 2014 (EWT unpublished data)**

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

binocular fields and large blind areas like those of bustards and cranes and are also known to be vulnerable to power line collisions.

Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins et al., 2010; Martin et al., 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (Alonso & Alonso, 1999; Barrientos et al., 2011; Bernardino et al., 2018; Jenkins et al., 2010; Koops & De Jong, 1982; Sporer et al., 2013), including to some extent for bustards (Barrientos et al., 2012; Hoogstad 2015 pers.comm). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. Barrientos et al. (2011) reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease of 55–94% in bird mortalities. Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5m, whereas using the same devices at 10m intervals only reduces the mortality by 57%. Barrientos et al. (2012) found that larger BFDs were more effective in reducing Great Bustard collisions than smaller ones. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin et al., 2010).

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

**Table 143** presents the powerline sensitive species occurring in the development area which are more vulnerable to mortality risks resulting from collisions with the Impumelelo Grid Connection overhead powerline.

**Table 14: Powerline sensitive species occurring in the development area which are vulnerable to mortality risks resulting from electrocution on the Impumelelo Grid Connection**

Species	Global status	Regional status	Occurrence likelihood
African Black Duck	Least Concern	Least Concern	Medium
African Darter	Least Concern	Least Concern	High
African Sacred Ibis	Least Concern	Least Concern	High
African Spoonbill	Least Concern	Least Concern	High
Black-headed Heron	Least Concern	Least Concern	High
Black-necked Grebe	Least Concern	Least Concern	High
Blue Crane	Vulnerable	Near Threatened	High
Blue Korhaan	Near Threatened	Least Concern	High
Cape Shoveler	Least Concern	Least Concern	High
Cape Teal	Least Concern	Least Concern	High
Denham's Bustard	Near Threatened	Vulnerable	Medium



<b>Species</b>	<b>Global status</b>	<b>Regional status</b>	<b>Occurrence likelihood</b>
Egyptian Goose	Least Concern	Least Concern	High
Glossy Ibis	Least Concern	Least Concern	High
Goliath Heron	Least Concern	Least Concern	Medium
Great Crested Grebe	Least Concern	Least Concern	Medium
Great Egret	Least Concern	Least Concern	Medium
Greater Flamingo	Least Concern	Near Threatened	High
Grey Heron	Least Concern	Least Concern	High
Hadada Ibis	Least Concern	Least Concern	High
Hamerkop	Least Concern	Least Concern	Medium
Intermediate Egret	Least Concern	Least Concern	High
Lesser Flamingo	Near Threatened	Near Threatened	Medium
Little Egret	Least Concern	Least Concern	High
Little Grebe	Least Concern	Least Concern	High
Maccoa Duck	Endangered	Near Threatened	High
Marsh Owl	Least Concern	Least Concern	High
Northern Black Korhaan	Least Concern	Least Concern	High
Purple Heron	Least Concern	Least Concern	Medium
Red-billed Teal	Least Concern	Least Concern	High
Red-knobbed Coot	Least Concern	Least Concern	High
Reed Cormorant	Least Concern	Least Concern	High
Secretarybird	Endangered	Vulnerable	Medium
South African Shelduck	Least Concern	Least Concern	High
Southern Pochard	Least Concern	Least Concern	High
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Spur-winged Goose	Least Concern	Least Concern	High
Squacco Heron	Least Concern	Least Concern	Medium
Western Barn Owl	Least Concern	Least Concern	Medium
Western Cattle Egret	Least Concern	Least Concern	High
White Stork	Least Concern	Least Concern	Medium
White-backed Duck	Least Concern	Least Concern	Medium
White-breasted Cormorant	Least Concern	Least Concern	High
White-faced Whistling Duck	Least Concern	Least Concern	Medium
Yellow-billed Duck	Least Concern	Least Concern	High
African Openbill	Least Concern	Least Concern	Low
Black Heron	Least Concern	Least Concern	Low
Black-crowned Night Heron	Least Concern	Least Concern	Low
Blue-billed Teal	Least Concern	Least Concern	Low
Fulvous Whistling Duck	Least Concern	Least Concern	Low
Great White Pelican	Least Concern	Vulnerable	Low
Knob-billed Duck	Least Concern	Least Concern	Low
Southern Bald Ibis	Vulnerable	Vulnerable	Low
Wattled Crane	Vulnerable	Critically Endangered	Low
White-bellied Bustard	Least Concern	Vulnerable	Low
Yellow-billed Stork	Least Concern	Endangered	Low

## 9. IMPACT RATING

### 9.1. Impact criteria

See **APPENDIX 3: ASSESSMENT CRITERIA** for the assessment criteria employed to assess the impacts of the proposed Grid Connection.

### 9.2. Impact tables

#### **Construction phase**

Table 15, **Table 16**, and **Table 17** contain a summary of the impact assessment and proposed mitigation measures for the identified impacts:

#### Construction phase

- Displacement due to disturbance associated with the construction of the onsite substation and grid connection power line.
- Displacement due to habitat transformation associated with the construction of the onsite substation and grid connection power line.

#### Operational phase

- Collisions with the up to 132kV grid connection power line.
- Electrocutions within the onsite substation.

#### Decommissioning phase

- Displacement due to disturbance associated with the decommissioning of the onsite substation and grid connection power line.

## 9.2.1. Construction phase

**Table 15: [Construction phase] Displacement of priority avifauna due to disturbance associated with the construction of the grid infrastructure**

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						M	E	R	D	P	S	Rating	M	E	R	D	P	S	Rating
<b>Impact 1:</b>	Construction of the 132kV powerline grid infrastructure	Displacement of priority avifauna due to disturbance associated with the construction of the overhead powerline grid infrastructure	Construction	Negative	Moderate	4	1	1	2	5	40	N3	3	1	1	2	4	28	N2
<b>Significance</b>						<b>N3 - Moderate</b>							<b>N2 - Low</b>						
<b>Impact 2:</b>	Construction of the 132kV powerline grid infrastructure	Displacement of priority species due to habitat transformation because of the construction of the overhead powerline grid infrastructure	Construction	Negative	Moderate	3	1	3	2	4	36	N3	2	1	1	2	4	24	N2
<b>Significance</b>						<b>N3 - Moderate</b>							<b>N2 - Low</b>						

### 9.2.2. Operational phase

Table 16: [Operational phase]: Mortality risks of powerline priority bird species associated with the operational phase of the grid infrastructure

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation						Rating	Post-Mitigation						Rating
						M	E	R	D	P	S		M	E	R	D	P	S	
<b>Impact 2:</b>	High voltage overhead lines	Electrocution mortality in the substations	Operational	Negative	Moderate	5	2	3	4	4	56	<b>N3</b>	5	2	3	4	1	14	<b>N1</b>
<b>Significance</b>						<b>N3 - Moderate</b>							<b>N1 - Very Low</b>						
<b>Impact 3:</b>	High voltage overhead lines	Bird mortality and injury resulting from collisions with the 132kV powerline	Operational	Negative	Moderate	5	2	3	4	4	56	<b>N4</b>	5	2	3	4	2	28	<b>N2</b>
<b>Significance</b>						<b>N4 - High</b>							<b>N2 - Low</b>						

### 9.2.3. Decommissioning phase

Table 17: [Decommissioning phase]: Displacement of priority avifauna due to disturbance associated with the dismantling of the grid infrastructure.

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						M	E	R	D	P	S	Rating	M	E	R	D	P	S	Rating
Impact 1:	Dismantling of the 132kV powerline grid infrastructure	Displacement of priority avifauna due to disturbance associated with the dismantling of the 132kV grid infrastructure.	Construction	Negative	moderate	5	2	3	4	5	40	N3	3	1	1	2	4	28	N2
<b>Significance</b>						<b>N3 - Moderate</b>							<b>N2 - Low</b>						



### 9.3. Cumulative impacts

The “cumulative impact” of this development project refers to the collective past, present, and foreseeable future effects that the development, alongside related developments may have on the long-term ecological viability of priority avifauna. Related developments may present compounded impacts beyond what can be observed or predicted from a single development considered in isolation. It is therefore necessary to consider each newly proposed development alongside related developments in a regional context. The role of the cumulative assessment is to determine whether the proposed project will significantly increase, or otherwise alter, the related impacts already presented by established regional developments. The regional consideration of this cumulative assessment refers to the area within a 55km radius of the proposed development’s project site. It should be noted, however, that for highly mobile animals such as birds, the cumulative impacts of related developments can extend beyond this regional context, as certain priority species populations (i.e., local, intra-African, and trans-continental migrants) can be affected by related developments at an international scale.

This section addresses whether the construction of the proposed development will result in:

- Unacceptable risks to powerline priority bird species.
- Unacceptable loss of powerline priority bird species.
- Large-scale environmental degradation or transformation
- Unacceptable increases in impacts already presented by established developments

According to the official database of DFFE and other documents in the public domain, there are currently at least five planned wind- and solar energy facilities within a 55 km radius of the proposed development (see **Figure 9**), two of which have been approved while three are pending approval. These are the following:

- Approved - 65.9 MW Tutuka Photovoltaic (PV) Energy Facility (ref: DEA/EIA/0002646/2014), ~40 km southeast of the proposed development.
- Approved - 75 MV Solar PV Energy Facility at Farm Grootvlei (NEAS ref: DEA/EIA/0000065/2011), ~35 km southeast of the proposed development.
- Pending approval - Forzando North Coal Mine Solar PV Facility (NEAS ref: DEA/EIA/0000991/2012) ~55 km southeast of the proposed development.
- Pending approval - 300 MW Vhuvhili Solar PV Energy Facility (NEAS ref: MPP/EIA/0001063/2022) ~18 km southeast of the proposed development.
- Pending approval - 200 MW Mukondeleli Wind Energy Facility (NEAS ref: unprocured), ~12 km east of the proposed development.

