UPGRADE ENERGY AFRICA (PTY) LTD
LEEUDORINGSTAD 132KV POWER LINE

Avifaunal Impact Assessment

DEA Reference: *(or applicable)*
Report Prepared by: Megan Diamond
Issue Date: 18 October 2022
Version No.: 00

UPGRADE ENERGY AFRICA (PTY) LTD

LEEUDORINGSTAD 132KV POWER LINE BASIC ASSESSMENT

AVIFAUNAL IMPACT ASSESSMENT

EXECUTIVE SUMMARY

Upgrade Energy Africa (Pty) Ltd (hereafter referred to as Upgrade Energy) proposes the construction and operation the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated loop-in loop-out (LILO) power lines and the Leeudoringstad 132kV power line required to evacuate the power generated at the Leeudoringstad Photovoltaic (PV) Solar Energy Facility (SEF) to the existing Eskom Vaal Reef Ten Substation. The Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated loop-in loop-out (LILO) power lines and the Leeudoringstad 132kV power line are routed across 19 land portions of the farms Leeubosch, Zwartlaagte, Matjiesspruit, Nevada, Klerksdrift, Yzerspruit and Wolvehuis, located between Leeudoringstad in the south-west and Orkney in the north-east, along the R502 road, The project falls within the Maquassi Hills Local Municipality within the Dr Kenneth Kaunda District Municipality in the North West Province. Two 132kV power line alternatives are proposed, located within a 300m corridor on either side of existing 132kV and 400kV power lines. The total length of proposed power line is approximately 42km in length. However, this report has assessed approximately 32km of the proposed power line alternatives, extending from the proposed switching station and substations to the south western boundary of land portion RE/21/114.

A screening report for the Leeudoringstad 132kV power line alignments was compiled by *SiVEST* on 22 September 2022. The majority of the proposed PAOI is considered to have a LOW-MEDIUM Animal Species sensitivity, with a very small section along the Vaal River categorised as HIGH sensitivity, based on the possible occurrence of Caspian Tern *Hydroprogne caspia*. A site sensitivity verification was conducted through the use of a desktop analysis and a field survey on 2 September 2022. Caspian Tern was not observed during the site verification survey and the proposed power line does not cross the Vaal River. The presence of suitable grassland habitat and large terrestrial power line priority species i.e. Northern Black Korhaan *Afrotis afraoides* confirm the sensitivity to be LOW-MEDIUM with regards to power line priority species.

The Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated loop-in loop-out (LILO) power lines and the Leeudoringstad 132kV power line alternatives are not located within an IBA. The Sandveld and Bloemhof Dam Nature Reserves IBA SA039 is the closest IBA and is located approximately 40km south-west of the proposed substations and power line alternatives. Despite the proximity (in bird terms) of the Sandveld and Bloemhof Dam Nature Reserves IBA to the PAOI and the reported occurrence of the aforementioned species (with the exception of Kori Bustard and Pink-backed Pelican) within the broader PAOI, the construction of the proposed substations and Leeudoringstad 132kV power line will not displace the species this IBA supports. The more common species associated with the IBA i.e. Barred Wren-Warbler, Kalahari Scrub Robin and Sociable Weaver may occur at the development site, however these species are relatively tolerant of disturbance and permanent

displacement from the area, as a result of the establishment of the substations and the Leeudoringstad 132kV power line, is unlikely.

A total of 259 bird species have been recorded within the Leeudoringstad 132kV power line project PAOI pentads during the SABAP2 atlassing period to date. The presence of these species in the broader area provides an indication of the diversity of species that could potentially occur along the route alignment. Of the 259 species, six are regional Red List species (i.e. SCC). Relevant to this development, 64 species are classified as power line sensitive species. Of the power line sensitive species, nine are likely to occur regularly at the substation locations and along the power line alignment, 25 are largely comprised of waterbirds and raptors that may traverse across the PAOI and the remaining 30 are likely to occur sporadically. It is important to note that the SCC have been recorded in very low numbers with less than five individual birds for each species being recorded over the fourteen-year survey period. No SCC species were observed during the field survey.

A spring survey was conducted on 2 September 2022, with a focused effort on the switching station, substation locations and the areas through which the proposed power line alternative and LILO power line alignments traverse and the broader PAOI. In order to describe the avifaunal community present, a concerted effort was made to sample the avifauna in all of the primary habitats that were available within the PAOI. All species encountered (observed and heard) during the site survey were noted. The site visit produced a combined list of 52 species. The majority of observations were of passerine species that are common to this area. Each of these species has the potential to be displaced by the construction of The Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated loop-in loop-out (LILO) power lines and the Leeudoringstad 132kV power line as a result of habitat transformation and/or disturbance. However, these species have persisted despite existing disturbance within the PAOI. This resilience, coupled with the fact that similar habitat is available throughout the broader area, means that the displacement impact will not be of regional or national significance.

Vegetation is one of the primary factors determining bird species distribution and abundance in an area. It is widely accepted within ornithological circles that vegetation structure is more important in determining which bird species will occur there. Whilst much of the distribution and abundance of bird species can be attributed to the broad vegetation types present in an area, it is the smaller spatial scale habitats (micro habitats) that support the requirements of a particular bird species that need to be examined in greater detail. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food availability, and various anthropogenic factors all of which will either attract or deter birds and are critically important in mapping the site in terms of avifaunal sensitivity and ultimately informing mitigation requirements. Assessment of the PAOI revealed three broadly described avifaunal micro habitats i.e. grassland, surface waterbodies, cultivated lands and exotic tree stands.

One of the main objectives of this assessment is to evaluate the identified feasible 132kV power line alternatives and nominate a preferred alternative for development. The alternative alignments that have been delineated for proposed Leeudoringstad 132kV occur within the same pentad. They are comprised of identical vegetation and micro habitats. Both alternatives are therefore likely to be identical in terms of species diversity and density. With this in mind, the selection of a preferred power line alternative is based on the proximity of the existing road and power line infrastructure within the PAOI to the proposed 132kV power line. Alternative 1 is considered to preferred alternative from an avifaunal perspective.

The habitat within which the PAOI is located is low to moderately sensitive from a potential bird impact perspective. In recent years, anthropogenic impacts, mostly in the form of urbanisation, agricultural and pastoral activities have largely transformed the landscape resulting in a negative impact on avifaunal diversity and abundance with the PAOI. The construction of the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated loop-in loop-out (LILO) power lines and the Leeudoringstad 132kV power line will result in impacts of MEDIUM-LOW significance to birds occurring in the vicinity of the new infrastructure, which can be reduced through the application of mitigation measures to LOW-NEGLIGIBLE levels. It is anticipated that the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated loop-in loop-out (LILO) power lines and the Leeudoringstad 132kV power line can be constructed and operated with acceptable levels of impact on the resident avifauna, subject to the following recommendations:

- Construction activities (i.e. all staff, vehicle and machinery) should be restricted to the immediate footprint of the infrastructure. The recommendations of the vegetation study must be strictly implemented.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifaunal species.
- Maximum use should be made of existing roads and the construction of new roads must be kept to a minimum.
- The 132kV power line must be constructed using a bird friendly structure (i.e. DT 7641/7649).
- Additional mitigation in the form of insulating sleeves on *jumpers* present on strain poles and terminal poles is also required, alternatively all jumpers must be suspended below the crossarms.
- Conduct a pre-construction inspection (avifaunal walk-through) of the final power line alignment, prior to construction, to identify any species that may be breeding on the site or within the immediate surrounds and to ensure that any impacts likely to affect breeding species (if any) are adequately managed and to identify the exact sections of power line requiring collision mitigation. As a minimum sections of power line that traverse across or adjacent to rivers, drainage lines, dams and cultivated lands will require collision mitigation.
- Power line marking in the form of bird flight diverters must be installed on the full span length on the earthwires, according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.
- If collision or electrocution impacts are recorded once the LILO and 132kV power line is operational, it is recommended that a representative from the Eskom-Endangered Wildlife Trust Strategic Partnership investigate the mortalities and provide recommendations for site-specific mitigation to be applied reactively.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint (especially the removal of natural vegetation) and rehabilitation of disturbed areas is concerned.
- In addition to this, the normal suite of environmental good practices should be applied, such as ensuring strict control of staff, vehicles and machinery on site and limiting the creation of new roads as far as possible.

In accordance with the outcomes of the impact assessment detailed in Section 6, in conjunction with the baseline conditions as presented in Section 5 and the impact management measures in Section 6, the proposed The Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated loop-in loop-out (LILO) power lines and the Leeudoringstad 132kV power line are **not deemed to present unmitigable negative environmental impacts.** It is this specialist's opinion that the construction of the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated loop-in loop-out (LILO) power lines and the Leeudoringstad 132kV power line will result in acceptable levels of impact on the resident avifauna subject to the aforementioned mitigation and management measures.

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;	Section 1.3
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Specialist Declaration
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1 and 1.2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.4 and 1.5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.4 and 1.5
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.4
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 5.1 Section 7
g) an identification of any areas to be avoided, including buffers;	Not Applicable
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;	Not Applicable
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
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 5 Section 6

k) any mitigation measures for inclusion in the EMPr;	Section 6
l) any conditions for inclusion in the environmental authorisation;	Section 6
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 6
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 8 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.	Standard for the Development and Expansion of Power Lines and Substations within Identified Geographical Areas

Standard for the Development and Expansion of Power Lines and Substations within Identified Geographical Areas

APPENDIX A – ENVIRONMENTAL SPECIFICATIONS

A.5. Avifauna

9. During the planning phase:

a. A 2 km buffer either side of the centre line of the proposed route of the power line alignment falling within the preliminary corridor must be drawn for verification of avifaunal sensitivity.

b. The Avifauna specialist must:

i. Use the most recently obtainable and available information (spatial and otherwise) as well as the screening tool, professional knowledge of the EAP and the avifauna specialist to determine, on a desktop level, the habitat sensitivity for avifaunal species along the power line route and/or substation location. BirdLife South Africa, WWF, the Endangered Wildlife Trust and VULPRO, must be contacted for their input.
ii. The power line bird mortality incident database of the Endangered Wildlife Trust must be consulted to determine which of the species occurring in the broader study area are typically impacted upon by power lines (EWT unpublished data).
iii. Establish habitat and migratory routes and likely flight paths based on the most recently obtainable and available desktop data and site verification.
iv. The conservation status of all avifaunal species recorded by the most recent iteration of the SABAP in the broader study area must be determined as per the most recent iteration of the list of threatened species and the IUCN Red Data List of Birds.
v. Based on the information collected on birds typically impacted upon by power lines, identify the presence of threatened species which include, as a minimum, Cranes, Flamingos, Vultures, Kori Bustards, and Pelicans.
vi. Where high risk areas are identified these areas must be confirmed with EWT by using their risk assessment tool29.
vii. Where the risk assessment tool identifies that mitigation measures can be applied, apply these mitigation measures in consultation with EWT, BirdLife South Africa and the local conservation agency.
viii. Where no acceptable mitigation measures can be applied, re-routing options or engineering solution, for example routing under the risk area identified or increasing the height of the power line in order to avoid potential collision risk areas, must be applied. Where engineering options are considered these must be discussed with EWT, BirdLife South Africa and the local conservation agency.

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

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

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:				
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)		Percentage Procurement recognition	
Specialist name:				
Specialist Qualifications:				
Professional affiliation/registration:				
Physical address:				
Postal address:				
Postal code:		Cell:		
Telephone:		Fax:		
E-mail:				

2. DECLARATION BY THE SPECIALIST

I, _____, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Name of Company:

Date:

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Name of Company

Date

Signature of the Commissioner of Oaths

Date

UPGRADE ENERGY AFRICA (PTY) LTD

LEEUDORINGSTAD 132KV POWER LINE BASIC ASSESSMENT

AVIFAUNAL IMPACT ASSESSMENT

Contents

List of Tables

List of Figures

List of Appendices

UPGRADE ENERGY AFRICA (PTY) LTD

LEEUDORINGSTAD 132KV POWER LINE BASIC ASSESSMENT

AVIFAUNAL IMPACT ASSESSMENT

1. INTRODUCTION

Upgrade Energy Africa (Pty) Ltd (hereafter referred to as *Upgrade Energy*) proposes the construction and operation a Switching Station, adjacent to the existing Leeubosch Traction Substation, an Independent Power Producer (IPP) Substation, the Genesis Orkney Solar Plant Substation, its associated loop-in and loop-out (LILO) power lines and the Leeudoringstad 132kV power line required to evacuate the power generated at the Leeudoringstad Photovoltaic (PV) Solar Energy Facility (SEF) to the existing Eskom Vaal Reef Ten Substation (requiring an increase in footprint size to accommodate an additional feeder bay) (FIGURE 1).

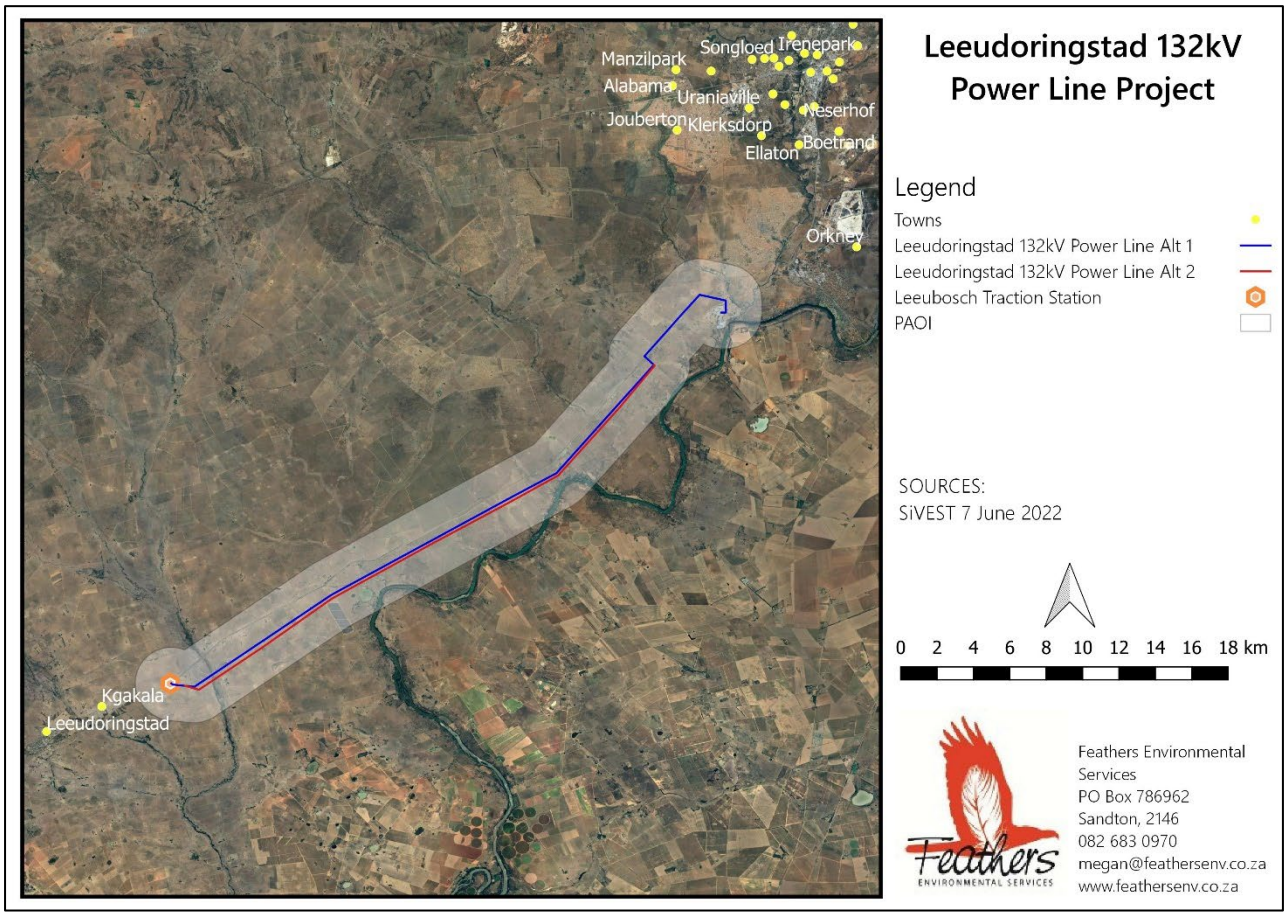

Figure 1 Regional map detailing the location of the proposed switching station, IPP substation, Orkney Solar Plant substation, LILO power lines, Leeudoringstad 132kV power line alternatives, located between Leeudoringstad and Orkney in the North West Province.

1.1 Scope and Objectives

Feathers Environmental Services CC (hereafter referred to as *Feathers*) was appointed by SiVEST SA (Pty) Ltd (hereafter referred to as *SiVEST*) to assess the proposed switching station, substations and 132kV power line and compile a specialist avifaunal assessment report, that will inform the Environmental Sensitivity Report required by the *Standard for the Development and Expansion of Power lines and Substations within Identified Geographical Areas* for the application of an Environmental Authorisation (EA) for the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated LILO power lines and Leeudoringstad 132kV power line. This report is based on a desktop review of the switching station, substation locations and the proposed power line alignments in addition to a field survey conducted over a one-day period, which uses a set methodology and various data sets to determine which avian species regularly occur within the area, the availability of bird micro habitats (i.e. avifaunal sensitive areas), the possible impacts of the substations and power line and their significance, in additional to the provision of recommendations for the mitigation of the anticipated impacts.

