SiVEST SA (PTY) LTD

PROPOSED CONSTRUCTION OF THE UJEKAMANZI 2 WIND ENERGY FACILITY MAIN TRANSMISSION SUBSTATION (MTS) AND LOOP-IN-LOOP-OUT (LILO) GRID CONNECTION, NEAR AMERSFOORT, MPUMALANGA CAPE PROVINCE, SOUTH AFRICA

Avifaunal Specialist Scoping Report

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AVIFAUNAL SPECIALIST ASSESSMENT

1. EXECUTIVE SUMMARY

ABO Wind renewable energies (Pty) Ltd (hereafter referred to as "ABO"), has appointed SiVEST SA (Pty) Ltd (hereafter referred to as "SiVEST") to undertake the required Scoping and Environmental Impact Assessment (S&EIA) process for the proposed development of the renewable energy cluster, located south of Ermelo in the Mpumalanga province. The project will consist of four separate EIA's, 2 x Wind Energy Facilities (WEF's), a Main Transmission Substation (MTS) (potentially including 2 x 132kV overhead powerlines) and a Loop-In-Loop-Out (LILO) for the grid connection. Each of the projects will require its own Environmental Authorisation and possibly its own impact assessment report.

Refer to the table below for the project overview:

PROJECTS	DESCRIPTION
2 x Wind Energy Facilities	• Approximate combined capacity: 650 MWac • Approximate properties affected/ Site extent: 20,000 ha • Associated infrastructure include: • Wind Turbine Generators • Substation complex, O&M buildings (workshop etc.), • Battery energy storage systems of 500MW/500MWh, which could • be either lithium-ion or redox flow technology, etc. • Underground cabling (33kV), Overhead powerlines (132kV), • Temporary site compound, Laydown areas, Access roads,
1 x Main Transmission Substation	The proposed development of a 400/132 kV MTS, including associated infrastructure at the MTS (potentially including 2 x 132kV OHL)
1 x Loop-In-Loop-Out grid connection	The proposed development of a 400 kV Loop-In-Loop-Out (LILO) from the existing 400 kV Overhead Power Line to the proposed MTS

In terms of the Environmental Impact Assessment (EIA) Regulations, which were published on 04 December 2014 [GNR 982, 983, 984 and 985) and amended on 07 April 2017 [promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017], various aspects of the proposed development are considered listed activities under GNR 327 and GNR 324 which may have an impact on the environment and therefore require authorisation from the National Competent Authority (CA), namely the Department of Environment, Forestry and Fisheries (DEFF), prior to the commencement of such

activities. Specialist studies have been commissioned to assess and verify the project under the new Gazetted specialist protocols.

This scoping level report deals with the potential impact of the **Ujekamanzi WEF 2 MTS and LILO grid connection** on avifauna.

1.1 Summary of Findings

1.1.1 400kV LILO powerlines

The proposed 400kV LILO powerlines will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of powerline sensitive species due to disturbance linked to construction activities in the construction phase.
- Collisions of powerline sensitive species with the overhead line in the operational phase.
- Displacement of powerline sensitive species due to disturbance linked to dismantling activities in the decommissioning phase.

1.1.1.1 Displacement of powerline sensitive species due to disturbance linked to construction activities in the construction phase.

Construction activities 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 in close proximity to 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. As far as powerline sensitive species are concerned, terrestrial species are most likely to be affected by displacement due to disturbance associated with the construction of the proposed powerline. There is Secretarybird nest within the PAOI located approximately 1.68km from the point where the LILO powerline will connect to the existing 400kV high voltage line.

The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

1.1.1.2 Collisions of powerline sensitive species with the overhead line in the operational phase.

The grid connection could potentially pose a collision risk to various species, particularly large terrestrial species, including SCC species such as Deham's Bustard, Blue Crane, Grey Crowned Crane, Southern Bald Ibis and Secretarybird, and various powerline sensitive.

The impact is rated as **medium** pre-mitigation and will be reduce to **low** post-mitigation.

1.1.1.3 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

The impact is likely to be similar to the construction phase. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

Table i summarises the expected impacts of the 400kV LILO powerlines and the proposed mitigation measures per impact.

Table i: Overall Impact Significance for the 400kV LILO powerline (Pre- and Post-Mitigation)

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. (4) A 500m all-infrastructure exclusion zone must be implemented around the Secretarybird nest located at -26.908013° 30.023092°.	Low
Operational: Collisions with the overhead grid connection	Medium	(1) The entire line must be marked with Bird Flight Diverters according to the relevant Eskom Engineering Instruction.	Low
Decommissioning: Displacement due to disturbance	Medium	(1) Driving must be limited to designated roads. (2) Existing roads should be used as much as possible. (3) Measures to control noise must be implemented according to industry best practice. (4) Access to the rest of the property must be restricted.	Low

1.1.2 Main Transmission Substation

The proposed Main Transmission Station will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of powerline sensitive species due to disturbance linked to construction activities in the construction phase.
- Displacement of powerline sensitive species due to habitat transformation linked to construction activities in the construction phase.
- Displacement of powerline sensitive species due to disturbance linked to dismantling activities in the decommissioning phase.

1.1.2.1 Displacement of powerline sensitive species due to disturbance linked to construction activities in the construction phase

Construction activities 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 in close proximity to 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. As far as powerline sensitive species are concerned, terrestrial species are most likely to be affected by displacement due to disturbance associated with the construction of the proposed powerline (see 9.2.2 for potential occurrence of Rudd's Lark (Globally and Regionally Endangered) and Yellow-breasted Pipit (Globally and Regionally Vulnerable)).

The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

1.1.2.2 Displacement of powerline sensitive species due to habitat transformation linked to construction activities in the construction phase

These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed onsite substation through transformation of habitat, which could result in temporary or permanent displacement of a range of species. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the substation yard is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing power lines, very little if any vegetation clearing will be required in the power line servitudes. However, preliminary modelling indicates that the proposed MTS footprint is partially located in Rudd's Lark (Globally and Regionally Endangered) and Yellow-breasted Pipit (Globally and Regionally Vulnerable) habitat. Some of the grassland species that could potentially be impacted could move away and breed elsewhere in the available grassland habitat, but both Rudd's Lark and Yellow-breasted Pipit species are highly habitat specific and require a very specific type of

high-altitude grassland for breeding. The option of relocating for the latter two species is therefore limited.

The impact is rated as **medium** pre-mitigation and will be reduce to **low** post-mitigation.

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

The impact is likely to be similar to the construction phase. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

Table ii summarises the expected impacts of the 400kV LILO powerlines and the proposed mitigation measures per impact.

Table ii: Overall Impact Significance for the MTS (Pre- and Post-Mitigation).

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Preliminary modelling indicates that the MTS footprint is located in Yellow-breasted Pipit habitat. The modelling will be further refined during the EIA phase, but it may be necessary for the MTS to be micro sited should the footprint still fall within Yellow-breasted Pipit habitat after final assessment of the habitat. (2) Construction activity should be restricted to the immediate footprint of the infrastructure. (3) Measures to control noise and dust should be applied according to current best practice in the industry. (4) Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.	Low
Operational: Displacement due to habitat transformation	Medium	(1) Preliminary modelling indicates that the MTS footprint is located in Yellow-breasted Pipit habitat. The modelling will be further refined during the EIA phase, but it may be necessary for the MTS to be micro sited should the footprint still fall	Low

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
		within Yellow-breasted Pipit habitat after final assessment of the habitat. (2) Construction activity should be restricted to the immediate footprint of the infrastructure as much as possible. (3) Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. (4) The mitigation measures proposed by the biodiversity specialist with regard to the minimisation of habitat destruction must be strictly implemented to limit the loss of natural grassland habitat for avifauna.	
Decommissioning: Displacement due to disturbance	Medium	(1) Driving must be limited to designated roads. (2) Existing roads should be used as much as possible. (3) Measures to control noise must be implemented according to industry best practice. (4) Access to the rest of the property must be restricted.	Low

1.2 Preliminary Conclusion and Impact Statement

1.2.1 400kV LILO powerlines

The proposed Ujekamanzi WEF 2 400 kV LILO powerlines will have a moderate impact on avifauna which, in all instances, could be reduced to a low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

1.2.2 Main Transmission Station

The proposed Ujekamanzi WEF 2 Main Transmission Station will have a moderate impact on avifauna which, in all instances, could be reduced to a low impact through appropriate mitigation. No fatal flaws

were discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	Section of Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 2
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 10
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Appendix 9 and 10
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 6
g) an identification of any areas to be avoided, including buffers;	Section 6
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 6
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 6
k) any mitigation measures for inclusion in the EMPr;	Appendix 7 and 8

l) any conditions for inclusion in the environmental authorisation;	Appendix 7 and 8
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Appendix 7 and 8
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
q) any other information requested by the competent authority.	Not applicable
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	All sections

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Glossary of Terms

Definitions	
Broader area	A consolidated data set for a total of 6 pentads where the Project Area of Impact is located.
Powerline sensitive species	Sensitive species were defined as species which could potentially be impacted by power line collisions or electrocutions, based on specific morphological and/or behavioural characteristics[1]. Sensitive species were further subdivided into raptors, waterbirds, terrestrial birds and corvids.
Solar priority species	Solar priority species which were defined as follows: • South African Red List species • South African endemics and near-endemics • Waterbirds; and • Raptors

List of Abbreviations

BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
DFFE	Department of Forestry, Fisheries and the Environment
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
HV	High voltage
IBA	Important Bird Area
IKA	Index of Kilometric Abundance
IUCN	International Union for Conservation of Nature
kV	Kilovolt
LILO	Loop-in - Loop-out
MTS	Main Transmission Substation
MV	Medium voltage
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
OHL	Overhead line
PAOI	Project Area of Impact
REDZ	Renewable Energy Development Zone
SABAP 1	South African Bird Atlas 1
SABAP 2	South African Bird Atlas 2
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa Protected Areas Database
WEF	Wind Energy Facility

[1] Other species were also considered in the case of potential displacement due to disturbance associated with the construction of the grid.

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1. INTRODUCTION

ABO Wind renewable energies (Pty) Ltd (hereafter referred to as "ABO"), has appointed SiVEST SA (Pty) Ltd (hereafter referred to as "SiVEST") to undertake the required Scoping and Environmental Impact Assessment (S&EIA) process for the proposed development of the renewable energy cluster, located south of Ermelo in the Mpumalanga province. The project will consist of four separate EIA's, 2 x Wind Energy Facilities (WEF's), a Main Transmission Substation (MTS) (potentially including 2 x 132kV overhead powerlines) and a Loop-In-Loop-Out (LILO) for the grid connection. Each of the projects will require its own Environmental Authorisation and possibly its own impact assessment report.

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This scoping level report deals with the potential impact of the **Ujekamanzi WEF 2 MTS and LILO grid connection** on avifauna.

1.1 Terms of Reference

The terms of reference for this scoping report are the following:

- Describe the affected environment from an avifaunal perspective;
- Discuss gaps in baseline data and other limitations;
- List and describe the expected impacts;
- Assess and evaluate the potential impacts;
- Give a considered opinion whether the project is fatally flawed from an avifaunal perspective; and
- If not fatally flawed, recommend mitigation measures to reduce the expected impacts.

For the general Terms of Reference for all specialist report, please see Appendix 1

1.2 Specialist Credentials

Please see Appendix 2 Specialist CVs

1.3 Assessment Methodology

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

- The **Project Area of Impact (PAOI)** of the proposed MTS and LILO was defined as an area comprising a 2km buffer around the proposed infrastructure.
- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town (https://sabap2.birdmap.africa/), as a means to ascertain which species occur within the **Broader Area** i.e. within a block consisting of 20 pentads (see Table 1). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 261 full protocol lists (i.e. surveys lasting a minimum of two hours each) have been completed for this area. In addition, 329 ad hoc protocol lists (i.e. surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the WEF application site was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2018 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 &

http://bgisviewer.sanbi.org).

- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2023) was used to view the broader area on a landscape level and to help identify sensitive bird habitat.
- Powerline sensitive species were defined as species which could potentially be impacted by power line collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Species classes which fall under these categories are raptors, large terrestrial birds, waterbirds and crows. Although not corresponding to the above description, certain threatened small terrestrial species were also included based on potential displacement by construction activities and habitat transformation.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the PAOI.
- The primary source of information on avifaunal diversity, abundance, and flight patterns at in the PAOI were the results of a pre-construction programme conducted over four seasons at the two proposed Ujekamanzi WEF application sites. The primary methods of data capturing are walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see Appendix 3 for a detailed explanation of the monitoring methods).

Table 1: The number of SABAP2 lists completed for the broader area

Pentad	Number of full protocol lists	Ad hoc protocol lists
2640_2950	3	**0**
2640_2955	9	**13**
2640_3000	19	**4**
2640_3005	26	**14**
2645_2950	2	**2**
2645_2955	8	**33**
2645_3000	9	**9**
2645_3005	7	**8**
2650_2950	4	**18**
2650_2955	28	**10**
2650_3000	18	**15**
2650_3005	14	**5**
2655_2950	4	**18**
2655_2955	17	**12**
2700_3000	16	**7**
2655_3005	29	**19**
2700_2950	11	**40**
2700_2955	4	**20**
2700_3000	17	**58**
2700_3005	16	**24**
Total	**261**	**329**

2. ASSUMPTIONS AND LIMITATIONS

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

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

- The SABAP2 dataset for the Broader Area is a relatively comprehensive but not complete dataset and provides a reasonable snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was therefore supplemented with personal observations, general knowledge of the area, and the results of the pre-construction monitoring.
- Conclusions in this study are based on experience of these and similar species at wind farm developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.
- The proposed buffer zones defined in this report are preliminary (scoping phase) and may be further refined during the impact assessment phase.

3. TECHNICAL DESCRIPTION

3.1 Project Location

The proposed project is located south of Ermelo in the Dr. Pixley Ka Isaka Seme Local Municipality within the Mpumalanga Province (**Error! Reference source not found. and 2**).

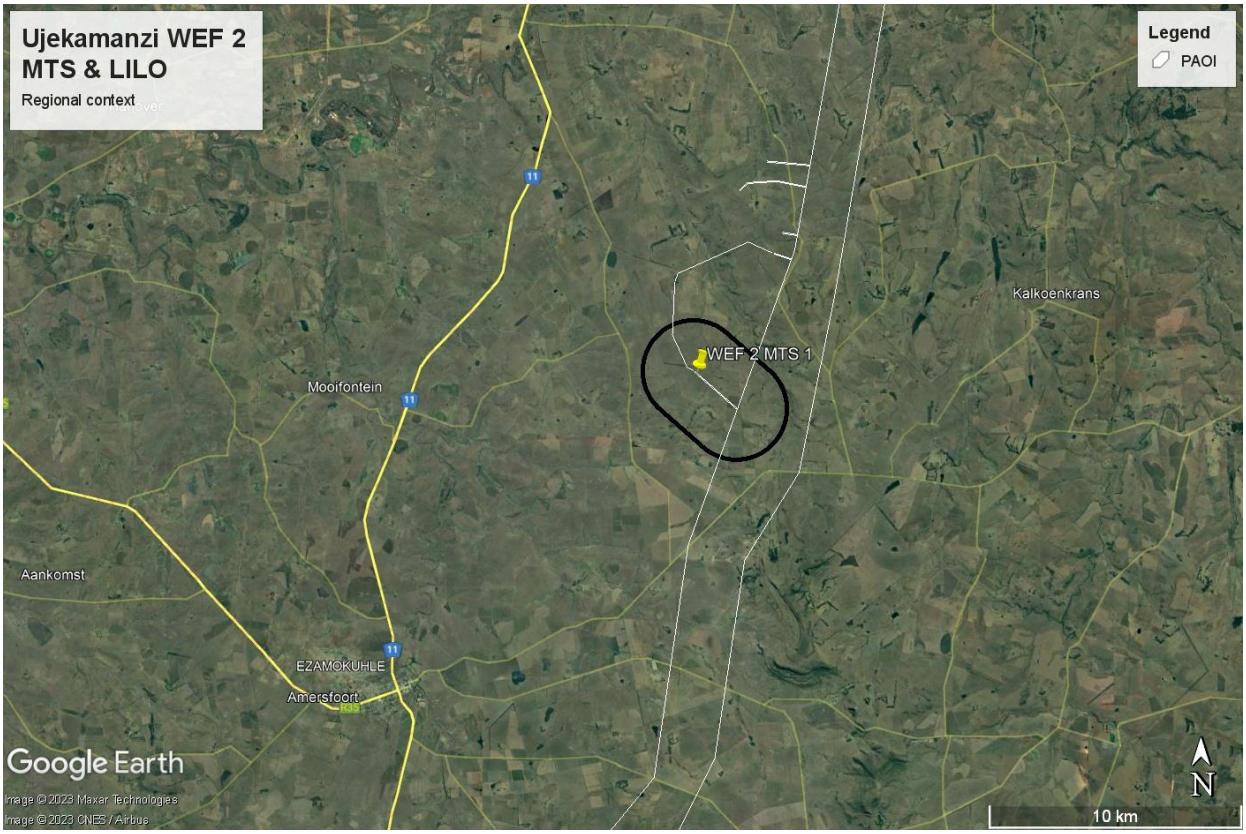

Figure 1: Regional Context Map.

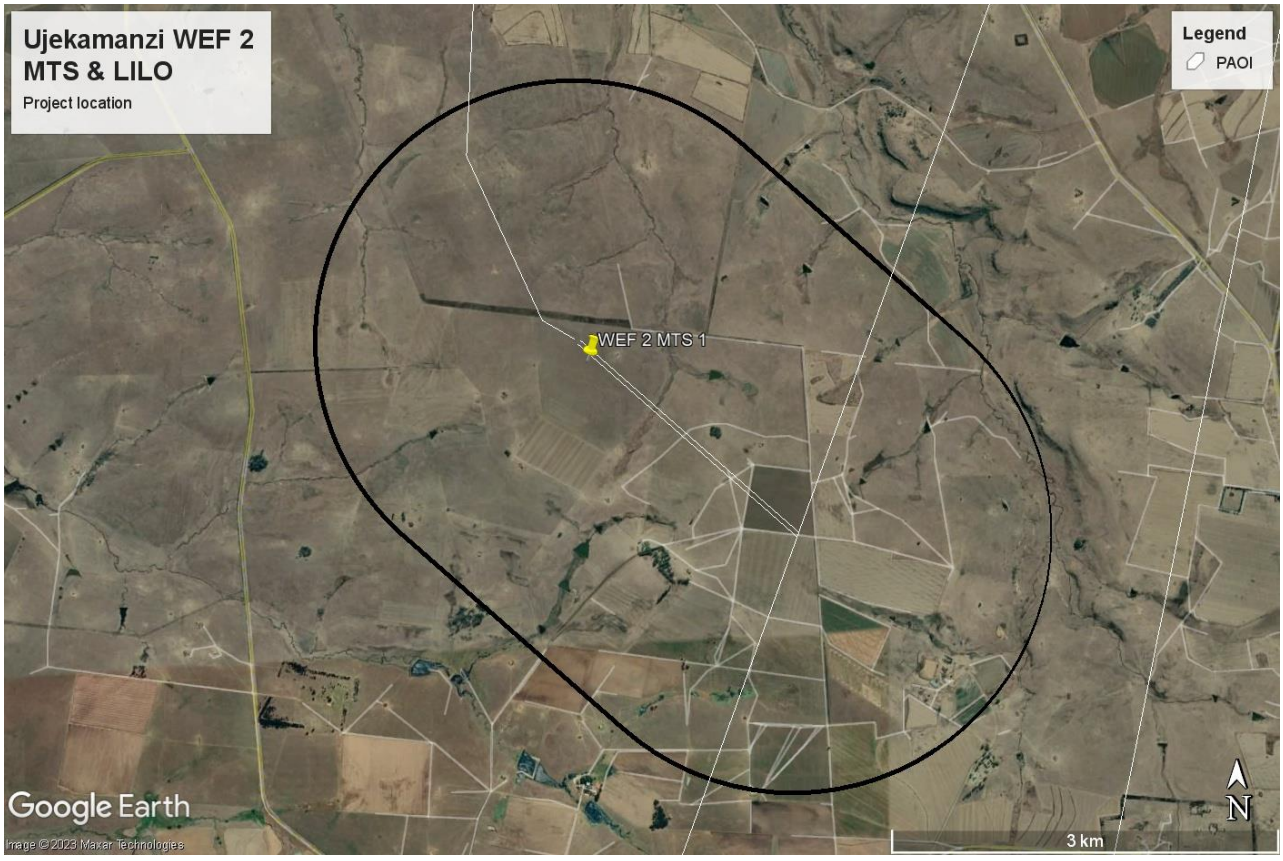

Figure 2: Location of proposed MTS alternatives & LILO lines.

