PROPOSED JESSA M, JESSA S AND JESSA Z GRID CONNECTION INFRASTRUCTURE PROJECTS NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA

Avifaunal Specialist Assessment Report

DEFF References: To Be Allocated
Report Prepared by: Chris van Rooyen Consulting
Issue Date: 30 December 2021
Version No.: 01

PROPOSED CONSTRUCTION OF THE JESSA M, JESSA S AND JESSA Z GRID CONNECTION INFRASTRUCTURE PROJECTS, NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA

AVIFAUNAL SPECIALIST ASSESSMENT

EXECUTIVE SUMMARY

Chris van Rooyen Consulting has been appointed by SLR South Africa Consulting (PTY) Ltd, on behalf of ENERTRAG South Africa (Pty) Ltd (hereafter referred to as "ESA"), to undertake an avifaunal impact assessment for the proposed construction of three wind energy facilities (WEFs) and associated grid connection (together known as the Jessa Projects) near Beaufort West in the Western Cape Province of South Africa.

The above-mentioned WEF and associated grid connection projects form part of a greater renewable energy project known as the 'Jessa Cluster', being proposed by ESA near the town of Beaufort West. The projects which form part of the proposed 'Jessa Cluster' include the following (Figure 1):

- Jessa M WEF – DFFE Reference Number: To be Allocated;
- Jessa M Grid Connection – DFFE Reference Number: To be Allocated;
- Jessa S WEF – DFFE Reference Number: To be Allocated;
- Jessa S M Grid Connection – DFFE Reference Number: To be Allocated;
- Jessa Z WEF – DFFE Reference Number: To be Allocated; and
- Jessa Z Grid Connection – DFFE Reference Number: To be Allocated.

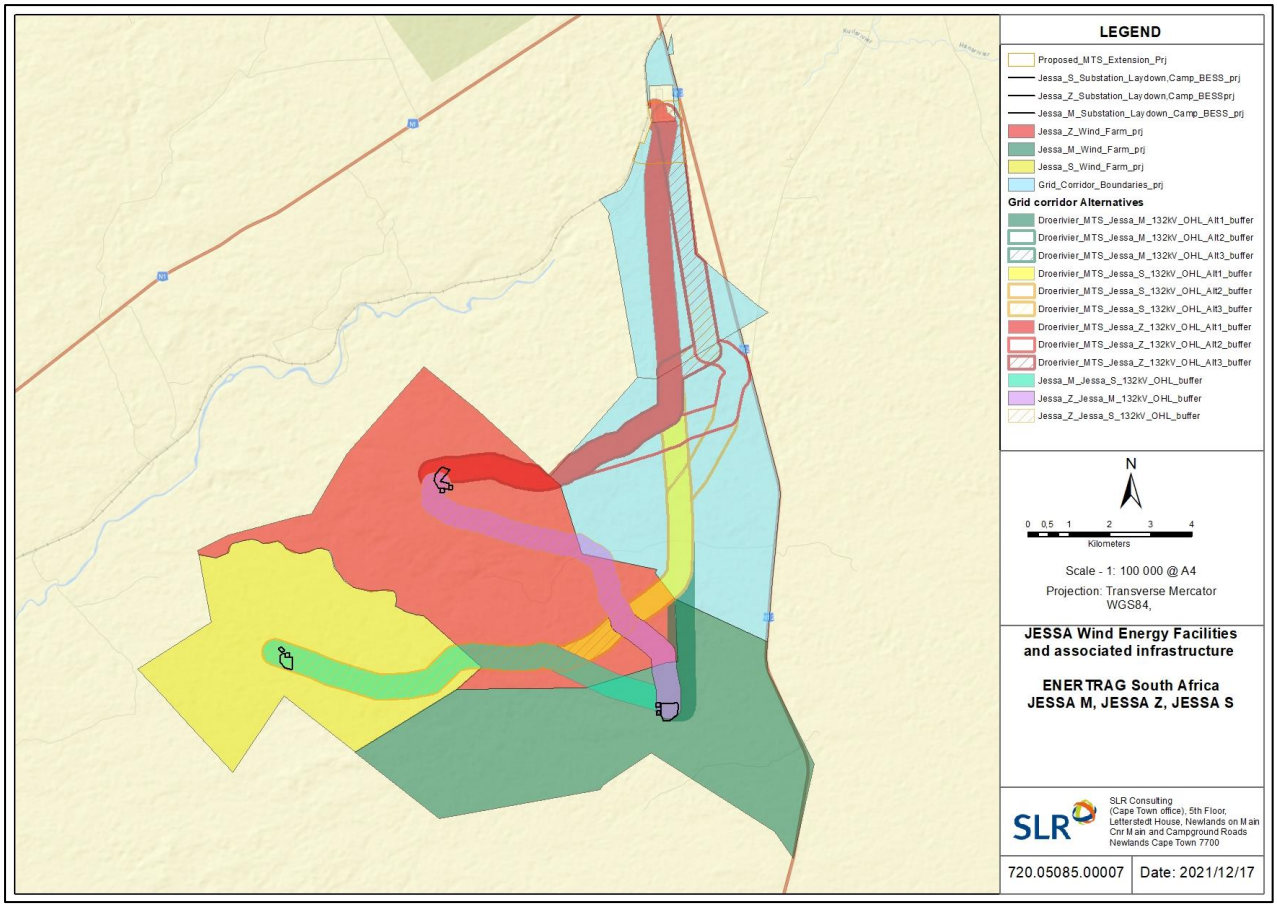

Figure 1: Map showing WEF & associated grid connection infrastructure projects which form part of proposed Jessa Cluster

The proposed Jessa grid connection infrastructure projects aim to feed the clean energy generated by the Jessa WEF projects (part of separate respective applications / BA processes and assessed in a standalone Avifauna report) into the national electricity grid.

The proposed grid connection infrastructure projects require several key components to facilitate the distribution and transmission of electricity at a large scale, which includes the following:

- An onsite high voltage collector substation (33kV/132kV) per grid connection project, to allow for the potential of multiple feeder bays of up to 132kV, as well as transformers, control building, telecommunication infrastructure and access roads;
- 132kV powerlines (either single or double circuit), connecting each WEF project (WEF projects part of separate respective applications / BA processes and assessed in a standalone Avifauna report) to each other via the substations;
- 132kV transmission lines from each WEF substation to the existing Eskom Droërivier MTS; and
- Upgrades to the existing Eskom Droërivier MTS (within the current footprint); or
- If required, an expansion / additional 132kV/400kV MTS (approx. 20ha in extent).

ESA proposes to connect all three Jessa WEF projects (part of separate respective applications / BA processes and assessed in a standalone Avifauna report) to the nearby existing Eskom Droërivier MTS through powerlines, transmitting up to 132kV (either single or double circuit).