1.2 Terms of Reference

Feathers has conducted this avifaunal impact assessment according to the following terms of reference, in accordance with the *Standard for the Development and Expansion of Power lines and Substations within Identified Geographical Areas* and the minimum report requirements listed in the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species (Government Gazette No 43855, 30 October 2020):

* Conduct a site sensitivity verification through the use of a desk top analysis, using satellite imagery and other available and relevant information, in addition to an on-site inspection (FIGURE 2);
* Assess various avifaunal datasets, including but not limited to Important Bird Areas (IBAs) and describe the avifaunal communities (particularly with reference to Species of Conservation Concern (SCC) most likely to impacted on by the substations and 132kV power line;
* Identify and confirm avifaunal microhabitats within the switching station and substation footprints and along the 132kV power line alignments and assess these for their suitability to support SCC and non-SCC priority (power line-sensitive) species, in terms of breeding, roosting and foraging;
* Describe the avifaunal communities most likely to be impacted, based on primary occurrence data collected during the site survey;
* Provide a detailed description of the impacts associated with the construction and operation of the switching station, substations and 132kV power line;
* Assess the significance (rated according to a pre-determined set of criteria of the identified direct, indirect and cumulative impacts, during the construction and operation phases of the switching station, substations and132kV power line, based on data collected in-field;
* Consider the switching station and substation locations and power line route alternatives and advise possible changes to the alignment (if necessary);
* Recommend practical mitigation measures for the management of the identified impacts, at each stage of the development process, for inclusion in the draft Environmental Management Programme (EMPr);
* Propose a monitoring programme for the sensitive areas, species or receptors (if necessary); and
* Describe the gaps in baseline data and an indication of the confidence levels.

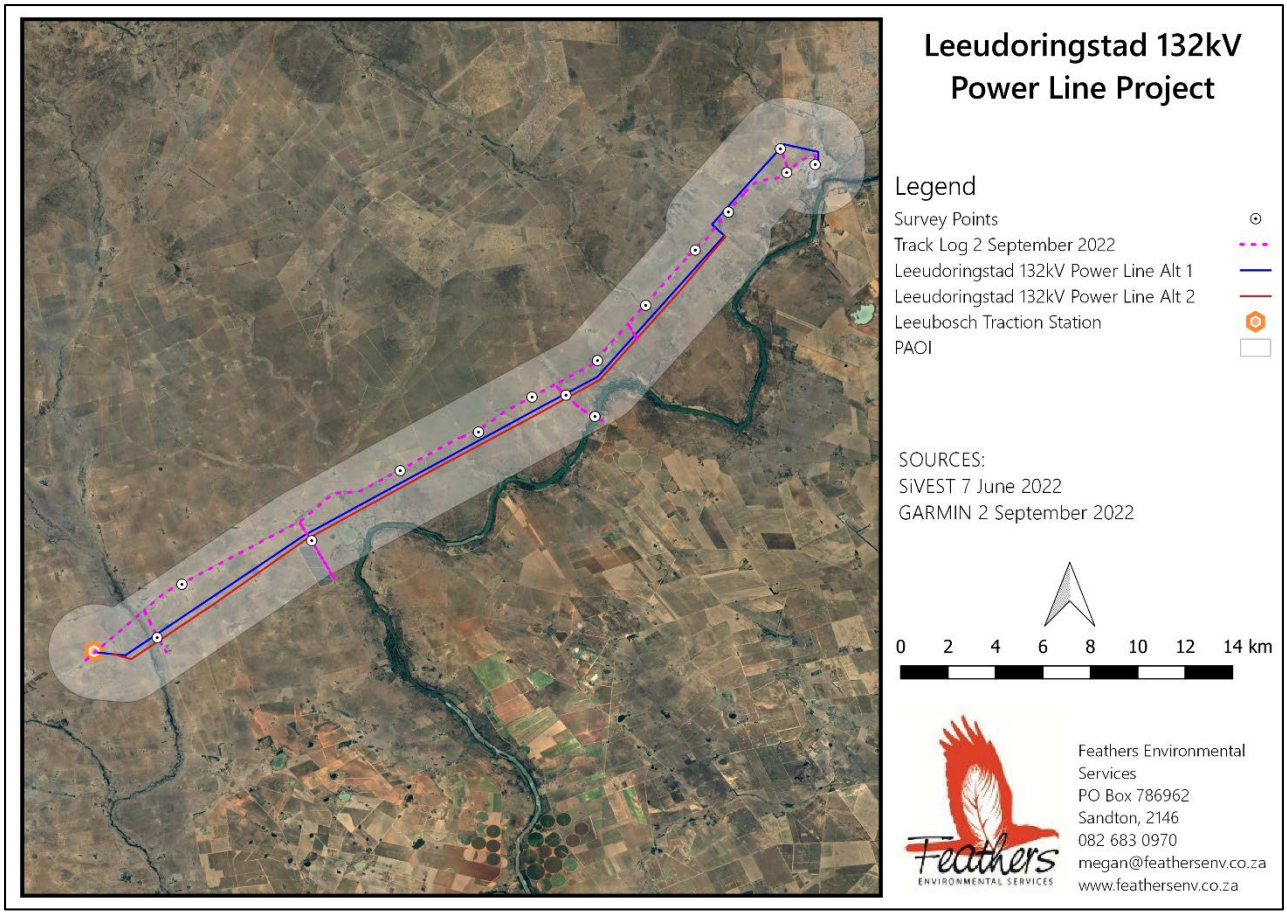

Figure 2: Regional map detailing the routes and habitats surveyed during the field assessment of the PAOI, conducted on 2 September 2022.

1.3 Specialist Credentials

Ms. Megan Diamond completed a Bachelor of Science degree in Environmental Management from the University of South Africa and has been involved in conservation for 20 years. She has 16 years' worth of experience in the field of bird interactions with electrical infrastructure and during this time has completed impact assessments for over 140 projects. During her tenure at the Endangered Wildlife Trust's Wildlife & Energy Programme and the Programme's primary project (i.e. the Eskom-EWT Strategic Partnership) from 2006 to 2013, Megan was responsible for assisting the energy industry and the national utility in minimising the negative impacts, associated with the construction and operation of electrical infrastructure, on wildlife through the provision of strategic guidance, risk and impact assessments, training and research. Megan (SACNASP Environmental Science Registration number 300022/14) currently owns and manages *Feathers Environmental Services* and is tasked with providing guidance to industry through the development of best practice procedures and avifaunal specialist studies for various developments including renewable energy facilities, power lines, power stations and substation infrastructure in addition to railway infrastructure and residential properties within South Africa and elsewhere within Africa. Megan has attended and presented at several conferences and facilitated workshops, as a subject expert, since 2007. Megan has authored and co-authored several academic papers, research reports and energy industry related guidelines, including the *BirdLife South Africa/ Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa* and the *Avian Wind Farm Sensitivity*

Map for South Africa (2015), and played an instrumental role in facilitating the endorsement of these two products by the South African Wind Energy Association (SAWEA), IAIAsa (International Association for Impact Assessment South Africa) and Eskom. She chaired the Birds and Wind Energy Specialist Group in South Africa (2011/2012) and the IUCN/SSC Crane Specialist Group's Crane and Power line Network (2013-2015), a working group comprised of subject matter experts from across the world, working in partnership to share lessons, develop capacity, pool resources, and accelerate collective learning towards finding innovative solutions to mitigate this impact on threatened crane populations. She is currently a member of the IUCN Stork, Ibis and Spoonbill Specialist Group and the Eskom-EWT Strategic Partnership Ludwig's Bustard Working Group.

PERSONAL DETAILS

Date of Birth	7 December 1978
Driver's License	Code A and B
Home Language	English
Other Languages	Afrikaans

EDUCATION

BSc Environmental Management | University of South Africa (UNISA)
2002 – 2009

ACCREDITATION

South African Council for Natural Scientific Professions | Environmental Science
Registration Number: 300022/14

EXPERIENCE

CC Member & Avifaunal Specialist | Feathers Environmental Services
July 2013 – Present

- Perform specialist avifaunal assessment studies to minimise the impact of industrial infrastructure on birds and their habitats;
- Provide strategic guidance to industry through the development of best practice procedures and guidelines;
- Review and comment on methodologies, specialist studies and EIA reports for Renewable Energy projects;
- Provide input into renewable energy and power line developments elsewhere in Africa and internationally;
- Attendance of specialist integration meetings;
- Stakeholder liaison;
- Manage the collection and collation of relevant and complete desktop and/or field datasets;
- Manage pre- and post-construction avifaunal monitoring data collected at wind and solar energy facilities;
- Site assessments, either as part of the project team or independently; and
- Preparation of reports according to project deadlines, including the use of Geographic Information Systems (GIS) to portray data.

Wildlife & Energy Programme Manager | Endangered Wildlife Trust
October 2006 – June 2013

Programme management

- Annual review of the programme's conservation and research strategic objectives in accordance with the EWT's and programme's vision and mission
- Compile and manage programme budgets, monthly reports, work plans and strategy;
- Formulate, prioritise and approve relevant research and conservation projects;
- Ensure quality delivery of all projects and their outputs;
- Participate in international network liaison;
- Produce regular popular articles & media releases on programme projects and outputs;
- Establish and maintain a network with relevant national & international stakeholders;
- Deliver presentations at relevant meetings, functions, workshops & conferences on behalf of the programme; and
- Identify & establish partnerships to achieve conservation goals.

Eskom –EWT Strategic Partnership

- Effective and sustainable management of the strategic partnership against its goals;
- Manage staff in this division;
- Develop and maintain relationships with Eskom;
- Negotiate the terms of reference for the annual service level agreements between EWT and Eskom, to ensure the sustainability of the relationship;
- Compile annual report to Eskom Corporate Environment and Sustainability;
- Produce monthly reports to Eskom's regional grids on the status of incident follow-up;
- Attend applicable forums to interact with Eskom stakeholders;
- Participate in international network liaison;
- Maintain a network with all relevant local and regional level stakeholders through meetings, forums and workshops;
- Identify research needs relating to the management of wildlife interaction with power lines;
- Conduct research projects on wildlife and power line interaction and present the results at national and international conferences and workshops;
- Development and implementation of training for Eskom field services staff (at various levels) in the management of wildlife interactions; and
- Conduct special investigations on power lines relating to wildlife induced faulting.

Environmental Impact Assessment Division

- Ensure that this division operates effectively and efficiently at all times and manage staff in this division; and
- Conduct specialist avifaunal studies for new power lines developments including: tendering/quoting for the projects, conducting field work, preparing reports, presenting results & negotiating the acceptance of recommendations, final "walk through" as part of Environmental Management Plans; general project management, all liaison with clients, Eskom, authorities, Interested and Affected Parties etc.

Programme Administrator & Assistant Research Officer| TRAFFIC East/Southern Africa: South Africa
August 2002 – September 2006

- Providing administrative support to the Project Manager & National Representative
- Co-coordinating and reporting to the Project Steering Committee and the Donor (DANIDA) on a budget of R3,5 million.
- The completion of data-capture process for the CITES permit database as well as assisting with the transformation of the permit database from DBase into Microsoft Access format.
- Liaise directly with Government environmental departments, regarding permit collection and queries.
- Providing information relating to CITES permits wildlife trade to interested parties i.e. Government departments and Provincial Nature Conservation authorities.
- Assisting the National Representative and Programme Officers of TRAFFIC East/Southern Africa: South Africa with their research or other general work as directed.

CONFERENCE ATTENDANCE

- Society for Conservation Biology 21st Annual Meeting (1-5 July 2007)
- The 6th TAWIRI Scientific Conference (3 – 6 December 2007) **Presented a paper titled "Co-operative management of wildlife and power line conflicts: an African solution"**
- Pan-African Ornithological Congress (7-12 September 2008)
- International Conference on Overhead Lines, Design, Construction, Inspection & Maintenance, Fort Collins Colorado USA. (29 March – 1 April 2010) **Presented a paper titled "Bird's eye view: how birds see is key to avoiding power line collision"**
- Windaba 2011 – Implementing South African Wind Energy (27-29 September 2011)
- Pan African Vulture Summit (16-20 April 2012) **Presented a paper titled "Electrification in Africa – Are our vultures being strung along"**
- 4th Wind Power Africa Conference & Renewable Energy Exhibition (28-30 May 2012) **Presented a paper titled "Wind Energy in Africa – what does this really mean for our continent's birds"**
- 13th Pan-African Ornithological Congress (14-21 October 2012) **Presented a paper titled "Stringing South Africa's Terrestrial Birds Along - Monitoring of Bird Interactions with Power Line and Experimental Testing of Bird Collision Mitigation at the Karoo Long Term Monitoring Site"**
- AEWA Single Species Action-Planning Workshop for the Conservation of the Grey Crowned Crane (10-13 September 2013) **Presented and participated in the workshop as a subject expert (energy and bird interactions)**

AUTHORED & CO-AUTHORED PAPERS

Jenkins, A.R., Smallie, J. & **Diamond, M.** 2009. Balls, flashers, flappers and coils: South African perspectives on a global search for ways to prevent avian collisions with overhead lines. In: Harebottle, D.M., Craig, A.J.F.K., Anderson, M.D., Rakatomonana, H. & Muchai, M. (eds). Proceedings of the 12th Pan-African Ornithological Congress, 2008. Cape Town, Animal Demography Unit.

Smallie, J., **Diamond, M**. & Jenkins, A. 2009. Lighting up the African continent – what does it mean for our birds? pp. 38–43. In: Harebottle, D.M., Craig, A.J.F.K., Anderson, M.D., Rakotomanana, H. & Muchai. (eds). *Proceedings of the 12th Pan-African Ornithological Congress, 2008.* Cape Town, Animal Demography Unit.

Jenkins, A. R., Smallie, J.J and **Diamond, M.** 2010 Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conservation International, page1 of16.

Retief, E.F., **Diamond, M**., Anderson, M.D., Smit, H.A., Jenkins, A.R., Brooks, M. 2011. Avian Wind Farm Sensitivity Map for South Africa.

Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Harrison, J.A., **Diamond, M**. And Smit, H.A. 2012. BirdLife South Africa / Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa.

Jenkins, A.R., De Goede, K.H., Sebele, L. and **Diamond, M**. 2013. Brokering a settlement between eagles and
industry: sustainable management of large raptors nesting on power infrastructure. Bird Conservation International (2013) 23:232 – 246.

Diamond, M., Harris, J., Mirande, C. and Austin, J. 2014. People of a feather flock together: A global initiative to address crane and power line interactions. 13th North American Crane Workshop Summary. Lafayette, Louisiana.

Page-Nicholson, S., Tate, G., Hoogstad, C., Murison, M., **Diamond, M.**, Blofield, A., Pretorius, M., Michael, M.D. 2018. Mitigating the Impact of Large Mammals on Wooden Electrical Distribution Poles in the Kruger National Park, South Africa. African Journal of Wildlife Research.

Diamond, M. and Hoogstad, C. (in press) Collisions and habitat loss associated with utility lines and wind turbines. IUCN SSC Crane Specialist Group – Crane Conservation Strategy.

1.4 Assessment Methodology

The following methods were employed to compile this avifaunal impact assessment report:

- The focus of this assessment is primarily on the potential impacts of the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated LILO power lines and Leeudoringstad 132kV power line on priority species. Priority species are defined as those species which could potentially be impacted by displacement through habitat transformation and/or disturbance as well as collision and electrocution based on specific morphological and/or behavioural characteristics. These include both SCC as defined by the *Species Environmental Assessment Guideline: Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa (2020)* i.e. those species listed on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered, Vulnerable, Near Threatened and Data Deficient, as well as certain other impact substation and power line susceptible species.
- By virtue of their mobility, the identification of bird presence and abundance cannot be confined to the switching station and substation locations and the Leeudoringstad 132kV power line alignments,

therefore the Project Area of Influence (PAOI) is defined as a 2km zone around the proposed development area. Avifaunal sensitivity has been defined for this PAOI (FIGURE 1).

- The proposed Switching Station, IPP Substation, Genesis Orkney Substation, its associated LILO power lines and Leeudoringstad 132kV power line are located largely within eight South African Bird Atlas Project 2 (SABAP2) pentad grid cells, however a larger area is necessary to obtain a dataset that is large enough (encompassing **12** pentad grid cells) to ensure that reasonable conclusions about species diversity and densities, in a particular habitat type, can be drawn. A total of 162 full protocol lists and 63 ad hoc protocol lists have been completed. The SABAP2 data is regarded as a reliable reflection of the avifauna which could potentially occur in the PAOI. The relevant pentads within the study area include: 2710_2615; 2710_2620; 2705_2615; 2705_2620; 2705_2625; 2705_2630; 2700_2625; 2700_2630; 2700_2635; 2700_2640; 2655_2635 and 2655_2640 (FIGURE 3);
- Collected and examined various avifaunal data sets (detailed in section 1.5 below) at a desktop level to determine the presence of species, that may be vulnerable to the impacts associated with the construction and operation of the switching station, substations and 132kV power line;
- Suitable avifaunal habitats and potential sensitive areas along the alignment, where impacts are likely to occur, were identified using various Geographic Information System (GIS) layers and Google Earth imagery and confirmed based on personal observations made during the site visit on 2 September 2022 (APPENDIX 2);
- Primary avifaunal diversity and occurrence data collected by means of incidental counts during a single season, one-day site visit to the substation locations and Leeudoringstad 132kV power line alternatives, conducted on 2 September 2022. Data was collected to ground truth the information gleaned from secondary data sources and to collect primary bird occurrence data within the switchi9ng station and substation locations and along the power line alignment and the immediate surrounds (FIGURE 2);
- The potential impacts, associated with the construction and operation of the switching station. substations and Leeudoringstad 132kV power line along the proposed route alternatives on the avifaunal community and their significance were predicted and assessed according to quantitative criteria; and
- Practical recommendations for the management and mitigation of impacts, related to the construction and operation of the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated LILO power lines and Leeudoringstad 132kV power line are provided in Section 6 for inclusion in the draft EMPr.