3.2 Project Description

3.2.1 MTS

The proposed development of a 400/132 kV Main Transmission Substation (MTS), including associated infrastructure at the MTS (such as 132 kV busbar and feeder bay(s) and 500 MVA 400/132 kV transformer with transformer bay). A single Substation hub could be combined with the Main Transmission Substation (MTS), alternatively a 132kV line will connect the Substation hub with the MTS.

Main Transmission Substation (MTS)	
Description of MTS	The proposed development of a 400/132 kV MTS (app. 15 ha), including associated infrastructure at the MTS.
Construction Methodology	The construction of each on-site substation would require the following activities: • A survey of the site on which the proposed on-site substations will be constructed; • Site clearing and levelling; • Construction of access roads to the proposed substation site (where required); • Construction of substation terraces and foundations; • Assembly and installation of equipment (including transformers); • Connection of conductors to equipment; • Testing of equipment; and • Rehabilitation of any disturbed areas and protection of erosion sensitive areas.
Detailed map where MTS will be located on site	To be determined during the detailed design phase

3.2.2 Loop-In-Loop-Out (LILO) Grid Connection

To facilitate the connection of the proposed projects to the national grid, it is proposed that the electrical grid connection will likely comprise of a new 400 kV Loop-In-Loop-Out (LILO) from the existing 400 kV Overhead Power Line to the proposed MTS. The proposed LILO will be located at a point where the existing powerline cross the study area/ project site (where the specialists assessed the entire extent of the properties).

Loop-In-Loop-Out (LILO) grid connection	
Description of Grid infrastructure	The proposed development of a 400 kV Loop-In-Loop-Out (LILO) from the existing 400 kV Overhead Power Line to the proposed on-site MTS

Loop-In-Loop-Out (LILO) grid connection	
Construction Methodology	The construction of each OHL would require the following activities: • A survey of the site where the proposed OHL will be constructed; • Site clearing (where required); • Construction of access roads to the proposed pylon positions (where required); • Construction of foundations; • Assembly and installation of equipment; • Stringing and connection of conductors; • Testing of equipment; and • Rehabilitation of any disturbed areas and protection of erosion sensitive areas.

3.3 Project Location and Layout Alternatives

There are four different alternatives for the location of the MTS and associated LILO lines that will be will be considered and assessed as part of the EIA.

3.3.1 No-go Alternative

The 'no-go' alternative is the option of not undertaking the proposed MTS and grid connection infrastructure projects. Hence, if the 'no-go' option is implemented, there would be no development. This alternative would result in no environmental impacts from the proposed project on the site or the surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report.

4. LEGAL REQUIREMENT AND GUIDELINES

5. LEGAL REQUIREMENT AND GUIDELINES

Table 2 below lists agreements and conventions which South Africa is party to, and which is directly relevant to the conservation of avifauna (BirdLife International 2023).

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

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of 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,	Regional

Convention name	Description	Geographic scope
	Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	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.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	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.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their	Regional

Convention name	Description	Geographic scope
	range and to reverse their decline when and where appropriate.	

5.1 National legislation

5.1.1 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.

5.1.2 The National Environmental Management Act (Act No. 107 of 1998) (NEMA)

The National Environmental Management Act (Act No. 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 all cases except for wind developments. In the case of wind energy developments, the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species where the output is 20MW or more (Government Gazette No 43110, 20 March 2020) is applicable[2].

[2] This is only the case with developments in Renewable Energy Development Zones (REDZ).

5.1.3 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.

5.2 Provincial legislation

5.2.1 Mpumalanga Nature Conservation Act 10 of 1998

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)).

5.3 Best Practice Guidelines

The South African “Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy projects in southern Africa” (Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2011) were followed for the pre-construction monitoring at the WEF, which included the area covered by the PAOI for the MTS and LILO lines. This document was published by the Endangered Wildlife Trust (EWT) and Birdlife South Africa (BLSA) in March 2011, and subsequently revised in 2011, 2012 and 2015.

6. DESCRIPTION OF THE RECEIVING ENVIRONMENT

6.1 Natural Environment

The PAOI is situated in the Grassland Biome, in the Mesic Highveld Grassland Bioregion (Muchina & Rutherford 2006). Vegetation on site consists of Amersfoort Highveld Clay Grassland. Amersfoort Highveld Clay Grassland is comprised of undulating grassland plains, with small, scattered patches of dolerite outcrops in areas, low hills, and pan depressions. The vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn (Mucina & Rutherford 2006). The topography in the project area is characterised by gentle undulating plains. A few drainage lines with associated wetlands and farm dams transect the PAOI.

Amersfoort, which is the closest town to the Project Site has a temperate climate. Summers are mild and winters are cold. The mean annual rainfall is around 811mm, and the mean annual temperature is around 20C°. **Figure 3** shows the mean monthly temperature and precipitation of Amersfoort (https://tcktcktck.org/south-africa/mpumalanga/amersfoort#).

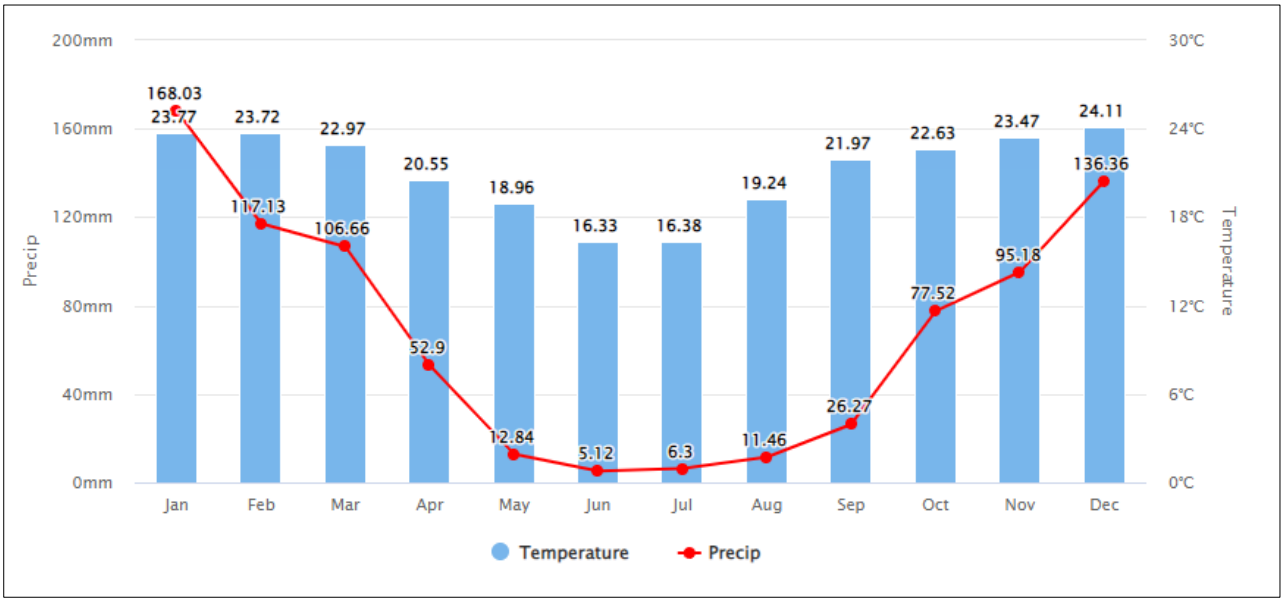

Figure 3: The mean monthly temperature and precipitation of Amersfoort.

6.2 Modified Environment

The predominant land use for this area is livestock grazing with some crop farming, mostly maize, soya beans and pastures.

Whilst the distribution and abundance of the bird species in the broader area are mostly associated with natural vegetation, as this comprises the majority of the habitat, it is also necessary to examine the few external modifications to the environment that have relevance for birds.

The following bird habitat features were identified in the project area (see Appendix 2 for examples of the habitat classes):

6.2.1 Grassland

The majority of the habitat in the project area comprises natural grassland, which is mostly comprised of a short, closed grassland cover.

The priority species which could potentially use the grassland in the PAOI on a regular basis are the following:

African Grass Owl
Amur Falcon
Black-rumped Buttonquail

Black-winged Kite
Black-winged Lapwing
Black-winged Pratincole
Blue Crane
Blue Korhaan
Common Buzzard
Denham's Bustard
Greater Kestrel
Grey-winged Francolin
Jackal Buzzard
Lanner Falcon
Long-crested Eagle
Marsh Owl
Martial Eagle
Montagu's Harrier
Pallid Harrier
Red-footed Falcon
Secretarybird
Southern Bald Ibis
Spotted Eagle-Owl
White Stork
White-bellied Bustard
Yellow-breasted Pipit

The priority species which could occasionally use the grassland in the PAOI are the following:

Black-bellied Bustard
Black-chested Snake Eagle
Rudd's Lark
Brown Snake Eagle
Lesser Kestrel
Cape Vulture
Black Harrier
Botha’s Lark

6.2.2 Drainage lines and wetlands

There are several wetlands in the PAOI, most of which are associated with drainage lines. Wetlands are characterised by static or slow flowing water and are extensively covered by tall emergent wetland vegetation.

The priority species which could potentially use the wetlands in the PAOI on a regular basis are the following:

African Fish Eagle
African Grass Owl
African Marsh Harrier
Black-winged Pratincole
Blue Crane

Grey Crowned Crane
Long-crested Eagle
Marsh Owl
Yellow-billed Stork

The priority species which could occasionally use the wetlands in the PAOI are the following:

Black Harrier

6.2.3 Agricultural lands

The PAOI contains a patchwork of agricultural fields. Some fields are lying fallow or are in the process of being re-vegetated by grass.

The priority species which could potentially use the agricultural fields in the PAOI on a regular basis are the following:

Amur Falcon
Black-winged Kite
Black-winged Pratincole
Blue Crane
Common Buzzard
Grey Crowned Crane
Lanner Falcon
Red-footed Falcon
Southern Bald Ibis
White Stork

The priority species which could occasionally use the agricultural lands in the PAOI are the following:

Lesser Kestrel

6.2.4 Alien trees

The PAOI contains few trees. Most trees are alien species, particularly Eucalyptus, Australian Acacia (Wattle), and Salix (Willow) species. Trees are often planted as wind breaks next to agricultural lands and around homesteads. Some of the drainage lines also have trees growing in them.

The priority species which could potentially use the alien trees in the PAOI on a regular basis are the following:

African Fish Eagle
African Harrier-Hawk
Amur Falcon
Black Sparrowhawk
Black-winged Kite
Common Buzzard

Greater Kestrel
Grey Crowned Crane
Jackal Buzzard
Lanner Falcon
Long-crested Eagle
Martial Eagle
Red-footed Falcon
Rufous-breasted Sparrowhawk
Secretarybird
Southern Bald Ibis
Spotted Eagle-Owl
White Stork

The priority species which could occasionally use the alien trees in the PAOI are the following:

Black-chested Snake Eagle
Brown Snake Eagle
Cape Vulture
Lesser Kestrel
Western Osprey

6.2.5 Dams

There are many ground dams of various sizes at the PAOI, located in drainage lines.

The priority species which could potentially use the dams in the PAOI on a regular basis are the following:

African Fish Eagle
Blue Crane
Southern Bald Ibis
Yellow-billed Stork

The priority species which could occasionally use the dams and pans in the PAOI are the following:

Greater Flamingo
Lesser Flamingo
Western Osprey

6.2.6 High voltage lines

The PAOI is transected by the the Camden Incandu 1 400kV powerline. Many birds use high voltage powerlines to roost on and occasionally even breed on them.

The priority species which could potentially use the high voltage lines in the PAOI on a regular basis are the following:

African Fish Eagle
Amur Falcon
Black-winged Kite
Common Buzzard
Greater Kestrel
Jackal Buzzard
Lanner Falcon
Long-crested Eagle
Martial Eagle
Red-footed Falcon
Southern Bald Ibis

The priority species which could occasionally use the high voltage lines in the PAOI are the following:

Black-chested Snake Eagle
Brown Snake Eagle
Cape Vulture
Lesser Kestrel

6.2.7 Rocky ridges

There are a small number of exposed ridges in the PAOI. These features are used by a number of priority species.

The priority species which could potentially use the rocky ridges in the PAOI on a regular basis are the following:

African Harrier-Hawk
Buff-streaked Chat
Common Buzzard
Greater Kestrel
Jackal Buzzard
Lanner Falcon
Southern Bald Ibis
Spotted Eagle-Owl

The priority species which could occasionally use the rocky outcrops and low cliffs in the PAOI are the following:

Cape Vulture

Appendix 4 provides a photographic record of the habitat at the application site.

6.3 Important Bird Areas

The PAOI is located between two Important Bird Areas (IBAs), namely with the Amersfoort-Bethal-Carolina IBA SA018 and the Grasslands IBA SA020 (Figure 4). Due to the close proximity of the IBAs, it is possible that some priority species which are also IBA trigger species, and which occur either permanently or sporadically in the IBAs, might be impacted by the project when they wander into the PAOI.

IBA triggers species that were recorded in the broader area and fall within this category are the following:

- Secretarybird
- Pied Avocet
- Denham's Bustard
- Blue Crane
- Grey Crowned Crane
- White-backed Duck
- Yellow-billed Duck
- Martial Eagle
- Lanner Falcon
- Greater Flamingo
- Lesser Flamingo
- Black-necked Grebe
- Little Grebe
- African Marsh Harrier
- Black Harrier
- Southern Bald Ibis
- African Grass Owl
- Southern Pochard
- Cape Shoveler
- White-winged Tern

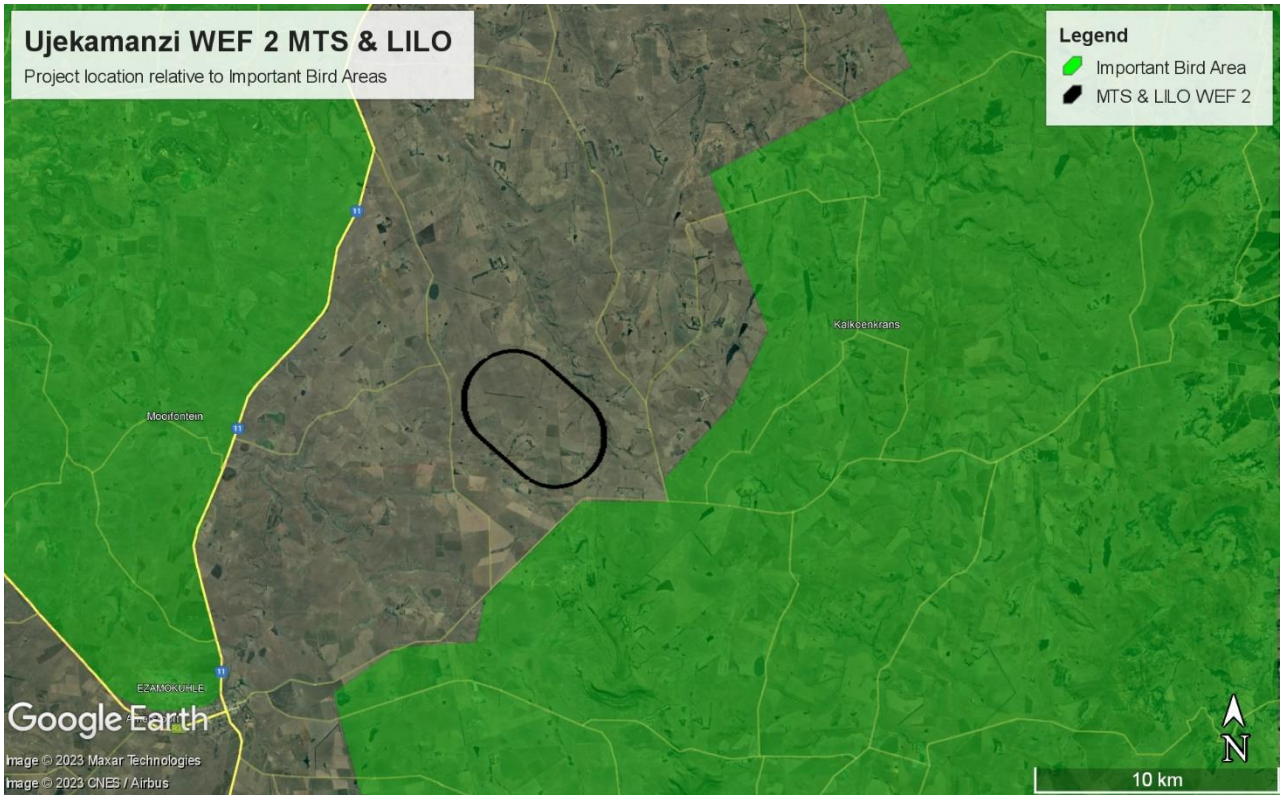

Figure 4: Important Bird Areas in the vicinity of the PAOI.

6.4 The DFFE National Screening Tool

According to the DFFE national screening tool, the habitat within the PAOI is classified as **Medium** and **High** sensitivity for birds according to the Animal Species Theme (Figure 5). The high sensitivity is linked to the potential occurrence of species of conservation concern (SCC) namely Grey Crowned Crane (Globally and Regionally Endangered), Southern Bald Ibis (Globally and Regionally Vulnerable). The medium sensitivity is linked to Grey Crowned Crane (Globally and Regionally Endangered), Southern Bald Ibis (Globally and Regionally Vulnerable), White-bellied Bustard (Regionally Vulnerable), Denham's Bustard (Globally near threatened and Regionally Vulnerable), Secretarybird (Globally Endangered and Regionally Vulnerable), Caspian Tern (Regionally Vulnerable) and African Grass Owl (Regionally Vulnerable).

The PAOI contains confirmed habitat for SCC as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the on-site surveys in the PAOI and immediate vicinity, including Grey Crowned Crane, Lanner Falcon, Denham's Bustard and Southern Bald Ibis. Based on these criteria, a PAOI classification of High sensitivity for avifauna is suggested.

See **Appendix 7** for the Site Sensitivity Verification Report.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY

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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Balearica regulorum
High	Aves-Eupodotis senegalensis
High	Aves-Geronticus calvus
Medium	Aves-Balearica regulorum
Medium	Aves-Eupodotis senegalensis
Medium	Aves-Neotis denhami
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Tyto capensis
Medium	Mammalia-Chrysospalax villosus
Medium	Mammalia-Ourebia ourebi ourebi

Figure 5: The classification of the PAOI for avifauna according to the terrestrial animal species theme in the DFFE National Screening Tool. The classification of High in the Terrestrial Animal Species Theme is linked to the potential presence of species of conservation concern (SCC), namely Grey Crowned Crane *Balearica regulorum* , Southern Bald Ibis *Geronticus calvus* and White-bellied *Bustard Eupodotis senegalensis*. The classification of Medium is linked to all of the above species and African Grass Owl *Tyto capensis,* Denham's Bustard *Neotis denhami*, Secretarybird *Sagitarius serpentarius* and Caspian Tern *Hydroprogne caspia.*

6.5 National Protected Areas

According to the South African Protected Areas database (SAPAD), the centre of the PAOI is located approximately 21km south the Langcarel Private Nature Reserve. Information on the reserve is hard to come by, but from a visual inspection of satellite imagery the habitat in the reserve seems generally similar to that in the PAOI i.e. a mosaic of grassland and agriculture. From an avifaunal perspective the state of the habitat and land use is more important than the legal status. It is therefore not expected that the avifauna in the reserve will differ in any material from that in the PAOI. Given the distance from the PAOI, it is not expected that the avifauna in the reserve will be significantly impacted by the proposed project.