Associated with each of these developments, is the infrastructure needed for connection to the national grid. The area within a 55 km radius of the project site includes approximately 3352 km of already-constructed overhead, high-voltage power lines (**Figure 9**). For this assessment, however, the total length can be reduced to a functional length approximately 1785 km, given that multiple parallel power lines arguably present the same impact as a single power line transect over the distance of parallel transmission. This overall reticular length can be further broken down into: ~494 km of 88 kV lines (functionally ~350 km), ~754 km of 132 kV lines

(functionally ~506 km), ~541 km of 275 kV lines (functionally ~169 km), ~1333 km of 400 kV lines (functionally ~773 km), and 230 km of 765 kV lines (functionally ~200 km) (**Figure 9**).

The proposed 132 KV Impumelelo Grid Connection will be at most 34 km, representing 1.0 % of the total length of all existing regional overhead power lines, or a functional contribution of 1.9 %. When considering only existing 132 kV power lines, this contribution becomes 4.5 % to the overall length, and 6.5 % to the functional length. The Impumelelo Grid Connection therefore represents a comparably small contribution to the existing overhead grid system. However, this grid connection likely represents a larger proportion of new grid infrastructure associated with regional renewable energy projects. Although the length of the pending grid infrastructure could not be procured, we estimate the contribution to be ~20-30% (depending on the number of approved projects, and length of the associated grid infrastructure). By extension, the pending grid infrastructure collectively contribute towards ~6-10 % of the functional length of regional overhead power lines.

These length contributions, though comparably low, increase the density of regional power lines. The Impumelelo Grid Connection alone will increase the density of overall overhead power lines from 227 m/km<sup>2</sup> to 229 m/km<sup>2</sup>, and the density of 132 kV lines from 51 m/km<sup>2</sup> to 53 m/km<sup>2</sup>. When considering new grid connection infrastructure from related regional projects (assuming all proposed projects are approved and the associated grid connection infrastructure are of similar length), the estimated future density of overhead powerlines may be up 238 m/km<sup>2</sup> overall and 62 m/km<sup>2</sup> of 132 kV powerlines. Heightened density of power lines increases collision risks to priority avifauna, compounding the impacts of electrocution risk, collisions with wind turbines/other renewable energy facilities, as well as the displacement associated with construction and decommission of these renewable energy projects.

The Impumelelo Grid Connection therefore represents a comparatively **low** contribution towards the total length of high voltage power lines within a 55km radius. However, this project will increase the density of planned and existing high voltage lines within a 55 km radius, and this cumulative effect represents a potentially **moderate** impact risk to priority avifauna, by compounding the collision risks imposed regional renewable energy projects onto powerline sensitive species.

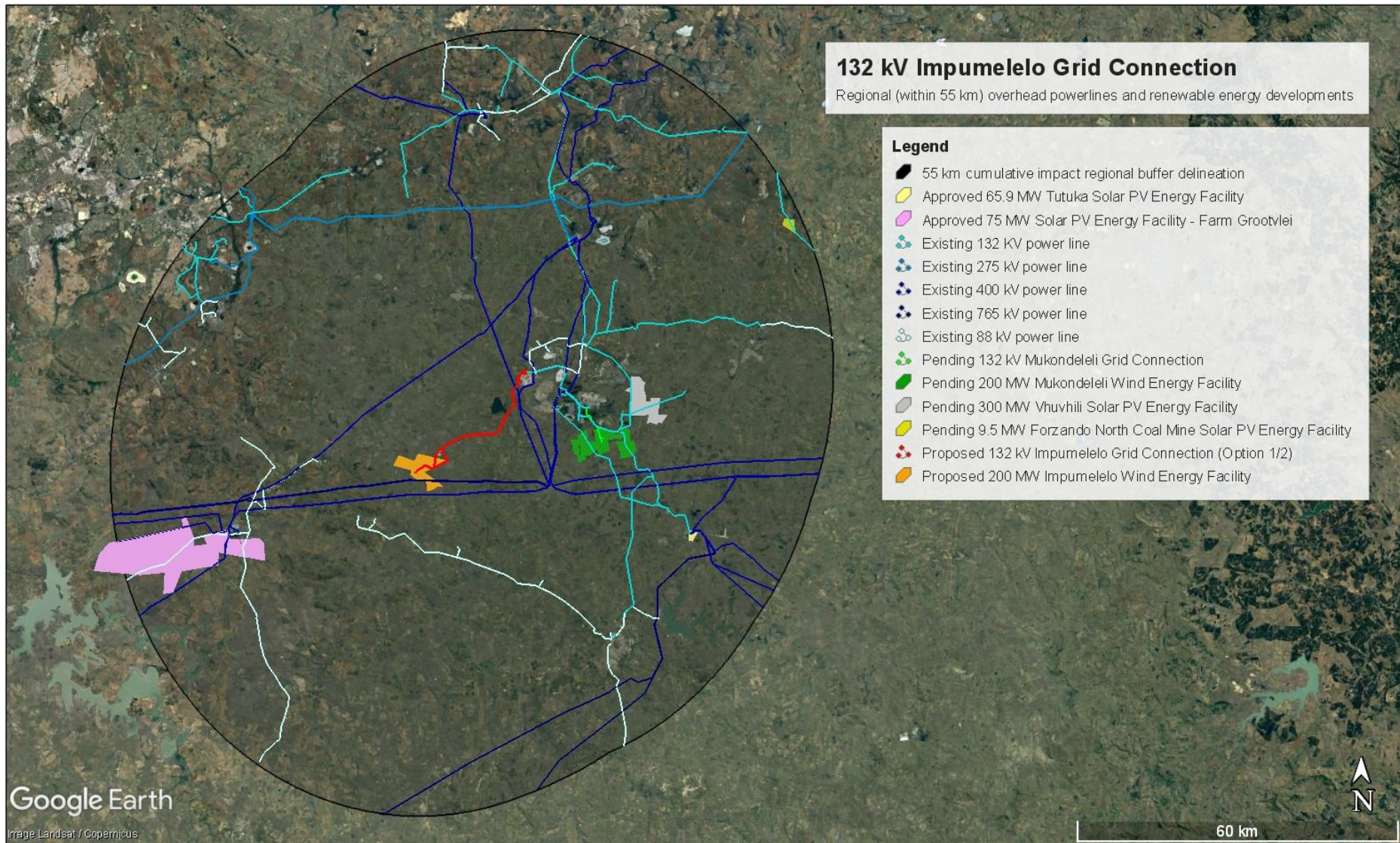


Figure 9: Existing overhead high voltage power lines and proposed renewable energy projects within 55 km of the proposed Impumelelo Grid Connection (source: DFFE Database 2022 & Cabanga Environmental).