1.5 Data Sources Used

The following data sources and reports were used in varying levels of detail for this study:

- Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020);
- Guidelines for the Implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for EIAs in South Africa produced by the South African National Biodiversity Institute on behalf of the Department of Environment, Forestry and Fisheries (2020) were consulted to determine the applicable protocol to be used;

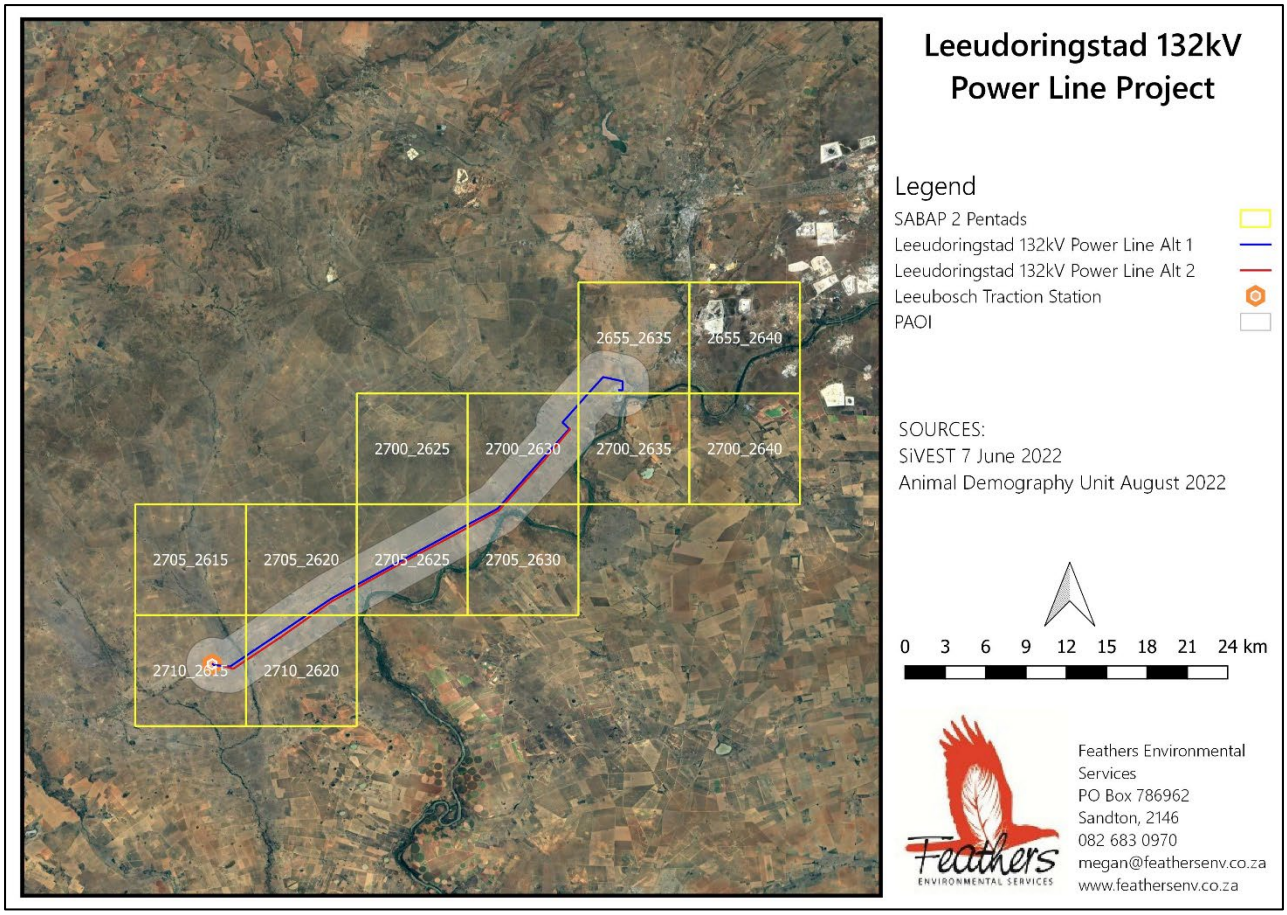

Figure 3: Location of the twelve South African Bird Atlas Project 2 (SABAP2) pentad grid cells that were considered for this assessment.

* The Standard for the Development and Expansion of Power lines and Substations within Identified Geographical Areas;
* Screening Reports for an Environmental Authorisation as required by the 2014 EIA Regulations - Proposed Site Environmental Sensitivity: Leeudoringstad Power Line, compiled by *SiVEST* on 22 September 2022;
* Bird distribution data of the South African Bird Atlas 2 (SABAP 2) (Animal Demography Unit, 30 August 2022);
* The Important Bird Areas (IBAs) report (Marnewick et al. 2015);
* Co-ordinated Waterbird Count Database (CWAC – Taylor et al. 1999);
* Coordinated Avifaunal Roadcount project database (CAR – Young et al, 2003);
* The global and regional conservation status and endemism information of all bird species (Taylor et al. 2015) and the latest (2022-1) IUCN Red List of Threatened Species (http://www.iucnredlist.org);
* Vulture movement, roost and colony data, received from Vulpro May, 2021;
* Vulture restaurant location data, received from Vulpro May, 2021;
* The power line - bird mortality incident database of the Eskom/Endangered Wildlife Trust Strategic Partnership (1996 to 2013) was consulted to determine which of the species occurring in the PAOI are typically impacted upon by power lines, and the extent of the impact;
* The latest vegetation classification described in the Vegetation Map of South Africa (South African National Biodiversity Institute, 2012 and Mucina & Rutherford, 2006);

* High-resolution Google Earth ©2022 imagery was used to examine the microhabitats within the PAOI;
* KMZ. shapefiles detailing the location of the switching station, IPP Substation, Genesis Orkney Substation, its associated LILO power lines and 132kV power line route, provided by *SiVEST* on 2 November 2022; and
* A one-day field survey of the proposed Switching Station, IPP Substation, Orkney Genesis Solar Plant Substation, its associated LILO power lines and the proposed Leeudoringstad 132kV power line alternatives and PAOI conducted on 2 September 2022 (spring survey) to form a first-hand impression of avifaunal species presence and micro-habitat occurring within the larger PAOI surrounding the proposed switching station, substations, LILO power lines and Leeudoringstad 132kV power line alternatives (FIGURE 3). This information, together with the SABAP2 data was used to compile a comprehensive list of species that could occur in the PAOI.

2. ASSUMPTIONS AND LIMITATIONS

The avifaunal specialist assumed that the sources of information used for this assessment are reliable. However, it must be noted that there are limiting factors and these may potentially detract from the accuracy of the predicted results.

* The report is the result of a short-term study and is based on a one-day site survey of the PAOI. No long-term, seasonal monitoring was conducted by the avifaunal specialist**.** This assessment relies upon secondary data sources with regards to bird occurrence and abundance such as the SABAP2 and IBA projects. These comprehensive datasets provide a valuable baseline against which any changes in species presence, abundance, and distribution can be monitored. However, primary information on bird habitat and avifaunal species occurrence collected during the site visit and together with professional judgement, based on extensive field experience since 2006, was used directly in determining which species of conservation importance are likely to occur within suitable avifaunal habitat types within the PAOI. Based on these findings, the specialist was able to identify and assess the anticipated impacts and provide recommendations for mitigation;
* The site survey of the Switching Station, IPP Substation, Orkney Genesis Solar Plant Substation, its associated LILO power lines and the proposed Leeudoringstad 132kV power line alternatives and the resultant observations were made in a single season (austral spring), during which time various species may not have been present in the PAOI and therefore may not be a true indication of all bird species potentially present in the area;
* The focus of this assessment is primarily on the potential impacts on regional SCC and non-SCC power line sensitive species i.e., species that are vulnerable to the displacement, collision and electrocution impacts associated with the construction and operation of the switching station, substations, LILO power lines and Leeudoringstad 132kV power line; and
* Predictions in this study are based on experience of these and similar species in different parts of South Africa, through the authors' experience working in the avifaunal specialist field since 2006. However, bird behaviour can't be reduced to formulas that will hold true under all circumstances. It must also be noted that, it is often not possible to entirely eliminate the risk of the disturbance and displacement impacts associated with the construction and operational activities. Our best possible efforts can probably not ensure zero impact on birds. Assessments such as this attempt to minimise

the risk as far as possible, and although the displacement impacts, associated with the construction and operation of the switching station, substations, LILO power lines and Leeudoringstad 132kV power line, will be unavoidable, they are likely to be temporary and of low significance.

The above limitations need to be stated as part of this assessment so that the reader fully understands the complexities. **However**, **they do not detract from the confidence that this author has in the findings of this impact assessment report and subsequent recommendations for this project**.

3. TECHNICAL DESCRIPTION

3.1 Project Location

The proposed Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated LILO power lines and the associated Leeudoringstad 132kV power line alternatives are routed across 19 land portions of the farms Leeubosch, Zwartlaagte, Matjiesspruit, Nevada, Klerksdrift, Yzerspruit and Wolvehuis, located between Leeudoringstad in the south-west and Orkney in the north-east, along the R502 road, The project falls within the Maquassi Hills Local Municipality within the Dr Kenneth Kaunda District Municipality in the North West Province (FIGURE 1).

3.2 Project Description

The proposed grid connection project involves the construction and operation the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, its associated LILO power lines and Leeudoringstad 132kV power line (single or double circuit) that will connect the aforementioned substations to the existing Vaal Reef Ten Substation.

<u>The scope of work in IPP substation:</u>

- Install a compact 132/33kV transformer substation with the associated protection equipment
- Install 2x33kV containerized switchgear

<u>The scope of work in the Leeubosch substation:</u>

- Install 1 x 132kV feeder bays at Leeubosch substation to accommodate the IPP compact 132/33kV substation
- Establish a completely new 132 kV single busbar
- Build approximately 32 km of a single circuit Tern line from Leeubosch substation to New 132kV Collector at Orkney Solar Farm

<u>The scope of work at the 132 kV Collector Station close to the Orkney Solar Farm:</u>

- Establish a new 132kV single busbar collector substation
- Build 2 x 132 kV feeder bays to connect the Leeudoringstad IPP and Orkney Solar Farm.
- Build approximately 10 km of double circuit Twin Tern line from the new collector station to the VaalReef Ten substation

The scope of work at the VaalReef Ten substation:

- Equip 1 x 132 kV feeder bay for a 10 km double circuit Twin Tern line

3.2.1 Layout Alternatives

Two 132kV power line alternatives are proposed, located within a 300m corridor on either side of existing 132kV and 400kV power lines. The total length of proposed power line is approximately 42km in length. However, this report has assessed approximately 32km of the proposed power line alternatives, extending from the proposed substations to the south western boundary of land portion RE/21/114 as instructed by *SiVEST* on 28 September 2022. *Genesis* will be undertaking the required environmental approvals for the 10km section of power line extending from land portion RE/21/114 to the Vaal Reef Ten Substation.

4. LEGAL REQUIREMENT AND GUIDELINES

The following pieces of legislation, policies and guidelines are applicable to this assessment:

4.1 The Convention on Biological Diversity

The Convention on Biological Diversity (CBD) is an international convention (to which South Africa is a signatory) and represents a commitment to sustainable development. The Convention has three main objectives: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources (http://www.cbd.int/convention/guide/). The convention makes provision (in a general policy guideline) for keeping and restoring biodiversity. In addition to this the CBD is an ardent supporter of thorough assessment procedures (Strategic Environmental Assessments (SEAs) and Environmental Impact Assessments (EIAs)) and requires that Parties apply these processes when planning activities that will have a biodiversity impact. An important principle encompassed by the CBD is the precautionary principle which essentially states that where serious threats to the environment exist, lack of full scientific certainty should not be used as a reason for delaying management of these risks. The burden of proof that the impact will *not* occur lies with the proponent of the activity posing the threat. In addition, the Aichi Biodiversity Targets (CBD 2011) address several priority issues i.e. the loss of biodiversity and its causes; reducing direct pressure on biodiversity; safeguarding ecosystems, species and genetic diversity and participatory planning to enhance implementation of biodiversity conservation. Each of these is relevant in the case of energy infrastructure and bird conservation through all project phases from planning to the implementation of mitigation measures for existing developments.

4.2 The Convention on the Conservation of Migratory Species of Wild Animals

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or the Bonn Convention) is an intergovernmental treaty and is the most appropriate instrument to deal with the conservation of terrestrial, aquatic and avian migratory species. The convention includes policy and guidelines

with regards to the impacts associated with man-made infrastructure. CMS requires that Parties (South Africa is a signatory) take measures to avoid migratory species from becoming endangered (Art II, par. 1 and 2) and to make every effort to prevent the adverse effects of activities and obstacles that seriously impede or prevent the migration of migratory species (Art III, par. 4b and 4c). At CMS/CoP7 (2002) Res. 7.2 on Impact Assessment and Migratory Species was accepted, requesting Parties to apply appropriate SEA and EIA procedures for all proposed developments. An agreement developed in the framework of CMS, in force since November 1999, brings the 119 Range States of the Africa Eurasian Waterbird Agreement (AEWA) region together in a common policy to protect migratory waterbirds that use the flyway from the Arctic to southern Africa. The agreement contains a number of obligations that are relevant to migratory waterbirds and energy infrastructure. AEWA has also published a series of practical guidelines that enable Parties to effectively address conservation issues influencing the status of migratory waterbirds. The most relevant guideline for migratory birds and energy infrastructure is the *Guideline on how to avoid, minimise or mitigate impact of infrastructural developments and related disturbance affecting waterbirds* (Tucker & Treweek, 2008).

4.3 The Agreement on the Conservation of African-Eurasian Migratory Water Birds

The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos, ducks, swans, geese, cranes, waders, gulls, terns, tropic birds, auks, frigate birds and even the South African penguin. The core activities carried out under AEWA are described in its Action Plan, which is legally binding for all countries that have joined the Agreement. The AEWA Action Plan details the various measures to be undertaken by Contracting Parties (South Africa included) to guarantee the conservation of migratory waterbirds within their national boundaries. These include species and habitat protection, and the management of human activities, as well as legal and emergency measures.

4.4 The National Environmental Management Act 107 of 1998 (NEMA)

The National Environmental Management Act 107 of 1998 (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated. NEMA also provides that a wide variety of listed developmental activities, 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.

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

The National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA) regulations on Threatened and Protected Species (TOPS) provides for the consolidation of biodiversity legislation through establishing national norms and standards for the management of biodiversity across all sectors and by different management authorities. The national Act provides for among other things, the management and conservation of South Africa's biodiversity; protection of species and ecosystems that necessitate national protection and the sustainable use of indigenous biological resources.

4.6 The National Environmental Management: Protected Areas Act 57 of 2003

The National Environmental Management: Protected Areas Act (No. 57 of 2003), as amended in 2014, provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. The Act also provides for the establishment of a national register of all national, provincial and local protected areas that are managed in accordance with national norms and standards; and to endure intergovernmental co-operation and public consultation in matters concerning protected areas. Protected areas are declared in order to regulate the area as a buffer zone for protection of a special nature reserve, world heritage site or nature reserve; to enable owners of land to take collective action to conserve biodiversity on their land and to seek legal recognition therefor; to protect the area if the area is sensitive to development due to its- (i) biological diversity; (ii) natural characteristics; (iii) scientific, cultural, historical, archaeological or geological value; (iv) scenic and landscape value; or (v) provision of environmental goods and services; to protect a specific ecosystem outside of a special nature reserve, world heritage site or nature reserve; to ensure that the use of natural resources in the area is sustainable. This Act explicitly states that no development, construction or farming may be permitted in a nature reserve or world heritage site without the prior written approval of the management authority.

4.7 The Standard for the Development and Expansion of Power Lines and Substations within Identified Geographical Areas

Section 24(2)(c) - (e) of NEMA provides the ability of the Minister, or MEC in concurrence with the Minister to identify activities and geographical areas within which activities may be excluded from the requirement to obtain environmental authorisation. Section 24(2)(d) provides the additional ability to link such exclusions with compliance with prescribed norms or standards. The *Standard for the Development and Expansion of Power lines and Substations within Identified Geographical Areas* allows for the exclusion of activities which relate to the development and expansion of electricity transmission and distribution infrastructure as identified in Listing Notices 1 and 2 of the Environmental Impact Assessment (EIA) Regulations. This Standard has been developed based on two Strategic Environmental Assessment (SEA) processes undertaken for the development of Electricity Grid Infrastructure (EGI) in South Africa. This Standard has been prepared to allow a proponent to achieve planning, routing, siting and remediation objectives that will ensure the acceptability of the impacts of the development of EGI including substations on the environment, independently from the need for an assessment by the competent authority. This Standard and exclusions do not apply in the following instances:

- Where any part of the infrastructure occurs on an area for which the environmental sensitivity for a relevant environmental theme is identified as being very high or high by the screening tool and confirmed to be such by the EAP or the relevant specialist for the identified environmental theme;
- Where the site verification for a specific theme identifies that the low or medium sensitivity rating of the screening tool is in fact high or very high; or
- Where the greater part of the proposed infrastructure fall outside of any strategic transmission corridor. Where this Standard does not apply, either the requirements of the EIA Regulations, or the requirements of Government Notice No. 113 in Government Gazette No. 41445 of 16 February 2018, read with the NEMA EIA Regulations, where relevant, apply to the relevant environmental theme for which the very high or high sensitivity has been identified, in respect of the portion of the development which occurs on the area where the environmental sensitivity is confirmed to be very high or high, or to the entire development where the greater part of the infrastructure falls outside of the strategic transmission corridor.