6.6 Avifauna in the study area

It is estimated that a total of 263 bird species could potentially occur in the Broader Area. Please refer to Appendix 5 which provides a comprehensive list of all the species in the Broader Area. Of the 263 species, 82 species are classified as powerline sensitive species. Of the powerline sensitive species in the broader area, 70 were recorded during the 12 months of pre-construction monitoring, and 66 powerline sensitive species are expected to occur regularly at the PAOI.

Error! Reference source not found. below lists all the wind priority sensitive species and the potential impacts on the respective species by the proposed WEF.

EN = Endangered,
VU = Vulnerable,
NT = Near threatened,
LC = Least Concern,
H = High
M = Medium
L = Low

Table 3: Powerline sensitive species recorded in the broader area.

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status	Recorded during monitoring	Likelihood of regular occurrence in PAOI	Grassland	Wetlands and drainage lines	Dams and pans	Low cliffs and rocky ridges	Agriculture	HV lines	Alien trees	LILO Powerlines - Collision	MTS & LILO - Displacement disturbance (breeding/roosting)	MTS - Displacement habitat transformation (breeding)
African Black Duck	*Anas sparsa*	12.26	0.00	-	-	x	M		x						x		
African Darter	*Anhinga rufa*	23.75	2.63	-	-	x	H		x	x				x	x		
African Fish Eagle	*Haliaeetus vocifer*	11.88	0.00	-	-	x	H		x	x			x	x			
African Grass Owl	*Tyto capensis*	0.00	0.00	-	VU	x	M	x	x						x	x	
African Harrier-Hawk	*Polyboroides typus*	7.66	10.53	-	-	x	M				x			x			
African Marsh Harrier	*Circus ranivorus*	1.53	2.63	-	EN	x	M		x								
African Sacred Ibis	*Threskiornis aethiopicus*	58.24	5.26	-	-	x	H		x	x		x		x	x		
African Spoonbill	*Platalea alba*	26.82	0.00	-	-	x	H		x	x				x	x		
African Swamphen	*Porphyrio madagascariensis*	3.07	0.30	-	-	x	M		x	x							
Amur Falcon	*Falco amurensis*	21.84	13.16	-	-	x	H	x				x	x	x			
Black Harrier	*Circus maurus*	0.38	0.00	EN	EN	x	L	x	x							x	
Black Heron	*Egretta ardesiaca*	0.00	0.00	-	-	x	M		x	x					x		
Black Sparrowhawk	*Accipiter melanoleucus*	15.33	0.00	-	-	x	H							x			
Black-bellied Bustard	*Lissotis melanogaster*	0.38	36.84	-	-		L	x							x	x	x
Black-chested Snake Eagle	*Circaetus pectoralis*	1.53	2.63	-	-		L	x					x	x			
Black-crowned Night Heron	*Nycticorax nycticorax*	0.38	2.63	-	-		L		x	x					x		
Black-headed Heron	*Ardea melanocephala*	57.85	0.00	-	-	x	H	x				x		x	x		
Black-necked Grebe	*Podiceps nigricollis*	3.83	0.00	-	-	x	H			x					x		
Black-winged Kite	*Elanus caeruleus*	63.22	10.53	-	-	x	H	x				x	x	x			
Blue Crane	*Grus paradisea*	26.82	5.26	VU	NT	x	H	x	x	x		x			x	x	x
Blue Korhaan	*Eupodotis caerulescens*	12.64	15.79	NT	LC	x	H	x							x	x	x

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status	Recorded during monitoring	Likelihood of regular occurrence in PAOI	Grassland	Wetlands and drainage lines	Dams and pans	Low cliffs and rocky ridges	Agriculture	HV lines	Alien trees	LILO Powerlines - Collision	MTS & LILO - Displacement disturbance (breeding/roosting)	MTS - Displacement habitat transformation (breeding)
Blue-billed Teal	*Spatula hottentota*	1.15	3.95	-	-		L		x	x					x		
Brown Snake Eagle	*Circaetus cinereus*	0.38	5.26	-	-		L	x					x	x			
Cape Crow	*Corvus capensis*	55.56	2.63	-	-	x	H	x				x	x	x			
Cape Shoveler	*Spatula smithii*	20.69	0.00	-	-	x	H		x	x					x		
Cape Teal	*Anas capensis*	0.38	0.61	-	-		L		x	x					x		
Cape Vulture	*Gyps coprotheres*	1.92	17.63	VU	EN	x	L	x			x		x	x	x		
Common Buzzard	*Buteo buteo*	24.52	36.84	-	-	x	H	x			x	x	x	x			
Common Moorhen	*Gallinula chloropus*	26.82	2.63	-	-	x	H										
Denham's Bustard	*Neotis denhami*	5.36	2.63	NT	VU	x	M	x							x	x	x
Egyptian Goose	*Alopochen aegyptiaca*	85.82	2.63	-	-	x	H		x	x		x	x	x	x		
Fulvous Whistling Duck	*Dendrocygna bicolor*	0.77	0.00	-	-		M		x	x					x		
Glossy Ibis	*Plegadis falcinellus*	8.43	0.00	-	-	x	M		x	x					x		
Goliath Heron	*Ardea goliath*	4.21	0.00	-	-	x	M		x	x					x		
Great Crested Grebe	*Podiceps cristatus*	4.98	0.00	-	-	x	M		x	x					x		
Great Egret	*Ardea alba*	6.13	0.00	-	-	x	M		x	x					x		
Greater Flamingo	*Phoenicopterus roseus*	2.30	23.68	-	NT		L			x					x		
Greater Kestrel	*Falco rupicoloides*	0.77	7.89	-	-	x	M	x			x		x	x			
Grey Crowned Crane	*Balearica regulorum*	17.62	0.00	EN	EN	x	H		x			x		x	x		
Grey Heron	*Ardea cinerea*	32.18	36.84	-	-	x	H		x	x					x		
Hadada Ibis	*Bostrychia hagedash*	86.97	5.26	-	-	x	H		x	x		x	x	x	x		
Hamerkop	*Scopus umbretta*	18.01	2.63	-	-	x	H		x	x					x		
Helmeted Guineafowl	*Numida meleagris*	50.57	0.00	-	-	x	H	x				x	x	x			

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status	Recorded during monitoring	Likelihood of regular occurrence in PAOI	Grassland	Wetlands and drainage lines	Dams and pans	Low cliffs and rocky ridges	Agriculture	HV lines	Alien trees	LILO Powerlines - Collision	MTS & LILO - Displacement disturbance (breeding/roosting)	MTS - Displacement habitat transformation (breeding)
Intermediate Egret	*Ardea intermedia*	9.20	21.05	-	-	x	M		x	x					x		
Jackal Buzzard	*Buteo rufofuscus*	26.05	0.00	-	-	x	H	x			x		x	x			
Knob-billed Duck	*Sarkidiornis melanotos*	0.77	2.63	-	-		L								x		
Lanner Falcon	*Falco biarmicus*	16.09	2.63	-	VU	x	H	x			x	x	x	x			
Lesser Flamingo	*Phoeniconaias minor*	0.38	2.63	NT	NT		L			x					x		
Lesser Kestrel	*Falco naumanni*	0.00	0.00	-	-		L	x				x	x	x			
Little Egret	*Egretta garzetta*	1.15	0.00	-	-	x	L		x	x					x		
Little Grebe	*Tachybaptus ruficollis*	46.36	0.00	-	-	x	H		x	x					x		
Long-crested Eagle	*Lophaetus occipitalis*	2.68	10.53	-	-	x	M	x	x				x	x			
Maccoa Duck	*Oxyura maccoa*	6.13	5.26	EN	NT	x	M		x	x					x		
Marsh Owl	*Asio capensis*	9.20	13.16	-	-	x	H	x	x						x	x	x
Martial Eagle	*Polemaetus bellicosus*	3.45	5.26	EN	EN	x	M	x					x	x			
Montagu's Harrier	*Circus pygargus*	1.53	7.89	-	-	x	M	x								x	
Pallid Harrier	*Circus macrourus*	0.00	0.00	NT	NT	x	M	x								x	
Pied Crow	*Corvus albus*	6.90	2.63	-	-	x	M	x		x		x	x	x			
Purple Heron	*Ardea purpurea*	6.51	2.63	-	-	x	M		x	x					x		
Red-billed Teal	*Anas erythrorhyncha*	22.99	0.00	-	-	x	H		x	x					x		
Red-footed Falcon	*Falco vespertinus*	0.00	0.00	VU	NT	x	M	x				x	x	x			
Red-knobbed Coot	*Fulica cristata*	71.65	10.53	-	-	x	H			x					x		
Reed Cormorant	*Microcarbo africanus*	63.60	0.00	-	-	x	H		x	x					x		
Rock Kestrel	*Falco rupicolus*	7.66	23.68	-	-	x	M				x		x				
Rudd's Lark	*Heteromirafra ruddi*	0.00	5.26	EN	EN	x	L	x								x	x

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status	Recorded during monitoring	Likelihood of regular occurrence in PAOI	Grassland	Wetlands and drainage lines	Dams and pans	Low cliffs and rocky ridges	Agriculture	HV lines	Alien trees	LILO Powerlines - Collision	MTS & LILO - Displacement disturbance (breeding/roosting)	MTS - Displacement habitat transformation (breeding)
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0.77	0.00	-	-	x	M							x			
Secretarybird	*Sagittarius serpentarius*	29.50	2.63	EN	VU	x	H	x						x	x	x	
South African Shelduck	*Tadorna cana*	49.04	0.00	-	-	x	H		x	x					x		
Southern Bald Ibis	*Geronticus calvus*	43.68	0.00	VU	VU	x	H	x		x	x	x	x	x	x	x	
Southern Pochard	*Netta erythrophthalma*	11.11	0.00	-	-	x	M								x		
Spotted Eagle-Owl	*Bubo africanus*	11.88	31.58	-	-	x	H	x			x			x	x		
Spur-winged Goose	*Plectropterus gambensis*	54.79	15.79	-	-	x	H		x	x		x	x		x		
Squacco Heron	*Ardeola ralloides*	1.15	31.58	-	-	x	M		x	x					x		
Western Barn Owl	*Tyto alba*	6.90	5.26	-	-	x	M	x				x		x	x		
Western Cattle Egret	*Bubulcus ibis*	27.97	23.68	-	-	x	H	x						x	x		
Western Osprey	*Pandion haliaetus*	0.38	10.53	-	-		L			x				x			
White Stork	*Ciconia ciconia*	11.88	0.00	-	-	x	H	x				x		x	x		
White-backed Duck	*Thalassornis leuconotus*	8.81	0.00	-	-	x	M		x	x					x		
White-bellied Bustard	*Eupodotis senegalensis*	11.49	23.68	-	VU	x	H	x							x	x	x
White-breasted Cormorant	*Phalacrocorax lucidus*	26.82	15.79	-	-	x	H		x	x				x	x		
Yellow-billed Duck	*Anas undulata*	68.20	0.00	-	-	x	H		x	x					x		
Yellow-billed Kite	*Milvus aegyptius*	1.92	0.00	-	-	x	L	x				x	x	x			
Yellow-billed Stork	*Mycteria ibis*	0.00	0.00	-	EN	x	M		x	x					x	x	x
Yellow-breasted Pipit	*Anthus chloris*	1.53	0.00	VU	VU	x	M	x									

6.7 Results of pre-construction bird monitoring

The powerline sensitive species that were recorded during the pre-construction monitoring at the Ujekamanzi WEF 1 and 2 Project Sites and immediate environment are listed in **Table 4**.

Table 4: Powerline sensitive species recorded during pre-construction monitoring.

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	SA status
African Black Duck	*Anas sparsa*	12.26	0.00	-	-
African Darter	*Anhinga rufa*	23.75	2.63	-	-
African Fish Eagle	*Haliaeetus vocifer*	11.88	0.00	-	-
African Grass Owl	*Tyto capensis*	0.00	0.00	-	VU
African Harrier-Hawk	*Polyboroides typus*	7.66	10.53	-	-
African Marsh Harrier	*Circus ranivorus*	1.53	2.63	-	EN
African Sacred Ibis	*Threskiornis aethiopicus*	58.24	5.26	-	-
African Spoonbill	*Platalea alba*	26.82	0.00	-	-
African Swamphen	*Porphyrio madagascariensis*	3.07	0.30	-	-
Amur Falcon	*Falco amurensis*	21.84	13.16	-	-
Black Harrier	*Circus maurus*	0.38	0.00	EN	EN
Black Heron	*Egretta ardesiaca*	0.00	0.00	-	-
Black Sparrowhawk	*Accipiter melanoleucus*	15.33	0.00	-	-
Black-headed Heron	*Ardea melanocephala*	57.85	0.00	-	-
Black-necked Grebe	*Podiceps nigricollis*	3.83	0.00	-	-
Black-winged Kite	*Elanus caeruleus*	63.22	10.53	-	-
Blue Crane	*Grus paradisea*	26.82	5.26	VU	NT
Blue Korhaan	*Eupodotis caerulescens*	12.64	15.79	NT	LC
Cape Crow	*Corvus capensis*	55.56	2.63	-	-
Cape Shoveler	*Spatula smithii*	20.69	0.00	-	-
Cape Vulture	*Gyps coprotheres*	1.92	17.63	VU	EN
Common Buzzard	*Buteo buteo*	24.52	36.84	-	-
Common Moorhen	*Gallinula chloropus*	26.82	2.63	-	-
Denham's Bustard	*Neotis denhami*	5.36	2.63	NT	VU
Egyptian Goose	*Alopochen aegyptiaca*	85.82	2.63	-	-
Glossy Ibis	*Plegadis falcinellus*	8.43	0.00	-	-
Goliath Heron	*Ardea goliath*	4.21	0.00	-	-
Great Crested Grebe	*Podiceps cristatus*	4.98	0.00	-	-
Great Egret	*Ardea alba*	6.13	0.00	-	-
Greater Kestrel	*Falco rupicoloides*	0.77	7.89	-	-
Grey Crowned Crane	*Balearica regulorum*	17.62	0.00	EN	EN
Grey Heron	*Ardea cinerea*	32.18	36.84	-	-
Hadada Ibis	*Bostrychia hagedash*	86.97	5.26	-	-
Hamerkop	*Scopus umbretta*	18.01	2.63	-	-
Helmeted Guineafowl	*Numida meleagris*	50.57	0.00	-	-
Intermediate Egret	*Ardea intermedia*	9.20	21.05	-	-
Jackal Buzzard	*Buteo rufofuscus*	26.05	0.00	-	-

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	SA status
Lanner Falcon	*Falco biarmicus*	16.09	2.63	-	VU
Little Egret	*Egretta garzetta*	1.15	0.00	-	-
Little Grebe	*Tachybaptus ruficollis*	46.36	0.00	-	-
Long-crested Eagle	*Lophaetus occipitalis*	2.68	10.53	-	-
Maccoa Duck	*Oxyura maccoa*	6.13	5.26	EN	NT
Marsh Owl	*Asio capensis*	9.20	13.16	-	-
Martial Eagle	*Polemaetus bellicosus*	3.45	5.26	EN	EN
Montagu's Harrier	*Circus pygargus*	1.53	7.89	-	-
Pallid Harrier	*Circus macrourus*	0.00	0.00	NT	NT
Pied Crow	*Corvus albus*	6.90	2.63	-	-
Purple Heron	*Ardea purpurea*	6.51	2.63	-	-
Red-billed Teal	*Anas erythrorhyncha*	22.99	0.00	-	-
Red-footed Falcon	*Falco vespertinus*	0.00	0.00	VU	NT
Red-knobbed Coot	*Fulica cristata*	71.65	10.53	-	-
Reed Cormorant	*Microcarbo africanus*	63.60	0.00	-	-
Rock Kestrel	*Falco rupicolus*	7.66	23.68	-	-
Rudd's Lark	*Heteromirafra ruddi*	0.00	5.26	EN	EN
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0.77	0.00	-	-
Secretarybird	*Sagittarius serpentarius*	29.50	2.63	EN	VU
South African Shelduck	*Tadorna cana*	49.04	0.00	-	-
Southern Bald Ibis	*Geronticus calvus*	43.68	0.00	VU	VU
Southern Pochard	*Netta erythrophthalma*	11.11	0.00	-	-
Spotted Eagle-Owl	*Bubo africanus*	11.88	31.58	-	-
Spur-winged Goose	*Plectropterus gambensis*	54.79	15.79	-	-
Squacco Heron	*Ardeola ralloides*	1.15	31.58	-	-
Western Barn Owl	*Tyto alba*	6.90	5.26	-	-
Western Cattle Egret	*Bubulcus ibis*	27.97	23.68	-	-
White Stork	*Ciconia ciconia*	11.88	0.00	-	-
White-backed Duck	*Thalassornis leuconotus*	8.81	0.00	-	-
White-bellied Bustard	*Eupodotis senegalensis*	11.49	23.68	-	VU
White-breasted Cormorant	*Phalacrocorax lucidus*	26.82	15.79	-	-
Yellow-billed Duck	*Anas undulata*	68.20	0.00	-	-
Yellow-billed Kite	*Milvus aegyptius*	1.92	0.00	-	-
Yellow-billed Stork	*Mycteria ibis*	0.00	0.00	-	EN
Yellow-breasted Pipit	*Anthus chloris*	1.53	0.00	VU	VU

7. SPECIALIST FINDINGS AND ASSESSMENT OF IMPACTS

7.1 400kV LILO lines

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

7.1.1 Electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the pole/tower design. In the case of the proposed power lines, no electrocution risk is envisaged because the proposed design of the 400kV line, should not pose an electrocution threat to any of the priority species which are likely to occur in the study area due to the large clearances between the live component and the live and grounded components.

7.1.2 Collisions

Collisions are the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). 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 (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the lower-resolution, and often restricted, forward vision that is useful to detect

obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 2012).

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

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 6 below).