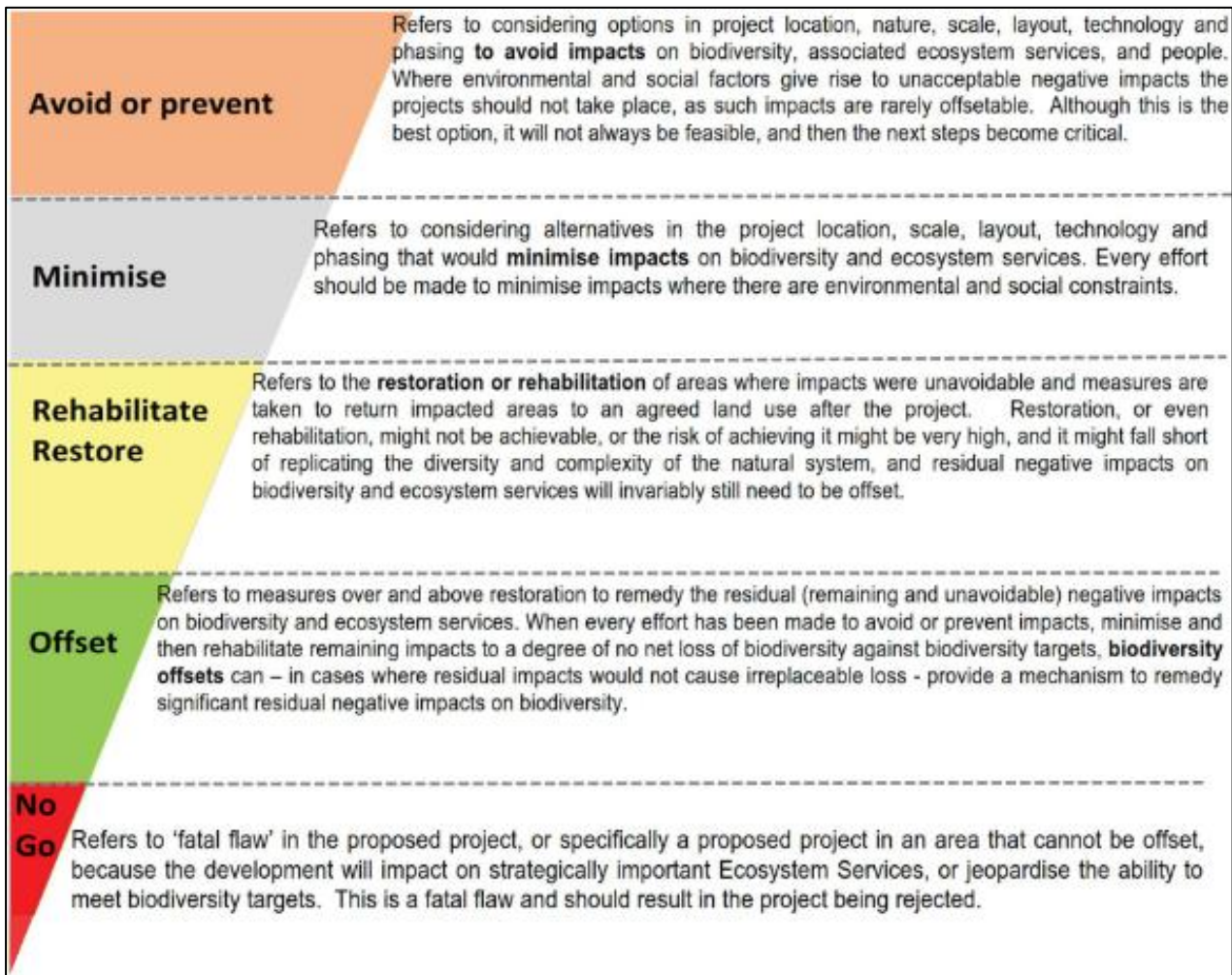


## 10. MITIGATION MEASURES

The impact significance without mitigation measures is assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the proposed Project. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in **Figure 10**.



**Figure 10: Mitigation sequence/hierarchy**

The mitigation measures that are proposed for the Project are listed below.

### 10.1. Pre-construction phase

- Conduct a pre-construction inspection to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed.
- The authorised alignment must be inspected by an avifaunal specialist by means of a “walk-through” inspection i.e., through a combination of satellite imagery supplemented with in situ inspections by vehicle and where necessary, on foot, once the pole positions have been finalised. The objective would be to demarcate the sections of the powerline that need to be fitted with Bird Flight Diverters.

### 10.2. Construction phase



- Once the relevant spans have been identified, Bird Flight Diverters must be fitted according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines).
- Additionally, LED bird flappers should be mounted onto the sections of the power line transecting a high sensitivity zone surrounding the Leeupan Dam, to reduce the potential risk of nocturnal collisions.
- Conduct a pre-construction inspection to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed.
- Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of powerline sensitive species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- Vegetation clearance should be limited to what is necessary.
- The mitigation measures proposed by the biodiversity specialist must be strictly enforced.

### 10.3.Operational phase

- The hardware within the proposed substation yard is too complex and the risk too low to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded by the maintenance staff once operational, site-specific mitigation (insulation) be applied reactively if need be. This is an acceptable approach because Red List powerline sensitive species are unlikely to frequent the substation, although some more common powerline sensitive species might well be present more often and exposed to the electrocution risk.

### 10.4.De-commissioning phase

- Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of powerline sensitive species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

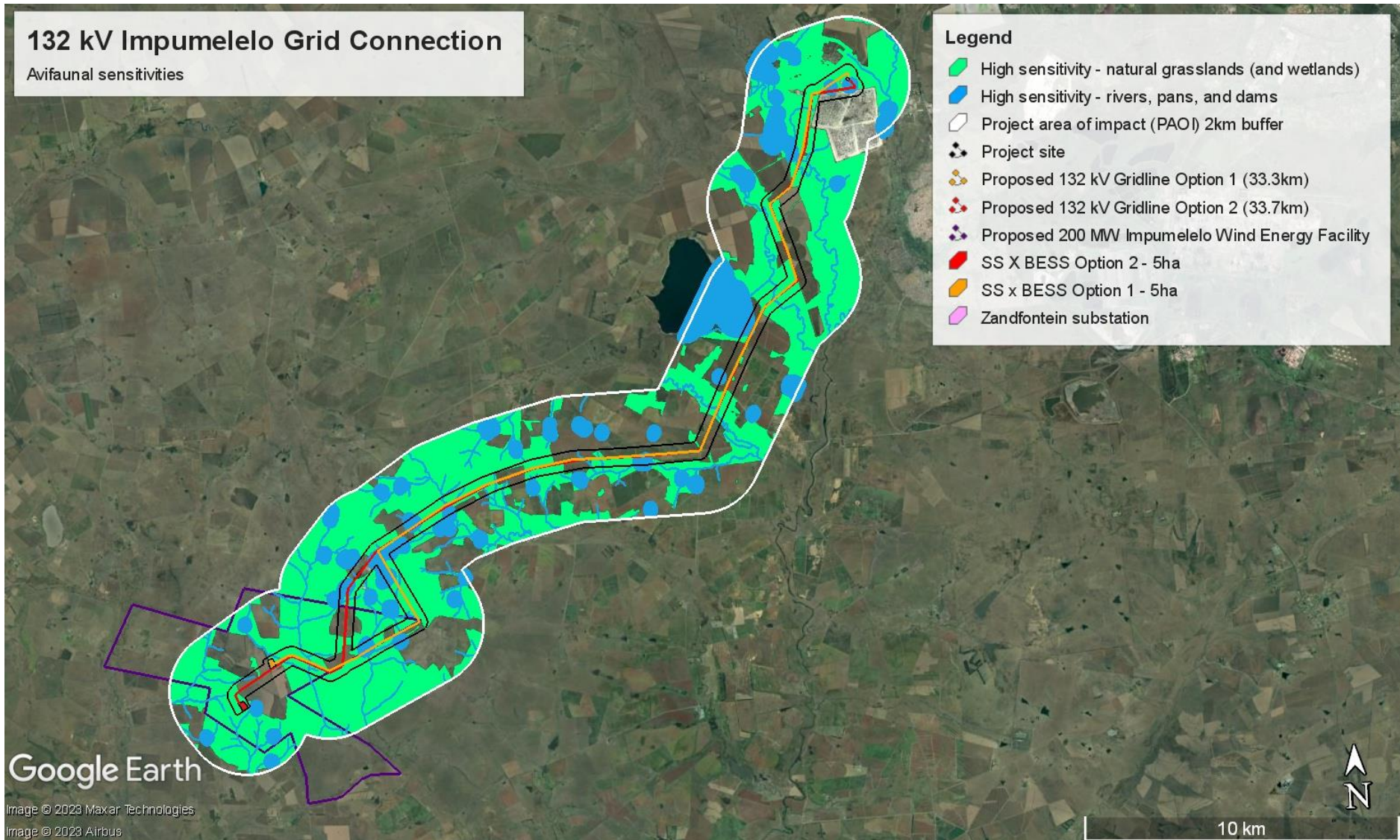
## 11. ENVIRONMENTAL SENSITIVITIES

The following specific environmental sensitivities were identified from an avifaunal perspective:

**Drainage lines, dams, pans, and associated wetlands.** These habitat features are important attractions for many power line sensitive species, particularly waterbirds, including Red List species expected to regularly occur in the development area: African Marsh Harrier, Blue Crane, Greater Flamingo, Lesser Flamingo, Maccua Duck, and Lanner Falcon. Birds commuting between these areas will be at risk of collision with the earthwire if they must cross over the grid connection. Spans crossing these areas, or situated between two or more such areas, must be identified during the walk-through inspection once the final tower positions have been determined and marked with Bird Flight Diverters, and/or LED bird flappers in specific instances (e.g. Leeupan).

**Natural grassland.** The natural grassland is vital breeding, roosting and foraging habitat for a variety of powerline sensitive species and will therefore be associated with significant flight activity. These include Red List species expected to regularly occur in the development area: African Marsh Harrier, Blue Crane, Denham's Bustard, Blue Korhaan, Lanner Falcon, and Secretarybird. Spans crossing these areas, or situated between two or more such areas, must be identified during the walk-through inspection once the final tower positions have been determined and marked with Bird Flight Diverters.

See **Figure 11** for the avifaunal sensitivities identified from a wind energy perspective.



**Figure 11: Avifaunal sensitivities within the Impumelelo Grid Connection project area of impact. High sensitivity areas include natural undisturbed grassland (shaded green), and wetlands, rivers/streams, pans, and dams (shaded blue).**

## 12. CONDITIONS FOR INCLUSION IN THE EMPr

Please see

**APPENDIX 4: ENVIRONMENTAL MANAGEMENT PROGRAMME**4 for the monitoring requirements to be included in the EMPr for the Impumelelo Grid Connection project.

## 13. 'NO-GO' ALTERNATIVES

The 'no-go' alternative is the option of not constructing the Impumelelo Grid Connection and associated infrastructure, where the *status quo* of the current status and/or activities on the project sites would prevail. This alternative would result in no additional impact on the receiving environment.