In terms of the EIA Regulations, 2014 (as amended), various aspects of the proposed grid connection infrastructure developments may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. Specialist studies have been commissioned to verify the sensitivity and assess the impacts of the grid connection infrastructure projects under the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020).

The scope of this report covers the Jessa M, Jessa S, and Jessa Z grid connection projects, including the potential expansion of the Droërivier MTS (see section 3). Even though these developments are three separate applications (i.e., three separate BA processes), they will be considered in the same specialist report.

1. SUMMARY OF FINDINGS

The proposed Jessa M, Jessa S and Jessa Z grid connection projects will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the switching / collector substations and the extension of the Droërivier MTS, in the construction phase.
- Collisions with the overhead line in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

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

Construction activities impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and (possibly) the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle. Large terrestrial species and some species of raptors are most likely to be affected by displacement due to disturbance. There is an active Martial Eagle territory with two nests at Tower 15 15 (-32.460369°S; 22.534269°E) and Tower 18 (-32.471507°S; 22.535406°E) on the Droërivier Proteus 1 400kV HV line. All the proposed grid connection options for the respective Jessa grid connection projects are located between 0 - 1.6km of a nest. The risk of the birds being temporary displaced due to disturbance by the construction activities are very high, unless mitigated. The impact is rated as **medium** pre-mitigation and **very low** post-mitigation for all three Jessa grid connection projects.

1.2 Displacement due to habitat transformation in the switching / collector substations and the extension of the Droërivier MTS in the construction phase

Construction activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed switching / collector substations for the three grid connection projects, through transformation of

habitat, 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 / collector substation yard for each respective grid connection project is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing powerlines, very little if any vegetation clearing will be required in the powerline servitudes for the grid connection projects. The habitat in the study area for the three grid connection projects is extensive, very uniform and largely untransformed from a bird impact perspective; therefore, the loss of a few hectares of habitat for priority species due to direct habitat transformation associated with the construction of the proposed switching / collector substation for the three grid connection projects, including the extension of the existing Droërivier MTS, is likely to have a low impact on them. The species most likely to be more heavily impacted would be small, common, non-Red Data species which happen to be resident in those few hectares of Karoo habitat. The impact is rated as **medium** pre-mitigation and **low** post-mitigation for all three Jessa grid connection projects.

1.3 Mortality caused by the collisions with the overhead line in the operational phase

The grid connection projects could potentially pose a collision risk to various species, particularly large terrestrial species, including Red Data species such as Ludwig's Bustard, Blue Crane, Karoo Korhaan and Secretarybird, as well as various waterbirds when the dams are full and the drainage lines contain water. The impact is rated as **medium** pre-mitigation and **low** post-mitigation for all three Jessa grid connection projects.

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

The impact is likely to be similar in nature and extent to the construction phase for all three Jessa grid connection projects.

1.5 Cumulative impacts

Four proposed renewable energy projects were considered within a 35km radius of the three proposed Jessa grid connection developments. No operational renewable energy facilities were identified. The authorised projects were identified using the latest (Q3 2021) Renewable Energy EIA Application Database for South Africa from the Department of Fisheries, Forestry and Environment (DFFE), in conjunction with information provided by Independent Power Producers (IPPs) operating in the broader region. It should be noted that this list is based on information available at the time of writing this report and as such, there may be other renewable energy projects proposed within the study area for the three Jessa grid connection projects. All of these projects require overhead grid connections, but information on the length of these grid connections could not be attained in all instances, therefore assumptions were made on the expected length of some of the connections, based on the distance from the Droërivier MTS. There are several HV lines feeding into the existing Eskom Droërivier MTS, of which ~ 270km is contained in the 35km radius around the three Jessa grid connection projects. The sum total of all the existing and planned HV lines in the 35km radius amounts to ~ 415km (assuming that the aforementioned solar developments will each contribute a maximum of ~15km i.e., ~60km in total), of which the proposed Jessa M, Jessa Z and Jessa S grid connection projects constitute a maximum of ~ 85km, or ~ 20%. The contribution of the Jessa M, Jessa Z and Jessa S grid connection projects to the cumulative impact of all the grid connections and existing HV lines is thus moderate.

However, the planned grid connections for renewable energy projects as a group constitute ~35% of the planned and existing HV network in the 35km radius around the grid connection project sites. The contribution of all three Jessa grid connection projects to the cumulative impact of the HV lines in the 35km radius, which is mainly collision mortality of priority species with the powerlines, is therefore **medium to high**, and the total amount of existing and planned HV lines in the 35km radius, namely ~415km, is high as well. The cumulative collision impact of all three Jessa grid connection projects and existing HV lines in the 35km radius is assessed to be **high** pre-mitigation but should be reduced to **medium** post-mitigation.

Table 1 below summarises the expected impacts of the three proposed Jessa grid connection projects and proposes mitigation measures per impact.

1.6 Conclusion and Impact Statement

The proposed Jessa M, Jessa Z and Jessa S grid connection projects will have a moderate impact on avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation. None of the proposed corridor options for each of the respective grid connection projects are fatally flawed, but Corridor Option 1 is preferred for all three Jessa grid connection projects. In addition, the area assessed for the potential expansion of the existing Eskom Droërivier MTS was found to be acceptable from an avifauna perspective. The proposed grid connection developments are therefore supported, provided the mitigation measures listed in this report are strictly implemented.

Table 1: Overall Impact Significance for the Jessa M, Jessa S and Jessa Z grid connection projects (Pre- and Post-Mitigation)

Nature of impact and Phase	Overall Impact Significance (Pre -Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction Phase			
Displacement due to disturbance	Medium Negative	(1) Construction activity to be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area to be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust to be applied according to current best practice in the industry. (3) The avifaunal specialist must conduct an inspection to see if the Martial Eagle nest at Tower 15 15 (-32.460369°S; 22.534269°E) and Tower 18 (-32.471507°S; 22.535406°E) of the Droërivier-Proteus 1 400kV HV line is active. If the nest is not active, the construction activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the construction period. This could include measures such as delaying some of the construction activities until after the breeding season.	Very low Negative
Displacement due to habitat transformation	Medium Negative	1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state, where possible, after construction. (2) Construction of new roads must only be considered if existing roads cannot be upgraded. (3) The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.	Low Negative
Operational Phase			
Collisions with the overhead grid connection	Medium Negative	(1) An avifaunal specialist must conduct a site walk-through of final pole positions prior to construction, to	Low Negative