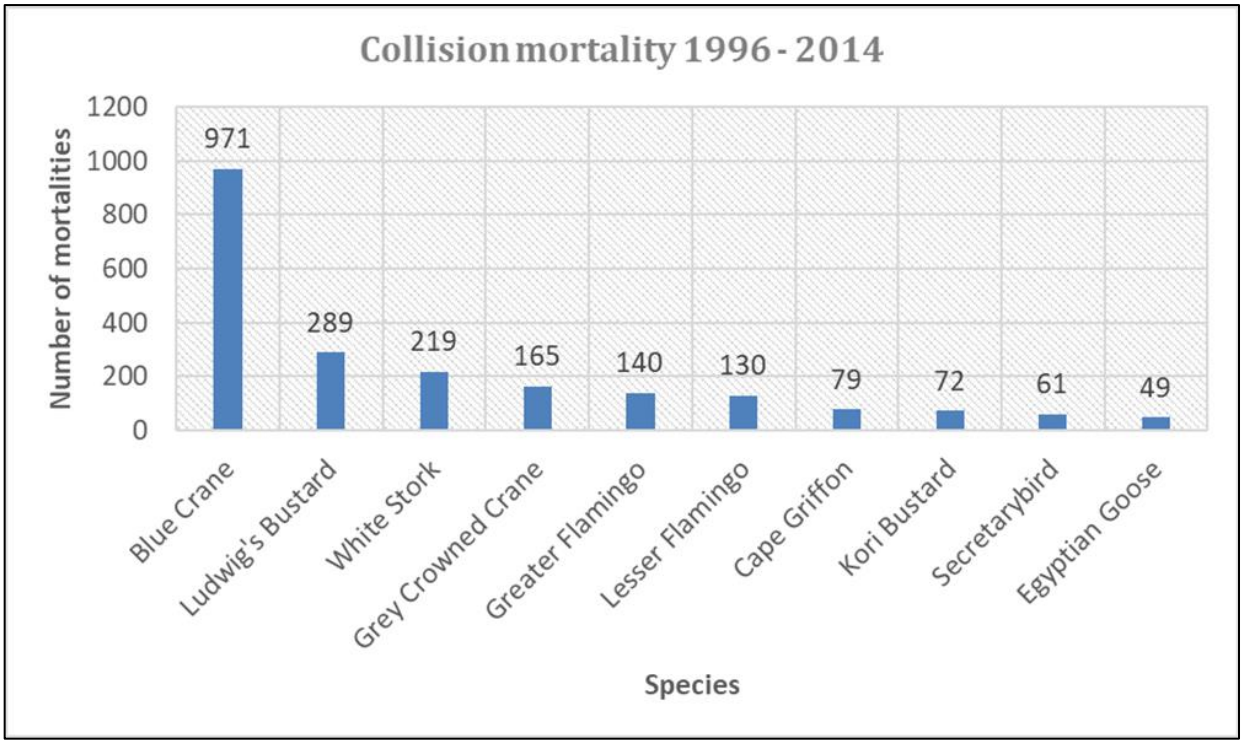

Figure 6: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

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

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 & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards *Ardeotis kori*, Blue Cranes *Anthropoides paradiseus* 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 (A*ccipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes, and are also known to be vulnerable to power line collisions.

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 (e.g. Bernardino *et al.* 2018; Sporer *et al.* 2013, Barrientos *et al*. 2011; Jenkins *et al*. 2010; Alonso & Alonso 1999; Koops & De Jong 1982), 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 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).

The powerline sensitive species which are potentially vulnerable to this impact are the following:

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status	Recorded during monitoring
African Black Duck	*Anas sparsa*	12.26	0.00	-	-	x
African Darter	*Anhinga rufa*	23.75	2.63	-	-	x

African Grass Owl	*Tyto capensis*	0.00	0.00	-	VU	x
African Sacred Ibis	*Threskiornis aethiopicus*	58.24	5.26	-	-	x
African Spoonbill	*Platalea alba*	26.82	0.00	-	-	x
Black Heron	*Egretta ardesiaca*	0.00	0.00	-	-	x
Black-bellied Bustard	*Lissotis melanogaster*	0.38	36.84	-	-	
Black-crowned Night Heron	*Nycticorax nycticorax*	0.38	2.63	-	-	
Black-headed Heron	*Ardea melanocephala*	57.85	0.00	-	-	x
Black-necked Grebe	*Podiceps nigricollis*	3.83	0.00	-	-	x
Blue Crane	*Grus paradisea*	26.82	5.26	VU	NT	x
Blue Korhaan	*Eupodotis caerulescens*	12.64	15.79	NT	LC	x
Blue-billed Teal	*Spatula hottentota*	1.15	3.95	-	-	
Cape Shoveler	*Spatula smithii*	20.69	0.00	-	-	x
Cape Teal	*Anas capensis*	0.38	0.61	-	-	
Cape Vulture	*Gyps coprotheres*	1.92	17.63	VU	EN	x
Denham's Bustard	*Neotis denhami*	5.36	2.63	NT	VU	x
Egyptian Goose	*Alopochen aegyptiaca*	85.82	2.63	-	-	x
Fulvous Whistling Duck	*Dendrocygna bicolor*	0.77	0.00	-	-	
Glossy Ibis	*Plegadis falcinellus*	8.43	0.00	-	-	x
Goliath Heron	*Ardea goliath*	4.21	0.00	-	-	x
Great Crested Grebe	*Podiceps cristatus*	4.98	0.00	-	-	x
Great Egret	*Ardea alba*	6.13	0.00	-	-	x
Greater Flamingo	*Phoenicopterus roseus*	2.30	23.68	-	NT	
Grey Crowned Crane	*Balearica regulorum*	17.62	0.00	EN	EN	x
Grey Heron	*Ardea cinerea*	32.18	36.84	-	-	x
Hadada Ibis	*Bostrychia hagedash*	86.97	5.26	-	-	x
Hamerkop	*Scopus umbretta*	18.01	2.63	-	-	x
Intermediate Egret	*Ardea intermedia*	9.20	21.05	-	-	x
Knob-billed Duck	*Sarkidiornis melanotos*	0.77	2.63	-	-	
Lesser Flamingo	*Phoeniconaias minor*	0.38	2.63	NT	NT	
Little Egret	*Egretta garzetta*	1.15	0.00	-	-	x
Little Grebe	*Tachybaptus ruficollis*	46.36	0.00	-	-	x
Maccoa Duck	*Oxyura maccoa*	6.13	5.26	EN	NT	x
Marsh Owl	*Asio capensis*	9.20	13.16	-	-	x
Purple Heron	*Ardea purpurea*	6.51	2.63	-	-	x
Red-billed Teal	*Anas erythrorhyncha*	22.99	0.00	-	-	x
Red-knobbed Coot	*Fulica cristata*	71.65	10.53	-	-	x
Reed Cormorant	*Microcarbo africanus*	63.60	0.00	-	-	x
Secretarybird	*Sagittarius serpentarius*	29.50	2.63	EN	VU	x
South African Shelduck	*Tadorna cana*	49.04	0.00	-	-	x
Southern Bald Ibis	*Geronticus calvus*	43.68	0.00	VU	VU	x
Southern Pochard	*Netta erythrophthalma*	11.11	0.00	-	-	x
Spotted Eagle-Owl	*Bubo africanus*	11.88	31.58	-	-	x
Spur-winged Goose	*Plectropterus gambensis*	54.79	15.79	-	-	x
Squacco Heron	*Ardeola ralloides*	1.15	31.58	-	-	x
Western Barn Owl	*Tyto alba*	6.90	5.26	-	-	x
Western Cattle Egret	*Bubulcus ibis*	27.97	23.68	-	-	x
White Stork	*Ciconia ciconia*	11.88	0.00	-	-	x
White-backed Duck	*Thalassornis leuconotus*	8.81	0.00	-	-	x
White-bellied Bustard	*Eupodotis senegalensis*	11.49	23.68	-	VU	x
White-breasted Cormorant	*Phalacrocorax lucidus*	26.82	15.79	-	-	x
Yellow-billed Duck	*Anas undulata*	68.20	0.00	-	-	x
Yellow-billed Stork	*Mycteria ibis*	0.00	0.00	-	EN	x

7.1.3 Displacement due to disturbance

Construction activities 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 in close proximity to 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. As far as powerline sensitive species are concerned, terrestrial species are most likely to be affected by displacement due to disturbance associated with the construction of the proposed powerline. There is Secretarybird nest within the PAOI located approximately 1.68km from the point where the LILO powerline will connect to the existing 400kV high voltage line.

The avifauna which are potentially vulnerable to this impact are listed below:

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status	Recorded during monitoring
African Grass Owl	*Tyto capensis*	0.00	0.00	-	VU	x
Black Harrier	*Circus maurus*	0.38	0.00	EN	EN	x
Black-bellied Bustard	*Lissotis melanogaster*	0.38	36.84	-	-	
Blue Crane	*Grus paradisea*	26.82	5.26	VU	NT	x
Blue Korhaan	*Eupodotis caerulescens*	12.64	15.79	NT	LC	x
Denham's Bustard	*Neotis denhami*	5.36	2.63	NT	VU	x
Marsh Owl	*Asio capensis*	9.20	13.16	-	-	x
Montagu's Harrier	*Circus pygargus*	1.53	7.89	-	-	x
Pallid Harrier	*Circus macrourus*	0.00	0.00	NT	NT	x
Rudd's Lark	*Heteromirafra ruddi*	0.00	5.26	EN	EN	x
Secretarybird	*Sagittarius serpentarius*	29.50	2.63	EN	VU	x
White-bellied Bustard	*Eupodotis senegalensis*	11.49	23.68	-	VU	x
Yellow-breasted Pipit	*Anthus chloris*	1.53	0.00	VU	VU	x

7.2 Main Transmission Substation (MTS)

7.2.1 Displacement due to habitat destruction

During the construction of 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, OHL and service road);

- Transportation of personnel, construction material and equipment to the site, and personnel away from the site;
- Removal of vegetation for the proposed substation and stockpiling of topsoil and cleared vegetation;
- Excavations for infrastructure;

These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed onsite substation through transformation of habitat, which could result in temporary or permanent displacement of a range of species. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the substation yard is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing power lines, very little if any vegetation clearing will be required in the power line servitudes. The various MTS alternatives are all situated in natural grassland. Many species to be directly impacted would be non-Red Data species which happen to be resident in those few hectares of grassland. However, preliminary modelling indicates that the proposed MTS footprint is partially located in Rudd's Lark (Globally and Regionally Endangered) and Yellow-breasted Pipit (Globally and Regionally Vulnerable) habitat. Some of the grassland species that could potentially be impacted could move away and breed elsewhere in the available grassland habitat, but both Rudd's Lark and Yellow-breasted Pipit species are highly habitat specific and require a very specific type of high-altitude grassland for breeding. The option of relocating for the latter two species is therefore limited.

The avifauna which are potentially vulnerable to this impact are the following:

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status
Black-bellied Bustard	*Lissotis melanogaster*	0.38	36.84	-	-
Blue Crane	*Grus paradisea*	26.82	5.26	VU	NT
Blue Korhaan	*Eupodotis caerulescens*	12.64	15.79	NT	LC
Denham's Bustard	*Neotis denhami*	5.36	2.63	NT	VU
Marsh Owl	*Asio capensis*	9.20	13.16	-	-
Rudd's Lark	*Heteromirafra ruddi*	0.00	5.26	EN	EN
White-bellied Bustard	*Eupodotis senegalensis*	11.49	23.68	-	VU
Yellow-breasted Pipit	*Anthus chloris*	1.53	0.00	VU	VU

7.2.2 Displacement due to disturbance

Construction activities 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 in close proximity to 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. As far as powerline sensitive

species are concerned, terrestrial species are most likely to be affected by displacement due to disturbance associated with the construction of the proposed powerline (see 7.2.1 for potential occurrence of Rudd's Lark (Globally and Regionally Endangered) and Yellow-breasted Pipit (Globally and Regionally Endangered)).

The avifauna which are potentially vulnerable to this impact are listed below:

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status	Recorded during monitoring
African Grass Owl	*Tyto capensis*	0.00	0.00	-	VU	x
Black Harrier	*Circus maurus*	0.38	0.00	EN	EN	x
Black-bellied Bustard	*Lissotis melanogaster*	0.38	36.84	-	-	
Blue Crane	*Grus paradisea*	26.82	5.26	VU	NT	x
Blue Korhaan	*Eupodotis caerulescens*	12.64	15.79	NT	LC	x
Denham's Bustard	*Neotis denhami*	5.36	2.63	NT	VU	x
Marsh Owl	*Asio capensis*	9.20	13.16	-	-	x
Montagu's Harrier	*Circus pygargus*	1.53	7.89	-	-	x
Pallid Harrier	*Circus macrourus*	0.00	0.00	NT	NT	x
Rudd's Lark	*Heteromirafra ruddi*	0.00	5.26	EN	EN	x
Secretarybird	*Sagittarius serpentarius*	29.50	2.63	EN	VU	x
White-bellied Bustard	*Eupodotis senegalensis*	11.49	23.68	-	VU	x
Yellow-breasted Pipit	*Anthus chloris*	1.53	0.00	VU	VU	x

7.3 The identification and assessment of potential impacts: 400kV LILO

The potential impacts on avifauna identified during the course of the study are listed and assessed in the tables below. The impact criteria are explained in Appendix 6.

7.3.1 Construction Phase

- Displacement of priority species due to disturbance associated with the construction of the LILO powerlines.

Table 5: Rating of impacts: Construction Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Avifauna	Displacement of avifauna due to disturbance associated with the powerline construction activities	1	3	2	3	1	3	30	_	Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. (4) A 500m all-infrastructure exclusion zone must be implemented around the	1	2	2	1	1	2	14	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
											Secretarybird nest located at -26.908013° 30.023092°.									

7.3.2 Operational Phase

- Mortality of priority species due to collisions with the LILO powerlines

Table 6: Rating of impacts: Operational Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operational Phase																				
Avifauna	Mortality of priority species due to collisions with the LILO powerlines	1	3	2	3	3	2	24	_	Medium	(1) The entire line must be marked with Bird Flight Diverters according to the relevant Eskom Engineering Instruction.	1	2	2	3	3	2	22	_	Low

7.3.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning (dismantling) of the LILO powerlines.

Table 7: Rating of impacts: Decommissioning Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Decommissioning Phase																				
Avifauna	Displacement due to disturbance associated with the dismantling of the LILO powerlines.	1	3	2	3	1	3	30	_	Medium	(1) Driving must be limited to designated roads. (2) Existing roads should be used as much as possible. (3) Measures to control noise must be implemented according to industry best practice. (4) Access to the rest of the property must be restricted.	1	3	1	2	1	2	16		Low

7.4 The identification and assessment of potential impacts: MTS

7.4.1 Construction Phase

- Displacement of priority species due to disturbance associated with the construction of the MTS.

Table 8: Rating of impacts: Construction Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Avifauna	Displacement of avifauna due to disturbance associated with the MTS construction activities	1	2	3	3	1	3	30	_	Medium	(1) Preliminary modelling indicates that the MTS footprint is located in Yellow-breasted Pipit habitat. The modelling will be further refined during the EIA phase, but it may be necessary for the MTS to be micro sited should the footprint still fall within Yellow-breasted Pipit habitat after final assessment of the habitat. (2) Construction activity should be restricted to the immediate footprint of the infrastructure. (3) Measures to control noise and dust should be applied according to current best practice in the industry. (4) Maximum use should be made of existing access	1	2	2	2	1	2	16	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
											roads and the construction of new roads should be kept to a minimum as far as practical.									

- Displacement of priority species due to habitat destruction associated with the construction of the MTS.

Table 9: Rating of impacts: Construction Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Avifauna	Displacement of avifauna due to disturbance associated with the MTS construction activities	1	2	3	3	4	3	36	_	Medium	(1) Preliminary modelling indicates that the MTS footprint is located in Yellow-breasted Pipit habitat. The modelling will be further refined during the EIA phase, but it may be necessary for the MTS to be micro sited should the footprint still fall within Yellow-breasted Pipit habitat after final assessment of the habitat. (2) Construction activity should be restricted to the immediate footprint of the infrastructure as much as possible. (3) Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. (4) The mitigation measures proposed by the biodiversity specialist with regard to the minimisation of habitat destruction must be strictly implemented to	1	2	2	2	1	2	16	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
											limit the loss of natural grassland habitat for avifauna.									

7.4.2 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning (dismantling) of the MTS.

Table 10: Rating of impacts: Decommissioning Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Decommissioning Phase																				
Avifauna	Displacement due to disturbance associated with the dismantling of the MTS	1	2	3	3	1	3	30	_	Medium	(5) Driving must be limited to designated roads. (6) Existing roads should be used as much as possible. (7) Measures to control noise must be implemented according to industry best practice. (8) Access to the rest of the property must be restricted.	1	3	1	2	1	2	16		Low

7.5 The identification of preliminary environmental sensitivities: 400kV LILO lines

The entire PAOI is a medium sensitivity zone from a powerline interaction perspective due to the recorded and potential presence of several powerline sensitive species of conservation concern (SCC) including Blue Crane, Denham's Bustard, Secretarybird, Grey Crowned Crane and Southern Bald Ibis. Mitigation in the form of Bird Flight Diverters should therefore be applied to the entire LILO line.

7.6 The identification of preliminary environmental sensitivities: MTS

The following preliminary environmental sensitivities were identified from an avifaunal perspective for the proposed MTS (**Figure 7**):

7.6.1 Very High sensitivity: All infrastructure exclusion zones

Included in this category are the following areas:

- Medium and high sensitivity buffers as defined by the aquatic specialist around drainage lines, dams and wetlands. This is to prevent the disturbance of priority species breeding and roosting in these areas. SCC in this category include, African Grass Owl, African Marsh Harrier, Black-winged Pratincole, Blue Crane, Grey Crowned Crane, and Yellow-billed Stork.
- 1km buffers around Southern Bald Ibis roosts and colonies to prevent displacement of birds due to disturbance and to reduce the risk of turbine collisions.
- 500m buffers around Secretarybird nests to prevent displacement of birds due to disturbance and to reduce the risk of turbine collisions.
- 500m buffers around Grey Crowned Crane roosts and potential breeding areas to prevent displacement of birds due to disturbance and to reduce the risk of turbine collisions.
- All the modelled Rudd's Lark habitat pockets.
- All the modelled Yellow-breasted Pipit habitat pockets.[3]

[3] See Appendix 8 for the methodology employed to model the Rudd's Lark and Yellow-breasted Pipit habitat.

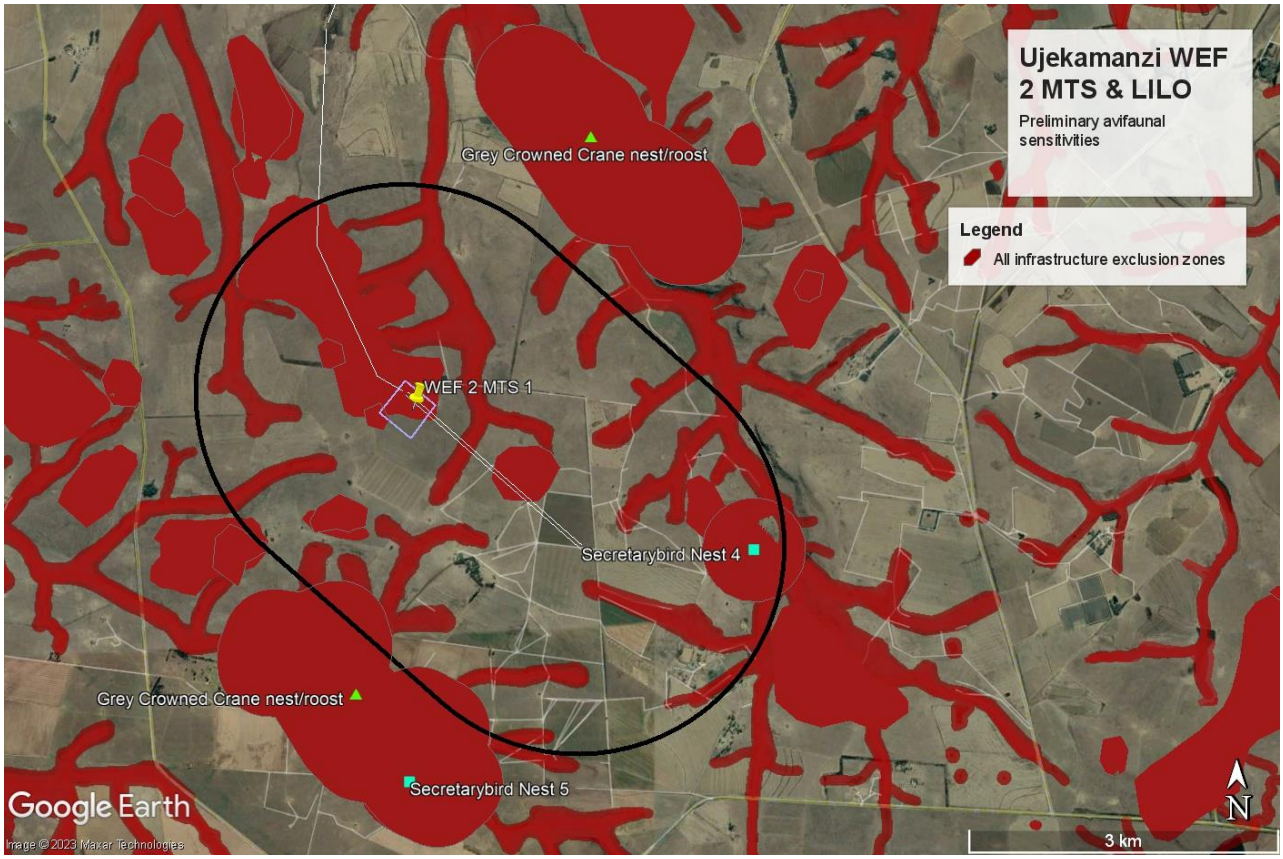

Figure 7: Preliminary avifaunal sensitivities

8. COMPARATIVE ASSESSMENT OF ALTERNATIVES

8.1 400kV LILO powerlines

Only one alternative was assessed.