4.8 North West Biodiversity Management Act No.4 of 2016 and The North West Biodiversity Management Amendment Bill of 2017

This Act and Bill have been published but not yet in force. It provides for the management and conservation of the North West Province's biophysical environment and protected areas within the framework of the National Environmental Management Act, 1998 (Act No 107 of 1998); to provide for the protection of species and ecological- systems that warrant provincial protection; to provide for the sustainable use of indigenous biological resources.

5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 Site Sensitivity Verification

A screening report for the Leeudoringstad 132kV power line alignments was compiled by *SiVEST* on 22 September 2022. The majority of the proposed PAOI is considered to have a LOW-MEDIUM Animal Species sensitivity, with a very small section along the Vaal River categorised as HIGH sensitivity, based on the possible occurrence of Caspian Tern *Hydroprogne caspia*. A site sensitivity verification was conducted through the use of a desktop analysis and a field survey on 2 September 2022. Caspian Tern was not observed during the site verification survey and the proposed power line does not cross the Vaal River. The presence of suitable grassland habitat and large terrestrial power line priority species i.e. Northern Black Korhaan *Afrotis afraoides* confirm the sensitivity to be LOW-MEDIUM with regards to power line priority species.

5.2 Relevant Bird Populations

5.2.1 Important Bird Areas

Some sites are exceptionally important for maintaining the taxa dependent upon the habitats and ecosystems in which they occur. Vigorous protection of the most critical sites is one important approach to conservation.

Many species may be effectively conserved by this means. Patterns of bird distribution are such that, in most cases, it is possible to select sites that support many species. These sites, carefully identified on the basis of the bird numbers and species complements they hold (i.e. globally threatened, range restricted and or migratory or congregatory species) are termed Important Bird Areas (IBAs). IBAs are selected such that, taken together, they form a network throughout the species' biogeographic distributions. IBAs are key sites for conservation – small enough to be conserved in their entirety and often already part of a protected-area network. The Leeubosch Traction Substation, Eskom Switching Station and Leeudoringstad 132kV power line alternatives are not located within an IBA. The Sandveld and Bloemhof Dam Nature Reserves IBA SA039 is the closest IBA and is located approximately 40km south-west of the proposed substations and power line alternatives (FIGURE 4). The dam regularly supports more than 5,000 waterbirds and on occasion more than 10,000 individuals. When the water level is low and islands and aquatic vegetation are exposed, the system becomes highly productive and suitable for many waterbird species. Global threatened species supported by this IBA include Lesser Flamingo *Phoeniconaias minor* and Kori Bustard *Ardeotis kori*. Regionally threatened species are Pink-backed Pelican *Pelecanus rufescens*, Caspian Tern and Greater Flamingo *Phoeniconaias roseus*. Congregatory waterbird species are Great Crested Grebe *Podiceps cristatus*, Little Grebe *Tachybaptus ruficollis*, African Darter *Anhinga rufa*, African Spoonbill *Platalea alba*, Cape Shoveler *Anas smithii*, Pied Avocet *Recurvirostra avosetta* , Goliath Heron *Ardea goliath*, Western Cattle Egret *Bubulcus ibis*, Egyptian Goose *Alopochen aegyptiaca*, South African Shelduck *Tadorna cana* and Red-knobbed Coot *Fulica cristata*. Range-restricted and biome-restricted species include Kalahari Scrub Robin *Erythropygia paena*, Barred Wren-Warbler *Calamonastes fasciolatus* and Sociable Weaver *Philetairus socius*, which are fairly common.

Despite the proximity (in bird terms) of the Sandveld and Bloemhof Dam Nature Reserves IBA to the PAOI and the reported occurrence of the aforementioned species (with the exception of Kori Bustard and Pink-backed Pelican) within the broader PAOI, the construction of the proposed substations and Leeudoringstad 132kV power line will not displace the species this IBA supports. The more common species associated with the IBA i.e. Barred Wren-Warbler, Kalahari Scrub Robin and Sociable Weaver may occur at the development site, however these species are relatively tolerant of disturbance and permanent displacement from the area, as a result of the establishment of the switching station. substations and the Leeudoringstad 132kV power line, is unlikely.

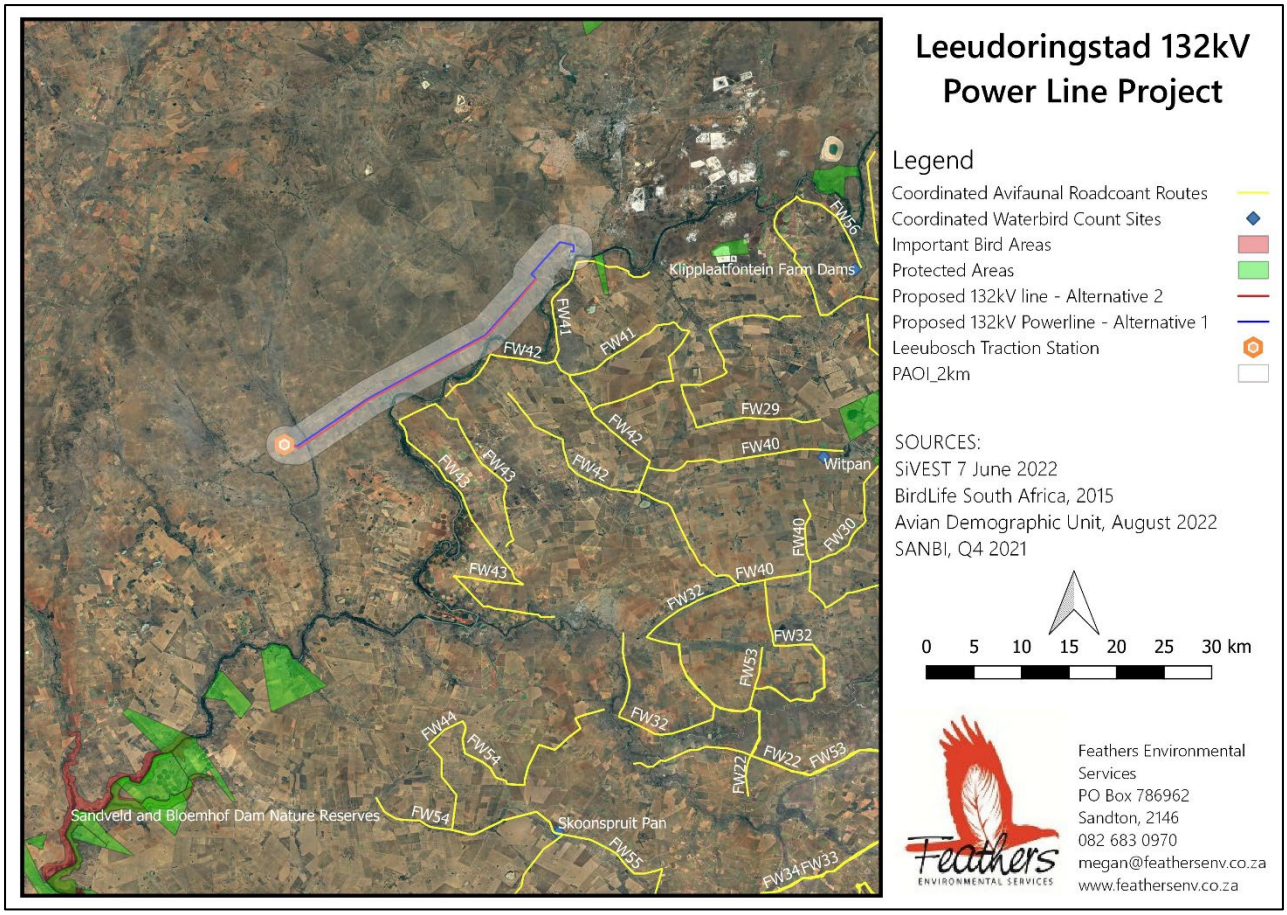

Figure 4: Regional map detailing the location of the Leeudoringstad 132kV power line alternatives in relation to Protected Areas, Important Bird Areas , Coordinated Waterbird Count Sites and Coordinated Avifaunal Roadcount Routes.

5.2.2 Protected Areas

The site does not form part of a formally protected area. The closest protected area is the Boskoppie Game Reserve (FIGURE 4) which is located approximately 8km to the north-east at its closest point. The proposed development is not expected to have any impact on the avifauna in this nature reserve due to the distance from the development.

5.2.3 Coordinated Avifaunal Roadcount (CAR) Routes

Cranes, bustards, storks and other large birds that spend most of their time on the ground, need wide, open spaces and are certainly not restricted to protected areas. Agricultural habitats are used extensively for feeding, roosting and breeding, often because no natural, pristine habitats are available, and sometimes because the agricultural habitats are especially attractive to birds. Because of their size and conspicuous nature, these birds can be monitored using a relatively simple technique i.e. the road count. The Coordinated Avifaunal Roadcounts (CAR) project monitors the populations of 36 species of large terrestrial birds in agricultural habitats, in addition to gamebirds, raptors and corvids along 350 fixed routes covering over 19 000km (http://car.adu.org.za/). Although CAR road counts do not give an absolute count of all the individuals in a population, they do provide a measure of relative abundance in a particular area. There are no CAR routes located within the confines of the PAOI (FIGURE 4) and therefore CAR data was not used as a criterion to assess the sensitivity and anticipated impacts within the project area.

5.2.4 Coordinated Waterbird Count (CWAC) Sites

A CWAC site is any body of water, other than the oceans, which supports a significant number (set at approximately 500 individual waterbirds, irrespective of the number of species) of birds which use the site for feeding, and/or breeding and roosting (Harrison et al, 2004). This definition includes natural pans, vleis, marshes, lakes, rivers, as well as a range of manmade impoundments (i.e. sewage works). The presence of a CWAC site within the PAOI is an indication of a large number of waterbird species occurring there and the overall sensitivity of the area. There are no CWAC sites located within the confines of the PAOI (FIGURE 4) and therefore CWAC data was not used as a criterion to assess the sensitivity and anticipated impacts within the project area.

5.2.5 South African Bird Atlas Project 2 Data (SABAP 2)

A total of 259 bird species have been recorded within the Leeudoringstad project PAOI pentads during the SABAP2 atlassing period to date (APPENDIX 1). The presence of these species in the broader area provides an indication of the diversity of species that could potentially occur along the route alignment. Of the 259 species, six are regional Red List species (i.e. SCC) (Taylor et al, 2015). Relevant to this development, 64 species are classified as power line sensitive species. Of the power line sensitive species, nine are likely to occur regularly at the substation locations and along the power line alignment, 25 are largely comprised of waterbirds and raptors that may traverse across the PAOI and the remaining 30 are likely to occur sporadically. APPENDIX 1 provides a comprehensive list of all the species. It is important to note that the SCC have been recorded in very low numbers with less than five individual birds for each species being recorded over the fourteen-year survey period. No SCC species were observed during the field survey.

Although this report focuses on SCC, since the impacts associated with the construction and operation of the substations and Leeudoringstad 132kV power line are likely to be more biologically significant for these species, the impact on non-SCC power line sensitive species is also assessed. Furthermore, SCC can often be used as surrogate species for the others in terms of impacts and the necessary mitigation. Each substation power line sensitive species' potential for occurring in a specific habitat class is indicated in TABLE 1, in addition to the type of impact that could potentially affect each species, specific to the location of this project.

5.2.6 Vulture Colonies, Nest Locations and Vulture Restaurants

Vultures are a far-ranging species and may forage across the broader PAOI, as carcasses become available (Wolter et al 2010). Cape Vulture *Gyps coprotheres* are capable of traversing large distances - individuals captured in the Eastern Cape, covered an area of approximately 366 km^2 (Pfeiffer et al. 2015) while those captured in the North West Province and Namibia foraged over much larger areas, approximately 90 845 km^2 and 21 320 km^2 respectively (Bamford et al. 2007, Phipps et al. 2013b). As a communal cliff-nesting raptor, Cape Vultures form large breeding colonies on suitable rock formations (Benson 2015) and also congregate at overnight roosts (cliffs, on power line poles/towers, or in trees) to sleep (Mundy et al. 1992, Dermody et al. 2011, Pfeiffer et al. 2015). As adult breeding Cape Vulture usually forage within a certain area around a central colony (Boshoff & Minnie 2011), the risk of impact is likely to be greatest closest to these sites. Cape Vulture can be expected to regularly use the air-space within 50km around their roosts and breeding locations, based

on fixed kernel density estimates (Venter et al, 2018). Vultures will occur well beyond these zones, but there is a lower probability of them occurring regularly beyond these core foraging ranges. Research suggests that Cape Vulture movement patterns and core foraging ranges are closely associated with the spatial distribution of power lines (Phipps *et al.* 2013). The vultures' ability to traverse vast distances and the high proportion of time they spend foraging outside protected areas and particularly in the vicinity of power lines makes them especially vulnerable to negative interactions (both collision and electrocution) with the expanding power line network across the region and in particular the power line infrastructure that forms part of this project. Continued, unmitigated mortality of adult breeding birds on the power line infrastructure will undoubtedly affect breeding success at breeding locations. There are no colonies or nest locations within a 50km radius of the PAOI.

To promote the survival of these high-flying scavengers, the practice of supplemental feeding of vultures in so called vulture restaurants, was initiated and today there are 236 documented vulture restaurants scattered throughout South Africa (Wolter et al, 2013). In this system of supplementary feeding, carcasses donated by stock farmers and hunters in the surrounding area are routinely placed out at selected sites, assisting in the continued survival of vultures. There are no vulture restaurants within 50km of the PAOI. The closest **active** restaurant (Ratzegaai) is located approximately 70km north of the PAOI (FIGURE 5).

5.2.7 Primary Data Collection

A spring survey was conducted on 2 September 2022, with a focused effort on the switching station, substation locations and the areas through which the proposed power line alternative alignments traverse and the broader PAOI. In order to describe the avifaunal community present, a concerted effort was made to sample the avifauna in all of the primary habitats that were available within the PAOI. All species encountered (observed and heard) during the site survey were noted and are indicated (highlighted in grey) in APPENDIX 1.

The site visit produced a combined list of 52 species. The majority of observations were of passerine species that are common to this area. Each of these species has the potential to be displaced by the construction of Switching Station, IPP Substation, genesis Orkney Solar Plant Substation, its associated LILO power lines and Leeudoringstad 132kV power line as a result of habitat transformation and/or disturbance. However, these species have persisted despite existing disturbance (i.e. pastoral and agricultural activity) within the PAOI. This resilience, coupled with the fact that similar habitat is available throughout the broader area, means that the displacement impact will not be of regional or national significance.

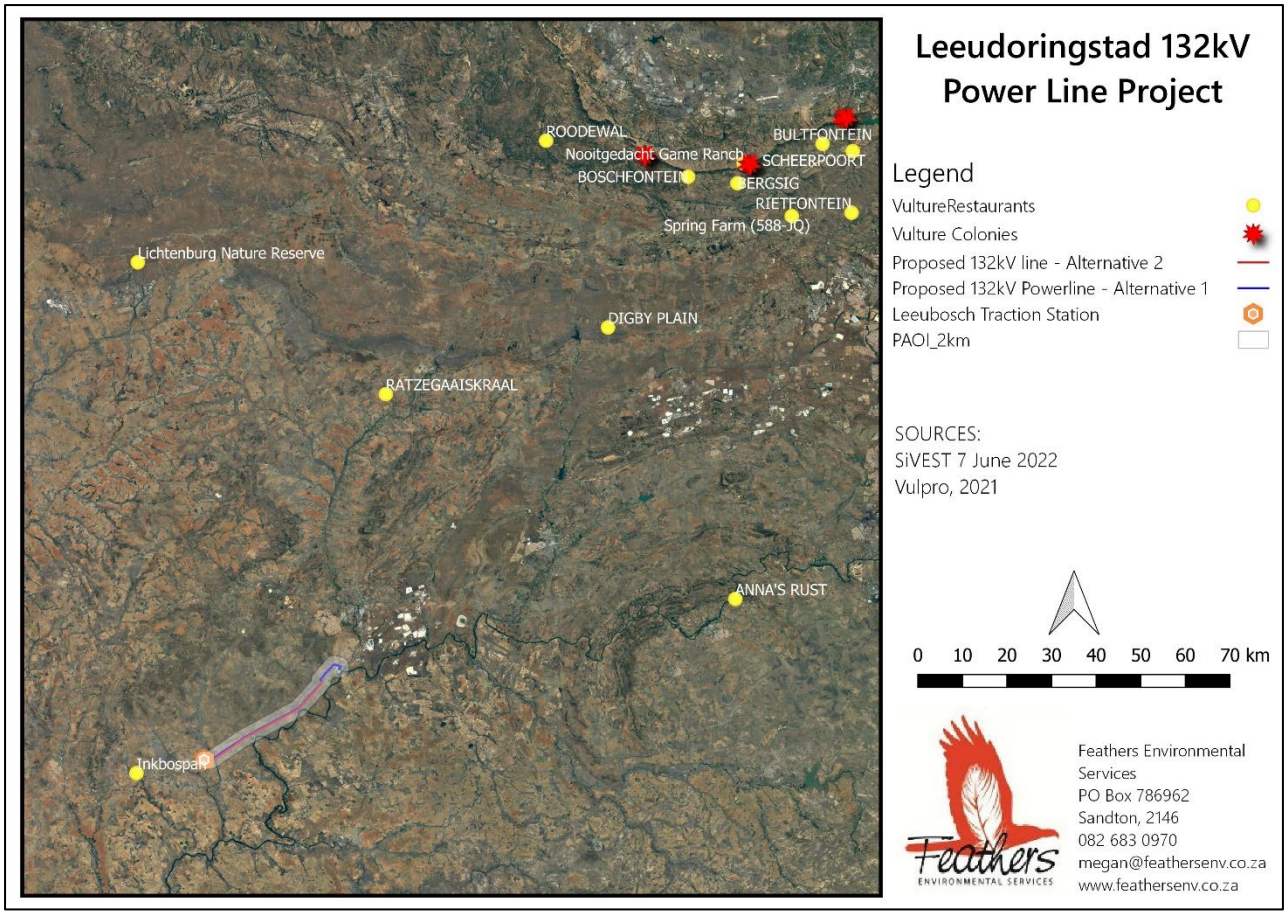

Figure 5: Cape Vulture Colonies and active Vulture Restaurants in relation to the Leeudoringstad 132kV power line alternatives

Table 1: Priority species potentially occurring at the site and within the broader PAOI.