		determine where Bird Flight Diverters (BFDs) are required. (2) BFDs must be installed, as per the instructions of the specialist following the walk-through. (3) The operational monitoring programme must include regular monitoring (i.e., quarterly) of the powerlines for collision mortalities. (4) If additional collision hot-spots are identified during quarterly monitoring, these sections must be marked with BFDs to reduce the collision risk.	
Decommissioning Phase			
Displacement due to disturbance	Medium Negative	(1) Decommissioning activity to be restricted to the immediate footprint of the infrastructure, as far as possible. Access to the remainder of the area to be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust to be applied according to current best practice in the industry. (3) The avifaunal specialist must conduct an inspection to see if the Martial Eagle nest at Tower 15 15 (-32.460369°S; 22.534269°E) and Tower 18 (-32.471507°S; 22.535406°E) of the Droërivier-Proteus 1 400kV HV line is active. If the nest is not active, the decommissioning activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the decommissioning period. This could include measures such as delaying some of the activities until after the breeding season.	Low Negative
Cumulative Impacts			
Cumulative impacts	Medium Negative	Implement all the mitigation measures applicable to avifauna in specialist studies compiled for the four (4) renewable energy grid connections within a 35km radius around the project, and this report (where applicable and practically possible).	Low Negative

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

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

l) any conditions for inclusion in the environmental authorisation;	Appendix 6 and Appendix 7
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Appendix 6 and Appendix 7
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
q) any other information requested by the competent authority.	Not applicable
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	All sections

PROPOSED CONSTRUCTION OF THE JESSA M, JESSA S AND JESSA Z GRID CONNECTION INFRASTRUCTURE PROJECTS, NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA

Contents

List of Tables

List of Figures

List of Appendices

Glossary of Terms

Definitions	
Broader area	A consolidated data set for a total of 12 pentads where the application sites are located.
Powerline priority species	Priority species for powerline development were defined as species which could potentially be impacted by power line collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Species classes which fall under these categories are raptors, large terrestrial birds, waterbirds and crows.

List of Abbreviations

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

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Avifaunal Impact Assessment: Jessa M, S and Z grid connection and expansion of the Droërivier MTS

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

Details of Specialist, Declaration and Undertaking Under Oath

Page 1 of 3

1. SPECIALIST INFORMATION

Specialist Company Name:	Afrimage Photography (Pty) Ltd t/a Chris van Rooyen Consulting			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4		
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.			
Physical address:	6 Pladda Drive, Plettenberg Bay, 2122			
Postal address:	P.O. Box 2676, Fourways			
Postal code:	2055			
Telephone:	0824549570			
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Chris van Rooyen, declare that –

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

Signature of the Specialist

Chris van Rooyen Consulting

Name of Company:

02 January 2022

Date

Details of Specialist, Declaration and Undertaking Under Oath

Page 2 of 3

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

Signature of the Specialist

Afrimage Photography (Pty) Ltd

Name of Company

02 January 2022

Date

JBA Rooyen
72WS-6

Signature of the Commissioner of Oaths

2022-01-02

Date

SOUTH AFRICAN POLICE SERVICE
PLETTENBERG BAY
2022 -01- 02
PLETTENBERGBAAI
SUID-AFRIKAANSE POLISIEDIENS

Details of Specialist, Declaration and Undertaking Under Oath

Page 3 of 3

PROPOSED CONSTRUCTION OF THE JESSA M, JESSA S AND JESSA Z GRID CONNECTION INFRASTRUCTURE PROJECTS, NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA

1. INTRODUCTION

Chris van Rooyen Consulting has been appointed by SLR South Africa Consulting (PTY) Ltd, on behalf of ENERTRAG South Africa (Pty) Ltd (hereafter referred to as "ESA"), to undertake an avifaunal impact assessment for the proposed construction of three wind energy facilities (WEFs) and associated grid connection (together known as the Jessa Projects) near Beaufort West in the Western Cape Province of South Africa (refer to Figure 2).

The above-mentioned wind energy facility and associated grid connection projects form part of a greater renewable energy project known as the 'Jessa Cluster', being proposed by ESA near the town of Beaufort West. The projects which form part of the proposed 'Jessa Cluster' include the following:

- 220MW Jessa M WEF – DFFE Reference Number: To be Allocated;
- Jessa M Grid Connection – DFFE Reference Number: To be Allocated;
- 203.5MW Jessa S WEF – DFFE Reference Number: To be Allocated;
- Jessa S M Grid Connection – DFFE Reference Number: To be Allocated;
- 220MW Jessa Z WEF – DFFE Reference Number: To be Allocated; and
- Jessa Z Grid Connection – DFFE Reference Number: To be Allocated.

A map showing the above-mentioned WEF & associated grid connection infrastructure projects which form part of proposed Jessa Cluster are shown in Figure 1 below.