8.2 MTS

Only one alternative was assessed.

8.3 No-Go Alternative

8.3.1 400kV LILO powerlines

The no-go alternative will result in the current *status quo* being maintained as far as the avifauna is concerned. The low human population in the area is definitely advantageous to sensitive avifauna, especially SCC. The no-go option would eliminate any additional impact on the ecological integrity of the proposed development site as far as avifauna is concerned.

8.3.2 MTS

The no-go alternative will result in the current *status quo* being maintained as far as the avifauna is concerned. The low human population in the area is definitely advantageous to sensitive avifauna, especially SCC. The no-go option would eliminate any additional impact on the ecological integrity of the proposed development site as far as avifauna is concerned.

9. CONCLUSION AND SUMMARY

9.1 400kV LILO powerlines

The proposed 400kV LILO powerlines will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of powerline sensitive species due to disturbance linked to construction activities in the construction phase.
- Collisions of powerline sensitive species with the overhead line in the operational phase.
- Displacement of powerline sensitive species due to disturbance linked to dismantling activities in the decommissioning phase.

9.1.1 *Displacement of powerline sensitive species due to disturbance linked to construction activities in the construction phase.*

Construction activities 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 in close proximity to 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. As far as powerline sensitive species are concerned, terrestrial species are most likely to be affected by displacement due to disturbance associated with the construction of the proposed powerline. There is Secretarybird nest within the PAOI located approximately 1.68km from the point where the LILO powerline will connect to the existing 400kV high voltage line.

The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

9.1.2 Collisions of powerline sensitive species with the overhead line in the operational phase.

The grid connection could potentially pose a collision risk to various species, particularly large terrestrial species, including SCC species such as Deham's Bustard, Blue Crane, Grey Crowned Crane, Southern Bald Ibis and Secretarybird, and various powerline sensitive.

The impact is rated as **medium** pre-mitigation and will be reduce to **low** post-mitigation.

9.1.3 *Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.*

The impact is likely to be similar to the construction phase. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

Table 11: Overall Impact Significance for the 400kV LILO powerlines (Pre- and Post-Mitigation)

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure. (2) Measures to control noise and dust should be applied according to current best practice in the industry. (3) Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. (4) A 500m all-infrastructure exclusion zone must be implemented around the Secretarybird nest located at -26.908013° 30.023092°.	Low
Operational: Collisions with the overhead grid connection	Medium	(1) The entire line must be marked with Bird Flight Diverters according to the relevant Eskom Engineering Instruction.	Low
Decommissioning: Displacement due to disturbance	Medium	(1) Driving must be limited to designated roads. (2) Existing roads should be used as much as possible. (3) Measures to control noise must be implemented according to industry best practice. (4) Access to the rest of the property must be restricted.	Low

9.2 Main Transmission Substation

The proposed Main Transmission Station will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of powerline sensitive species due to disturbance linked to construction activities in the construction phase.
- Displacement of powerline sensitive species due to habitat transformation linked to construction activities in the construction phase.
- Displacement of powerline sensitive species due to disturbance linked to dismantling activities in the decommissioning phase.

9.2.1 *Displacement of powerline sensitive species due to disturbance linked to construction activities in the construction phase.*

Construction activities 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 in close proximity to 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. As far as powerline sensitive species are concerned, terrestrial species are most likely to be affected by displacement due to disturbance associated with the construction of the proposed powerline (see 9.2.2 for potential occurrence of Rudd's Lark (Globally and Regionally Endangered) and Yellow-breasted Pipit (Globally and Regionally Endangered)).

The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

9.2.2 *Displacement of powerline sensitive species due to habitat transformation linked to construction activities in the construction phase.*

These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed onsite substation through transformation of habitat, which could result in temporary or permanent displacement of a range of species. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the substation yard is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing power lines, very little if any vegetation clearing will be required in the power line servitudes. The various MTS alternatives are all situated in natural grassland. Many species to be directly impacted would be non-Red Data species which happen to be resident in those few hectares of grassland. However, Alternative 3 is located in Rudd's Lark (Globally and Regionally Endangered) habitat, and Alternatives 1 and 2 are located in Yellow-breasted Pipit (Globally and Regionally Endangered) habitat. Some of the grassland species that could potentially be impacted could move away and breed elsewhere in the available grassland habitat, but both Rudd's Lark and Yellow-breasted Pipit species are highly habitat specific and require a very specific type of high-altitude grassland for breeding. The option of relocating for the latter two species is therefore limited.

The impact is rated as **medium** pre-mitigation and will be reduce to **low** post-mitigation.

9.2.3 *Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.*

The impact is likely to be similar to the construction phase. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

Table 12: Overall Impact Significance for the MTS (Pre- and Post-Mitigation)

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Preliminary modelling indicates that the MTS footprint is located in Yellow-breasted Pipit habitat. The modelling will be further refined during the EIA phase, but it may be necessary for the MTS to be micro sited should the footprint still fall within Yellow-breasted Pipit habitat after final assessment of the habitat. (2) Construction activity should be restricted to the immediate footprint of the infrastructure. (3) Measures to control noise and dust should be applied according to current best practice in the industry. (4) Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical.	Low
Operational: Displacement due to habitat transformation	Medium	(1) Preliminary modelling indicates that the MTS footprint is located in Yellow-breasted Pipit habitat. The modelling will be further refined during the EIA phase, but it may be necessary for the MTS to be micro sited should the footprint still fall within Yellow-breasted Pipit habitat after final assessment of the habitat. (2) Construction activity should be restricted to the immediate footprint of the infrastructure as much as possible. (3) Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum as far as practical. (4) The mitigation measures proposed by the biodiversity specialist with regard to the minimisation of habitat destruction must be strictly implemented to limit the loss of natural grassland habitat for avifauna.	Low

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Decommissioning: Displacement due to disturbance	Medium	(1) Driving must be limited to designated roads. (2) Existing roads should be used as much as possible. (3) Measures to control noise must be implemented according to industry best practice. (4) Access to the rest of the property must be restricted.	Low

9.3 Preliminary Conclusion and Impact Statement

9.3.1 400kV LILO powerlines

The proposed Ujekamanzi WEF 2 400 kV LILO powerlines will have a moderate impact on avifauna which, in all instances, could be reduced to a low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

9.3.2 Mains Transmission Station

The proposed Ujekamanzi WEF 2 Main Transmission Station will have a moderate impact on avifauna which, in all instances, could be reduced to a low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

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APPENDIX 1: TERMS OF REFERENCE

SPECIALIST REPORT REQUIREMENTS

1.1 Site Sensitivity Verification and Reporting

The requirements for Specialist Studies being undertaken in support of applications for Environmental Authorisation are specified in **Appendix 6** of the 2014 NEMA EIA Regulations (as amended), as well as the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320. These protocols stipulate the Procedures for the Assessment and Minimum Criteria for reporting on identified environmental themes in terms of Sections 24(5)(A) and (H) and 44 of the NEMA, when applying for EA.

The Assessment Protocols as per GN320 are as follows:

- **PART A:** This relates to the Site Sensitivity Verification (SSV) and Reporting requirements where a Specialist Assessment is required but no specific Assessment Protocol has been prescribed. In this instance, specialist assessment must comply with **Appendix 6** of the 2014 NEMA EIA Regulations (as amended). However, the current use of the land and the environmental sensitivity of the site under consideration as identified by the DFFE Screening Tool must be verified and confirmed and an SSV report must be compiled and included as an appendix to the Specialist Assessment. Where there are no sensitivity layers on the Screening Tool for a particular Specialist Assessment, then this must be stated in the actual Specialist Assessment and in the accompanying SSV report.
- **PART B:** This relates to the Site Sensitivity Verification (SSV) and Reporting requirements where a Specialist Assessment is required and a specific Assessment Protocol has been prescribed. The following Assessment Protocols are relevant to the proposed project:

    - Agriculture
    - Terrestrial Biodiversity
    - Aquatic Biodiversity
    - Archaeological, Cultural and Paleontology
    - Avifauna
    - Bat
    - Flicker
    - Geotechnical
    - Noise
    - Risk Assessment
    - Social
    - Traffic
    - Visual
    - Terrestrial Plant Species
    - Terrestrial Animal Species

1.2 Specialist Assessment Reports / Compliance Statements

Specialists are requested to provide ***four (4)*** scoping and environmental impact assessment reports and / or compliance statements that provides an assessment process for the following:

- Ujekamanzi WEF 1
- Ujekamanzi WEF 2
- Ujekamanzi MTS & LILO (On the WEF 1 site)
- Ujekamanzi LILO & LILO (On the WEF 2 site)

During the EIA phase, specialists will be required to update the scoping phase specialist report to provide a review of their findings in accordance with revised site layouts and to address any comments or concerns arising from the public participation process.

The specialist assessment reports and / or compliance statements should include the following sections:

1.2.1 Project Description

The specialist report must include the project description as provided above.

1.2.2 Terms of Reference

The specialist report must include an explanation of the terms of reference (TOR) applicable to the specialist study. Where relevant, a table must be provided at the beginning of the specialist report, listing the requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations, 2014 (as amended) and cross referencing these requirements with the relevant sections in the report. An MS Word version of this table will be provided by SiVEST.

1.2.3 Legal Requirements and Guidelines

The specialist report must include a thorough overview of all applicable best practice guidelines, relevant legislation, prescribed Assessment Protocols and authority requirements.

1.2.4 Methodology

The report must include a description of the methodology applied in carrying out the specialist assessment.

1.2.5 Specialist Findings / Identification of Impacts

The report must present the findings of the specialist studies and explain the implications of these findings for the proposed development (e.g. permits, licenses etc.). This section of the report should also identify any sensitive and/or 'no-go' areas on the development site or within the power line assessment corridors. These areas must be mapped clearly with a supporting explanation provided.

This section of the report should also specify if any further assessment will be required.

1.2.6 Environmental Impact Assessment

The impacts (both direct and indirect) of the proposed SEF and the proposed grid connection infrastructure (during the Construction, Operation and Decommissioning phases) are to be assessed and rated *separately* according to the methodology developed by SiVEST. Specialists will be required to make use of the impact rating matrix provided (in Excel format) for this purpose, and *separate tables* must be provided for the SEF and for the grid connection infrastructure respectively. **Please note that the significance of Cumulative Impacts should also be rated in this section.** Both the methodology and the rating matrix will be provided by SiVEST.

Please be advised that this section must include mitigation measures aimed at minimising the impact of the proposed development.

1.2.7 Input To The Environmental Management Programme (EMPr)

The report must include a description of the key monitoring recommendations for each applicable mitigation measure identified for each phase of the project for inclusion in the Environmental Management Programme (EMPr) or Environmental Authorisation (EA).

Please make use of the Impact Rating Table (in Excel format) for each of the phases i.e. Design, Construction, Operation and Decommissioning.

1.2.8 Cumulative Impact Assessment

Cumulative impact assessments must be undertaken for the proposed SEF and associated grid connection infrastructure to determine the cumulative impact that will materialise if other Renewable Energy Facilities (REFs) and large scale industrial developments are constructed within 35kms of the proposed development.

The cumulative impact assessment must contain the following:

- A cumulative environmental impact statement noting whether the overall impact is acceptable; and
- A review of the specialist reports undertaken for other REFs and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered.

In order to assist the specialists in this regard, SiVEST will provide the following documentation/data:

- A summary table listing all REFs identified within 35kms of the proposed SEF;
- A map showing the location of the identified REFs; and
- KML files.

It should be noted that it is the specialist's responsibility to source the relevant EIA / BA reports that are available in the public domain. SiVEST will assist, where possible.

1.2.9 No Go Alternative

Consideration must be given to the “no-go” option in the EIA process. The “no-go” option assumes that the site remains in its current state, i.e. there is no construction of a SEF and associated infrastructure in the proposed project area and the status quo would be preserved.

1.2.10 Comparative Assessment Of Alternatives

As mentioned, alternatives for the Substation location, construction / laydown area and power line route alignment have been identified. These alternatives are being considered as part of the EIA / BA processes and as such specialists are required to undertake a comparative assessment of the alternatives mentioned above as per the latest table provided by SiVEST.

1.2.11 Conclusion / Impact Statement

The conclusion section of the specialist report must include an Impact Statement, indicating whether any fatal flaws have been identified and ultimately whether the proposed development can be authorised or not (i.e. whether EA should be granted / issued or not).

1.2.12 Executive Summary

Specialists must provide an Executive Summary summarising the findings of their report to allow for easy inclusion in the EIA / BA reports.

1.2.13 Specialist Declaration of Independence

A copy of the Specialist Declaration of Interest (DoI) form, containing original signatures, must be appended to all Draft and Final Reports. This form will be provided to the specialists. *Please note that the undertaking / affirmation under oath section of the report must be signed by a Commissioner* of Oaths.

APPENDIX 2: SPECIALIST CV

Curriculum vitae: Chris van Rooyen

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

Key Experience

Chris van Rooyen has 26 years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Key Project Experience

Bird Impact Assessment Studies for Solar Energy Plants:

1. Concentrated Solar Power Plant, Upington, Northern Cape.
2. Globeleq De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos PV project, Copperton, Northern Cape
4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena PV Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla PV Project, Aggeneys, Northern Cape
8. Biotherm Sendawo PV Project, Vryburg, North-West
9. Biotherm Tlisitseng PV Project, Lichtenburg, North-West
10. JUWI Hotazel Solar Park Project, Hotazel, Northern Cape
11. Namakwa Solar Project, Aggeneys, Northern Cape
12. Brypaal Solar Power Project, Kakamas, Northern Cape
13. ABO Vryburg 1,2,3 Solar PV Project, Vryburg, North-West
14. NamPower CSP Facility near Arandis, Namibia
15. Dayson Klip PV Facility near Upington, Northern Cape
16. Geelkop PV Facility near Upington, Northern Cape
17. Oya PV Facility, Ceres, Western Cape
18. Vrede and Rondawel PV Facilities, Free State
19. Kolkies & Sadawa PV Facilities, Western Cape
20. Leeuwbosch PV1 and 2 and Wildebeeskuil PV1 and 2 Facilities, North-West
21. Kenhardt PV 3,4 and 5, Northern Cape
22. Wittewal PV, Grootfontein PV and Hoekdoornen PV Facilities, Touws River, Western Cape

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV
14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation
37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation

60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV
94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
118. Matla-Glockner 400kV
119. Delmas North 44kV
120. Houwhoek 11kV Refurbishment
121. Clau-Clau 132kV

122. Ngwedi-Silwerkrans 134kV
123. Nieuwehoop 400kV walk-through
124. Booysendal 132kV Switching Station
125. Tarlton 132kV
126. Medupi - Witkop 400kV walk-through
127. Germiston Industries Substation
128. Sekgame 132kV
129. Botswana – South Africa 400kV Transfrontier Interconnector
130. Syferkuil – Rampheri 132kV
131. Queens Substation and associated 132kV powerlines
132. Oranjemond 400kV Transmission line
133. Aries – Helios – Juno walk-down
134. Kuruman Phase 1 and 2 Wind Energy facilities 132kV Grid connection
135. Transnet Thaba 132kV

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

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Somerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm Blesbokfontein)
8. N17 Section: Springs To Leandra –"Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek 314 Ir)
9. South African Police Services Gauteng Radio Communication System: Portion 136 Of The Farm 528 Jq, Lindley.
10. Report for the proposed upgrade and extension of the Zeekoegat Wastewater Treatment Works, Gauteng.
11. Bird Impact Assessment for Portion 265 (a portion of Portion 163) of the farm Rietfontein 189-JR, Gauteng.
12. Bird Impact Assessment Study for Portions 54 and 55 of the Farm Zwartkop 525 JQ, Gauteng.
13. Bird Impact Assessment Study Portions 8 and 36 of the Farm Nooitgedacht 534 JQ, Gauteng.
14. Shumba's Rest Bird Impact Assessment Study
15. Randfontein Golf Estate Bird Impact Assessment Study
16. Zilkaatsnek Wildlife Estate
17. Regenstein Communications Tower (Namibia)
18. Avifaunal Input into Richards Bay Comparative Risk Assessment Study
19. Maquasa West Open Cast Coal Mine
20. Glen Erasmia Residential Development, Kempton Park, Gauteng
21. Bird Impact Assessment Study, Weltevreden Mine, Mpumalanga
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Mpumalanga
24. Lindley Estate, Lanseria, Gauteng
25. Proposed open cast iron ore mine on the farm Lylyveld 545, Northern Cape
26. Avifaunal monitoring for the Sishen Mine in the Northern Cape as part of the EMPr requirements
27. Steelpoort CNC Bird Impact Assessment Study

Professional affiliations

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

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation
Biology) Nationality	:	South African
Years of experience	:	22 years

Key Qualifications

Albert Froneman (*Pr.Sci.Nat*) has more than 22 years' experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee and has presented various papers at international conferences and workshops. At present he is consulting to ACSA with wildlife hazard management on all their airports. He also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies. He has co-authored many avifaunal specialist studies and pre-construction monitoring reports for proposed renewable energy developments across South Africa. He also has vast experience in using Geographic Information Systems to analyse and interpret avifaunal data spatially and derive meaningful conclusions. Since 2009 Albert has been a registered Professional Natural Scientist (reg. nr 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

Key Project Experience

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

1. Jeffrey's Bay Wind Farm – 12-months preconstruction avifaunal monitoring project
2. Oysterbay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
3. Ubuntu Wind Energy Project near Jeffrey's Bay – 12-months preconstruction avifaunal monitoring project
4. Bana-ba-Pifu Wind Energy Project near Humansdorp – 12-months preconstruction avifaunal monitoring project
5. Excelsior Wind Energy Project near Caledon – 12-months preconstruction avifaunal monitoring project
6. Laingsburg Spitskopvlakte Wind Energy Project – 12-months preconstruction avifaunal monitoring project
7. Loeriesfontein Wind Energy Project Phase 1, 2 & 3 – 12-months preconstruction avifaunal monitoring project
8. Noupoort Wind Energy Project – 12-months preconstruction avifaunal monitoring project
9. Vleesbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
10. Port Nolloth Wind Energy Project – 12-months preconstruction avifaunal monitoring project
11. Langhoogte Caledon Wind Energy Project – 12-months preconstruction avifaunal monitoring project
12. Lunsklip – Stilbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
13. Indwe Wind Energy Project – 12-months preconstruction avifaunal monitoring project
14. Zeeland St Helena bay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
15. Wolseley Wind Energy Project – 12-months preconstruction avifaunal monitoring project
16. Renosterberg Wind Energy Project – 12-months preconstruction avifaunal monitoring project