Should the 'no-go' alternative be considered, there would be no impact on the existing environmental baseline and no benefits to the local economy and affected communities. The alternative also bears the opportunity cost of missed socio-economic benefits to the local community that would otherwise realise from establishing the farms which form part of the project sites. The option of not developing also entails that the bid to provide renewable/clean energy to the national grid and contribute to meeting the country's energy demands will be forfeited.

However, from a strictly avifaunal perspective, the 'no-go' alternative will result in the current *status quo* being maintained. The 'no-go' option would eliminate any additional impact on the ecological integrity of the proposed 132kV grid infrastructure development site, as far as avifauna is concerned.

## 14. SUMMARY AND CONCLUSION

The proposed Impumelelo Grid Connection could have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Electrocution in the onsite substations in the operational phase.
- Collisions with the 132kV HV overhead lines in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

### 14.1 Displacement of priority species due to habitat transformation in the construction phase

The loss of habitat for powerline sensitive species due to direct habitat transformation associated with the construction of the proposed Impumelelo Grid Connection is likely to be moderate due to the small size of the footprint, but ideally high-quality grassland should be avoided if possible. In summary, the powerline priority bird species which may regularly occur at the development area could be impacted by habitat transformation associated with the development of the grid infrastructure: Blue Crane, Blue Korhaan, Denham's Bustard, Marsh



Owl, Northern Black Korhaan, and Secretarybird. The impact is rated as **moderate** pre-mitigation and **low** post-mitigation.

## 14.2 Displacement of priority species due to disturbance linked to construction activities in the construction phase

It is inevitable that a measure of displacement will take place at the Impumelelo Grid Connection development area for the priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species in the remaining high-quality grassland, wetlands and wetland fringes the most, as this could temporarily disrupt their reproductive cycle. Some species might be able to recolonise the area after the completion of the construction phase, but for some species, this might only be partially the case, resulting in lower densities than before. In summary, the powerline priority bird species which may regularly occur at the development area could be impacted by disturbances during the construction phase: African Fish Eagle, African Harrier-Hawk, African Marsh Harrier, Black Sparrowhawk, Black-chested Snake Eagle, Black-winged Kite, Blue Crane, Blue Korhaan, Denham's Bustard, Greater Kestrel, Jackal Buzzard, Lanner Falcon, Marsh Owl, Northern Black Korhaan, Secretarybird, and Spotted Eagle-Owl. The impact is rated as **moderate** pre-mitigation and **low** post-mitigation.

## 14.3 Electrocuting of priority species in substations in the operational phase

Electrocutions within the proposed on-site substation yard are possible but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls, and certain species of waterbirds. In summary, the following powerline priority bird species which may regularly occur at the development area are vulnerable to electrocution in this manner: African Fish Eagle, African Harrier-Hawk, African Marsh Harrier, African Sacred Ibis, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Cape Crow, Common Buzzard, Egyptian Goose, Greater Kestrel, Hadada Ibis, Hamerkop, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Marsh Owl, Pied Crow, Rock Kestrel, Spotted Eagle-Owl, Western Barn Owl, and Western Cattle Egret. The impact is rated as **moderate** pre-mitigation and **very low** post-mitigation.

## 14.4 Collisions of priority species with the overhead 132kV powerlines in the operational phase

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



priority bird species which may regularly occur at the development area are particularly vulnerable to risk of collisions with the overhead 132kV powerlines: African Black Duck, African Darter, African Sacred Ibis, African Spoonbill, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Cape Shoveler, Cape Teal, Denham's Bustard, Egyptian Goose, Glossy Ibis, Goliath Heron, Great Crested Grebe, Great Egret, Greater Flamingo, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Maccoa Duck, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-breasted Cormorant, White-faced Whistling Duck, and Yellow-billed Duck. The impact is rated as **high** pre-mitigation and **low** post-mitigation.

#### 14.5 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed Grid Connection. The impact is rated as **moderate** pre-mitigation and **low** post-mitigation.

#### 14.6 Cumulative impacts

The total length of overhead 132kV powerlines for proposed Impumelelo Grid Connection is approximately 34km. There is a total length of approximately 3352 km of overhead high voltage powerlines in a 55km radius of the development area, although for the purpose of this avifaunal risk assessment, this can be reduced to a functional length approximately 1785 km, given that several overhead powerlines run parallel for part of their respective lengths. The Impumelelo Grid Connection therefore represents a comparatively **Low** contribution towards the total length of high voltage power lines within a 55 km radius. However, this project will increase the density of planned and existing high voltage lines within a 55 km radius, and this cumulative effect represents a potentially **Moderate** impact risk to priority avifauna.

### 15. CONCLUSION AND IMPACT STATEMENT

The proposed Impumelelo Grid Connection could have a **moderate to high** impact on avifauna which, in most instances, could be reduced to **low** through appropriate mitigation, although some moderate residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed Grid Connection development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

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## APPENDIX 1: SPECIES LIST FOR THE BROADER AREA

Appendix 1 Table 1: Bird species list of the broader area for the Impumelelo Grid Connection, compiled from SABAP2 observations, alongside pre-construction monitoring observations.

Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
Bokmakierie	<i>Telophorus zeylonus</i>	24.8	2.5	Least Concern	Least Concern
Brubru	<i>Nilaus afer</i>	1.9	0.0	Least Concern	Least Concern
Hamerkop	<i>Scopus umbretta</i>	9.8	2.8	Least Concern	Least Concern
Neddicky	<i>Cisticola fulvicapilla</i>	12.0	0.9	Least Concern	Least Concern
Quailfinch	<i>Ortygospiza atricollis</i>	45.4	11.5	Least Concern	Least Concern
Ruff	<i>Calidris pugnax</i>	11.1	2.0	Least Concern	Least Concern
Sanderling	<i>Calidris alba</i>	0.0	0.3	Least Concern	Least Concern
Secretarybird	<i>Sagittarius serpentarius</i>	7.5	8.1	Endangered	Vulnerable
Bar-throated Apalis	<i>Apalis thoracica</i>	6.0	0.0	Least Concern	Least Concern
Pied Avocet	<i>Recurvirostra avosetta</i>	13.3	3.0	Least Concern	Least Concern
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>	16.1	1.8	Least Concern	Least Concern
Black-collared Barbet	<i>Lybius torquatus</i>	25.1	2.0	Least Concern	Least Concern
Crested Barbet	<i>Trachyphonus vaillantii</i>	23.6	3.0	Least Concern	Least Concern
European Bee-eater	<i>Merops apiaster</i>	0.5	0.0	Least Concern	Least Concern
Swallow-tailed Bee-eater	<i>Merops hirundineus</i>	0.2	0.0	Least Concern	Least Concern
Southern Red Bishop	<i>Euplectes orix</i>	80.2	26.1	Least Concern	Least Concern
Yellow-crowned Bishop	<i>Euplectes afer</i>	31.6	9.6	Least Concern	Least Concern
Little Bittern	<i>Ixobrychus minutus</i>	0.2	0.3	Least Concern	Least Concern
Southern Boubou	<i>Laniarius ferrugineus</i>	1.9	0.5	Least Concern	Least Concern
African Red-eyed Bulbul	<i>Pycnonotus nigricans</i>	19.0	1.5	Least Concern	Least Concern
Dark-capped Bulbul	<i>Pycnonotus tricolor</i>	13.0	2.0	Least Concern	Least Concern
Cape Bunting	<i>Emberiza capensis</i>	16.1	0.5	Least Concern	Least Concern
Cinnamon-breasted Bunting	<i>Emberiza tahapisi</i>	9.5	1.3	Least Concern	Least Concern
Lark-like Bunting	<i>Emberiza impetuani</i>	0.2	0.0	Least Concern	Least Concern

Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
White-bellied Bustard	<i>Eupodotis senegalensis</i>	0.5	0.0	Least Concern	Vulnerable
Common Buttonquail	<i>Turnix sylvaticus</i>	1.0	0.0	Least Concern	Least Concern
Common Buzzard	<i>Buteo buteo</i>	14.3	3.1	Least Concern	Least Concern
Jackal Buzzard	<i>Buteo rufofuscus</i>	8.9	2.6	Least Concern	Least Concern
Black-throated Canary	<i>Crithagra atrogularis</i>	61.9	10.4	Least Concern	Least Concern
Cape Canary	<i>Serinus canicollis</i>	7.6	0.5	Least Concern	Least Concern
Yellow Canary	<i>Crithagra flaviventris</i>	43.9	10.7	Least Concern	Least Concern
Yellow-fronted Canary	<i>Crithagra mozambica</i>	6.4	1.4	Least Concern	Least Concern
Ant-eating Chat	<i>Myrmecocichla formicivora</i>	48.1	15.2	Least Concern	Least Concern
Familiar Chat	<i>Oenanthe familiaris</i>	5.5	0.5	Least Concern	Least Concern
Sickle-winged Chat	<i>Emarginata sinuata</i>	0.7	0.1	Least Concern	Least Concern
Cloud Cisticola	<i>Cisticola textrix</i>	22.9	9.5	Least Concern	Least Concern
Desert Cisticola	<i>Cisticola aridulus</i>	1.0	0.8	Least Concern	Least Concern
Levaillant's Cisticola	<i>Cisticola tinniens</i>	72.0	16.2	Least Concern	Least Concern
Pale-crowned Cisticola	<i>Cisticola cinnamomeus</i>	2.5	1.5	Least Concern	Least Concern
Wailing Cisticola	<i>Cisticola lais</i>	18.3	1.5	Least Concern	Least Concern
Wing-snapping Cisticola	<i>Cisticola ayresii</i>	15.7	4.0	Least Concern	Least Concern
Zitting Cisticola	<i>Cisticola juncidis</i>	45.2	10.9	Least Concern	Least Concern
Red-knobbed Coot	<i>Fulica cristata</i>	81.2	26.3	Least Concern	Least Concern
Reed Cormorant	<i>Microcarbo africanus</i>	71.3	19.5	Least Concern	Least Concern
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>	21.8	5.5	Least Concern	Least Concern
African Crake	<i>Crecoptis egregia</i>	0.2	0.0	Least Concern	Least Concern
Baillon's Crake	<i>Zapornia pusilla</i>	0.0	0.3	Least Concern	Least Concern
Black Crake	<i>Zapornia flavirostra</i>	0.7	0.0	Least Concern	Least Concern
Blue Crane	<i>Grus paradisea</i>	10.7	4.3	Vulnerable	Near Threatened
Wattled Crane	<i>Grus carunculata</i>	0.1	0.0	Vulnerable	Critically Endangered
Cape Crow	<i>Corvus capensis</i>	22.3	10.2	Least Concern	Least Concern
Pied Crow	<i>Corvus albus</i>	17.8	2.6	Least Concern	Least Concern

Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
African Cuckoo	<i>Cuculus gularis</i>	0.2	0.0	Least Concern	Least Concern
Diederik Cuckoo	<i>Chrysococcyx caprius</i>	19.6	3.1	Least Concern	Least Concern
Jacobin Cuckoo	<i>Clamator jacobinus</i>	0.2	0.0	Least Concern	Least Concern
Red-chested Cuckoo	<i>Cuculus solitarius</i>	2.2	0.0	Least Concern	Least Concern
African Darter	<i>Anhinga rufa</i>	17.1	0.8	Least Concern	Least Concern
Cape Turtle Dove	<i>Streptopelia capicola</i>	86.7	21.2	Least Concern	Least Concern
Laughing Dove	<i>Spilopelia senegalensis</i>	84.0	23.6	Least Concern	Least Concern
Namaqua Dove	<i>Oena capensis</i>	11.6	1.8	Least Concern	Least Concern
Red-eyed Dove	<i>Streptopelia semitorquata</i>	72.7	11.5	Least Concern	Least Concern
Rock Dove	<i>Columba livia</i>	22.0	1.6	Least Concern	Least Concern
African Black Duck	<i>Anas sparsa</i>	8.3	0.9	Least Concern	Least Concern
Fulvous Whistling Duck	<i>Dendrocygna bicolor</i>	0.2	0.0	Least Concern	Least Concern
Knob-billed Duck	<i>Sarkidiornis melanotos</i>	1.0	0.0	Least Concern	Least Concern
Maccoa Duck	<i>Oxyura maccoa</i>	10.6	1.0	Endangered	Near Threatened
White-backed Duck	<i>Thalassornis leuconotus</i>	4.3	0.8	Least Concern	Least Concern
White-faced Whistling Duck	<i>Dendrocygna viduata</i>	10.5	1.8	Least Concern	Least Concern
Yellow-billed Duck	<i>Anas undulata</i>	67.8	17.7	Least Concern	Least Concern
African Fish Eagle	<i>Haliaeetus vocifer</i>	5.1	0.8	Least Concern	Least Concern
Black-chested Snake Eagle	<i>Circaetus pectoralis</i>	1.1	0.5	Least Concern	Least Concern
Booted Eagle	<i>Hieraaetus pennatus</i>	0.2	0.0	Least Concern	Least Concern
Brown Snake Eagle	<i>Circaetus cinereus</i>	0.2	0.0	Least Concern	Least Concern
Long-crested Eagle	<i>Lophaetus occipitalis</i>	0.5	0.0	Least Concern	Least Concern
Martial Eagle	<i>Polemaetus bellicosus</i>	0.5	0.3	Endangered	Endangered
Spotted Eagle-Owl	<i>Bubo africanus</i>	4.5	0.3	Least Concern	Least Concern
Great Egret	<i>Ardea alba</i>	2.0	1.0	Least Concern	Least Concern
Intermediate Egret	<i>Ardea intermedia</i>	13.6	3.8	Least Concern	Least Concern
Little Egret	<i>Egretta garzetta</i>	13.3	1.8	Least Concern	Least Concern
Western Cattle Egret	<i>Bubulcus ibis</i>	48.4	13.9	Least Concern	Least Concern



Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
Amur Falcon	<i>Falco amurensis</i>	16.5	4.8	Least Concern	Least Concern
Lanner Falcon	<i>Falco biarmicus</i>	6.0	2.0	Least Concern	Vulnerable
Red-footed Falcon	<i>Falco vespertinus</i>	0.4	0.3	Vulnerable	Near Threatened
Cuckoo Finch	<i>Anomalospiza imberbis</i>	1.2	0.0	Least Concern	Least Concern
Red-headed Finch	<i>Amadina erythrocephala</i>	11.3	1.1	Least Concern	Least Concern
Red-billed Firefinch	<i>Lagonosticta senegala</i>	0.2	0.0	Least Concern	Least Concern
Southern Fiscal	<i>Lanius collaris</i>	86.7	27.9	Least Concern	Least Concern
Greater Flamingo	<i>Phoenicopterus roseus</i>	31.1	9.3	Least Concern	Near Threatened
Lesser Flamingo	<i>Phoeniconaias minor</i>	10.6	3.3	Near Threatened	Near Threatened
African Paradise Flycatcher	<i>Terpsiphone viridis</i>	3.4	0.0	Least Concern	Least Concern
Fairy Flycatcher	<i>Stenostira scita</i>	8.1	0.8	Least Concern	Least Concern
Fiscal Flycatcher	<i>Melaenornis silens</i>	23.0	2.0	Least Concern	Least Concern
Spotted Flycatcher	<i>Muscicapa striata</i>	3.6	0.3	Least Concern	Least Concern
Grey-winged Francolin	<i>Scleroptila afra</i>	5.8	0.3	Least Concern	Least Concern
Orange River Francolin	<i>Scleroptila gutturalis</i>	43.3	17.9	Least Concern	Least Concern
Red-winged Francolin	<i>Scleroptila levaillantii</i>	1.0	0.0	Least Concern	Least Concern
Grey Go-away-bird	<i>Crinifer concolor</i>	1.4	0.3	Least Concern	Least Concern
Domestic Goose	<i>Anser anser domesticus</i>	0.7	1.0	Least Concern	Least Concern
Egyptian Goose	<i>Alopochen aegyptiaca</i>	80.8	29.1	Least Concern	Least Concern
Spur-winged Goose	<i>Plectropterus gambensis</i>	28.0	7.0	Least Concern	Least Concern
Cape Grassbird	<i>Sphenoeacus afer</i>	0.5	0.0	Least Concern	Least Concern
Black-necked Grebe	<i>Podiceps nigricollis</i>	21.0	4.8	Least Concern	Least Concern
Great Crested Grebe	<i>Podiceps cristatus</i>	8.9	1.5	Least Concern	Least Concern
Little Grebe	<i>Tachybaptus ruficollis</i>	63.4	17.9	Least Concern	Least Concern
Common Greenshank	<i>Tringa nebularia</i>	9.9	0.5	Least Concern	Least Concern
Helmeted Guineafowl	<i>Numida meleagris</i>	61.0	13.3	Least Concern	Least Concern
Grey-headed Gull	<i>Chroicocephalus cirrocephalus</i>	28.3	6.8	Least Concern	Least Concern
Lesser Black-backed Gull	<i>Larus fuscus</i>	4.8	2.0	Least Concern	Least Concern

Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
African Marsh Harrier	<i>Circus ranivorus</i>	2.2	1.5	Least Concern	Endangered
Black Harrier	<i>Circus maurus</i>	0.2	0.6	Endangered	Endangered
Montagu's Harrier	<i>Circus pygargus</i>	1.7	1.0	Least Concern	Least Concern
Pallid Harrier	<i>Circus macrourus</i>	1.2	0.0	Near Threatened	Near Threatened
African Harrier-Hawk	<i>Polyboroides typus</i>	1.1	0.1	Least Concern	Least Concern
White-crested Helmetshrike	<i>Prionops plumatus</i>	0.5	0.0	Least Concern	Least Concern
Black Heron	<i>Egretta ardesiaca</i>	0.0	0.3	Least Concern	Least Concern
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	1.6	0.0	Least Concern	Least Concern
Black-headed Heron	<i>Ardea melanocephala</i>	68.6	21.6	Least Concern	Least Concern
Goliath Heron	<i>Ardea goliath</i>	6.9	2.0	Least Concern	Least Concern
Grey Heron	<i>Ardea cinerea</i>	29.0	7.0	Least Concern	Least Concern
Purple Heron	<i>Ardea purpurea</i>	5.9	1.3	Least Concern	Least Concern
Squacco Heron	<i>Ardeola ralloides</i>	3.3	2.5	Least Concern	Least Concern
European Honey-buzzard	<i>Pernis apivorus</i>	0.5	0.0	Least Concern	Least Concern
Brown-backed Honeybird	<i>Prodotiscus regulus</i>	2.2	1.3	Least Concern	Least Concern
Greater Honeyguide	<i>Indicator indicator</i>	0.7	0.0	Least Concern	Least Concern
Lesser Honeyguide	<i>Indicator minor</i>	1.4	0.3	Least Concern	Least Concern
African Hoopoe	<i>Upupa africana</i>	5.1	0.5	Least Concern	Least Concern
African Sacred Ibis	<i>Threskiornis aethiopicus</i>	38.4	10.5	Least Concern	Least Concern
Glossy Ibis	<i>Plegadis falcinellus</i>	22.9	5.8	Least Concern	Least Concern
Hadada Ibis	<i>Bostrychia hagedash</i>	85.7	31.1	Least Concern	Least Concern
Southern Bald Ibis	<i>Geronticus calvus</i>	0.2	0.0	Vulnerable	Vulnerable
Greater Kestrel	<i>Falco rupicoloides</i>	13.4	6.4	Least Concern	Least Concern
Lesser Kestrel	<i>Falco naumanni</i>	1.2	0.0	Least Concern	Least Concern
Rock Kestrel	<i>Falco rupicolus</i>	9.3	7.3	Least Concern	Least Concern
Giant Kingfisher	<i>Megaceryle maxima</i>	3.0	0.0	Least Concern	Least Concern
Malachite Kingfisher	<i>Corythornis cristatus</i>	6.7	2.0	Least Concern	Least Concern
Pied Kingfisher	<i>Ceryle rudis</i>	8.3	1.6	Least Concern	Least Concern

Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
Black-winged Kite	<i>Elanus caeruleus</i>	73.0	26.1	Least Concern	Least Concern
Yellow-billed Kite	<i>Milvus aegyptius</i>	0.5	0.3	Least Concern	Least Concern
Blue Korhaan	<i>Eupodotis caerulescens</i>	27.7	12.4	Near Threatened	Least Concern
Northern Black Korhaan	<i>Afrotis afroides</i>	14.8	5.4	Least Concern	Least Concern
African Wattled Lapwing	<i>Vanellus senegallus</i>	17.5	1.6	Least Concern	Least Concern
Blacksmith Lapwing	<i>Vanellus armatus</i>	89.4	35.5	Least Concern	Least Concern
Crowned Lapwing	<i>Vanellus coronatus</i>	68.6	22.2	Least Concern	Least Concern
Eastern Clapper Lark	<i>Mirafra fasciolata</i>	0.7	0.0	Least Concern	Least Concern
Eastern Long-billed Lark	<i>Certhilauda semitorquata</i>	6.3	0.0	Least Concern	Least Concern
Melodious Lark	<i>Mirafra cheniana</i>	1.4	0.0	Least Concern	Least Concern
Pink-billed Lark	<i>Spizocorys conirostris</i>	10.8	4.4	Least Concern	Least Concern
Red-capped Lark	<i>Calandrella cinerea</i>	65.3	26.8	Least Concern	Least Concern
Rufous-naped Lark	<i>Mirafra africana</i>	20.8	4.1	Least Concern	Least Concern
Spike-heeled Lark	<i>Chersomanes albofasciata</i>	23.5	9.9	Least Concern	Least Concern
Cape Longclaw	<i>Macronyx capensis</i>	88.9	33.1	Least Concern	Least Concern
Banded Martin	<i>Riparia cincta</i>	4.8	2.0	Least Concern	Least Concern
Brown-throated Martin	<i>Riparia paludicola</i>	29.6	5.5	Least Concern	Least Concern
Common House Martin	<i>Delichon urbicum</i>	5.1	0.3	Least Concern	Least Concern
Rock Martin	<i>Ptyonoprogne fuligula</i>	10.6	1.3	Least Concern	Least Concern
Common Moorhen	<i>Gallinula chloropus</i>	14.2	0.8	Least Concern	Least Concern
Lesser Moorhen	<i>Paragallinula angulata</i>	0.0	0.3	Least Concern	Least Concern
Red-faced Mousebird	<i>Urocolius indicus</i>	20.4	1.3	Least Concern	Least Concern
Speckled Mousebird	<i>Colius striatus</i>	9.8	0.8	Least Concern	Least Concern
White-backed Mousebird	<i>Colius colius</i>	0.7	0.0	Least Concern	Least Concern
Common Myna	<i>Acridotheres tristis</i>	41.9	8.6	Least Concern	Least Concern
African Openbill	<i>Anastomus lamelligerus</i>	0.5	0.3	Least Concern	Least Concern
Black-headed Oriole	<i>Oriolus larvatus</i>	0.7	0.3	Least Concern	Least Concern
Common Ostrich	<i>Struthio camelus</i>	6.0	2.8	Least Concern	Least Concern

Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
Marsh Owl	<i>Asio capensis</i>	12.2	2.9	Least Concern	Least Concern
Western Barn Owl	<i>Tyto alba</i>	3.6	0.3	Least Concern	Least Concern
Greater Painted-snipe	<i>Rostratula benghalensis</i>	0.0	0.3	Least Concern	Near Threatened
Great White Pelican	<i>Pelecanus onocrotalus</i>	0.2	0.0	Least Concern	Vulnerable
Speckled Pigeon	<i>Columba guinea</i>	80.7	24.3	Least Concern	Least Concern
African Pipit	<i>Anthus cinnamomeus</i>	84.9	29.4	Least Concern	Least Concern
African Rock Pipit	<i>Anthus crenatus</i>	5.5	1.3	Near Threatened	Near Threatened
Buffy Pipit	<i>Anthus vaalensis</i>	0.2	0.3	Least Concern	Least Concern
Long-billed Pipit	<i>Anthus similis</i>	0.2	0.0	Least Concern	Least Concern
Nicholson's Pipit	<i>Anthus nicholsoni</i>	9.9	0.8	Least Concern	Least Concern
Plain-backed Pipit	<i>Anthus leucophrys</i>	2.8	0.3	Least Concern	Least Concern
Yellow-breasted Pipit	<i>Anthus chloris</i>	0.2	0.3	Vulnerable	Vulnerable
Chestnut-banded Plover	<i>Charadrius pallidus</i>	6.5	2.0	Least Concern	Near Threatened
Common Ringed Plover	<i>Charadrius hiaticula</i>	9.9	1.8	Least Concern	Least Concern
Grey Plover	<i>Pluvialis squatarola</i>	0.5	0.0	Least Concern	Least Concern
Kittlitz's Plover	<i>Charadrius pecuarius</i>	28.2	6.0	Least Concern	Least Concern
Three-banded Plover	<i>Charadrius tricollaris</i>	51.3	12.0	Least Concern	Least Concern
White-fronted Plover	<i>Charadrius marginatus</i>	1.7	0.0	Least Concern	Least Concern
Southern Pochard	<i>Netta erythrophthalma</i>	25.2	5.5	Least Concern	Least Concern
Black-winged Pratincole	<i>Glareola nordmanni</i>	4.8	0.3	Near Threatened	Near Threatened
Black-chested Prinia	<i>Prinia flavicans</i>	51.6	5.4	Least Concern	Least Concern
Tawny-flanked Prinia	<i>Prinia subflava</i>	5.5	1.3	Least Concern	Least Concern
Green-winged Pytilia	<i>Pytilia melba</i>	1.9	0.3	Least Concern	Least Concern
Common Quail	<i>Coturnix coturnix</i>	15.9	4.0	Least Concern	Least Concern
Red-billed Quelea	<i>Quelea quelea</i>	60.7	14.0	Least Concern	Least Concern
African Rail	<i>Rallus caerulescens</i>	0.0	0.5	Least Concern	Least Concern
Cape Robin-Chat	<i>Cossypha caffra</i>	23.7	1.8	Least Concern	Least Concern
European Roller	<i>Coracias garrulus</i>	0.7	0.8	Least Concern	Near Threatened

Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
Lilac-breasted Roller	<i>Coracias caudatus</i>	0.2	0.0	Least Concern	Least Concern
Common Sandpiper	<i>Actitis hypoleucos</i>	2.9	0.3	Least Concern	Least Concern
Curllew Sandpiper	<i>Calidris ferruginea</i>	7.2	0.5	Near Threatened	Least Concern
Marsh Sandpiper	<i>Tringa stagnatilis</i>	7.7	1.3	Least Concern	Least Concern
Wood Sandpiper	<i>Tringa glareola</i>	6.6	0.3	Least Concern	Least Concern
Streaky-headed Seedeater	<i>Crithagra gularis</i>	12.5	0.5	Least Concern	Least Concern
South African Shelduck	<i>Tadorna cana</i>	24.0	5.0	Least Concern	Least Concern
Cape Shoveler	<i>Spatula smithii</i>	36.4	8.3	Least Concern	Least Concern
Crimson-breasted Shrike	<i>Laniarius atrococcineus</i>	0.4	0.0	Least Concern	Least Concern
Lesser Grey Shrike	<i>Lanius minor</i>	1.7	0.0	Least Concern	Least Concern
Red-backed Shrike	<i>Lanius collurio</i>	4.0	0.5	Least Concern	Least Concern
African Snipe	<i>Gallinago nigripennis</i>	14.1	2.3	Least Concern	Least Concern
Cape Sparrow	<i>Passer melanurus</i>	79.4	21.2	Least Concern	Least Concern
House Sparrow	<i>Passer domesticus</i>	34.6	7.8	Least Concern	Least Concern
Southern Grey-headed Sparrow	<i>Passer diffusus</i>	38.6	8.6	Least Concern	Least Concern
Chestnut-backed Sparrow-Lark	<i>Eremopterix leucotis</i>	6.3	0.0	Least Concern	Least Concern
White-browed Sparrow-Weaver	<i>Plocepasser mahali</i>	42.4	14.0	Least Concern	Least Concern
Black Sparrowhawk	<i>Accipiter melanoleucus</i>	3.6	0.0	Least Concern	Least Concern
African Spoonbill	<i>Platalea alba</i>	31.2	6.4	Least Concern	Least Concern
Swainson's Spurfowl	<i>Pternistis swainsonii</i>	74.9	19.7	Least Concern	Least Concern
Cape Starling	<i>Lamprotornis nitens</i>	34.5	9.6	Least Concern	Least Concern
Pied Starling	<i>Lamprotornis bicolor</i>	2.3	0.3	Least Concern	Least Concern
Red-winged Starling	<i>Onychognathus morio</i>	12.8	1.0	Least Concern	Least Concern
Violet-backed Starling	<i>Cinnyricinclus leucogaster</i>	1.4	0.0	Least Concern	Least Concern
Wattled Starling	<i>Creatophora cinerea</i>	3.0	0.0	Least Concern	Least Concern
Black-winged Stilt	<i>Himantopus himantopus</i>	25.1	8.6	Least Concern	Least Concern
Little Stint	<i>Calidris minuta</i>	19.9	5.3	Least Concern	Least Concern
African Stonechat	<i>Saxicola torquatus</i>	88.8	39.5	Least Concern	Least Concern

Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
White Stork	<i>Ciconia ciconia</i>	2.0	1.1	Least Concern	Least Concern
Yellow-billed Stork	<i>Mycteria ibis</i>	0.2	0.0	Least Concern	Endangered
Amethyst Sunbird	<i>Chalcomitra amethystina</i>	9.2	0.8	Least Concern	Least Concern
Malachite Sunbird	<i>Nectarinia famosa</i>	8.7	0.8	Least Concern	Least Concern
White-bellied Sunbird	<i>Cinnyris talatala</i>	10.6	0.0	Least Concern	Least Concern
Barn Swallow	<i>Hirundo rustica</i>	33.9	10.2	Least Concern	Least Concern
Greater Striped Swallow	<i>Cecropis cucullata</i>	41.7	8.3	Least Concern	Least Concern
Lesser Striped Swallow	<i>Cecropis abyssinica</i>	0.0	0.3	Least Concern	Least Concern
South African Cliff Swallow	<i>Petrochelidon spilodera</i>	53.1	12.5	Least Concern	Least Concern
White-throated Swallow	<i>Hirundo albicularis</i>	37.2	6.4	Least Concern	Least Concern
African Swamphen	<i>Porphyrio madagascariensis</i>	1.2	0.0	Least Concern	Least Concern
African Black Swift	<i>Apus barbatus</i>	0.7	0.0	Least Concern	Least Concern
African Palm Swift	<i>Cypsiurus parvus</i>	13.4	2.0	Least Concern	Least Concern
Alpine Swift	<i>Tachymarpis melba</i>	0.7	0.0	Least Concern	Least Concern
Common Swift	<i>Apus apus</i>	1.4	0.3	Least Concern	Least Concern
Horus Swift	<i>Apus horus</i>	0.7	0.3	Least Concern	Least Concern
Little Swift	<i>Apus affinis</i>	27.0	1.6	Least Concern	Least Concern
White-rumped Swift	<i>Apus caffer</i>	36.9	5.3	Least Concern	Least Concern
Brown-crowned Tchagra	<i>Tchagra australis</i>	1.7	0.5	Least Concern	Least Concern
Blue-billed Teal	<i>Spatula hottentota</i>	0.5	0.3	Least Concern	Least Concern
Cape Teal	<i>Anas capensis</i>	19.8	3.9	Least Concern	Least Concern
Red-billed Teal	<i>Anas erythrorhyncha</i>	47.0	10.3	Least Concern	Least Concern
Caspian Tern	<i>Hydroprogne caspia</i>	1.4	0.8	Least Concern	Vulnerable
Whiskered Tern	<i>Chlidonias hybrida</i>	14.7	4.6	Least Concern	Least Concern
White-winged Tern	<i>Chlidonias leucopterus</i>	7.7	1.0	Least Concern	Least Concern
Spotted Thick-knee	<i>Burhinus capensis</i>	29.8	4.4	Least Concern	Least Concern
Karoo Thrush	<i>Turdus smithi</i>	13.6	2.0	Least Concern	Least Concern
Sentinel Rock Thrush	<i>Monticola explorator</i>	4.6	1.3	Near Threatened	Least Concern



Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
Ruddy Turnstone	<i>Arenaria interpres</i>	0.5	0.0	Least Concern	Least Concern
African Pied Wagtail	<i>Motacilla aguimp</i>	0.0	0.3	Least Concern	Least Concern
Cape Wagtail	<i>Motacilla capensis</i>	70.1	17.9	Least Concern	Least Concern
Western Yellow Wagtail	<i>Motacilla flava</i>	1.9	0.0	Least Concern	Least Concern
African Reed Warbler	<i>Acrocephalus baeticatus</i>	10.2	0.3	Least Concern	Least Concern
Chestnut-vented Warbler	<i>Curruca subcoerulea</i>	0.2	0.3	Least Concern	Least Concern
Great Reed Warbler	<i>Acrocephalus arundinaceus</i>	1.0	0.0	Least Concern	Least Concern
Icterine Warbler	<i>Hippolais icterina</i>	0.2	0.0	Least Concern	Least Concern
Lesser Swamp Warbler	<i>Acrocephalus gracilirostris</i>	12.3	1.0	Least Concern	Least Concern
Little Rush Warbler	<i>Bradypterus baboecala</i>	1.2	0.0	Least Concern	Least Concern
Marsh Warbler	<i>Acrocephalus palustris</i>	0.2	0.0	Least Concern	Least Concern
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>	1.2	0.0	Least Concern	Least Concern
Willow Warbler	<i>Phylloscopus trochilus</i>	3.5	0.0	Least Concern	Least Concern
Blue Waxbill	<i>Uraeginthus angolensis</i>	0.2	0.0	Least Concern	Least Concern
Common Waxbill	<i>Estrilda astrild</i>	30.1	6.9	Least Concern	Least Concern
Orange-breasted Waxbill	<i>Amandava subflava</i>	2.9	1.0	Least Concern	Least Concern
Cape Weaver	<i>Ploceus capensis</i>	1.0	0.0	Least Concern	Least Concern
Southern Masked Weaver	<i>Ploceus velatus</i>	86.6	22.7	Least Concern	Least Concern
Capped Wheatear	<i>Oenanthe pileata</i>	35.1	18.3	Least Concern	Least Concern
Mountain Wheatear	<i>Myrmecocichla monticola</i>	20.5	1.5	Least Concern	Least Concern
Cape White-eye	<i>Zosterops virens</i>	19.5	2.0	Least Concern	Least Concern
Long-tailed Paradise Whydah	<i>Vidua paradisaea</i>	1.0	0.0	Least Concern	Least Concern
Pin-tailed Whydah	<i>Vidua macroura</i>	37.6	9.8	Least Concern	Least Concern
Fan-tailed Widowbird	<i>Euplectes axillaris</i>	16.7	3.3	Least Concern	Least Concern
Long-tailed Widowbird	<i>Euplectes progne</i>	79.0	26.9	Least Concern	Least Concern
Red-collared Widowbird	<i>Euplectes ardens</i>	4.1	1.1	Least Concern	Least Concern
White-winged Widowbird	<i>Euplectes albonotatus</i>	17.1	3.8	Least Concern	Least Concern
Green Wood Hoopoe	<i>Phoeniculus purpureus</i>	14.6	1.6	Least Concern	Least Concern

Species name	Scientific name	SABAP2 Full protocol	SABAP Ad hoc protocol	Global status	Regional status
Cardinal Woodpecker	<i>Dendropicos fuscescens</i>	5.3	0.0	Least Concern	Least Concern
Golden-tailed Woodpecker	<i>Campethera abingoni</i>	0.2	0.0	Least Concern	Least Concern
Red-throated Wryneck	<i>Jynx ruficollis</i>	18.1	3.4	Least Concern	Least Concern
Black-winged Lapwing	<i>Vanellus melanopterus</i>	0.0	0.0	Least Concern	Least Concern
Denham's Bustard	<i>Neotis denhami</i>	0.0	0.0	Near Threatened	Vulnerable
Black-winged Red Bishop	<i>Euplectes hordeaceus</i>	0.0	0.0	Least Concern	Least Concern
Common Starling	<i>Sturnus vulgaris</i>	0.0	0.0	Least Concern	Least Concern
Fork-tailed Drongo	<i>Dicrurus adsimilis</i>	0.0	0.0	Least Concern	Least Concern
Kurrichane Thrush	<i>Turdus libonyana</i>	0.0	0.0	Least Concern	Least Concern
Levaillant's Cuckoo	<i>Clamator levaillantii</i>	0.0	0.0	Least Concern	Least Concern
Orange River White-eye	<i>Zosterops pallidus</i>	0.0	0.0	Least Concern	Least Concern
Red-capped Robin-Chat	<i>Cossypha natalensis</i>	0.0	0.0	Least Concern	Least Concern
Red-chested Flufftail	<i>Sarothrura rufa</i>	0.0	0.0	Least Concern	Least Concern