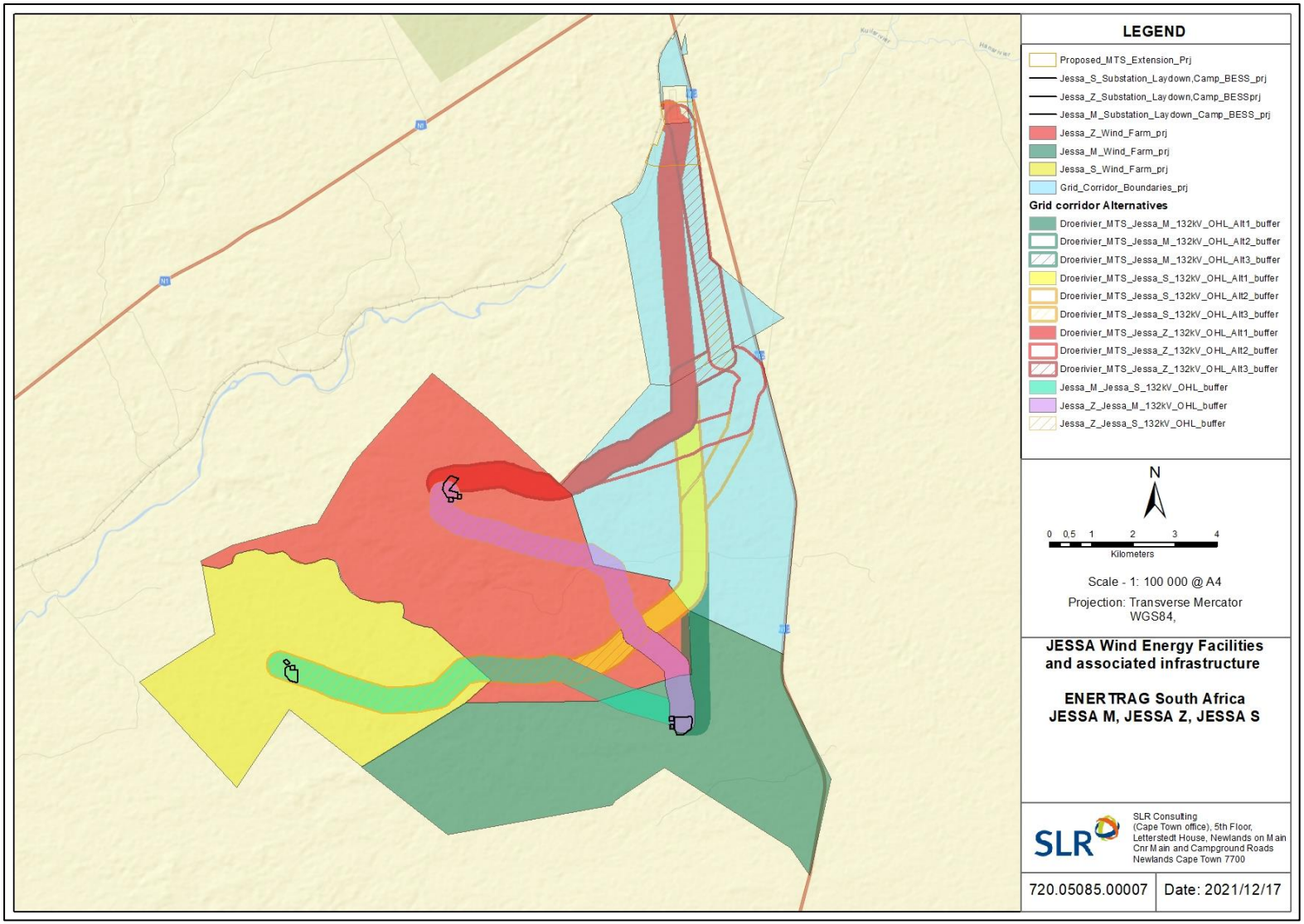

Figure 1: Map showing WEF & associated grid connection infrastructure projects which form part of proposed Jessa Cluster

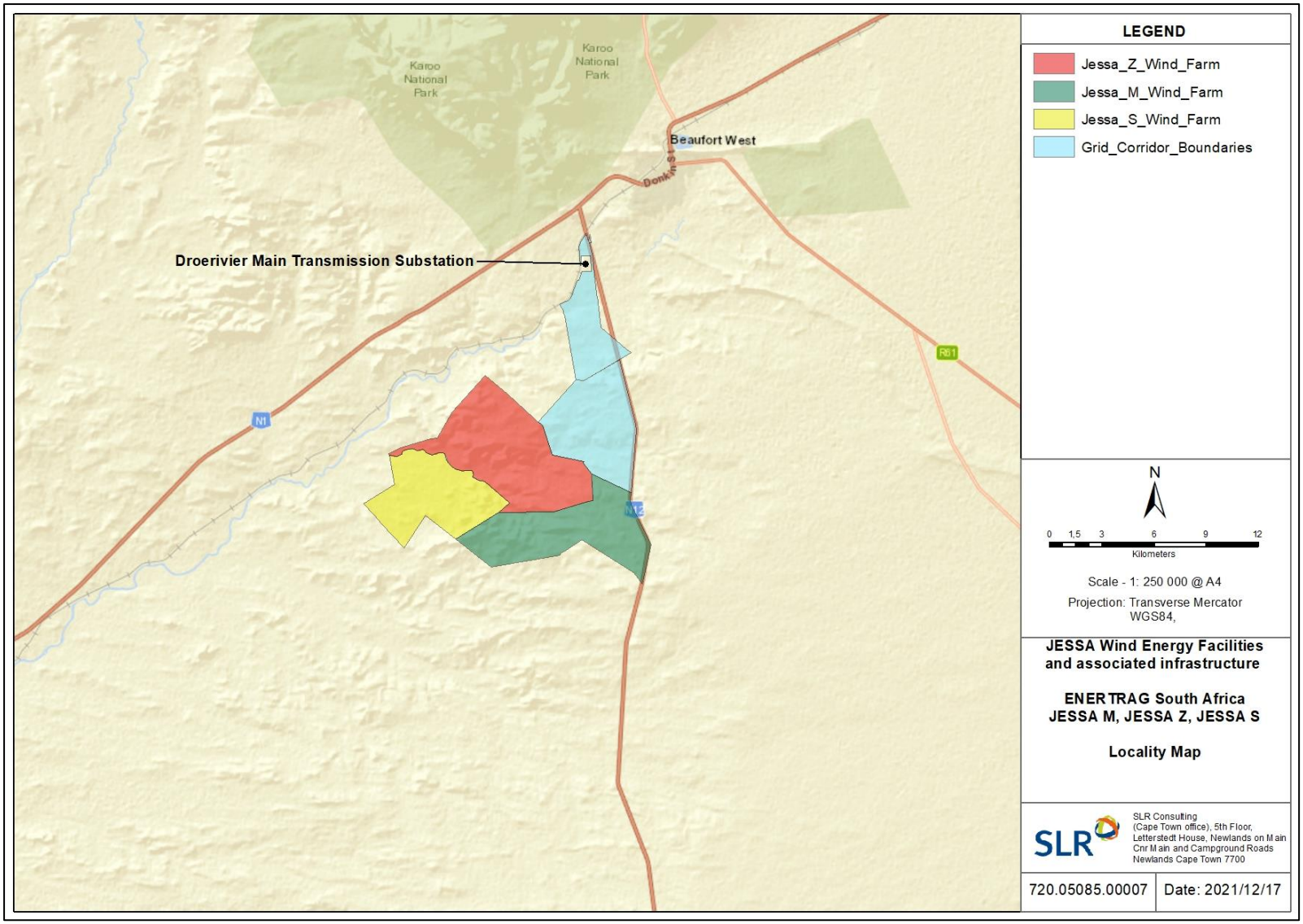

Figure 2: Regional Context Map for Jessa WEF & associated grid connection infrastructure projects which form part of proposed Jessa Cluster

The proposed Jessa grid connection infrastructure projects aim to feed the clean energy generated by the Jessa WEF projects (part of separate respective applications / BA processes and assessed in a standalone Avifauna report) into the national electricity grid.

In terms of the EIA Regulations, 2014 (as amended), various aspects of the proposed grid connection infrastructure developments may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. Specialist studies have been commissioned to verify the sensitivity and assess the impacts of the grid connection infrastructure projects under the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020).

The scope of this report covers the Jessa M, Jessa S and Jessa Z grid connection infrastructure projects, including the potential expansion of the Droërivier Main Transmission Substation (MTS) (see section 3). Even though these developments are three separate applications (i.e., three separate BA processes), they will be considered in the same specialist report.