17. De Aar – North (Mulilo) Wind Energy Project – 12-months preconstruction avifaunal monitoring project (2014)
18. De Aar – South (Mulilo) Wind Energy Project – 12-months bird monitoring
19. Namies – Aggenys Wind Energy Project – 12-months bird monitoring
20. Pofadder - Wind Energy Project – 12-months bird monitoring
21. Dwarsrug Loeriesfontein - Wind Energy Project – 12-months bird monitoring
22. Waaihoek – Utrecht Wind Energy Project – 12-months bird monitoring
23. Amathole – Butterworth Wind Energy Project – 12-months bird monitoring & EIA specialist study
24. De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
25. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
26. R355 Solar Energy Facility 12-month bird monitoring (Mainstream)
27. Aletta Solar Energy Facility 12-month bird monitoring (Biotherm)
28. Maralla Solar Energy Facility 12-month bird monitoring (Biotherm)
29. Groenekloof Solar Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
30. Tsitsikamma Solar Energy Facility 24-months post-construction monitoring (Cennergi)
31. Noupoort Solar Energy Facility 24-months post-construction monitoring (Mainstream)
32. Kokerboom Solar Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
33. KurumanSolar Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
34. Mañhica Solar Energy Facility 12-month bird monitoring & EIA specialist study (Windlab)
35. Klipheuwel-Dassiefontein Solar Energy Facility, Caledon, Western Cape – Operational phase bird monitoring – Year 5 (Klipheuwel-Dassiefontein Solar Energy Facility)
36. Kwagga Solar Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
37. Pienaarspoort Solar Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO). Beaufort West and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
38. Duiker Solar Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
39. Perdekraal East Solar Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
40. Swellendam Solar Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
41. Lombardskraal Solar Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
42. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre- construction monitoring (Mainstream)
43. Great Karoo Solar Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
44. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
45. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
46. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
47. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
48. Kappa Solar PV facility, Touwsrivier, Western Cape, pre-construction monitoring (Veroniva)
49. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
50. Pofadder Solar Energy Facility, Northren Cape, Screening Report (AtlanticEnergy)
51. Haga Haga Solar Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
52. Banken Solar Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
53. Hartebeest Solar Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).
54. Iphiko Wind Energy facilities, Laingsburg, Western Cape, screening and pre- construction monitoring (G7 Energies)

55. Kangnas Solar Energy Facility, Northern Cape, Operational Phase 2 years avifaunal monitoring (Mainstream)
56. Perdekraal East Solar Energy Facility, Northern Cape, Operational Phase 2 years avifaunal monitoring (Mainstream)
57. Aberdeen 1, 2 & Aberdeen Kudu (3&4) Wind Energy Facilities, Eastern Cape, 12- month pre-construction monitoring (Atlantic Renewable Energy Partners)
58. Loxton / Beaufort West Wind Energy Facilities, Northern Cape, 12-month pre- construction monitoring (Genesis Eco-Energy Developments)
59. Ermelo & Volksrust Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
60. Aardvark Solar PV facility, Copperton, Northern Cape, 12-month pre-construction monitoring (ABO)
61. Bestwood Solar PV facility, Kathu, Northern Cape, pre-construction monitoring (AMDA)
62. Boundary Solar PV facility, Kimberley, Northern Cape, Site sensitivity verification (Atlantic Renewable Energy Partners)
63. Excelsior Solar Energy Facility, Swellendam, Western Cape, Operational Phase 2 years avifaunal monitoring & implementation of Shut Down on Demand (SDOD) pro-active mitigation strategy (Biotherm)
64. De Aar cluster Solar PV facilities, De Aar, Western Cape, Site sensitivity verification (Atlantic Renewable Energy Partners)
65. Rinkhals Solar PV facilities, Kimberley, Northern Cape, Pre-construction monitoring (ABO)
66. Kolkies Sadawa Solar PV facilities, Touwsrivier, Western Cape, pre-construction monitoring (Mainstream)
67. Leeudoringstad Solar PV facilities, Leeudoringstad, North West, Pre-construction monitoring (Upgrade Energy)
68. Noupoort Umsobomvu Solar PV facilities, Noupoort, Northern Cape, Pre-construction monitoring (EDF Renewables)
69. Oya Solar PV facilities, Matjiesfontein, Western Cape, pre-construction monitoring (G7 Energies)
70. Scafell Solar PV facilities, Sasolburg, Free state, pre-construction monitoring (Mainstream)
71. Vrede & Rondawel Solar PV facilities, Kroonstad, Free state, pre-construction monitoring (Mainstream)
72. Gunstfontein Wind Energy Facilities, Sutherland, Northern Cape, additional pre- construction monitoring (ACED)
73. Ezelsjacht Solar Energy Facility, De Doorns, Western Cape, pre-construction monitoring (Mainstream)
74. Klipkraal Solar Energy Facility, Fraserburg, Northern Cape, avifaunal screening (Klipkraal SEF)
75. Pofadder Solar Energy Facility, Pofadder, Northern Cape, pre-construction monitoring (Atlantic Renewable Energy Partners)

Bird Impact Assessment studies and / or GIS analysis:

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

8. Southern Region Pro-active GIS Blue Crane Collision Project.
9. Specialist advisor ~ Implementation of a bird detection radar system and development of an airport wildlife hazard management and operational environmental management plan for the King Shaka International Airport
10. Matsapha International Airport – bird hazard assessment study with management recommendations
11. Evaluation of aviation bird strike risk at candidate solid waste disposal sites in the Ekurhuleni Metropolitan Municipality
12. Gateway Airport Authority Limited – Gateway International Airport, Polokwane: Bird hazard assessment; Compile a bird hazard management plan for the airport
13. Bird Specialist Study - Evaluation of aviation bird strike risk at the Mwakirunge Landfill site near Mombasa Kenya
14. Bird Impact Assessment Study - Proposed Weltevreden Open Cast Coal Mine Belfast, Mpumalanga
15. Avian biodiversity assessment for the Mafube Colliery Coal mine near Middelburg Mpumalanga
16. Avifaunal Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
17. Avifaunal Impact Assessment Study (with specific reference to African Grass Owls and other Red List species) Stone Rivers Arch
18. Airport bird and wildlife hazard management plan and training to Swaziland Civil Aviation Authority (SWACAA) for Matsapha and Sikhupe International Airports.Bird Impact Assessment Study - Proposed 60 year Ash Disposal Facility near to the Kusile Power Station
19. Avifaunal pre-feasibility assessment for the proposed Montrose dam, Mpumalanga
20. Bird Impact Assessment Study – Proposed ESKOM Phantom Substation near Knysna, Western Cape
21. Habitat sensitivity map for Denham's Bustard, Blue Crane and White-bellied Korhaan in the Kouga Municipal area of the Eastern Cape Province
22. Swaziland Civil Aviation Authority – Sikhuphe International Airport – Bird hazard management assessment
23. Avifaunal monitoring – extension of Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
24. Avifaunal Specialist Study – Meerkat Hydro Electric Dam – Hope Town, Northern Cape
25. The Stewards Pan Reclamation Project – Bird Impact Assessment study
26. Airports Company South Africa – Avifaunal Specialist Consultant – Airport Bird and Wildlife Hazard Mitigation
27. Strategic Environmental Assessment For Gas Pipeline Development, CSIR
28. Avifaunal Specialist Assessment - Proposed monopole telecommunications mast – Roodekrans, Roodepoort, Gauteng (Enviroworks)
29. Gromis-Nama-Aggeneis 400kv Ipp Integration: Environmental Screening - Avifaunal Specialist Desktop Study
30. Melkspruit - Rouxville 132kV Distribution Line - Avifaunal Amendment and Walk-through Report
31. Gamma - Kappa 2nd 765kV transmission line – Avifaunal impact assessment GIS analysis

Geographic Information System analysis & maps

1. ESKOM Power line Makgalakwena EIA – GIS specialist & map production
2. ESKOM Power line Benficosa EIA – GIS specialist & map production
3. ESKOM Power line Riversong EIA – GIS specialist & map production
4. ESKOM Power line Waterberg NDP EIA – GIS specialist & map production
5. ESKOM Power line Bulge Toulon EIA – GIS specialist & map production
6. ESKOM Power line Bulge DORSET EIA – GIS specialist & map production
7. ESKOM Power lines Marblehall EIA – GIS specialist & map production
8. ESKOM Power line Grootpan Lesedi EIA – GIS specialist & map production
9. ESKOM Power line Tanga EIA – GIS specialist & map production
10. ESKOM Power line Bokmakierie EIA – GIS specialist & map production

11. ESKOM Power line Rietfontein EIA – GIS specialist & map production
12. Power line Anglo Coal EIA – GIS specialist & map production
13. ESKOM Power line Camcoll Jericho EIA – GIS specialist & map production
14. Hartbeespoort Residential Development – GIS specialist & map production
15. ESKOM Power line Mantsole EIA – GIS specialist & map production
16. ESKOM Power line Nokeng Flourspar EIA – GIS specialist & map production
17. ESKOM Power line Greenview EIA – GIS specialist & map production
18. Derdepoort Residential Development – GIS specialist & map production
19. ESKOM Power line Boynton EIA – GIS specialist & map production
20. ESKOM Power line United EIA – GIS specialist & map production
21. ESKOM Power line Gutshwa & Malelane EIA – GIS specialist & map production
22. ESKOM Power line Origstad EIA – GIS specialist & map production
23. Zilkaatsnek Development Public Participation –map production
24. Belfast – Paarde Power line - GIS specialist & map production
25. Solar Park Solar Park Integration Project Bird Impact Assessment Study – avifaunal GIS analysis.
26. Kappa-Omega-Aurora 765kV Bird Impact Assessment Report – Avifaunal GIS analysis.
27. Gamma – Kappa 2nd 765kV – Bird Impact Assessment Report – Avifaunal GIS analysis.
28. ESKOM Power line Kudu-Dorstfontein Amendment EIA – GIS specialist & map production.
29. ProposedHeilbron filling station EIA – GIS specialist & map production
30. ESKOM Lebatlhane EIA – GIS specialist & map production
31. ESKOM Pienaars River CNC EIA – GIS specialist & map production
32. ESKOM Lemara Phiring Ohrigstad EIA – GIS specialist & map production
33. ESKOM Pelly-Warmbad EIA – GIS specialist & map production
34. ESKOM Rosco-Bracken EIA –GIS specialist & map production
35. ESKOM Ermelo-Uitkoms EIA – GIS specialist & map production
36. ESKOM Wisani bridge EIA – GIS specialist & map productionCity of Tswane – New bulkfeeder pipeline projects x3Map production
37. ESKOM Lebohang Substation and 132kV Distribution Power Line Project Amendment GIS specialist & map production
38. ESKOM Geluk Rural Powerline GIS & Mapping
39. Eskom Kimberley Strengthening Phase 4 Project GIS & Mapping
40. ESKOM Kwaggafontein - Amandla Amendment Project GIS & Mapping
41. ESKOM Lephalale CNC – GIS Specialist & Mapping
42. ESKOM Marken CNC – GIS Specialist & Mapping
43. ESKOM Lethabong substation and powerlines – GIS Specialist & Mapping
44. ESKOM Magopela- Pitsong 132kV line and new substation – GIS Specialist & Mapping
45. Vlakfontein Filling Station – GIS Specialist & Mapping - EIA
46. Prieska – Hoekplaas Solar PV & BESS - GIS Specialist & Mapping – EIA
47. Mulilo Total Hydra Storage (MTHS) De Aar - GIS Specialist & Mapping – EIA
48. Merensky Uchoba Powerline, Steelpoort - GIS Specialist & Mapping – EIA
49. Douglas Solar Part 2 Amendment – grid connection - GIS Specialist & Mapping – EIA

Professional affiliations

- South African Council for Natural Scientific Professions (SACNASP) registered Professional Natural Scientist (reg. nr 400177/09) – specialist field: Zoological Science. Registered since 2009.
- Southern African Wildlife Management Association - Member
- Zoological Society of South Africa - Member

APPENDIX 3: PRE-CONSTRUCTION MONITORING PROTOCOL

1. OBJECTIVES

The objective of the pre-construction monitoring at the proposed Ujekamanzi Wind Energy Facility WEF 1 and 2 was to gather baseline data over a period of four seasons on the following aspects pertaining to avifauna:

- The abundance and diversity of birds at the wind farm sites and a suitable control site to measure the potential displacement effect of the wind farm.
- Flight patterns of priority species at the wind farm sites to assess the potential collision risk with the turbines.

2. METHODS

One set of guidelines are applicable to this wind facility:

- Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa.* Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa. Hereafter referred to as the wind guidelines.

The wind guidelines are applicable to all wind energy facilities which require environmental authorisation. The wind guidelines require a minimum of four site visits a year. Wind priority species were identified using the latest (November 2014) BirdLife SA (BLSA) list of priority species for wind farms. Red List species were identified from Taylor *et al.* (2015).

The monitoring surveys were conducted at the proposed WEF site and a control site by a team of monitors in the following time envelopes:

- Survey 1: 2 - 10 April 2022, 9 – 24 May 2022
- Survey 2: 4 July - 01 August 2022
- Survey 3: 5 – 27 September 2022
- Survey 4: 12 – 28 January 2023

Monitoring was conducted in the following manner:

- Two drive transects were identified totalling 19.5km and 20.4km respectively on the development site, and one drive transect in the control site with a total length of 14.6km.
- One or two monitors travelling slowly (± 10km/h) in a vehicle recorded all birds on both sides of the transect. The observer(s) stopped at regular intervals (every 500m) to scan the environment with binoculars. Drive transects were counted three times per sampling session.
- In addition, 14 walk transects of 1km each were identified at the development site, and two at the control site, and counted 4 times per sampling season. All birds were recorded during walk transects.
- The following variables were recorded:
  - Species
  - Number of birds
  - Date
  - Start time and end time
  - Estimated distance from transect

- Wind direction
- Wind strength (estimated Beaufort scale)
- Weather (sunny; cloudy; partly cloudy; rain; mist)
- Temperature (cold; mild; warm; hot)
- Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground) and
- Co-ordinates (priority species only)

The aim with drive transects is primarily to record large priority species (i.e. raptors and large terrestrial species), while walk transects are primarily aimed at recording small passerines. The objective of the transect monitoring is to gather baseline data on the use of the site by birds in order to measure potential displacement by the wind farm activities.

- Twenty-nine vantage points[4] (VPs) were identified from which the majority of the proposed development area can be observed, to record the flight altitude and patterns of priority species. One VP was also identified on the control site. The following variables were recorded for each flight:
  - Species
  - Number of birds
  - Date
  - Start time and end time
  - Wind direction
  - Wind strength (estimated Beaufort scale 1-7)
  - Weather (sunny; cloudy; partly cloudy; rain; mist)
  - Temperature (cold; mild; warm; hot)
  - Flight altitude (high i.e. >300m; medium i.e. 30m – 300m; low i.e. <30m)
  - Flight mode (soar; flap; glide; kite; hover) and
  - Flight time (in 15 second-intervals).

The objective of vantage point counts is to measure the potential collision risk with the turbines.

Ten potential focal points (FP) of bird activity have been identified thus far. The focal points are as follows:

- FP 1 - Pan
- FP 2 - Southern Bald Ibis 1 - roost
- FP 3 - Southern Bald Ibis 2 - colony 2 (Kalkoenkrans)
- FP 4 - Grey Crowned Crane roost 1 and heronry
- FP 5 - Pan
- FP 6 - Secretarybird nest N1
- FP 7 - Secretarybird nest N2
- FP 8 - Secretarybird roost R1
- FP 9 - Secretarybird roost R2
- FP 10 – Grey Crowned Crane roost 2
- FP 11 – Southern Bald Ibis 3 – roost / colony
- FP 12 – Martial Eagle nest
- FP 13 – Southern Bald Ibis feeding area
- FP 14 -- Southern Bald Ibis feeding roost
- FP 15 - Southern Bald Ibis feeding roost
- FP 16 – Grey Crowned Crane roost

[4] The VPs 19, 20, 21 and 25 were only utilised for Surveys 1 and 2 after which they were dropped due to a change in the project site area. VP 29 was only utilised for Survey 4 when 24 hours was done when the project site was changed at the last minute. An additional 24 hours will be completed for the final analysis of the data.

- FP 17 – Secretarybird nest
- FP18 - Secretarybird nest
- FP 19 – White Stork roost
- FP 20 – Grey Crowned Crane roost
- FP 21 – Grey Crowned Crane roost
- FP 22 – Secretarybird nest

See Figure 1 for a map of the transects, vantage points and focal points used for the monitoring.

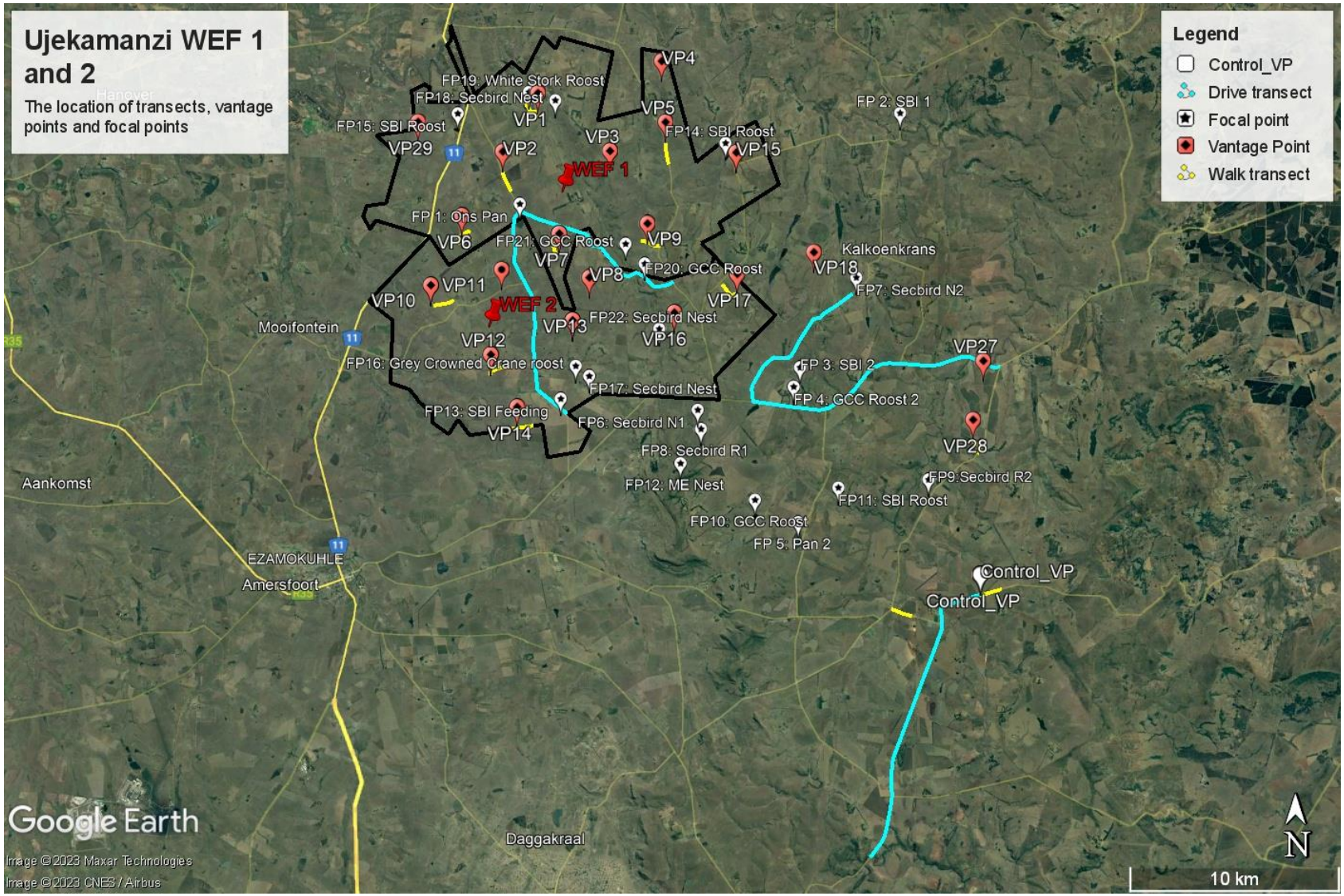


Figure 1: Area where monitoring was implemented, with position of VPs, focal points, drive transects, walk transects and Ujekamanzi WEF 1 and 2. The control area is located approximately 14km south-east of the Ujekamanzi WEF 2 project site.