Species name	Scientific name	Full protocol	Ad hoc protocol	RD_Regional	Likelihood of regular occurrence in study area	Grassland/Open Woodland	Surface Waterbodies	Cultivated Lands	Exotic Tree Stands	Powerline priority	Recorded during surveys	Electrocution Substation	Electrocution HV	Powerline - Collision	Displacement - Disturbance	Displacement - Habitat transformation
African Black Duck	*Anas sparsa*	9,3	0,0	-	L		x			x				x		
African Darter	*Anhinga rufa*	46,3	7,9	-	M		x			x				x		
African Fish Eagle	*Haliaeetus vocifer*	17,3	4,8	-	M		x		x	x		x				
African Harrier-Hawk	*Polyboroides typus*	1,2	0,0	-	L	x				x		x				
African Sacred Ibis	*Threskiornis aethiopicus*	29,0	4,8	-	H		x	x		x	x	x		x	x	
African Spoonbill	*Platalea alba*	7,4	0,0	-	M		x			x				x		
Amur Falcon	*Falco amurensis*	13,0	7,9	-	H	x		x	x	x		x			x	x
Black Heron	*Egretta ardesiaca*	1,9	1,6	-	L					x				x		
Black Sparrowhawk	*Accipiter melanoleucus*	0,6	0,0	-	L	x			x	x		x			x	x
Black-chested Snake Eagle	*Circaetus pectoralis*	0,6	0,0	-	L	x				x		x			x	x
Black-crowned Night Heron	*Nycticorax nycticorax*	2,5	0,0	-	L		x			x				x		
Black-headed Heron	*Ardea melanocephala*	13,6	0,0	-	M	x	x	x		x		x		x	x	
Black-winged Kite	*Elanus caeruleus*	38,3	9,5	-	H	x		x		x	x	x			x	
Blue-billed Teal	*Spatula hottentota*	0,6	0,0	-	L		x			x				x		
Brown Snake Eagle	*Circaetus cinereus*	0,6	0,0	-	L	x				x		x			x	x
Cape Shoveler	*Spatula smithii*	12,3	0,0	-	M		x			x				x		
Cape Teal	*Anas capensis*	5,6	0,0	-	L		x			x				x		
Common Buzzard	*Buteo buteo*	4,9	4,8	-	M	x		x	x	x		x				
Common Moorhen	*Gallinula chloropus*	17,3	3,2	-	M		x			x						
Egyptian Goose	*Alopochen aegyptiaca*	59,3	11,1	-	H		x	x		x	x	x		x	x	x
Fulvous Whistling Duck	*Dendrocygna bicolor*	1,2	0,0	-	L		x			x				x		

Species name	Scientific name	Full protocol	Ad hoc protocol	RD_Regional	Likelihood of regular occurrence in study area	Grassland/Open Woodland	Surface Waterbodies	Cultivated Lands	Exotic Tree Stands	Powerline priority	Recorded during surveys	Electrocution Substation	Electrocution HV	Powerline - Collision	Displacement - Disturbance	Displacement - Habitat transformation
Gabar Goshawk	*Micronisus gabar*	4,9	0,0	-	L	x				x		x			x	x
Glossy Ibis	*Plegadis falcinellus*	8,6	3,2	-	M		x			x				x		
Goliath Heron	*Ardea goliath*	5,6	1,6	-	L		x			x				x		
Great Crested Grebe	*Podiceps cristatus*	1,2	0,0	-	L		x			x				x		
Great Egret	*Ardea alba*	1,2	0,0	-	L		x			x				x		
Greater Flamingo	*Phoenicopterus roseus*	2,5	0,0	NT	L		x			x				x		x
Greater Kestrel	*Falco rupicoloides*	7,4	1,6	-	M	x		x	x	x		x			x	x
Grey Heron	*Ardea cinerea*	23,5	1,6	-	M		x			x				x		
Hadada Ibis	*Bostrychia hagedash*	87,7	6,3	-	H	x	x	x	x	x	x	x		x	x	x
Hamerkop	*Scopus umbretta*	4,9	0,0	-	M		x			x				x		
Helmeted Guineafowl	*Numida meleagris*	50,6	7,9	-	H	x		x		x	x	x		x	x	x
Intermediate Egret	*Ardea intermedia*	1,2	0,0	-	L		x			x				x		
Jackal Buzzard	*Buteo rufofuscus*	0,0	1,6	-	L	x				x		x			x	x
Lanner Falcon	*Falco biarmicus*	0,6	0,0	VU	M	x		x		x		x			x	x
Lesser Flamingo	*Phoeniconaias minor*	1,2	0,0	NT	L		x			x				x		
Lesser Kestrel	*Falco naumanni*	8,6	6,3	-	M	x		x	x	x		x				x
Little Egret	*Egretta garzetta*	15,4	4,8	-	M		x			x				x		x
Little Grebe	*Tachybaptus ruficollis*	22,8	1,6	-	M		x			x	x			x		
Little Sparrowhawk	*Accipiter minullus*	3,1	0,0	-	L	x			x	x		x			x	x
Marsh Owl	*Asio capensis*	0,6	0,0	-	L	x				x		x		x	x	x
Northern Black Korhaan	*Afrotis afraoides*	56,2	4,8	-	H	x		x		x	x			x	x	x
Ovambo Sparrowhawk	*Accipiter ovampensis*	0,6	0,0	-	L	x			x	x		x			x	x
Pale Chanting Goshawk	*Melierax canorus*	1,2	0,0	-	M	x				x	x	x			x	x

Species name	Scientific name	Full protocol	Ad hoc protocol	RD_Regional	Likelihood of regular occurrence in study area	Grassland/Open Woodland	Surface Waterbodies	Cultivated Lands	Exotic Tree Stands	Powerline priority	Recorded during surveys	Electrocution Substation	Electrocution HV	Powerline - Collision	Displacement - Disturbance	Displacement - Habitat transformation
Pied Crow	*Corvus albus*	58,0	11,1	-	H	x		x	x	x	x	x			x	x
Purple Heron	*Ardea purpurea*	4,3	0,0	-	L			x		x				x		
Red-billed Teal	*Anas erythrorhyncha*	19,1	0,0	-	M		x			x				x		
Red-footed Falcon	*Falco vespertinus*	0,6	0,0	NT	M	x		x	x	x		x				
Red-knobbed Coot	*Fulica cristata*	25,3	1,6	-	M		x			x	x			x		
Reed Cormorant	*Microcarbo africanus*	42,6	4,8	-	M		x			x				x		
Rock Kestrel	*Falco rupicolus*	0,6	0,0	-	L	x				x		x			x	x
South African Shelduck	*Tadorna cana*	21,0	1,6	-	M		x			x				x		
Southern Pochard	*Netta erythrophthalma*	5,6	1,6	-	L		x			x				x		
Spur-winged Goose	*Plectropterus gambensis*	13,0	3,2	-	M		x	x		x				x	x	
Squacco Heron	*Ardeola ralloides*	5,6	0,0	-	L		x			x				x		
Striated Heron	*Butorides striata*	3,1	0,0	-	L		x			x				x		
Western Barn Owl	*Tyto alba*	1,2	1,6	-	L	x		x	x	x		x		x	x	x
Western Cattle Egret	*Bubulcus ibis*	50,6	15,9	-	H	x		x		x	x	x		x	x	x
White-backed Duck	*Thalassornis leuconotus*	0,6	0,0	-	L		x			x				x		
White-breasted Cormorant	*Phalacrocorax lucidus*	34,0	3,2	-	M		x			x	x			x		
White-faced Whistling Duck	*Dendrocygna viduata*	9,9	1,6	-	M		x			x				x		
Yellow-billed Duck	*Anas undulata*	50,0	4,8	-	M		x			x				x		
Yellow-billed Kite	*Milvus aegyptius*	1,2	0,0	-	L	x		x	x	x		x				x

5.3 Avifaunal Habitats

Vegetation is one of the primary factors determining bird species distribution and abundance in an area. It is widely accepted within ornithological circles that vegetation structure is more important in determining which bird species will occur there. The classification of vegetation types is from Mucina & Rutherford (2006 and 2012), while from an avifaunal perspective, the Atlas of southern African Birds (SABAP1) recognises six primary vegetation divisions or biomes within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison et al. 1997). Whilst much of the distribution and abundance of bird species can be attributed to the broad vegetation types present in an area, it is the smaller spatial scale habitats (micro habitats) that support the requirements of a particular bird species that need to be examined in greater detail. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food availability, and various anthropogenic factors all of which will either attract or deter birds and are critically important in mapping the site in terms of avifaunal sensitivity and ultimately informing mitigation requirements. Assessment of the PAOI revealed three broadly described avifaunal micro habitats i.e. grassland, surface waterbodies, cultivated lands and exotic tree stands. APPENDIX 2 provides a photographic record of the bird habitats.

5.3.1 Grassland

The PAOI is located in the Grassland Biome, in the Dry Highveld Grassland Bioregion, comprised of a mixture of open woodland with a strong grassland component. The habitat in the broader area is more variable and consists of fallow fields (recovering grassland), natural grassland, shrubland, some wetland and pans, and agricultural activities. Mucina & Rutherford (2006) classifies the natural vegetation in the assessment area as Vaal-Vet Sandy Grassland (FIGURE 6).

Vaal-Vet Sandy Grassland occurs in the North-West and Free State Provinces, in an area south of Lichtenburg and Ventersdorp, stretching to Klerksdorp, Leeudoringstad, Bothaville and Brandfort. It is situated in the summer rainfall region with a mean annual precipitation of $\pm$ 530 m, where summers are mild to hot and winters very cold with frequent frost. The landscape is dominated by plains with some scattered, slightly irregular undulating plains and hills. Low-tussock grasslands with strong karroid elements and the relative dominance of the grass species *Themeda triandra* are important features.

Of South Africa's 841 bird species, 350 occur in the Grassland Biome. This includes 29 species of conservation concern (i.e. those species declining in numbers), ten endemics, and as many as 40 specialist species that are exclusively dependent on grassland habitat. Grasslands represent a significant feeding area for many bird species in densely populated areas and will typically attract Black-winged Pratincole *Glareola nordmanni*, Lanner Falcon *Falco biarmicus* and Red-footed Falcon *Falco vespertinus* recorded during the SABAP2 survey period. Grassland patches are also a favourite foraging area for game birds such as francolins, spurfowl and Helmeted Guineafowl *Numida meleagris*. This in turn could attract raptors because of both the presence and accessibility of prey.

5.3.2 Surface Waterbodies (Rivers & Pans)

Rivers provide important corridors of microhabitat for waterbirds (13 of which are mostly restricted to riverine habitat in southern Africa) that will regularly utilise rivers not only as a source of drinking water and food, but

also for bathing and cover for skulking species. In addition, the thick riverine woodland with large shady riparian trees, offers important breeding substrate for a variety of birds, including raptors (Hockey et al 2005). The Vaal River is a prominent feature within the PAOI, but is not traversed by or located directly adjacent to the proposed power line, therefore potential displacement impacts as a result of habitat loss and disturbance are likely to be low. The proposed power line does cross the Klipspruit, Matjiesspruit and Ysterspruit ephemeral rivers which only flow for short periods in the rainy season, but pools of water can persist for many months attracting various waterbirds.

The PAOI also contains pans which are endorheic wetlands having closed drainage systems; water usually flows in from small catchments but with no outflow from the pan basins themselves. They are typical of poorly drained, relatively flat and dry regions. Water depth is shallow (<3m) with flooding characteristically ephemeral (Harrison *et al*. 1997). When these pans hold water (which is only likely after exceptional rainfall events), they attract waterbirds, while large raptors could use them for bathing and drinking. When the pans are dry, they may be covered with grass, which is attractive to several large terrestrial species for foraging, roosting and breeding.

Relevant to this assessment, these waterbodies are likely to attract Caspian Tern, Greater and Lesser Flamingo as well as a diversity of non-SCC waterfowl i.e. African Black Duck *Anas sparsa*, Black-headed Heron *Ardea melanocephala*, Egyptian Goose *Alopochen aegyptiaca*, Grey Heron, Hamerkop *Scopus umbretta*, Little Egret *Egretta garzetta*, Little Grebe, Red-billed Teal *Anas erythrorhyncha*, Red-knobbed Coot, Reed Cormorant *Microcarbo africanus*, Spur-winged Goose *Plectropterus gambensis*, White-faced Whistling Duck *Dendrocygna viduata* and Yellow-billed Duck *Anas undulata*. The presence of waterbodies in the PAOI is an indicator of collision risk.

5.3.3 Cultivated Lands

Arable or cultivated land represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten by birds, or attract insects which are in turn eaten by birds. Relevant to this study, commercial (irrigated) and subsistence agriculture occur within the PAOI and may be a draw card for Lanner Falcon and Red-footed Falcon in addition to several non-SCC priority species e.g. Amur Falcon *Falco amurensis*, Black-headed Heron, Black-winged Kite *Elanus caeruleus*, Common Buzzard *Buteo buteo*, Egyptian Goose, Greater Kestrel *Falco rupicoloides*, Hadeda Ibis *Bostrychia hagedash*, Helmeted Guineafowl, Northern Black Korhaan *Afrotis afraoides*, Spur-winged Goose *Plectropterus gambensis* and Western Cattle Egret that also use freshly ploughed and old lands to feed in.

5.3.4 Exotic Tree Stands

Although stands of *Eucalyptus* are strictly speaking invader species, they have become important refuges for certain species of raptors, particularly Amur Falcon and Red-footed Falcon Palearctic migrants, which will commonly roost in small stands of *Eucalyptus* in suburbs of small towns. Black Sparrowhawk *Accipiter melanoleucus* and Ovambo Sparrowhawk *Accipiter ovampensis* are another two species as well as Lesser Kestrel *Falco naumanni* and African Fish Eagle *Haliaeetus vocifer* that use these trees for roosting and breeding purposes.