1.1 Terms of Reference

The terms of reference for this report are the following:

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

1.2 Specialist Credentials

Please see Appendix 1 for Specialist CVs.

1.3 Assessment Methodology

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

- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the Animal Demography Unit of the University of Cape Town (ADU 2021), as a means to ascertain which species occurs within the broader area i.e., within a block consisting of 12 pentads (see Table 1). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 115 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 128 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.,* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.,* 2005).

- The global threatened status of all priority species was determined by consulting the (2021.3) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the respective application sites for the grid connection projects was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.,* 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford, 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.,* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2021) was used in order to view the broader area on a landscape level and to help identify sensitive bird habitat.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the study area relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the study area.
- The primary source of information on avifaunal diversity, abundance and flight patterns at the study area were the results of a pre-construction programme conducted over four seasons (August, September, November, December 2020 and March 2021) at the proposed Jessa M, Jessa S and Jessa Z grid connection project application sites in 2020 and 2021. The primary methods of data capturing were walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see Appendix 2 for a detailed explanation of the monitoring methods).
- Information gained from pre-construction monitoring at potential WEF sites in proximity and in similar habitat to the current project sites (namely the Beaufort West WEF, Trakas WEF, Koup 1 and 2 WEFs and Kwagga 1, 2 and 3 WEFs) assisted in providing a comprehensive picture of avifaunal abundance and diversity in the greater area, including the current study area for three grid connection projects.

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

Pentad	Number of full protocol lists	Ad hoc protocol lists
3225_2220	8	**14**
3225_2225	13	**18**
3225_2230	16	**23**
3225_2235	9	**11**
3230_2220	5	**1**
3220_2225	2	**7**
3220_2230	20	**25**
3220_2235	22	**8**
3235_2220	3	**1**
3235_2225	12	**5**
3235_2230	3	**15**
3235_2235	2	**0**
Total	**115**	**128**

2. ASSUMPTIONS AND LIMITATIONS

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

- The SABAP2 dataset is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed grid connection project sites. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, and the results of the pre-construction monitoring conducted over four seasons.
- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.
- Priority species for powerline development were defined as species which could potentially be impacted by powerline collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Species classes which fall under these categories are raptors, large terrestrial birds, waterbirds and crows.
- The impact zone of the proposed 132kV grid was assumed to be 2km area around the proposed alignments for the respective grid connection projects.
- Despite exhaustive and time-consuming internet searches, no information could be located on the specifications of the four renewable energy projects within a 35km radius around the proposed Jessa M, Jessa Z and Jessa S grid connection projects, and specifically the length of the proposed grid connections. Assumptions therefore had to be made on the likely length of these grid connections. No reports pertaining to the impact on avifauna were found on the internet either.

3. TECHNICAL DESCRIPTION

3.1 Project Location

The proposed Jessa grid connection projects are located approximately 8-15km south of the town Beaufort West in the Beaufort West Local Municipality, Western Cape Province. The sites are also located adjacent to the N12 road on the farms listed in Table 2 below. Figures 3-5 provide an indication of the locality of the proposed grid connection developments.

Table 2: Grid Connection Farm Portions

Project name	Farm portion & number	Farm name	21-digit code
Jessa Z Grid Connection	Portion 0 of Farm 432	Beaufort West Road	C00900000000043200000
	Portion 10 of Farm 170	Weltevreden	C00900000000017000010
	Portion 1 of Farm 319	Boeteka	C00900000000031900001
	Portion 5 of Farm 319	Boeteka	C00900000000031900005
	Portion 6 of Farm 319	Boeteka	C00900000000031900006
	Portion 7 of Farm 319	Boeteka	C00900000000031900007
Jessa M Grid Connection	Portion 10 of Farm 170	Weltevreden	C00900000000017000010
	Portion 0 of Farm 330	Lombards Kraal	C00900000000033000000
	Portion 1 of Farm 319	Boeteka	C00900000000031900001
	Portion 5 of Farm 319	Boeteka	C00900000000031900005
	Portion 6 of Farm 319	Boeteka	C00900000000031900006
Jessa S Grid Connection	Portion 0 of Farm 432	Beaufort West Road	C00900000000043200000
	Portion 10 of Farm 170	Weltevreden	C00900000000017000010
	Portion 0 of Farm 319	Boeteka	C00900000000031900000
	Portion 1 of Farm 319	Boeteka	C00900000000031900001
	Portion 5 of Farm 319	Boeteka	C00900000000031900005