APPENDIX 4: BIRD HABITAT

Figure 1: Natural grassland in PAOI.

Figure 2: Drainage line and wetland in the PAOI.

Figure 3: Farm dam in Broader Area. Similar dams are present in the PAOI.

Figure 4: Agriculture – field with Blue Cranes. Similar fields are present in the PAOI.

Figure 5: Low cliffs and rocky ridges in the Broader Area. Similar features are present in the PAOI.

Figure 6: Alien trees in PAOI.

APPENDIX 5: SPECIES LIST FOR THE BROADER AREA

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status
African Black Duck	*Anas sparsa*	12.26	0.00	-	-
African Black Swift	*Apus barbatus*	1.92	1.22	-	-
African Darter	*Anhinga rufa*	23.75	2.63	-	-
African Fish Eagle	*Haliaeetus vocifer*	11.88	0.00	-	-
African Grass Owl	*Tyto capensis*	0.00	0.00	-	VU
African Harrier-Hawk	*Polyboroides typus*	7.66	10.53	-	-
African Hoopoe	*Upupa africana*	4.60	31.58	-	-
African Jacana	*Actophilornis africanus*	0.38	2.63	-	-
African Marsh Harrier	*Circus ranivorus*	1.53	2.63	-	EN
African Olive Pigeon	*Columba arquatrix*	1.15	7.89	-	-
African Palm Swift	*Cypsiurus parvus*	0.38	0.00	-	-
African Paradise Flycatcher	*Terpsiphone viridis*	4.98	2.63	-	-
African Pipit	*Anthus cinnamomeus*	79.31	5.26	-	-
African Rail	*Rallus caerulescens*	6.51	0.00	-	-
African Reed Warbler	*Acrocephalus baeticatus*	1.53	0.91	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	58.24	5.26	-	-
African Snipe	*Gallinago nigripennis*	13.79	0.00	-	-
African Spoonbill	*Platalea alba*	26.82	0.00	-	-
African Stonechat	*Saxicola torquatus*	93.10	0.00	-	-
African Swamphen	*Porphyrio madagascariensis*	3.07	0.30	-	-
African Wattled Lapwing	*Vanellus senegallus*	26.05	0.00	-	-
African Yellow Warbler	*Iduna natalensis*	2.68	28.27	-	-
Alpine Swift	*Tachymarptis melba*	1.15	0.30	-	-
Amethyst Sunbird	*Chalcomitra amethystina*	1.92	5.78	-	-
Amur Falcon	*Falco amurensis*	21.84	13.16	-	-
Ant-eating Chat	*Myrmecocichla formicivora*	86.97	0.00	-	-
Banded Martin	*Riparia cincta*	34.48	0.00	-	-
Barn Swallow	*Hirundo rustica*	32.18	0.30	-	-
Bar-throated Apalis	*Apalis thoracica*	3.45	0.00	-	-
Black Crake	*Zapornia flavirostra*	6.51	0.00	-	-
Black Harrier	*Circus maurus*	0.38	0.00	EN	EN
Black Heron	*Egretta ardesiaca*	0.00	0.00	-	-
Black Saw-wing	*Psalidoprocne pristoptera*	0.38	0.00	-	-
Black Sparrowhawk	*Accipiter melanoleucus*	15.33	0.00	-	-
Black-bellied Bustard	*Lissotis melanogaster*	0.38	36.84	-	-
Black-chested Prinia	*Prinia flavicans*	6.51	0.00	-	-
Black-chested Snake Eagle	*Circaetus pectoralis*	1.53	2.63	-	-

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status
Black-collared Barbet	*Lybius torquatus*	13.41	13.16	-	-
Black-crowned Night Heron	*Nycticorax nycticorax*	0.38	2.63	-	-
Black-headed Heron	*Ardea melanocephala*	57.85	0.00	-	-
Black-headed Oriole	*Oriolus larvatus*	5.75	2.63	-	-
Black-necked Grebe	*Podiceps nigricollis*	3.83	0.00	-	-
Black-rumped Buttonquail	*Turnix nanus*	1.15	18.42	-	EN
Blacksmith Lapwing	*Vanellus armatus*	57.09	13.16	-	-
Black-throated Canary	*Crithagra atrogularis*	50.96	7.89	-	-
Black-winged Kite	*Elanus caeruleus*	63.22	10.53	-	-
Black-winged Lapwing	*Vanellus melanopterus*	18.01	13.16	-	-
Black-winged Pratincole	*Glareola nordmanni*	2.30	0.00	NT	NT
Black-winged Stilt	*Himantopus himantopus*	6.90	0.00	-	-
Blue Crane	*Grus paradisea*	26.82	5.26	VU	NT
Blue Korhaan	*Eupodotis caerulescens*	12.64	15.79	NT	LC
Blue-billed Teal	*Spatula hottentota*	1.15	3.95	-	-
Bokmakierie	*Telophorus zeylonus*	50.96	28.95	-	-
Botha's Lark	*Spizocorys fringillaris*	0.77	0.00	EN	EN
Brown Snake Eagle	*Circaetus cinereus*	0.38	5.26	-	-
Brown-hooded Kingfisher	*Halcyon albiventris*	0.00	0.00	-	-
Brown-throated Martin	*Riparia paludicola*	44.44	0.00	-	-
Buff-streaked Chat	*Campicoloides bifasciatus*	5.75	7.89	-	-
Buffy Pipit	*Anthus vaalensis*	0.00	0.00	-	-
Cape Bunting	*Emberiza capensis*	10.73	13.16	-	-
Cape Canary	*Serinus canicollis*	73.18	2.63	-	-
Cape Crow	*Corvus capensis*	55.56	2.63	-	-
Cape Grassbird	*Sphenoeacus afer*	18.39	2.63	-	-
Cape Longclaw	*Macronyx capensis*	89.66	0.00	-	-
Cape Robin-Chat	*Cossypha caffra*	37.93	0.00	-	-
Cape Rock Thrush	*Monticola rupestris*	0.38	0.30	-	-
Cape Shoveler	*Spatula smithii*	20.69	0.00	-	-
Cape Sparrow	*Passer melanurus*	76.25	0.00	-	-
Cape Starling	*Lamprotornis nitens*	9.96	0.00	-	-
Cape Teal	*Anas capensis*	0.38	0.61	-	-
Cape Turtle Dove	*Streptopelia capicola*	85.82	0.00	-	-
Cape Vulture	*Gyps coprotheres*	1.92	17.63	VU	EN
Cape Wagtail	*Motacilla capensis*	77.39	0.30	-	-
Cape Weaver	*Ploceus capensis*	34.48	0.00	-	-
Cape White-eye	*Zosterops virens*	21.07	3.04	-	-
Capped Wheatear	*Oenanthe pileata*	7.28	13.37	-	-
Cardinal Woodpecker	*Dendropicos fuscescens*	1.92	0.30	-	-

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status
Cinnamon-breasted Bunting	*Emberiza tahapisi*	2.68	0.00	-	-
Cloud Cisticola	*Cisticola textrix*	17.24	18.42	-	-
Common Buttonquail	*Turnix sylvaticus*	0.38	7.89	-	-
Common Buzzard	*Buteo buteo*	24.52	36.84	-	-
Common Greenshank	*Tringa nebularia*	4.98	7.89	-	-
Common House Martin	*Delichon urbicum*	4.60	0.00	-	-
Common Moorhen	*Gallinula chloropus*	26.82	2.63	-	-
Common Myna	*Acridotheres tristis*	9.20	0.00	-	-
Common Ostrich	*Struthio camelus*	1.92	10.53	-	-
Common Quail	*Coturnix coturnix*	38.31	0.00	-	-
Common Sandpiper	*Actitis hypoleucos*	2.30	0.00	-	-
Common Swift	*Apus apus*	0.00	27.96	-	-
Common Waxbill	*Estrilda astrild*	60.15	14.89	-	-
Crested Barbet	*Trachyphonus vaillantii*	1.92	10.53	-	-
Croaking Cisticola	*Cisticola natalensis*	0.38	26.32	-	-
Crowned Lapwing	*Vanellus coronatus*	57.85	10.53	-	-
Cuckoo Finch	*Anomalospiza imberbis*	1.15	5.26	-	-
Curlew Sandpiper	*Calidris ferruginea*	0.38	0.00	NT	LC
Dark-capped Bulbul	*Pycnonotus tricolor*	33.33	0.00	-	-
Denham's Bustard	*Neotis denhami*	5.36	2.63	NT	VU
Desert Cisticola	*Cisticola aridulus*	0.00	0.00	-	-
Diederik Cuckoo	*Chrysococcyx caprius*	18.39	0.00	-	-
Drakensberg Prinia	*Prinia hypoxantha*	12.26	0.00	-	-
Eastern Clapper Lark	*Mirafra fasciolata*	9.20	5.26	-	-
Eastern Long-billed Lark	*Certhilauda semitorquata*	4.98	0.00	-	-
Egyptian Goose	*Alopochen aegyptiaca*	85.82	2.63	-	-
European Bee-eater	*Merops apiaster*	0.00	31.58	-	-
Fairy Flycatcher	*Stenostira scita*	0.38	10.53	-	-
Fan-tailed Widowbird	*Euplectes axillaris*	30.27	3.04	-	-
Fiery-necked Nightjar	*Caprimulgus pectoralis*	0.38	0.00	-	-
Fiscal Flycatcher	*Melaenornis silens*	8.05	0.00	-	-
Fork-tailed Drongo	*Dicrurus adsimilis*	9.96	21.05	-	-
Fulvous Whistling Duck	*Dendrocygna bicolor*	0.77	0.00	-	-
Giant Kingfisher	*Megaceryle maxima*	6.90	2.63	-	-
Glossy Ibis	*Plegadis falcinellus*	8.43	0.00	-	-
Golden-breasted Bunting	*Emberiza flaviventris*	2.30	13.16	-	-
Golden-tailed Woodpecker	*Campethera abingoni*	0.00	0.00	-	-
Goliath Heron	*Ardea goliath*	4.21	0.00	-	-
Great Crested Grebe	*Podiceps cristatus*	4.98	0.00	-	-
Great Egret	*Ardea alba*	6.13	0.00	-	-

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status
Great Reed Warbler	*Acrocephalus arundinaceus*	0.77	0.91	-	-
Greater Flamingo	*Phoenicopterus roseus*	2.30	23.68	-	NT
Greater Honeyguide	*Indicator indicator*	0.38	0.00	-	-
Greater Kestrel	*Falco rupicoloides*	0.77	7.89	-	-
Greater Striped Swallow	*Cecropis cucullata*	48.28	9.73	-	-
Green Wood Hoopoe	*Phoeniculus purpureus*	2.30	1.52	-	-
Grey Crowned Crane	*Balearica regulorum*	17.62	0.00	EN	EN
Grey Heron	*Ardea cinerea*	32.18	36.84	-	-
Grey-headed Gull	*Chroicocephalus cirrocephalus*	0.77	36.84	-	-
Grey-winged Francolin	*Scleroptila afra*	39.46	21.05	-	-
Ground Woodpecker	*Geocolaptes olivaceus*	0.77	0.00	NT	LC
Groundscraper Thrush	*Turdus litsitsirupa*	0.00	0.00	-	-
Hadada Ibis	*Bostrychia hagedash*	86.97	5.26	-	-
Hamerkop	*Scopus umbretta*	18.01	2.63	-	-
Helmeted Guineafowl	*Numida meleagris*	50.57	0.00	-	-
Horus Swift	*Apus horus*	1.53	1.22	-	-
House Sparrow	*Passer domesticus*	22.61	0.00	-	-
Intermediate Egret	*Ardea intermedia*	9.20	21.05	-	-
Jackal Buzzard	*Buteo rufofuscus*	26.05	0.00	-	-
Karoo Thrush	*Turdus smithi*	3.45	0.30	-	-
Kittlitz's Plover	*Charadrius pecuarius*	5.75	0.00	-	-
Klaas's Cuckoo	*Chrysococcyx klaas*	0.00	13.16	-	-
Knob-billed Duck	*Sarkidiornis melanotos*	0.77	2.63	-	-
Kurrichane Thrush	*Turdus libonyana*	2.68	10.33	-	-
Lanner Falcon	*Falco biarmicus*	16.09	2.63	-	VU
Laughing Dove	*Spilopelia senegalensis*	27.20	0.00	-	-
Lazy Cisticola	*Cisticola aberrans*	3.07	5.26	-	-
Lesser Flamingo	*Phoeniconaias minor*	0.38	2.63	NT	NT
Lesser Grey Shrike	*Lanius minor*	0.38	0.00	-	-
Lesser Honeyguide	*Indicator minor*	0.77	0.00	-	-
Lesser Kestrel	*Falco naumanni*	0.00	0.00	-	-
Lesser Moorhen	*Paragallinula angulata*	0.00	21.05	-	-
Lesser Striped Swallow	*Cecropis abyssinica*	0.38	0.61	-	-
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	8.81	5.47	-	-
Levaillant's Cisticola	*Cisticola tinniens*	70.50	0.00	-	-
Lilac-breasted Roller	*Coracias caudatus*	0.00	0.00	-	-
Little Egret	*Egretta garzetta*	1.15	0.00	-	-
Little Grebe	*Tachybaptus ruficollis*	46.36	0.00	-	-
Little Rush Warbler	*Bradypterus baboecala*	4.60	0.00	-	-

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status
Little Stint	*Calidris minuta*	2.30	0.00	-	-
Little Swift	*Apus affinis*	12.64	6.69	-	-
Long-billed Pipit	*Anthus similis*	0.38	2.63	-	-
Long-crested Eagle	*Lophaetus occipitalis*	2.68	10.53	-	-
Long-tailed Widowbird	*Euplectes progne*	86.21	1.22	-	-
Maccoa Duck	*Oxyura maccoa*	6.13	5.26	EN	NT
Malachite Kingfisher	*Corythornis cristatus*	10.34	10.53	-	-
Malachite Sunbird	*Nectarinia famosa*	8.81	2.74	-	-
Marsh Owl	*Asio capensis*	9.20	13.16	-	-
Marsh Sandpiper	*Tringa stagnatilis*	0.77	0.00	-	-
Martial Eagle	*Polemaetus bellicosus*	3.45	5.26	EN	EN
Montagu's Harrier	*Circus pygargus*	1.53	7.89	-	-
Mountain Wheatear	*Myrmecocichla monticola*	10.34	11.85	-	-
Namaqua Dove	*Oena capensis*	2.30	2.63	-	-
Neddicky	*Cisticola fulvicapilla*	2.30	0.00	-	-
Nicholson's Pipit	*Anthus nicholsoni*	1.53	0.00	-	-
Olive Thrush	*Turdus olivaceus*	0.38	3.95	-	-
Olive Woodpecker	*Dendropicos griseocephalus*	2.30	4.26	-	-
Orange-breasted Waxbill	*Amandava subflava*	9.96	4.56	-	-
Pale-crowned Cisticola	*Cisticola cinnamomeus*	20.31	0.00	-	-
Pallid Harrier	*Circus macrourus*	0.00	0.00	NT	NT
Pied Avocet	*Recurvirostra avosetta*	1.53	0.00	-	-
Pied Crow	*Corvus albus*	6.90	2.63	-	-
Pied Kingfisher	*Ceryle rudis*	12.64	0.00	-	-
Pied Starling	*Lamprotornis bicolor*	54.41	0.00	-	-
Pink-billed Lark	*Spizocorys conirostris*	1.53	7.89	-	-
Pin-tailed Whydah	*Vidua macroura*	50.57	0.00	-	-
Plain-backed Pipit	*Anthus leucophrys*	1.15	0.00	-	-
Purple Heron	*Ardea purpurea*	6.51	2.63	-	-
Quailfinch	*Ortygospiza atricollis*	53.64	2.63	-	-
Red-backed Shrike	*Lanius collurio*	0.38	0.00	-	-
Red-billed Quelea	*Quelea quelea*	55.17	0.00	-	-
Red-billed Teal	*Anas erythrorhyncha*	22.99	0.00	-	-
Red-capped Lark	*Calandrella cinerea*	76.25	2.63	-	-
Red-chested Cuckoo	*Cuculus solitarius*	0.38	0.00	-	-
Red-chested Flufftail	*Sarothrura rufa*	1.15	2.63	-	-
Red-collared Widowbird	*Euplectes ardens*	6.51	16.72	-	-
Red-eyed Dove	*Streptopelia semitorquata*	58.24	36.84	-	-
Red-faced Mousebird	*Urocolius indicus*	1.92	0.00	-	-
Red-footed Falcon	*Falco vespertinus*	0.00	0.00	VU	NT

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status
Red-headed Finch	*Amadina erythrocephala*	0.77	15.79	-	-
Red-knobbed Coot	*Fulica cristata*	71.65	10.53	-	-
Red-throated Wryneck	*Jynx ruficollis*	23.75	20.67	-	-
Red-winged Francolin	*Scleroptila levaillantii*	24.14	7.89	-	-
Red-winged Starling	*Onychognathus morio*	3.45	0.00	-	-
Reed Cormorant	*Microcarbo africanus*	63.60	0.00	-	-
Rock Dove	*Columba livia*	6.51	0.00	-	-
Rock Kestrel	*Falco rupicolus*	7.66	23.68	-	-
Rock Martin	*Ptyonoprogne fuligula*	8.81	0.00	-	-
Rudd's Lark	*Heteromirafra ruddi*	0.00	5.26	EN	EN
Ruff	*Calidris pugnax*	5.36	0.00	-	-
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0.77	0.00	-	-
Rufous-naped Lark	*Mirafra africana*	1.15	2.63	-	-
Sand Martin	*Riparia riparia*	0.77	5.26	-	-
Secretarybird	*Sagittarius serpentarius*	29.50	2.63	EN	VU
Sentinel Rock Thrush	*Monticola explorator*	0.38	5.17	NT	LC
South African Cliff Swallow	*Petrochelidon spilodera*	42.15	6.99	-	-
South African Shelduck	*Tadorna cana*	49.04	0.00	-	-
Southern Bald Ibis	*Geronticus calvus*	43.68	0.00	VU	VU
Southern Black Flycatcher	*Melaenornis pammelaina*	0.38	2.63	-	-
Southern Boubou	*Laniarius ferrugineus*	8.81	2.63	-	-
Southern Fiscal	*Lanius collaris*	87.74	2.63	-	-
Southern Grey-headed Sparrow	*Passer diffusus*	62.45	0.00	-	-
Southern Masked Weaver	*Ploceus velatus*	84.29	9.12	-	-
Southern Pochard	*Netta erythrophthalma*	11.11	0.00	-	-
Southern Red Bishop	*Euplectes orix*	89.27	2.63	-	-
Speckled Mousebird	*Colius striatus*	14.94	2.63	-	-
Speckled Pigeon	*Columba guinea*	59.77	10.53	-	-
Spike-heeled Lark	*Chersomanes albofasciata*	61.69	2.63	-	-
Spotted Eagle-Owl	*Bubo africanus*	11.88	31.58	-	-
Spotted Flycatcher	*Muscicapa striata*	1.53	0.00	-	-
Spotted Thick-knee	*Burhinus capensis*	16.48	1.52	-	-
Spur-winged Goose	*Plectropterus gambensis*	54.79	15.79	-	-
Squacco Heron	*Ardeola ralloides*	1.15	31.58	-	-
Streaky-headed Seedeater	*Crithagra gularis*	9.96	0.00	-	-
Swainson's Spurfowl	*Pternistis swainsonii*	65.13	0.00	-	-
Tawny-flanked Prinia	*Prinia subflava*	0.00	0.00	-	-
Three-banded Plover	*Charadrius tricollaris*	41.76	0.00	-	-
Village Weaver	*Ploceus cucullatus*	2.30	10.33	-	-

Species name	Scientific name	SABAP 2 full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	SA status
Wailing Cisticola	*Cisticola lais*	3.45	5.26	-	-
Western Barn Owl	*Tyto alba*	6.90	5.26	-	-
Western Cattle Egret	*Bubulcus ibis*	27.97	23.68	-	-
Western Osprey	*Pandion haliaetus*	0.38	10.53	-	-
Whiskered Tern	*Chlidonias hybrida*	14.18	0.61	-	-
White Stork	*Ciconia ciconia*	11.88	0.00	-	-
White-backed Duck	*Thalassornis leuconotus*	8.81	0.00	-	-
White-bellied Bustard	*Eupodotis senegalensis*	11.49	23.68	-	VU
White-bellied Sunbird	*Cinnyris talatala*	0.00	0.00	-	-
White-breasted Cormorant	*Phalacrocorax lucidus*	26.82	15.79	-	-
White-browed Sparrow-Weaver	*Plocepasser mahali*	0.77	0.00	-	-
White-rumped Swift	*Apus caffer*	25.67	0.30	-	-
White-throated Swallow	*Hirundo albigularis*	39.85	0.30	-	-
White-winged Tern	*Chlidonias leucopterus*	1.53	0.30	-	-
White-winged Widowbird	*Euplectes albonotatus*	0.00	2.13	-	-
Willow Warbler	*Phylloscopus trochilus*	1.92	0.30	-	-
Wing-snapping Cisticola	*Cisticola ayresii*	43.30	0.00	-	-
Wood Sandpiper	*Tringa glareola*	6.51	0.00	-	-
Yellow Bishop	*Euplectes capensis*	2.30	0.00	-	-
Yellow Canary	*Crithagra flaviventris*	7.28	2.63	-	-
Yellow-billed Duck	*Anas undulata*	68.20	0.00	-	-
Yellow-billed Kite	*Milvus aegyptius*	1.92	0.00	-	-
Yellow-billed Stork	*Mycteria ibis*	0.00	0.00	-	EN
Yellow-breasted Pipit	*Anthus chloris*	1.53	0.00	VU	VU
Yellow-crowned Bishop	*Euplectes afer*	37.16	13.16	-	-
Yellow-fronted Canary	*Crithagra mozambica*	4.98	10.53	-	-
Yellow-throated Bush Sparrow	*Gymnoris superciliaris*	0.00	0.00	-	-
Zitting Cisticola	*Cisticola juncidis*	37.93	0.00	-	-

APPENDIX 6: ASSESSMENT CRITERIA

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

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

1.1 Determination of Significance of Impacts

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

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

1.2 Impact Rating System

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

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

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

1.2.1 Rating System Used to Classify Impacts

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

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.