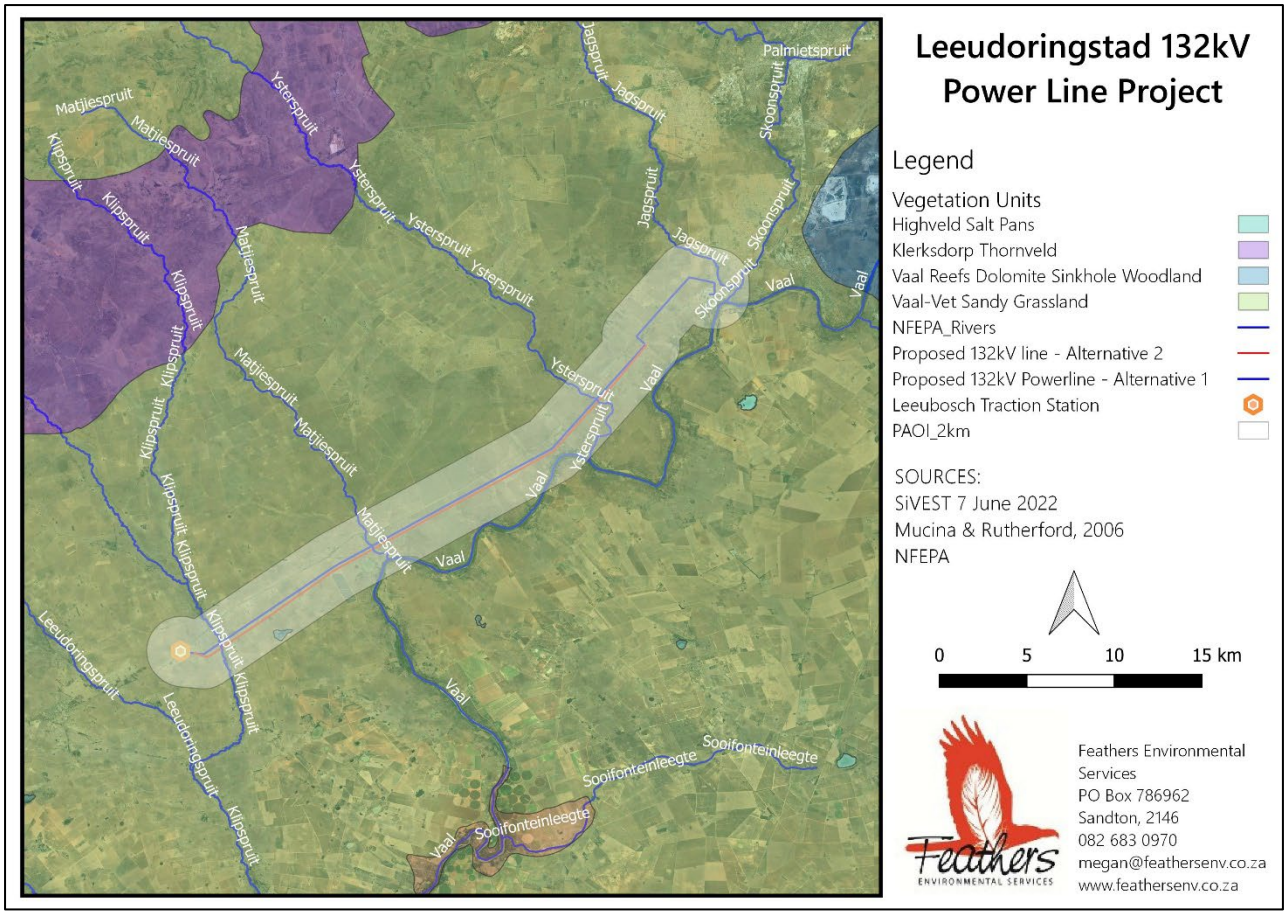

Figure 6: Regional map detailing the various vegetation types and river systems occurring within the Leeudoringstad 132kV power line alternatives PAOI.

6. SPECIALIST FINDINGS / IDENTIFICATION AND ASSESSMENT OF IMPACTS

Poorly sited or designed facilities and infrastructure can negatively impact not only vulnerable species and habitats, but also entire ecological processes. The effects of any development on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitats affected and the number and diversity of species present. With so many variables involved, the impacts of each development must be assessed individually. Each of these potential effects can interact, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss and disturbance causes a reduction in birds using an area which may then reduce the risk of collision). The principal areas of concern for SCC and non-SCC substation and power line sensitive species related to the proposed switching station, substations and Leeudoringstad 132kV power line are:

6.1 Construction Phase

6.1.1 Displacement as a result of habitat loss or transformation

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. This impact is dependent on various factors i.e., the location and the scale of the facility, the amount of habitat affected; the uniqueness of the habitat; and the sensitivity and conservation status of the bird species utilizing that habitat. Areas of habitat will be cleared to accommodate the Switching Station IPP Substation, Genesis Orkney Solar Plant Substation infrastructure and to a limited extent the 132kV and LILO tower/pylon footprints, reducing the amount of habitat available to birds for foraging, roosting and breeding (Smallie, 2013) which could result in temporary or permanent displacement. 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 switching station and substations is unavoidable. In the case of the LILO and 132kV power line, the direct habitat transformation is limited to the tower footprints and the narrow access road/track under the power line. The habitat in the study area is highly uniform from a bird impact perspective and in addition to the low SCC abundances, the displacement impact will not be of regional or national significance.

6.1.2 Displacement as a result of disturbance

Excavation and construction activities are a source of significant disturbance particularly as a result of the machinery and construction personnel that are present on site for the duration of the construction of the switching station, substations, LILO power lines and Leeudoringstad 132kV power line. For most bird species, construction activities are likely to be a cause of temporary disturbance impacting on foraging, and roosting behaviours but in more extreme cases, construction may impact on the breeding success of certain species particularly if the disturbance happens during a critical part of the breeding cycle, resulting in temporary breeding failure or permanent nest abandonment. The PAOI is already subjected to a degree of disturbance in the form of pastoral activities, in addition to vehicle and pedestrian traffic. Construction activities within the PAOI are likely to result in the temporary displacement as opposed to permanent displacement of species from the area. Each of the power line sensitive species has the potential to be displaced by the construction of the switching station, substations, LILO power lines and the Leeudoringstad 132kV power line as a result of disturbance. However, many of these species have persisted despite existing disturbance within the PAOI. This resilience, coupled with the fact that similar habitat is available throughout the broader area, means that the displacement impact will not be of regional or national significance.

6.1.3 Direct mortality as a result of construction activities

Bird mortality as a result of construction activities is improbable because birds are incredibly mobile and able to move out of harm's way. If mortality does occur, it is likely to be confined to a localised area and restricted to immobile species e.g. nestlings. No terrestrial bird species (ground) nest locations were observed during the site survey.

6.2 Operational Phase

6.2.1 Mortality due to collisions with the 132kV power line conductors and/or earth wires

Collisions are the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. Quantifying this impact in terms of the likely number of birds that will be impacted, is very difficult because a number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from incidental record keeping by the Endangered Wildlife Trust: Wildlife & Energy Programme it is possible to give a measure of what species are likely to be impacted upon (Jenkins et al. 2010). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line (FIGURE 7). Relevant to this development, collisions are likely to occur in the vicinity of the vulture restaurant, sections of power line that traverse across or close to waterbodies, open grassland habitat and cultivated lands. However, the location of the Leeudoringstad 132kV power line adjacent to the existing 132kV and 400kV may reduce the risk of collisions to birds, particularly if the conductor and/or earthwires are at the same height above ground. The reasons for that are two-fold, namely it creates a more visible obstacle to birds and the resident birds, particularly breeding adults, which are accustomed to an obstacle in that geographic location and have learnt to avoid it (APLIC 2012; Sundar & Choudhury 2005).

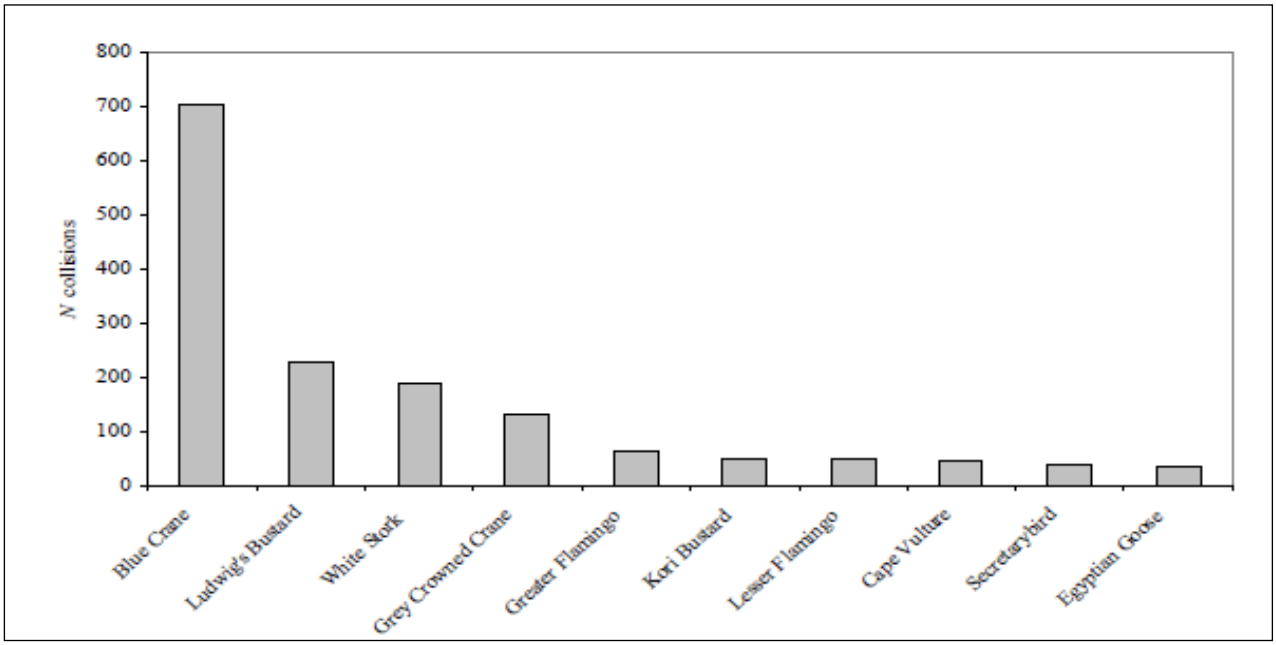

Figure 7: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2007 (Jenkins et al. 2010)

6.2.2 Mortality due to electrocutions within the substations and on the 132kV power line infrastructure

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).

Electrocutions within the proposed Switching Station, IPP Substation, Genesis Orkney Solat Plant Substation and the existing Vaal Reefs 10 Substation are possible but should not affect the more sensitive SCC as these species are unlikely to use the infrastructure within the substation yards for perching or roosting. Since it is difficult to predict with any certainty where birds are likely to nest within the substation yards, coupled with the costs associated with insulating the entire substation, electrocutions will need to be mitigated using site-specific recommendations if and when they occur.

With regards to electrocution risk on the LILO power lines and 132kV power line infrastructure, this is strongly influenced by the power line voltage and design of the tower/pole structure and mainly affects larger, perching species that are capable of spanning the spaces between energized components. This is particularly likely when more than one bird attempts to sit on the same pole, a behaviour that is typical of gregarious vulture species when perching or roosting. The clearance distances between the live components and/or live and earthed components of the 132kV tower structure should be sufficient to reduce the risk of electrocutions for most raptor species. The best possible mitigation is the construction of the power line using an *Eskom* approved bird friendly pole/tower design (DT 7641/7649) accordance with the Distribution Technical Bulletin relating to bird friendly structures (APPENDIX 3). Additional mitigation in the form of insulating sleeves on *jumpers* present on strain poles and terminal poles is also required, alternatively all jumpers must be suspended below the crossarms. It is important to note that the existing 132kV and 400kV power lines may currently serve as a roost for certain species. This will create a shielding effect for the new line in that the birds are most likely to continue to roost on the existing power line infrastructure, as this is an established roost and is designed in such a way that the birds can roost comfortably in numbers on the self-support towers. This should further reduce the risk of electrocution on the new power line.

6.2.3 Impact on the quality of the supply

Although this does not form part of the brief, it is important to mention that birds could have an impact on the proposed power line infrastructure. Both bird streamers and bird pollution occur as a result of birds perching and defecating on the pole tops and, often directly above live conductors causing electrical faults on power lines. The more faults that occur on a line, the poorer the quality of electrical supply to the end users. The construction of the power line using the steel monopole structure will minimise this impact in that limited perching space on the structure is available to raptors that will readily utilise the power line towers on which to roost. Site specific mitigation can be applied reactively should this impact occur post construction.

Bird nests may also cause faults through nest material, protruding into the air gap between live components on the power line infrastructure. Crows in particular often incorporate wire and other conductive material into their nests. When nests cause flashovers, the nesting material may catch fire. This in turn can lead to equipment damage or a general veld fire. Apart from the cost of replacing damaged equipment, the resultant veld fire can lead to claims for damages from landowners. Power line poles in turn provide nesting substrate for certain bird species, some of which might benefit through the increased availability of nesting substrates on the power line infrastructure. Site specific mitigation can be applied reactively should this impact occur.

6.3 Decommissioning Phase

6.3.1 Displacement as a result of disturbance

The PAOI is already subjected to a degree of disturbance associated with pastoral activities, vehicle and pedestrian traffic. While the decommissioning of the switching station, substations and the Leeudoringstad 132kV power line in this area will undoubtedly displace some species, the bird species likely to occupy this area, and the fact that similar habitat is available within the broader PAOI, displacement as a result of disturbance is unlikely to be permanent and of national significance.

6.4 Cumulative Impacts

Cumulative Impact in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities .

The role of the cumulative impact assessment is to determine if such impacts are relevant to the proposed project (i.e. whether the addition of the proposed project in the proposed areas will increase the impact). This section addresses whether the construction of the proposed development will result in unacceptable risk or loss, complete or whole-scale changes to the environment and/or unacceptable increase in impact.

The proposed Leeudoringstad 132kV power alignment equates to a maximum length of approximately 32km. There are approximately 15 existing high voltage powerlines and significantly more distribution and reticulation lines totalling hundreds of kilometres within the 30km radius around the Leeudoringstad 132kV power line PAOI (Figure 8). The Leeudoringstad 132kV power line will increase the total number of existing and planned high voltage lines by a small percentage, therefore the contribution of the proposed 132kV power line to the cumulative impact of all the high voltage lines is deemed to be of LOW significance. The combined cumulative impact of the existing power lines, the Leeudoringstad 132kV power line and all future proposed power lines on avifauna within a 30km radius is considered to be of MEDIUM significance.

The cumulative impact of displacement due to disturbance and habitat transformation associated with the Switching Station, IPP Substation and Genesis Orkney Solar Plant Substation is considered to be LOW, due to the small size of the development footprints, and the availability of similar habitat within the 30km radius area. The cumulative impact of potential electrocutions within the switching station and substations is also likely to be LOW as it is expected to be a rare event.

6.5 Overall Impact Rating

A qualitative methodology was used to describe, evaluate and rate the significance of the aforementioned impacts associated with the construction and operation of the switching station, substations, LILO power lines and the Leeudoringstad 132kV power line. This assessment is presented in tabular format below (TABLE 2) for both pre- and post-mitigation according to set criteria provided by *SiVEST*.

Table 2: Impact Significance Ratings

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																				
Vegetation (avian microhabitats) Priority avian species (SCC and substation/power line sensitive species)	***Displacement as a result of habitat loss or transformation*** Vegetation clearing for access roads, substations and power line towers and servitudes will impact on vegetation and the avian species that these habitats support	1	4	3	2	3	3	39	-	Medium	Avoid removal of sensitive vegetation types. The recommendations of the botanical study **must be strictly implemented**, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned. Construction activity should be restricted to the immediate footprint of the infrastructure. All construction activities should be strictly managed according to generally accepted	2	3	2	2	2	2	22	-	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
											environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment. All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.									
Priority avian species (SCC and substation/power line sensitive species)	***Displacement as a result of disturbance*** Excavation and construction activities are a source of significant	2	3	2	3	1	3	33	-	Medium	Conduct a pre-construction inspection (avifaunal walk-through) of the final power line alignment, prior to construction, to identify any species that may be breeding	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
	disturbance particularly as a result of the machinery and construction personnel that are present on site for the duration of the construction										on the site or within the immediate surrounds and to ensure that any impacts likely to affect breeding species (if any) are adequately managed and to identify the exact sections of power line requiring collision mitigation.									
Priority avian species (SCC and substation/power line sensitive species)	***Direct mortality as a result of construction activities*** Likely to be confined to a localised area and restricted to immobile species e.g. nestlings.	2	2	2	3	1	2	20	-	Low	Conduct a pre-construction inspection (avifaunal walk-through) of the final power line alignment, prior to construction, to identify any species that may be breeding on the site or within the immediate surrounds	2	1	1	2	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																				
Priority avian species (SCC and substation/power line sensitive species)	***Mortality due to collisions with the LILO power lines and 132kV power line conductors and/or earth wires*** Collisions are the biggest single threat posed by power lines. Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines	2	4	2	3	3	3	42	-	Medium	Conduct a pre-construction inspection (avifaunal walk-through) of the final LILO and 132kV power line alignments, prior to construction, to identify the exact sections of power line requiring collision mitigation. Power line marking in the form of bird flight diverters must be installed on the full span length on the earthwires, according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). Light and dark	2	2	2	2	2	2	20	-	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
											colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors and earthwires are strung.									
Priority avian species (SCC and substation/power line sensitive species)	***Mortality due to electrocutions within the switching station and substations*** 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	2	2	2	3	1	3	30	-	Medium	If electrocution impacts are recorded once the substations are operational, it is recommended that a representative from the Eskom-Endangered Wildlife Trust Strategic Partnership investigate the mortalities and provide recommendations for site-specific mitigation to be applied reactively.	2	1	1	1	1	1	6	-	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
	components and/or live and earthed components																			
Priority avian species (SCC and substation/power line sensitive species)	***Mortality due to electrocutions on the LILO and 132kV power line infrastructure*** Electrocution risk is strongly influenced by the power line voltage and design of the tower/pole structure and mainly affects larger, perching species that are capable of spanning the spaces between energized components.	2	2	2	3	3	3	36	-	Medium	The best possible mitigation is the construction of the power line using an *Eskom* approved bird friendly pole/tower design (DT 7641/7649) accordance with the Distribution Technical Bulletin relating to bird friendly structures. Additional mitigation in the form of insulating sleeves on *jumpers* present on strain poles and terminal poles is also required, alternatively	2	1	1	1	1	1	6	-	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
											all jumpers must be suspended below the crossarms.									
Decommissioning Phase																				
Priority avian species (SCC and substation/power line sensitive species)	***Displacement as a result of disturbance*** Dismantling of the substations and power lines may be a source of disturbance to the avifaunal community	1	3	2	2	1	2	18	-	Low	Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. Measures to control noise should be applied according to current best practice in the industry.	1	2	1	1	1	1	6	-	Low

7. COMPARATIVE ASSESSMENT OF ALTERNATIVES

One of the main objectives of this assessment is to evaluate the identified feasible 132kV power line alternatives and nominate a preferred alternative for development. The alternative alignments that have been delineated for proposed Leeudoringstad 132kV occur within the same pentad. They are comprised of identical vegetation and micro habitats. Both alternatives are therefore likely to be identical in terms of species diversity and density. With this in mind, the selection of a preferred power line alternative is based on the proximity of the existing road and power line infrastructure within the PAOI to the proposed 132kV power line (TABLE 3).