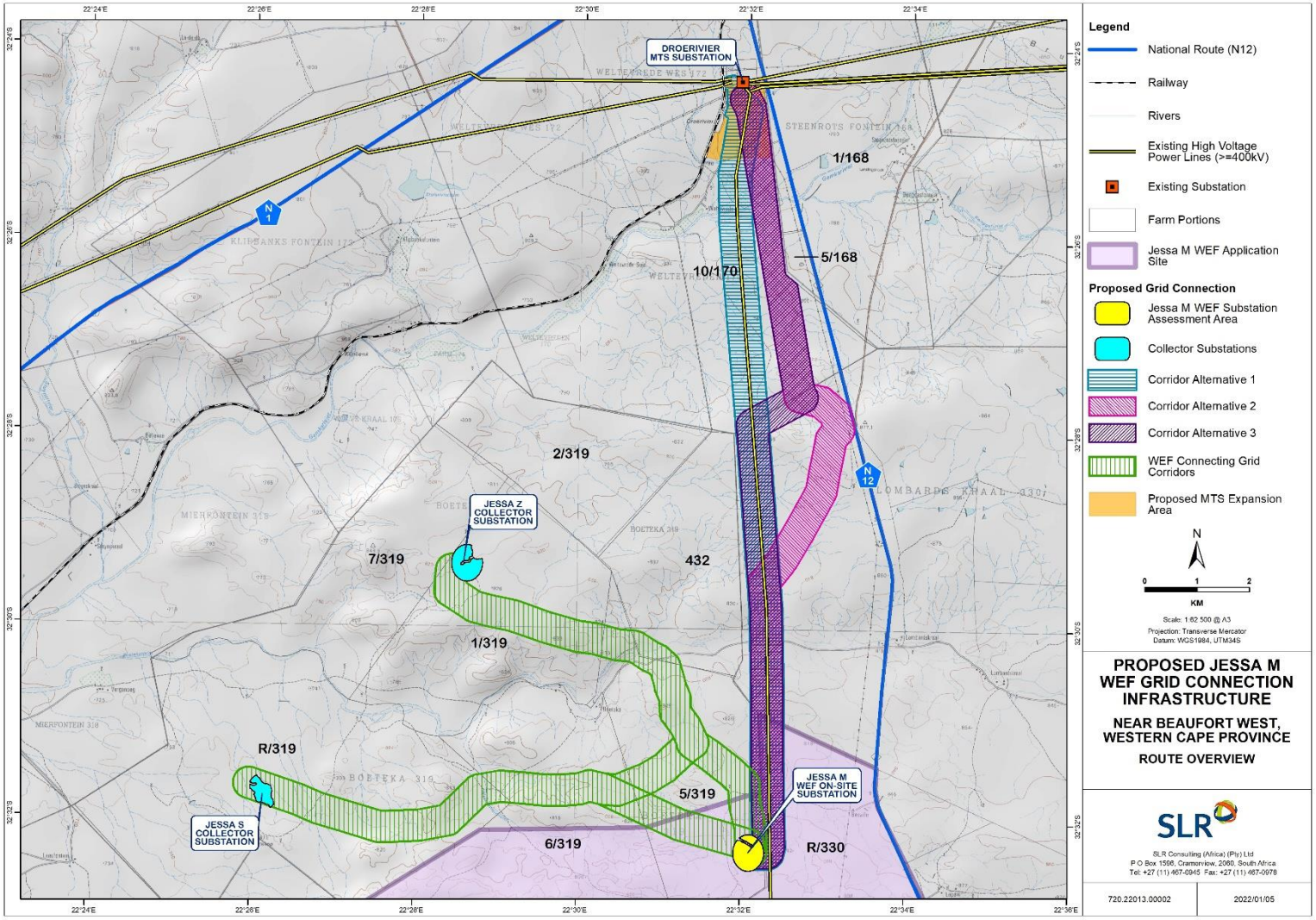

Figure 3: Layout Map for Jessa M Grid Connection Project

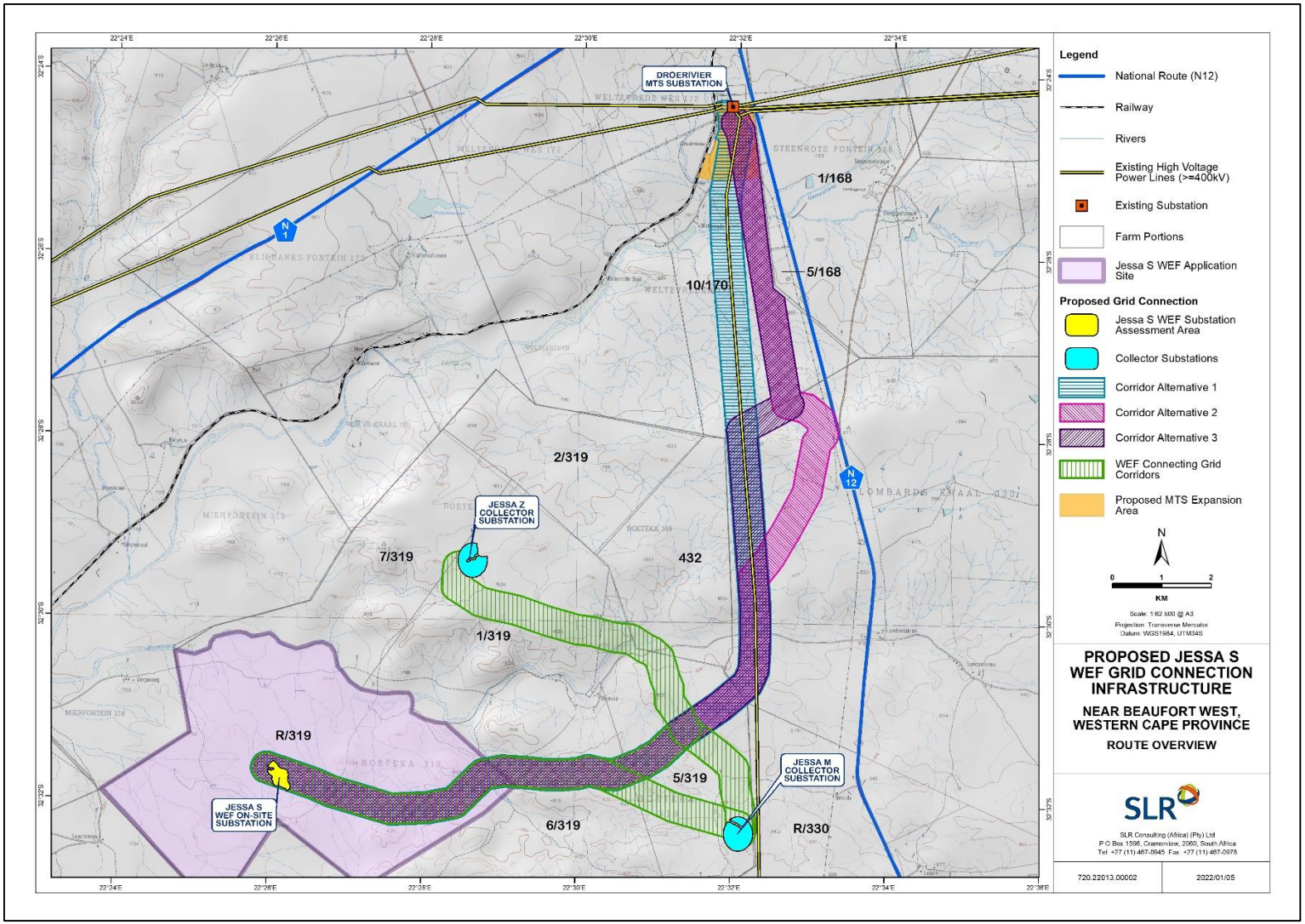

Figure 4: Layout Map for Jessa S Grid Connection Project

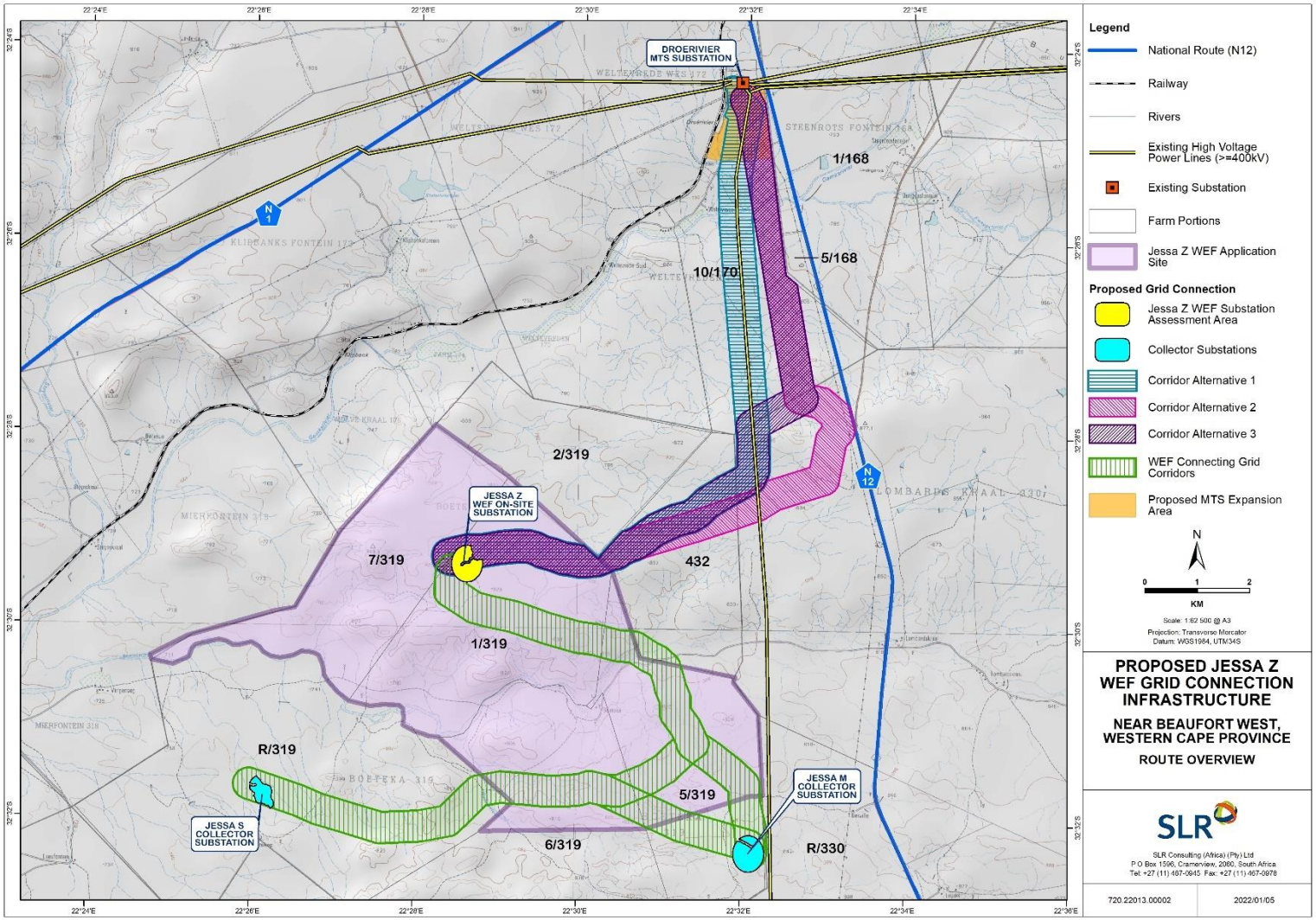

Figure 5: Layout Map for Jessa Z Grid Connection Project

3.2 Project Description

ESA is proposing to construct three grid connection infrastructure projects (namely the Jessa Z, Jessa M and Jessa S Grid Connection projects), which will form part of a greater renewable energy project known as the 'Jessa Cluster' being proposed near the town of Beaufort West. The projects which form part of the proposed 'Jessa Cluster' include the following (Figure 1):

- 220MW Jessa M WEF – DFFE Reference Number: To be Allocated;
- Jessa M Grid Connection – DFFE Reference Number: To be Allocated;
- 203.5MW Jessa S WEF – DFFE Reference Number: To be Allocated;
- Jessa S M Grid Connection – DFFE Reference Number: To be Allocated;
- 220MW Jessa Z WEF – DFFE Reference Number: To be Allocated; and
- Jessa Z Grid Connection – DFFE Reference Number: To be Allocated.

The grid connection infrastructures projects include overhead powerlines (either single circuit or double circuit), switching stations and access roads. The grid connection infrastructures projects will service the above-mentioned Jessa WEF projects. Once built, the proposed WEF projects are intended to connect directly to the nearby existing Eskom Droërivier Main Transmission Substation (MTS), through a powerline of up to 132 kilovolts (kV) (either single or double circuit). The proposed grid connection projects will also involve the possible expansion of the existing Droërivier MTS.

The proposed Grid Connection infrastructure projects require several key components to facilitate the distribution and transmission of electricity at a large scale, which includes the following:

- An onsite high voltage connecter substation (33kV/132kV) per Grid Connection project, to allow for the potential of multiple feeder bays of up to 132kV, as well as transformers, control building, telecommunication infrastructure and access road. A site area of up to approximately 300 000m² (i.e., 550m x 550m or approximately 30ha) will also be assessed for the switching station portion of the substation and connection of the associated powerlines which form part of each grid connection project.