3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		

1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.

4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE (S)

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.

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

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.

2 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

APPENDIX 7: SITE SENSITIVITY VERIFICATION

SITE SENSITIVITY VERIFICATION REPORT (IN TERMS OF THE PROCEDURES FOR THE ASSESSMENT AND MINIMUM CRITERIA FOR REPORTING ON IDENTIFIED ENVIRONMENTAL THEMES PUBLISHED IN GN 1150 ON 30 OCTOBER 2020)

1 INTRODUCTION

In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a reconnaissance visit has been undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

2 SITE SENSITIVITY VERIFICATION

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

- The **project area of impact (PAOI)** of the proposed MTS and LILO was defined as an area comprising a 2km buffer around the proposed infrastructure (including alternatives).
- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town (https://sabap2.birdmap.africa/), as a means to ascertain which species occur within the **Broader Area** i.e. within a block consisting of 20 pentads (see Table 1). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 261 full protocol lists (i.e. surveys lasting a minimum of two hours each) have been completed for this area. In addition, 329 ad hoc protocol lists (i.e. surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the WEF application site was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2018 beta2) from

the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).

- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2023) was used to view the broader area on a landscape level and to help identify sensitive bird habitat.
- Powerline sensitive species were defined as species which could potentially be impacted by power line collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Species classes which fall under these categories are raptors, large terrestrial birds, waterbirds and crows. Although not corresponding to the above description, certain threatened small terrestrial species were also included based on potential displacement by construction activities and habitat transformation.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the PAOI.
- The primary source of information on avifaunal diversity, abundance, and flight patterns at in the PAOI were the results of a pre-construction programme conducted over four seasons at the two proposed Ujekamanzi WEF application sites. The primary methods of data capturing are walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see Appendix 3 for a detailed explanation of the monitoring methods).

3 OUTCOME OF SITE VERIFICATION

3.1 Natural environment

The PAOI is situated in the Grassland Biome, in the Mesic Highveld Grassland Bioregion (Muchina & Rutherford 2006). Vegetation on site consists of a mix of of Amersfoort Highveld Clay Grassland and Wakkerstroom Montane Grassland. Amersfoort Highveld Clay Grassland is comprised of undulating grassland plains, with small, scattered patches of dolerite outcrops in areas, low hills, and pan depressions. The vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn (Mucina & Rutherford 2006). Wakkerstroom Montane Grassland is more prevalent in the east of the Project Site and to comprises predominantly short montane grasslands on the plateaus and the relatively flat areas. The topography in the project area is characterised by gentle undulating plains. A few drainage lines with associated wetlands and farm dams transect the PAOI. There are a few rocky ridges in some places.

Amersfoort, which is the closest town to the Project Site has a temperate climate. Summers are mild and winters are cold. The mean annual rainfall is around 811mm, and the mean annual temperature is around

20C°. **Figure 1** shows the mean monthly temperature and precipitation of Amersfoort (https://tcktcktck.org/south-africa/mpumalanga/amersfoort#).

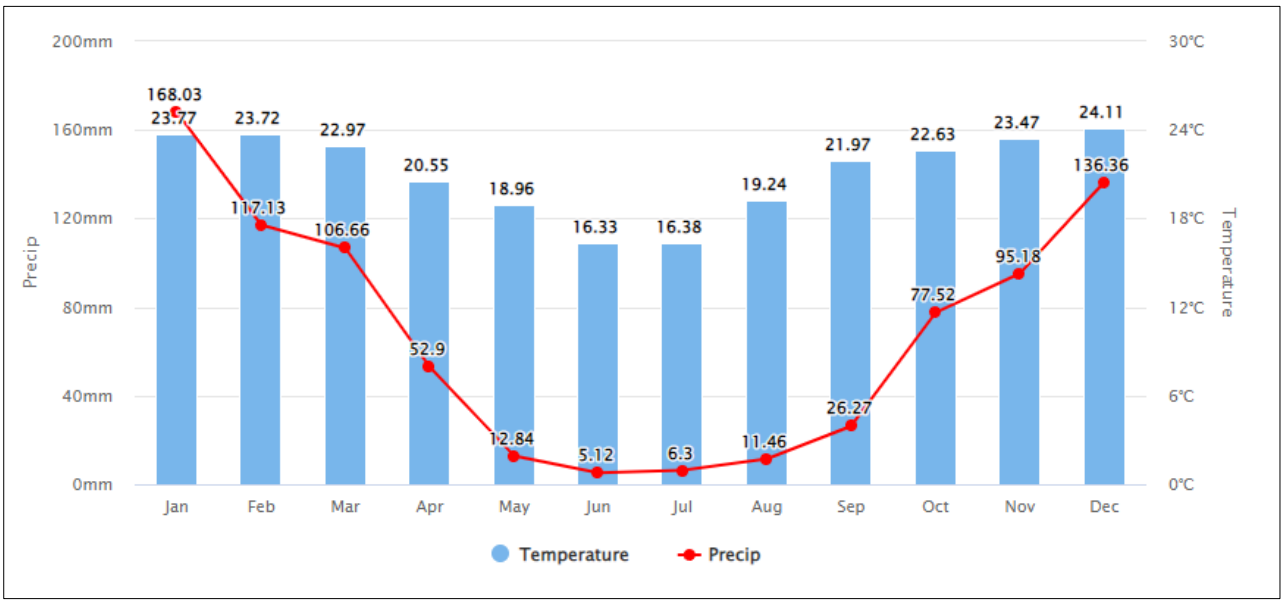


Figure 1: The mean monthly temperature and precipitation of Amersfoort.

3.2 Modified environment

The predominant land use for this area is livestock grazing with some crop farming, mostly maize, soya beans and pastures.

Whilst the distribution and abundance of the bird species in the broader area are mostly associated with natural vegetation, as this comprises the majority of the habitat, it is also necessary to examine the few external modifications to the environment that have relevance for birds.

The following bird habitat features were identified in the project area:

- *Grassland*

The majority of the habitat in the project area comprises natural grassland, which is mostly comprised of a short, closed grassland cover.

Figure 1: Grassland

The powerline sensitive species which could potentially use the grassland in the PAOI on a regular basis are the following:

African Grass Owl
Amur Falcon
Black-rumped Buttonquail
Black-winged Kite
Black-winged Lapwing
Black-winged Pratincole
Blue Crane
Blue Korhaan
Common Buzzard
Denham's Bustard
Greater Kestrel
Grey-winged Francolin
Jackal Buzzard
Lanner Falcon
Long-crested Eagle
Marsh Owl

Martial Eagle
Montagu's Harrier
Pallid Harrier
Red-footed Falcon
Secretarybird
Southern Bald Ibis
Spotted Eagle-Owl
White Stork
White-bellied Bustard
Yellow-breasted Pipit

The powerline sensitive species which could occasionally use the grassland in the PAOI are the following:

Black-bellied Bustard
Black-chested Snake Eagle
Botha's Lark
Brown Snake Eagle
Lesser Kestrel
Cape Vulture
Black Harrier
Rudd’s Lark

- *Drainage lines and wetlands*

There are several wetlands in the PAOI, most of which are associated with drainage lines. Wetlands are characterised by static or slow flowing water and are extensively covered by tall emergent wetland vegetation.

Figure 2: Drainage line and wetland

The powerline sensitive species which could potentially use the wetlands in the PAOI on a regular basis are the following:

African Fish Eagle
African Grass Owl
African Marsh Harrier
Black-winged Pratincole
Blue Crane
Grey Crowned Crane
Long-crested Eagle
Marsh Owl
Yellow-billed Stork

The powerline sensitive species which could occasionally use the wetlands in the PAOI are the following:

Black Harrier

- *Agricultural lands*

The PAOI contains a patchwork of agricultural fields. Some fields are lying fallow or are in the process of being re-vegetated by grass.

Figure 3: Agricultural fields in the broader area. The PAOI contains similar fields.

The powerline sensitive species which could potentially use the agricultural fields in the PAOI on a regular basis are the following:

Amur Falcon
Black-winged Kite
Black-winged Pratincole
Blue Crane
Common Buzzard
Grey Crowned Crane
Lanner Falcon
Red-footed Falcon
Southern Bald Ibis
White Stork

The powerline sensitive species which could occasionally use the agricultural lands in the PAOI are the following:

Lesser Kestrel

- *Alien trees*

The PAOI contains few trees. Most trees are alien species, particularly Eucalyptus, Australian Acacia (Wattle), and Salix (Willow) species. Trees are often planted as wind breaks next to agricultural lands and around homesteads. Some of the drainage lines also have trees growing in them.

Figure 4: Alien trees

The powerline sensitive species which could potentially use the alien trees in the PAOI on a regular basis are the following:

African Fish Eagle
African Harrier-Hawk
Amur Falcon
Black Sparrowhawk
Black-winged Kite
Common Buzzard
Greater Kestrel
Grey Crowned Crane
Jackal Buzzard

Lanner Falcon
Long-crested Eagle
Martial Eagle
Red-footed Falcon
Rufous-breasted Sparrowhawk
Secretarybird
Southern Bald Ibis
Spotted Eagle-Owl
White Stork

The powerline sensitive species which could occasionally use the alien trees in the PAOI are the following:

Black-chested Snake Eagle
Brown Snake Eagle
Cape Vulture
Lesser Kestrel
Western Osprey

- *Dams*

There are many ground dams of various sizes at the PAOI, located in drainage lines.

Figure 5: A typical farm dam in the broader area. Many similar dams are present in the PAOI.

The powerline sensitive species which could potentially use the dams in the PAOI on a regular basis are the following:

African Fish Eagle
Blue Crane
Southern Bald Ibis
Yellow-billed Stork

The powerline sensitive species which could occasionally use the dams and pans in the PAOI are the following:

Greater Flamingo
Lesser Flamingo
Western Osprey

- *High voltage lines*

The PAOI is transected by the two high voltage lines namely the Camden Incandu 1 and Camden Chivelston 2 400kV powerlines. Many birds use high voltage powerlines to roost on and occasionally even breed on them.

Figure 5: High voltage lines

The powerline sensitive species which could potentially use the high voltage lines in the PAOI on a regular basis are the following:

African Fish Eagle
Amur Falcon
Black-winged Kite
Common Buzzard
Greater Kestrel
Jackal Buzzard
Lanner Falcon
Long-crested Eagle
Martial Eagle
Red-footed Falcon
Southern Bald Ibis

The powerline sensitive species which could occasionally use the high voltage lines in the PAOI are the following:

Black-chested Snake Eagle
Brown Snake Eagle
Cape Vulture
Lesser Kestrel

- *Rocky ridges*

There are a number of exposed ridges in the PAOI. These features are used by a number of priority species.

The powerline sensitive species which could potentially use the rocky ridges in the PAOI on a regular basis are the following:

African Harrier-Hawk
Buff-streaked Chat
Common Buzzard
Greater Kestrel
Jackal Buzzard
Lanner Falcon
Southern Bald Ibis
Spotted Eagle-Owl

The powerline sensitive species which could occasionally use the rocky outcrops and low cliffs in the PAOI are the following:

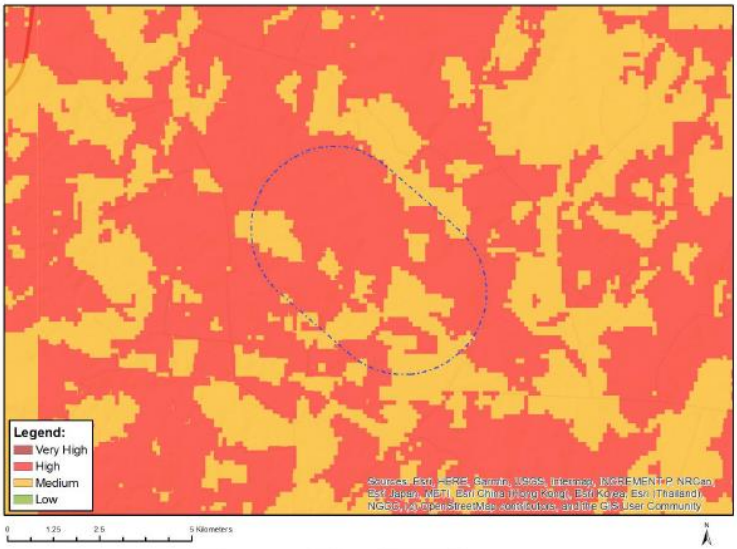
Cape Vulture

4 The DFFE National Screening Tool

According to the DFFE national screening tool, the habitat within the PAOI is classified as **Medium** and **High** sensitivity for birds according to the Animal Species Theme (Figure 6). The high sensitivity is linked to the potential occurrence of species of conservation concern (SCC) namely Grey Crowned Crane (Globally and Regionally Endangered), Southern Bald Ibis (Globally and Regionally Vulnerable). The medium sensitivity is linked to Grey Crowned Crane (Globally and Regionally Endangered), Southern Bald Ibis (Globally and Regionally Vulnerable), White-bellied Bustard (Regionally Vulnerable), Denham's Bustard (Globally near threatened and Regionally Vulnerable), Secretarybird (Globally Endangered and Regionally Vulnerable), Caspian Tern (Regionally Vulnerable) and African Grass Owl (Regionally Vulnerable).

The PAOI contains confirmed habitat for SCC as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the on-site surveys in the PAOI and immediate vicinity, including Grey Crowned Crane, Lanner Falcon, Denham's Bustard and Southern Bald Ibis. Based on these criteria, a PAOI classification of High sensitivity for avifauna is suggested.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Balearica regulorum
High	Aves-Eupodotis senegalensis
High	Aves-Geronticus calvus
Medium	Aves-Balearica regulorum
Medium	Aves-Eupodotis senegalensis
Medium	Aves-Neotis denhami
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Tyto capensis
Medium	Mammalia-Chrysospalax villosus
Medium	Mammalia-Ourebia ourebi ourebi

Figure 6: The classification of the PAOI for avifauna according to the terrestrial animal species theme in the DFFE National Screening Tool. The classification of High in the Terrestrial Animal Species Theme is linked to the potential presence of species of conservation concern (SCC), namely Grey Crowned Crane *Balearica regulorum* , White-bellied *Bustard Eupodotis senegalensis* and Southern Bald Ibis *Geronticus calvus*. The classification of Medium is linked to all of the above species and Caspian Tern *Hydroprogne caspia*

5 CONCLUSION

The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was

confirmed during the integrated pre-construction monitoring programme. Based on the field surveys, a classification of **High** sensitivity for avifauna in the screening tool is suggested.

APPENDIX 8: MODELLING METHODOLOGY

1 Data analysis

I scripted and used an R workflow to prepare, pre-process and analyse remote sensing data acquired by the Sentinel 2 satellite platform (Copernicus 2023). A classification modelling framework, which included the use of an ensemble model, was used to assess habitat suitability for target species. An ensemble modelling approach incorporates the use of more than one classification algorithm, drawing on the strengths of each and resisting any inherent bias that could be present in a single model. This general modelling process has been previously used in multiple peer-reviewed avian habitat suitability studies (Colyn et al. 2020a; Colyn et al. 2020b; Colyn et al. 2020c). We used a stepwise variable selection technique to conduct a data driven process of variable selection. Variable selection includes the removal of highly correlated variables, thereby preventing autocorrelation and improving the interpretation of final model results (Vignali et al. 2020).

The occurrence datasets represent all recent (post 2010) presence localities recorded for Rudd's Lark (*Heteromirafra ruddi*), Botha's Lark (*Spizocorys fringillaris*), and Yellow-breasted Pipit (*Anthus chloris*) recorded across the mesic highland grasslands that incorporate their distributions. The modelling workflow included data partitioning, model training, variable selection, model testing, model optimization through hyperparameter tuning and final model predictions. The occurrence data largely included presence data with absence data being limited geographically to certain areas of greater survey coverage. Subsequently, to supplement existing absence data additional pseudo-absence data was generated across the area of interest using the Dismo R package (Hijmans et al. 2022). We partitioned the overall occurrence and pseudo-absence dataset into training (80%) and testing (20%) subsets. Subsequently, we trained the primary models using the MaxEnt, Random Forest and ANN algorithms, followed by hyperparameter tuning and model optimization using the genetic algorithm (Vignali et al. 2020). Variable importance and partial dependence plots were generated for the final set of variables selected following initial model training and optimization. A final global model was trained using the entire training occurrence dataset for each species, and this model was then used to make predictions of habitat suitability within the local area of interest (i.e. proposed development footprint).

Model performance was assessed using the Receiver-operating characteristic (ROC) and associated area under the curve (AUC-ROC) value (Freeman and Moisen 2008). ROC plots compare the true positive and false positive rates and are commonly used as a metric of model performance in classification studies (Jimenez-Valverde 2012; Sofaer et al. 2018). I used the package PresenceAbsence (Freeman and Moisen 2008) to create ROC-AUC plots and generate threshold selection statistics. Threshold selection assesses the relationship between the predicted and observed values to generate thresholds that can be used to convert model outputs from a continuous format to a binary one.

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