## APPENDIX 2: HABITAT FEATURES AT THE PROPOSED DEVELOPMENT AREA



**Figure A2.1: Natural grassland tracts within the PAOI.**



**Figure A2.2: A Drainage line within the PAOI (unnamed river).**





**Figure A2.3: Herbaceous wetland (red arrow) within the PAOI**



**Figure A2.4: A dam present within the PAOI, with a stand of alien trees in the background.**





**Figure A2.5: A field of commercial cereal agriculture (maize) within the PAOI.**



**Figure A2.6: Alien trees are interspersed throughout the PAOI.**

## APPENDIX 3: ASSESSMENT CRITERIA

The numerical values are tabulated below					
Criteria	Number of Points to Score				
	Score 1	Score 2	Score 3	Score 4	Score 5
Impact Magnitude (M)	Very low	Low	Medium	High	Very high
Impact Extent (E)	Site only	Local	Regional	National	International
Impact Reversibility (R)	Reversible	-	Recoverable	-	Irreversible
Impact Duration (D)	Immediate	Short Term	Medium term	Long term	Permanent
Probability of Occurrence (P)	Improbable	Low	Medium	High	Definite

Based on impact significance criteria determined by DEAT, 1998					
CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
<b>Impact Magnitude (M)</b> The degree of alteration of the affected environmental receptor	Very low	Low	Medium	High	Very high
<b>Impact Extent (E)</b> The geographical extent of the impact on a given environmental receptor	<b>Site:</b>  Site only	<b>Local:</b>  Inside activity area	<b>Regional:</b>  Outside activity area	<b>National:</b>  National scope or level	<b>International:</b> Across borders or boundaries
<b>Impact Reversibility (R)</b> The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	<b>Reversible:</b>  Recovery without rehabilitation	-	<b>Recoverable:</b>  Recovery with rehabilitation	-	<b>Irreversible:</b>  Not possible despite action
<b>Impact Duration (D)</b> The length of permanence of the impact on the environmental receptor	<b>Immediate:</b>  On impact	<b>Short term:</b>  0-5 years	<b>Medium term:</b>  5-15 years	<b>Long term:</b>  Project life	<b>Permanent:</b>  Indefinite
<b>Probability of Occurrence (P)</b> The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probably	Definite

ENVIRONMENTAL SIGNIFICANCE = (MAGNITUDE + EXTENT + REVERSIBILITY + DURATION) x PROBABILITY					
TOTAL SCORE	4 to 15	16 to 30	31 to 60	61 to 80	81 to 100
ENVIRONMENTAL SIGNIFICANCE RATING	Very low	Low	Moderate	High	Very High

	Negative	Positive
4-15	Very Low	Very Low
16-30	Low	Low
31-60	Moderate	Moderate
61-80	High	High
81-100	Very High	Very High

# APPENDIX 4: ENVIRONMENTAL MANAGEMENT PROGRAMME

**Table 18: Environmental Management Programme (EMPr): High voltage grid infrastructure management plan for the planning and design phase**

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
<b>Avifauna: Displacement due to disturbance</b>					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	Conduct a pre-construction inspection to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed.	1. Walk-through by avifaunal specialist to record any Red List species nests.	1. Once-off	1. Developer
<b>Avifauna: Mortality due to collision with the overhead power line</b>					
Mortality of avifauna due to collisions with the overhead power line.	Reduction of avian collision mortality	Demarcate sections of the overhead power line to be marked with Eskom approved Bird Flight Diverters (BFDs).	1. Walk-through by avifaunal specialist. 2. Fit Bird Flight Diverters on the earthwire at the demarcated sections of the OHL according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). This includes LED nocturnal flappers in the case of Leeupan.	1. Once-off 2. Once-off	1. Developer 2. Contractor and ECO

**Table 19: Management Plan for the Construction Phase**

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
<b>Avifauna: Displacement due to disturbance</b>					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of priority avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMP <sub>r</sub> .)	<ol style="list-style-type: none"> <li>1. Driving is only permitted in designated roads.</li> <li>2. Maximum use of existing roads.</li> <li>3. Measures to control noise and dust according to latest best practice.</li> <li>4. Restricted access to the rest of the property outside the designated construction area.</li> <li>5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation and rehabilitation of the footprint.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that construction personnel are made aware of the impacts relating to off-road driving.</li> <li>2. Construction access roads must be demarcated clearly. Undertake site inspections to verify.</li> <li>3. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance.</li> <li>4. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations.</li> <li>5. Monitor via site inspections and report non-compliance</li> </ol>	<ol style="list-style-type: none"> <li>1. Daily</li> <li>2. Monthly</li> <li>3. Monthly</li> <li>4. Monthly</li> <li>5. Monthly</li> </ol>	<ol style="list-style-type: none"> <li>2. Contractor and ECO</li> <li>3. Contractor and ECO</li> <li>4. Contractor and ECO</li> <li>5. Contractor and ECO</li> <li>6. Contractor and ECO</li> </ol>

**Table 20: Management Plan for the Operational Phase**

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
<b>Avifauna: Displacement due to habitat transformation in the substations</b>					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the wind turbines and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the biodiversity specialist study.	<ol style="list-style-type: none"> <li>2. Develop a Habitat Rehabilitation Plan (HRP) and ensure that it is approved.</li> <li>1. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.</li> </ol>	<ol style="list-style-type: none"> <li>1. Appointment of rehabilitation specialist to develop HRP.</li> <li>2. Site inspections to monitor progress of HRP.</li> <li>3. Adaptive management to ensure HRP goals are met.</li> </ol>	<ol style="list-style-type: none"> <li>1. Once-off</li> <li>2. Once a year</li> <li>3. As and when required</li> </ol>	<ol style="list-style-type: none"> <li>1. Facilities operator</li> </ol>
<b>Avifauna: Mortality of avifauna due to collision with the overhead 132kV power line</b>					
Mortality of avifauna due to collisions with the overhead power line.	Reduction of avian collision mortality	<ol style="list-style-type: none"> <li>1. Monitor the collision mortality on the power line.</li> <li>2. Apply additional BFDs if additional collision hotspots are discovered.</li> </ol>	<ol style="list-style-type: none"> <li>1. Avifaunal specialist to conduct quarterly inspections of the power line for a period of two years.</li> <li>2. Apply additional BFDs if additional collision hotspots are discovered.</li> </ol>	<ol style="list-style-type: none"> <li>1. Quarterly</li> <li>2. As and when require</li> </ol>	<ol style="list-style-type: none"> <li>1. Facilities operator</li> </ol>
<b>Avifauna: Mortality of avifauna due to electrocution in the substations</b>					
Mortality of avifauna due to electrocutions in the substation.	Reduction of avian electrocution mortality	<ol style="list-style-type: none"> <li>1. Monitor the electrocution mortality in the substation.</li> <li>3. Apply mitigation if electrocution happens regularly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Regular inspections of the substation yard</li> </ol>	<ol style="list-style-type: none"> <li>1. Monthly</li> </ol>	<ol style="list-style-type: none"> <li>2. Facility operator</li> </ol>



**Table 21: Management Plan for the Decommissioning Phase**

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
<b>Avifauna: Displacement due to disturbance associated with the dismantling activities</b>					
The noise and movement associated with the de-commissioning activities at the grid connection footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the EMPr.	<p>A site-specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and must apply good environmental practice during construction. The EMPr must specifically include the following:</p> <ol style="list-style-type: none"> <li>1. No off-road driving.</li> <li>2. Maximum use of existing roads.</li> <li>3. Measures to control noise and dust according to latest best practice.</li> <li>4. Restricted access to the rest of the property.</li> <li>5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.</li> </ol>	<ol style="list-style-type: none"> <li>1. Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance.</li> <li>2. Ensure that construction personnel are made aware of the impacts relating to off-road driving.</li> <li>3. Access roads must be demarcated clearly. Undertake site inspections to verify.</li> <li>4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance.</li> <li>5. Ensure that the footprint area is demarcated and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.</li> </ol>	<ol style="list-style-type: none"> <li>1. On a daily basis</li> <li>2. Monthly</li> <li>3. Monthly</li> <li>4. Monthly</li> <li>5. Monthly</li> </ol>	<ol style="list-style-type: none"> <li>1. Contractor and ECO</li> <li>2. Contractor and ECO</li> <li>3. Contractor and ECO</li> <li>4. Contractor and ECO</li> <li>5. Contractor and ECO</li> </ol>