Table 3: Comparative assessment of alternative power line alignments

Alternative	Preference	Reasons (incl. potential issues)
POWERLINE ALTERNATIVES		
Powerline Alternative 1	PREFERRED	This alternative is located closer to the R502 road which is a fairly significant source of disturbance in the PAOI and is located further from the Vaal River, a habitat that poses a higher collision risk. This alignment is also adjacent to the existing Harrisburg-Leeubos 132kV which is similar in height to the proposed Leeudoringstad 132kV and may reduce the risk of collisions, as explained in Section 6.2 above.
Powerline Alternative 2	LEAST PREFERRED	This alternative is least preferred owing to its proximity to the Vaal River. Although orientating power lines adjacent to existing power line infrastructure is a collision risk reducing factor, the location of this alternative to the existing Ferrum-Mercury 400kV may not have the desired effect as a result of the difference in structure height.

7.1 No-Go Alternative

The no-go alternative will result in the current status quo i.e. natural habitat being maintained at the proposed substation sites as far as the avifauna is concerned, which would be beneficial to the avifauna currently occurring there. In addition, the absence of additional power line infrastructure within the PAOI will not increase the risk of power line related avian interactions and mortality.

8. CONCLUSION

The habitat within which the PAOI is located is low to moderately sensitive from a potential bird impact perspective. In recent years, anthropogenic impacts, mostly in the form of urbanisation, agricultural and pastoral activities have largely transformed the landscape resulting in a negative impact on avifaunal diversity and abundance with the PAOI. The construction of the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, associated LILO power lines and Leeudoringstad 132kV power line will result in impacts of MEDIUM-LOW significance to birds occurring in the vicinity of the new infrastructure, which can be reduced through the application of mitigation measures to LOW-NEGLIGIBLE levels. It is anticipated that the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, associated LILO power lines and Leeudoringstad 132kV power line can be constructed and operated with acceptable levels of impact on the resident avifauna, subject to the following recommendations:

- Construction activities (i.e. all staff, vehicle and machinery) should be restricted to the immediate footprint of the infrastructure. The recommendations of the vegetation study must be strictly implemented.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifaunal species.
- Maximum use should be made of existing roads and the construction of new roads must be kept to a minimum.
- The LILO power lines and 132kV power line must be constructed using a bird friendly structure (i.e. DT 7641/7649).
- Additional mitigation in the form of insulating sleeves on *jumpers* present on strain poles and terminal poles is also required, alternatively all jumpers must be suspended below the crossarms.
- Conduct a pre-construction inspection (avifaunal walk-through) of the final power line alignment, prior to construction, to identify any species that may be breeding on the site or within the immediate surrounds and to ensure that any impacts likely to affect breeding species (if any) are adequately managed and to identify the exact sections of power line requiring collision mitigation. As a minimum sections of power line that traverse across or adjacent to rivers, drainage lines, dams and cultivated lands will require collision mitigation.
- Power line marking in the form of bird flight diverters must be installed on the full span length on the earthwires, according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.
- If collision or electrocution impacts are recorded once the 132kV power line is operational, it is recommended that a representative from the Eskom-Endangered Wildlife Trust Strategic Partnership investigate the mortalities and provide recommendations for site-specific mitigation to be applied reactively.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint (especially the removal of natural vegetation) and rehabilitation of disturbed areas is concerned.
- In addition to this, the normal suite of environmental good practices should be applied, such as ensuring strict control of staff, vehicles and machinery on site and limiting the creation of new roads as far as possible.

8.1 Impact Statement

In accordance with the outcomes of the impact assessment detailed in Section 6, in conjunction with the baseline conditions as presented in Section 5 and the impact management measures in Section 6, the proposed Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, associated LILO power lines and Leeudoringstad 132kV power line are **not deemed to present unmitigable negative environmental impacts.** It is this specialist's opinion that the construction of the Switching Station, IPP Substation, Genesis Orkney Solar Plant Substation, associated LILO power lines and Leeudoringstad 132kV power line will result in acceptable levels of impact on the resident avifauna subject to the aforementioned mitigation and management measures.

9. REFERENCES

Anderson, M.D. 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

Animal Demography Unit. 2015. http://cwac.adu.org.za/. Accessed 11 March 2022

Animal Demography Unit. 2017. http://car.adu.org.za/. Accessed 11 March 2022

Avian Power Line Interaction Committee (APLIC). 2012. Mitigating Bird Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute. Washington D.C.

Benson PC. 2015. A survey of Cape vulture breeding colonies in South Africa's northern provinces (Transvaal Region) – an update 2013 Ornithological Observations. 6: 31–36.

Bibby CJ, Burgess ND, Hill DA, Mustoe SH. 2000. Bird Census Techniques. 2nd edition. London: Academic Press.

Dermody BJ, Tanner CJ, and AL Jackson. 2011. The evolutionary pathway to obligate scavenging in Gyps vultures. PLoS One 6: e24635.

Endangered Wildlife Trust – Wildlife & Energy Programme (EWT-WEP). 2013. Eskom-EWT Strategic Partnership Central Incident Register.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1&2. BirdLife South Africa, Johannesburg.

Hobbs, J.C.A. & Ledger J.A. 1986a. The Environmental Impact of Linear Developments; Power lines and Avifauna. (Third International Conference on Environmental Quality and Ecosystem Stability. Israel, June 1986).

Hobbs, J.C.A. & Ledger J.A. 1986b. "Power lines, Birdlife and the Golden Mean." Fauna and Flora, 44, pp 23-27.

Hockey, P.A.R, Dean, W.R.J and Ryan, P. 2005. Robert's birds of southern Africa (Vii) edition. The John Voelcker Bird Book Fund, Johannesburg.

Hugh-Jones, M.E. and de Vos, V., 2002. Anthrax and Wildlife. Revue scientifique et technique (International Office of Epizootics) 21, 359-383.

Jenkins, A.R., Smallie, J.J. & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. *Bird Conservation International* 20: 263-278

Kruger, R. & Van Rooyen, C.S. 1998. Evaluating the risk that existing power lines pose to large raptors by using risk assessment methodology: the Molopo Case Study. (5th World Conference on Birds of Prey and Owls: 4 - 8 August 1998. Midrand, South Africa.)

Kruger, R. 1999. Towards solving raptor electrocutions on Eskom Distribution Structures in South Africa. M. Phil. Mini-thesis. University of the Orange Free State. Bloemfontein. South Africa.

Ledger, J.A. & Annegarn H.J. 1981. “Electrocution Hazards to the Cape Vulture (Gyps coprotheres) in South Africa”. Biological Conservation, 20, pp15-24.

Ledger, J.A. 1984. “Engineering Solutions to the problem of Vulture Electrocutions on Electricity Towers.” The Certificated Engineer, 57, pp 92-95.

Ledger, J.A., J.C.A. Hobbs & Smith T.V. 1992. Avian Interactions with Utility Structures: Southern African Experiences. (Proceedings of the International Workshop on Avian Interactions with Utility Structures, Miami, Florida, 13-15 September 1992. Electric Power Research Institute.)
IUCN (2016). The IUCN Red List of threatened species. http://www.iucnredlist.org/ Accessed on 26 November 2017.

Marnewick, M.D., Retief E.F., Theron N.T., Wright D.R., Anderson T.A. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.

Martin, G.R., Shaw, J.M. 2010. Bird collisions with power lines: Failing to see the way ahead? Biol. Conserv. (2010), doi:10.1016/j.biocon.2010.07.014.

Mucina, L; Rutherford, C. 2006. The Vegetation of South Africa, Lesotho and Swaziland, South African National Biodiversity Institute, Pretoria.

Mudur, G., 2001. Human anthrax in India may be linked to vulture decline. British Medical Journal 322, 320.

Mundy P, Butchart D, Ledger J, and S Piper. 1992. The vultures of Africa. Acorn Books. Randburg

Pfeiffer MB, Venter JA, and CT Downs. 2015. Foraging range and habitat use by Cape vulture Gyps coprotheres from the Msikaba colony, Eastern Cape province, South Africa. Koedoe 57: 1–11.

Phipps WL, Willis SG, Wolter K, and V Naidoo. 2013b. Foraging ranges of immature African white-backed vultures (Gyps africanus) and their use of protected areas in Southern Africa. PLoS One 8: e52813.

Phipps WL, Wolter K, Michael MD, MacTavish LM, and RW Yarnell. 2013a. Do power lines and protected areas present a catch-22 situation for Cape vultures (Gyps coprotheres)? PLoS One 8: e76794.

Shaw, J.M. 2013. Power line collisions in the Karoo: Conserving Ludwig’s Bustard. Unpublished PhD thesis. Percy FitzPatrick Institute of African Ornithology, Department of Biological Sciences, Faculty of Science University of Cape Town May 2013.

Sharp, D., 2001. Meloxicam to prevent rabies? The Lancet 367, 887-888.

Smallie, J. 2007. Avifaunal Specialist Study: The Proposed Gamma Substation. The Endangered Wildlife Trust.

Southern African Bird Atlas Project 2 (SABAP2). http://sabap2.adu.org.za. Accessed 11 March 2022

South African National Biodiversity Institute. http://bgisviewer.sanbi.org. 11 March 2022
Taylor, P.B., Navarro, R.A., Wren- Sargent, M., Harrison, J.A. & Kieswetter, S.L. 1999. TOTAL CWAC Report. Coordinated waterbird counts in South Africa, 1992-97. Avian Demography Unit, University of Cape Town.

Sundar, K.S.G. and Choudhury, B.C. 2005. Mortality of sarus ranes (*Grus antigone*) due to electricity wires in Uttar Pradesh, India. Environmental Conservation 32 (3): 260–269. Foundation for Environmental Conservation.

Taylor, M.R., Peacock, F. and Wanless, R.M. (eds) 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

Van Rooyen, C.S. & Ledger, J.A. 1999. “Birds and utility structures: Developments in southern Africa” in Ferrer, M. & G..F.M. Janns. (eds.) Birds and Power lines. Quercus: Madrid, Spain, pp 205-230

Van Rooyen, C.S. 1998. Raptor mortality on power lines in South Africa. (5th World Conference on Birds of Prey and Owls: 4 - 8 August 1998. Midrand, South Africa.)

Van Rooyen, C.S. 1999**.** An overview of the Eskom - EWT Strategic Partnership in South Africa. (EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999, Charleston, South Carolina.)

Van Rooyen, C.S. 2000. “An overview of Vulture Electrocutions in South Africa.” Vulture News, 43, pp 5-22. Vulture Study Group: Johannesburg, South Africa.

Van Rooyen, C.S. 2004a. The Management of Wildlife Interactions with overhead lines. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

Van Rooyen, C.S. 2004b. Investigations into vulture electrocutions on the Edwardsdam-Mareetsane 132kV feeder, Unpublished report, Endangered Wildlife Trust, Johannesburg.

Van Rooyen, C.S. & Taylor, P.V. 1999. Bird Streamers as probable cause of electrocutions in South Africa. (EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999. Charleston, South Carolina)

Venter JA, Martens FR, and Wolter K. 2018. Recommended conservation buffer sizes derived from movement data of breeding adult Cape (Gyps coprotheres) in South Africa. Nelson Mandela University unpublished report

Wolter, K. Phipps, L. & Naidoo, V. 2010. Foraging and distribution ranges of Cape Vultures (*Gyps coprotheres*) in the Greater Pilanesberg region. Report NR: RES/RR/09/31609. Eskom Research and Innovation Department

Wolter, K., Guegnard, A., Neser, W., Boemans, B., and Whittington-Jones, C. 2013. Vulture Restaurant Monitoring Protocol. VulPro.

Young, D.J., Harrison, J.A, Navarro, R.A., Anderson, M.A., & Colahan, B.D. (Eds). 2003. Big birds on farms: Mazda CAR Report 1993-2001. Avian Demography Unit: Cape Town.

APPENDIX 1: SOUTH AFRICAN BIRD ATLAS PROJECT DATA (SABAP2) FOR THE LEEUDORINGSTAD SUBSTATIONS AND 132kV POWER LINE PROJECT

Species name	Scientific name	Full protocol	Ad hoc protocol	Regional Red List	Endemic (SA)	Endemic (SA) - detail
Acacia Pied Barbet	*Tricholaema leucomelas*	79,6	1,6	-		
African Black Duck	*Anas sparsa*	9,3	0,0	-		
African Black Swift	*Apus barbatus*	1,2	0,0	-		
African Darter	*Anhinga rufa*	46,3	7,9	-		
African Firefinch	*Lagonosticta rubricata*	2,5	0,0	-		
African Fish Eagle	*Haliaeetus vocifer*	17,3	4,8	-		
African Harrier-Hawk	*Polyboroides typus*	1,2	0,0	-		
African Hoopoe	*Upupa africana*	40,7	6,3	-		
African Jacana	*Actophilornis africanus*	4,3	1,6	-		
African Palm Swift	*Cypsiurus parvus*	32,1	6,3	-		
African Paradise Flycatcher	*Terpsiphone viridis*	11,7	1,6	-		
African Pied Wagtail	*Motacilla aguimp*	9,9	0,0	-		
African Pipit	*Anthus cinnamomeus*	33,3	3,2	-		
African Rail	*Rallus caerulescens*	0,6	0,0	-		
African Red-eyed Bulbul	*Pycnonotus nigricans*	91,4	9,5	-		
African Reed Warbler	*Acrocephalus baeticatus*	13,0	1,6	-		
African Sacred Ibis	*Threskiornis aethiopicus*	29,0	4,8	-		
African Snipe	*Gallinago nigripennis*	0,6	0,0	-		
African Spoonbill	*Platalea alba*	7,4	0,0	-		
African Stonechat	*Saxicola torquatus*	42,6	6,3	-		
African Wattled Lapwing	*Vanellus senegallus*	2,5	0,0	-		
Amethyst Sunbird	*Chalcomitra amethystina*	2,5	1,6	-		
Amur Falcon	*Falco amurensis*	13,0	7,9	-		
Ant-eating Chat	*Myrmecocichla formicivora*	35,2	6,3	-		
Ashy Tit	*Melaniparus cinerascens*	16,7	0,0	-		
Banded Martin	*Riparia cincta*	0,0	1,6	-		
Barn Swallow	*Hirundo rustica*	25,9	11,1	-		
Barred Wren-Warbler	*Calamonastes fasciolatus*	2,5	0,0	-		
Bar-throated Apalis	*Apalis thoracica*	19,1	0,0	-		
Bearded Woodpecker	*Chloropicus namaquus*	0,0	1,6	-		
Black Crake	*Zapornia flavirostra*	6,8	1,6	-		
Black Heron	*Egretta ardesiaca*	1,9	1,6	-		
Black Sparrowhawk	*Accipiter melanoleucus*	0,6	0,0	-		
Black-chested Prinia	*Prinia flavicans*	90,7	6,3	-		
Black-chested Snake Eagle	*Circaetus pectoralis*	0,6	0,0	-		
Black-collared Barbet	*Lybius torquatus*	31,5	1,6	-		
Black-crowned Night Heron	*Nycticorax nycticorax*	2,5	0,0	-		
Black-faced Waxbill	*Brunhilda erythronotos*	3,7	1,6	-		
Black-headed Heron	*Ardea melanocephala*	13,6	0,0	-		
Blacksmith Lapwing	*Vanellus armatus*	79,0	6,3	-		
Black-throated Canary	*Crithagra atrogularis*	72,8	3,2	-		
Black-winged Kite	*Elanus caeruleus*	38,3	9,5	-		
Black-winged Pratincole	*Glareola nordmanni*	0,6	0,0	NT		
Black-winged Stilt	*Himantopus himantopus*	11,7	1,6	-		
Blue Waxbill	*Uraeginthus angolensis*	38,3	3,2	-		
Blue-billed Teal	*Spatula hottentota*	0,6	0,0	-		
Blue-cheeked Bee-eater	*Merops persicus*	1,9	1,6	-		
Bokmakierie	*Telophorus zeylonus*	13,6	1,6	-		