- 132kV powerlines (either single or double circuit), connecting each Jessa WEF project to each other via the substations;
- 132kV transmission lines from each Jessa WEF substation to the existing Eskom Droërivier MTS; and
- Upgrades to the existing Eskom Droërivier MTS (within the current footprint); or
- If required, an expansion / additional 132kV/400kV MTS (approx. 20ha in extent).

ESA proposes to connect all three Jessa WEF projects to the nearby existing Eskom Droërivier MTS through powerlines, transmitting up to 132kV (either single or double circuit). The proposed grid connection projects therefore aim to feed the electricity generated by the proposed Jessa WEF projects into the national grid.

To allow efficient transmission, the electricity generated by the wind turbines undergoes a voltage 'step-up' process that occurs at each wind turbine, where power is stepped up to a maximum of 33kV (either in the turbine or in a small transformer container next to the turbine) and again at each WEF substation where power is stepped up to 132kV. The power is then transferred through a switching station (next to each WEF substation) along a 132kV line where it will connect into the Droërivier MTS and will form part of the national grid.

It is expected that the combined assessed project area (for all WEF and Grid Connection projects) will cover an area of approximately 13 000ha.

3.3 Layout alternatives

A site area of up to approximately 300 000m^2 (i.e., 550m x 550m or approximately 30ha) was assessed for the switching station portion of the substation[1] and connection of the associated powerlines which form part of each grid connection project.

In addition, as part of the site area, three 132kV powerline route alternatives have been assessed for each grid connection project, to link each proposed Jessa WEF project to the existing Eskom Droërivier MTS (see Figures 6 - 8 below). Powerline corridors with widths of 600m (i.e., 300m on either side of centre line) are being considered and have been assessed for the powerline route alternatives for each respective grid connection project, to allow flexibility when routing the proposed powerlines within the authorised corridors.