Species name	Scientific name	Full protocol	Ad hoc protocol	Regional Red List	Endemic (SA)	Endemic (SA) - detail
Bronze Mannikin	*Spermestes cucullata*	0,6	1,6	-		
Brown Snake Eagle	*Circaetus cinereus*	0,6	0,0	-		
Brown-crowned Tchagra	*Tchagra australis*	43,8	1,6	-		
Brown-hooded Kingfisher	*Halcyon albiventris*	31,5	3,2	-		
Brown-throated Martin	*Riparia paludicola*	22,2	3,2	-		
Brubru	*Nilaus afer*	8,6	0,0	-		
Buffy Pipit	*Anthus vaalensis*	4,9	0,0	-		
Burchell's Coucal	*Centropus burchellii*	8,0	1,6	-		
Cape Longclaw	*Macronyx capensis*	24,7	4,8	-		
Cape Penduline Tit	*Anthoscopus minutus*	3,1	0,0	-		
Cape Robin-Chat	*Cossypha caffra*	71,6	3,2	-		
Cape Shoveler	*Spatula smithii*	12,3	0,0	-		
Cape Sparrow	*Passer melanurus*	87,7	14,3	-		
Cape Starling	*Lamprotornis nitens*	57,4	4,8	-		
Cape Teal	*Anas capensis*	5,6	0,0	-		
Cape Turtle Dove	*Streptopelia capicola*	72,8	9,5	-		
Cape Wagtail	*Motacilla capensis*	46,3	6,3	-		
Cape Weaver	*Ploceus capensis*	0,6	0,0	-	x	Near endemic
Cape White-eye	*Zosterops virens*	11,7	1,6	-	x	Near endemic
Capped Wheatear	*Oenanthe pileata*	6,2	0,0	-		
Cardinal Woodpecker	*Dendropicos fuscescens*	11,7	3,2	-		
Caspian Tern	*Hydroprogne caspia*	2,5	0,0	VU		
Chestnut-backed Sparrow-Lark	*Eremopterix leucotis*	3,7	0,0	-		
Chestnut-vented Warbler	*Curruca subcoerulea*	88,9	4,8	-		
Chinspot Batis	*Batis molitor*	10,5	1,6	-		
Cinnamon-breasted Bunting	*Emberiza tahapisi*	8,6	1,6	-		
Cloud Cisticola	*Cisticola textrix*	11,1	0,0	-	x	Near endemic
Common Buttonquail	*Turnix sylvaticus*	0,6	0,0	-		
Common Buzzard	*Buteo buteo*	4,9	4,8	-		
Common Greenshank	*Tringa nebularia*	1,2	0,0	-		
Common Moorhen	*Gallinula chloropus*	17,3	3,2	-		
Common Myna	*Acridotheres tristis*	77,2	25,4	-		
Common Ostrich	*Struthio camelus*	19,1	1,6	-		
Common Quail	*Coturnix coturnix*	1,2	0,0	-		
Common Sandpiper	*Actitis hypoleucos*	3,7	1,6	-		
Common Scimitarbill	*Rhinopomastus cyanomelas*	24,7	3,2	-		
Common Swift	*Apus apus*	1,2	0,0	-		
Common Waxbill	*Estrilda astrild*	5,6	0,0	-		
Common Whitethroat	*Curruca communis*	4,3	0,0	-		
Crested Barbet	*Trachyphonus vaillantii*	88,3	6,3	-		
Crimson-breasted Shrike	*Laniarius atrococcineus*	11,1	0,0	-		
Crowned Lapwing	*Vanellus coronatus*	79,0	7,9	-		
Dark-capped Bulbul	*Pycnonotus tricolor*	0,6	0,0	-		
Desert Cisticola	*Cisticola aridulus*	30,9	1,6	-		
Diederik Cuckoo	*Chrysococcyx caprius*	34,6	1,6	-		
Domestic Goose	*Anser anser domesticus*	14,8	0,0	-		
Double-banded Courser	*Rhinoptilus africanus*	0,6	0,0	-		
Dusky Indigobird	*Vidua funerea*	1,9	0,0	-		
Eastern Clapper Lark	*Mirafra fasciolata*	17,3	1,6	-		
Eastern Long-billed Lark	*Certhilauda semitorquata*	0,6	0,0	-	x	Endemic (SA, Lesotho, Swaziland)
Egyptian Goose	*Alopochen aegyptiaca*	59,3	11,1	-		

Species name	Scientific name	Full protocol	Ad hoc protocol	Regional Red List	Endemic (SA)	Endemic (SA) - detail
European Bee-eater	*Merops apiaster*	30,9	1,6	-		
Fairy Flycatcher	*Stenostira scita*	3,7	0,0	-	x	Near endemic
Familiar Chat	*Oenanthe familiaris*	2,5	0,0	-		
Fiscal Flycatcher	*Melaenornis silens*	61,7	3,2	-	x	Near endemic
Fork-tailed Drongo	*Dicrurus adsimilis*	4,3	0,0	-		
Fulvous Whistling Duck	*Dendrocygna bicolor*	1,2	0,0	-		
Gabar Goshawk	*Micronisus gabar*	4,9	0,0	-		
Garden Warbler	*Sylvia borin*	0,6	0,0	-		
Giant Kingfisher	*Megaceryle maxima*	16,7	3,2	-		
Glossy Ibis	*Plegadis falcinellus*	8,6	3,2	-		
Golden-breasted Bunting	*Emberiza flaviventris*	0,6	0,0	-		
Golden-tailed Woodpecker	*Campethera abingoni*	6,8	1,6	-		
Goliath Heron	*Ardea goliath*	5,6	1,6	-		
Great Crested Grebe	*Podiceps cristatus*	1,2	0,0	-		
Great Egret	*Ardea alba*	1,2	0,0	-		
Great Reed Warbler	*Acrocephalus arundinaceus*	1,2	1,6	-		
Greater Flamingo	*Phoenicopterus roseus*	2,5	0,0	NT		
Greater Honeyguide	*Indicator indicator*	2,5	1,6	-		
Greater Kestrel	*Falco rupicoloides*	7,4	1,6	-		
Greater Striped Swallow	*Cecropis cucullata*	45,7	7,9	-		
Green Wood Hoopoe	*Phoeniculus purpureus*	19,1	1,6	-		
Green-winged Pytilia	*Pytilia melba*	20,4	1,6	-		
Grey Go-away-bird	*Crinifer concolor*	1,2	0,0	-		
Grey Heron	*Ardea cinerea*	23,5	1,6	-		
Grey-headed Gull	*Chroicocephalus cirrocephalus*	8,0	0,0	-		
Hadada Ibis	*Bostrychia hagedash*	87,7	6,3	-		
Hamerkop	*Scopus umbretta*	4,9	0,0	-		
Helmeted Guineafowl	*Numida meleagris*	50,6	7,9	-		
House Sparrow	*Passer domesticus*	59,3	11,1	-		
Icterine Warbler	*Hippolais icterina*	1,2	0,0	-		
Intermediate Egret	*Ardea intermedia*	1,2	0,0	-		
Jackal Buzzard	*Buteo rufofuscus*	0,0	1,6	-	x	Near endemic
Jacobin Cuckoo	*Clamator jacobinus*	2,5	0,0	-		
Jameson's Firefinch	*Lagonosticta rhodopareia*	5,6	1,6	-		
Kalahari Scrub Robin	*Cercotrichas paena*	66,7	3,2	-		
Karoo Thrush	*Turdus smithi*	35,8	1,6	-	x	Near endemic
Kittlitz's Plover	*Charadrius pecuarius*	3,1	0,0	-		
Klaas's Cuckoo	*Chrysococcyx klaas*	2,5	0,0	-		
Lanner Falcon	*Falco biarmicus*	0,6	0,0	VU		
Lark-like Bunting	*Emberiza impetuani*	3,7	0,0	-		
Laughing Dove	*Spilopelia senegalensis*	96,9	25,4	-		
Lesser Flamingo	*Phoeniconaias minor*	1,2	0,0	NT		
Lesser Grey Shrike	*Lanius minor*	8,6	3,2	-		
Lesser Honeyguide	*Indicator minor*	4,9	1,6	-		
Lesser Kestrel	*Falco naumanni*	8,6	6,3	-		
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	35,8	1,6	-		
Levaillant's Cisticola	*Cisticola tinniens*	40,7	0,0	-		
Lilac-breasted Roller	*Coracias caudatus*	2,5	0,0	-		
Little Bee-eater	*Merops pusillus*	6,8	0,0	-		
Little Bittern	*Ixobrychus minutus*	0,6	0,0	-		
Little Egret	*Egretta garzetta*	15,4	4,8	-		

Species name	Scientific name	Full protocol	Ad hoc protocol	Regional Red List	Endemic (SA)	Endemic (SA) - detail
Little Grebe	*Tachybaptus ruficollis*	22,8	1,6	-		
Little Rush Warbler	*Bradypterus baboecala*	3,1	0,0	-		
Little Sparrowhawk	*Accipiter minullus*	3,1	0,0	-		
Little Stint	*Calidris minuta*	4,9	0,0	-		
Little Swift	*Apus affinis*	43,8	9,5	-		
Long-billed Crombec	*Sylvietta rufescens*	12,3	0,0	-		
Long-tailed Paradise Whydah	*Vidua paradisaea*	10,5	1,6	-		
Long-tailed Widowbird	*Euplectes progne*	37,0	7,9	-		
Malachite Kingfisher	*Corythornis cristatus*	10,5	0,0	-		
Marsh Owl	*Asio capensis*	0,6	0,0	-		
Marsh Warbler	*Acrocephalus palustris*	3,7	0,0	-		
Melodious Lark	*Mirafra cheniana*	0,6	0,0	-	x	Near endemic
Mountain Wheatear	*Myrmecocichla monticola*	2,5	0,0	-		
Namaqua Dove	*Oena capensis*	20,4	0,0	-		
Natal Spurfowl	*Pternistis natalensis*	16,7	1,6	-		
Neddicky	*Cisticola fulvicapilla*	70,4	7,9	-		
Northern Black Korhaan	*Afrotis afraoides*	56,2	4,8	-		
Orange River Francolin	*Scleroptila gutturalis*	13,6	1,6	-		
Orange River White-eye	*Zosterops pallidus*	67,9	3,2	-		
Orange-breasted Waxbill	*Amandava subflava*	0,6	0,0	-		
Ovambo Sparrowhawk	*Accipiter ovampensis*	0,6	0,0	-		
Pale Chanting Goshawk	*Melierax canorus*	1,2	0,0	-		
Pearl-breasted Swallow	*Hirundo dimidiata*	1,9	0,0	-		
Pied Avocet	*Recurvirostra avosetta*	1,9	0,0	-		
Pied Crow	*Corvus albus*	58,0	11,1	-		
Pied Kingfisher	*Ceryle rudis*	13,0	0,0	-		
Pied Starling	*Lamprotornis bicolor*	9,9	3,2	-	x	Endemic (SA, Lesotho, Swaziland)
Pink-billed Lark	*Spizocorys conirostris*	2,5	0,0	-		
Pin-tailed Whydah	*Vidua macroura*	19,1	1,6	-		
Plain-backed Pipit	*Anthus leucophrys*	3,1	0,0	-		
Pririt Batis	*Batis pririt*	45,7	1,6	-		
Purple Heron	*Ardea purpurea*	4,3	0,0	-		
Purple Indigobird	*Vidua purpurascens*	1,9	0,0	-		
Quailfinch	*Ortygospiza atricollis*	29,6	0,0	-		
Rattling Cisticola	*Cisticola chiniana*	44,4	3,2	-		
Red-backed Shrike	*Lanius collurio*	17,3	1,6	-		
Red-billed Firefinch	*Lagonosticta senegala*	15,4	0,0	-		
Red-billed Quelea	*Quelea quelea*	54,3	6,3	-		
Red-billed Teal	*Anas erythrorhyncha*	19,1	0,0	-		
Red-breasted Swallow	*Cecropis semirufa*	1,9	0,0	-		
Red-capped Lark	*Calandrella cinerea*	11,7	0,0	-		
Red-chested Cuckoo	*Cuculus solitarius*	8,0	0,0	-		
Red-collared Widowbird	*Euplectes ardens*	4,9	3,2	-		
Red-eyed Dove	*Streptopelia semitorquata*	90,1	20,6	-		
Red-faced Mousebird	*Urocolius indicus*	72,2	7,9	-		
Red-footed Falcon	*Falco vespertinus*	0,6	0,0	NT		
Red-headed Finch	*Amadina erythrocephala*	11,7	1,6	-		
Red-knobbed Coot	*Fulica cristata*	25,3	1,6	-		
Red-throated Wryneck	*Jynx ruficollis*	4,9	0,0	-		
Reed Cormorant	*Microcarbo africanus*	42,6	4,8	-		
Rock Dove	*Columba livia*	27,2	3,2	-		

Species name	Scientific name	Full protocol	Ad hoc protocol	Regional Red List	Endemic (SA)	Endemic (SA) - detail
Rock Kestrel	*Falco rupicolus*	0,6	0,0	-		
Rock Martin	*Ptyonoprogne fuligula*	1,2	0,0	-		
Ruff	*Calidris pugnax*	5,6	1,6	-		
Rufous-naped Lark	*Mirafra africana*	40,1	3,2	-		
Sabota Lark	*Calendulauda sabota*	24,1	0,0	-		
Scaly-feathered Weaver	*Sporopipes squamifrons*	61,1	4,8	-		
Shaft-tailed Whydah	*Vidua regia*	7,4	0,0	-		
South African Cliff Swallow	*Petrochelidon spilodera*	43,2	19,0	-	x	Endemic (SA, Lesotho, Swaziland) Breeding
South African Shelduck	*Tadorna cana*	21,0	1,6	-		
Southern Fiscal	*Lanius collaris*	66,0	15,9	-		
Southern Grey-headed Sparrow	*Passer diffusus*	54,3	3,2	-		
Southern Masked Weaver	*Ploceus velatus*	95,1	22,2	-		
Southern Pochard	*Netta erythrophthalma*	5,6	1,6	-		
Southern Red Bishop	*Euplectes orix*	58,0	12,7	-		
Speckled Mousebird	*Colius striatus*	28,4	1,6	-		
Speckled Pigeon	*Columba guinea*	67,9	7,9	-		
Spike-heeled Lark	*Chersomanes albofasciata*	4,9	1,6	-		
Spotted Flycatcher	*Muscicapa striata*	13,6	0,0	-		
Spotted Thick-knee	*Burhinus capensis*	3,7	0,0	-		
Spur-winged Goose	*Plectropterus gambensis*	13,0	3,2	-		
Squacco Heron	*Ardeola ralloides*	5,6	0,0	-		
Striated Heron	*Butorides striata*	3,1	0,0	-		
Swainson's Spurfowl	*Pternistis swainsonii*	62,3	3,2	-		
Swallow-tailed Bee-eater	*Merops hirundineus*	1,9	0,0	-		
Tawny-flanked Prinia	*Prinia subflava*	4,3	1,6	-		
Thick-billed Weaver	*Amblyospiza albifrons*	8,6	0,0	-		
Three-banded Plover	*Charadrius tricollaris*	10,5	1,6	-		
Tinkling Cisticola	*Cisticola rufilatus*	0,6	0,0	-		
Village Indigobird	*Vidua chalybeata*	11,1	1,6	-		
Violet-eared Waxbill	*Granatina granatina*	9,3	1,6	-		
Wattled Starling	*Creatophora cinerea*	39,5	3,2	-		
Western Barn Owl	*Tyto alba*	1,2	1,6	-		
Western Cattle Egret	*Bubulcus ibis*	50,6	15,9	-		
Whiskered Tern	*Chlidonias hybrida*	6,2	0,0	-		
White-backed Duck	*Thalassornis leuconotus*	0,6	0,0	-		
White-backed Mousebird	*Colius colius*	49,4	3,2	-		
White-bellied Sunbird	*Cinnyris talatala*	30,9	0,0	-		
White-breasted Cormorant	*Phalacrocorax lucidus*	34,0	3,2	-		
White-browed Scrub Robin	*Cercotrichas leucophrys*	1,2	0,0	-		
White-browed Sparrow-Weaver	*Plocepasser mahali*	80,9	12,7	-		
White-faced Whistling Duck	*Dendrocygna viduata*	9,9	1,6	-		
White-fronted Bee-eater	*Merops bullockoides*	34,0	1,6	-		
White-rumped Swift	*Apus caffer*	19,8	6,3	-		
White-throated Robin-Chat	*Cossypha humeralis*	0,6	0,0	-		
White-throated Swallow	*Hirundo albigularis*	24,1	3,2	-		
White-winged Tern	*Chlidonias leucopterus*	2,5	1,6	-		
White-winged Widowbird	*Euplectes albonotatus*	11,7	1,6	-		
Willow Warbler	*Phylloscopus trochilus*	9,9	1,6	-		
Wood Sandpiper	*Tringa glareola*	6,8	0,0	-		
Yellow Canary	*Crithagra flaviventris*	50,6	1,6	-		
Yellow-bellied Eremomela	*Eremomela icteropygialis*	2,5	0,0	-		

Species name	Scientific name	Full protocol	Ad hoc protocol	Regional Red List	Endemic (SA)	Endemic (SA) - detail
Yellow-billed Duck	*Anas undulata*	50,0	4,8	-		
Yellow-billed Kite	*Milvus aegyptius*	1,2	0,0	-		
Yellow-crowned Bishop	*Euplectes afer*	11,7	1,6	-		
Yellow-fronted Canary	*Crithagra mozambica*	3,1	0,0	-		
Yellow-throated Bush Sparrow	*Gymnoris superciliaris*	1,2	0,0	-		
Zitting Cisticola	*Cisticola juncidis*	9,3	3,2	-		

APPENDIX 2: AVIFAUNAL HABITAT OBSERVED IN THE LEEUDORINGSTAD 132KV POWER LINE PAROJECT PAOI

Figure 1. Grassland habitat

Figure 2. Open woodland

Figure 3. Shrubland

Figure 4. Vaal River

Figure 5. Klipspruit ephemeral river

Figure 6. Ysterspruit ephemeral river

Figure 7. Cultivated lands

Figure 8. Exotic tree stands

APPENDIX 3: RECOMMENDED 132kV STRUCTURE TYPE (DT 7641/7649)