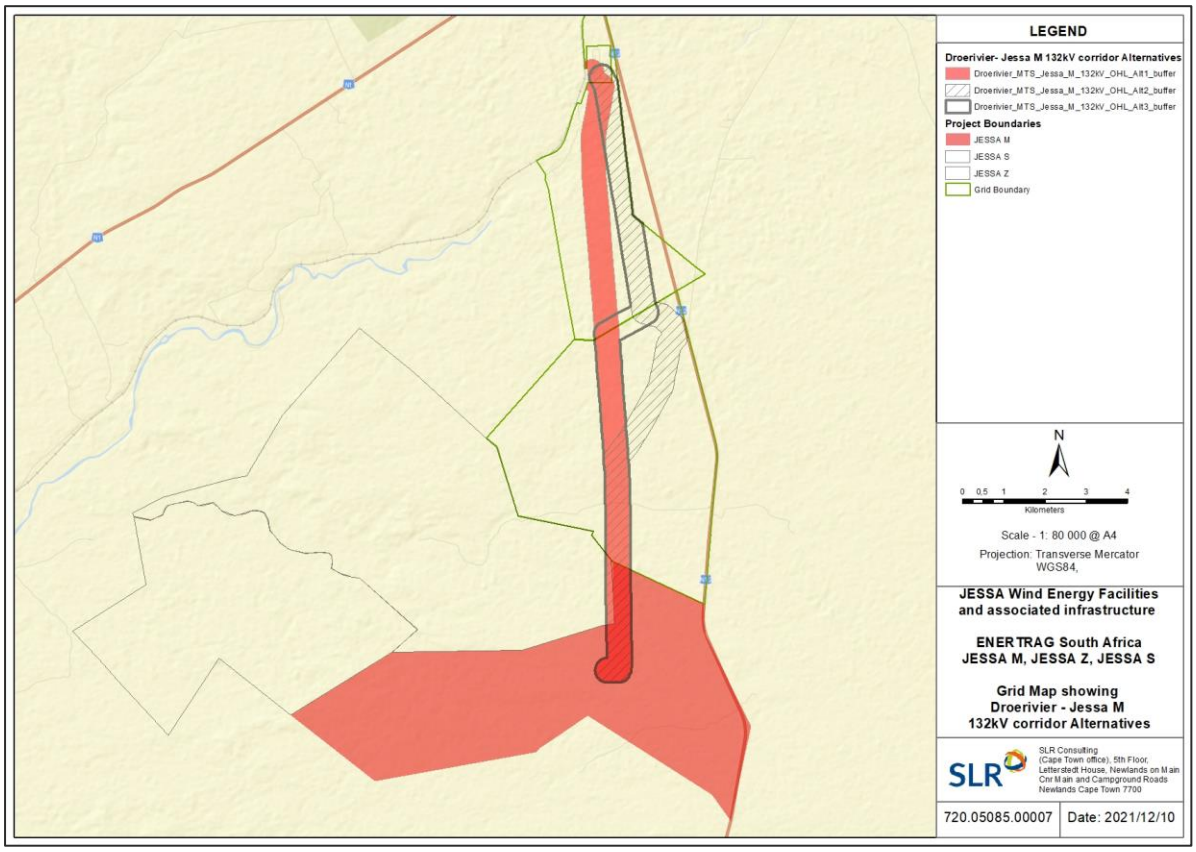

Figure 6: Powerline route alternatives to link proposed Jessa M WEF project to existing Eskom Droërivier MTS

[1] Laydown, O&M buildings, ablutions and BESS will also be located within the 30ha footprint and is included in the respective Jessa WEF projects.

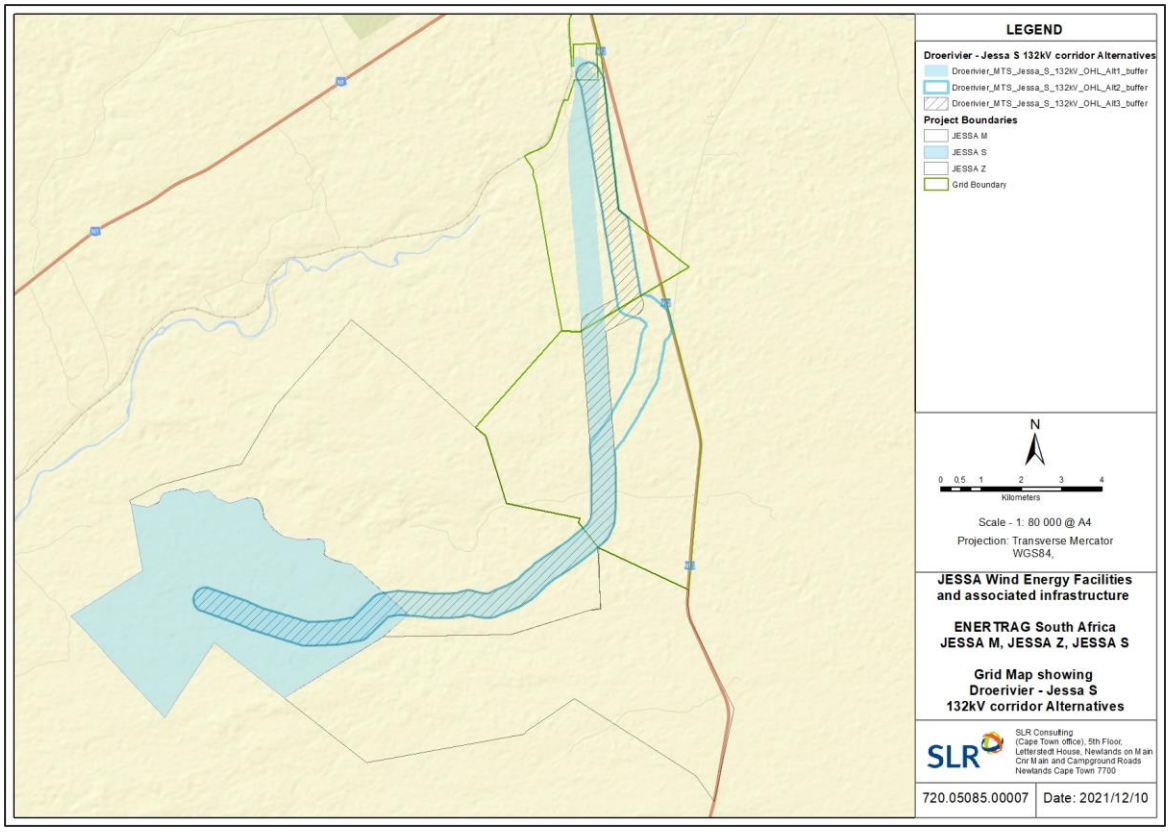

Figure 7: Powerline route alternatives to link proposed Jessa S WEF project to existing Eskom Dröerivier MTS

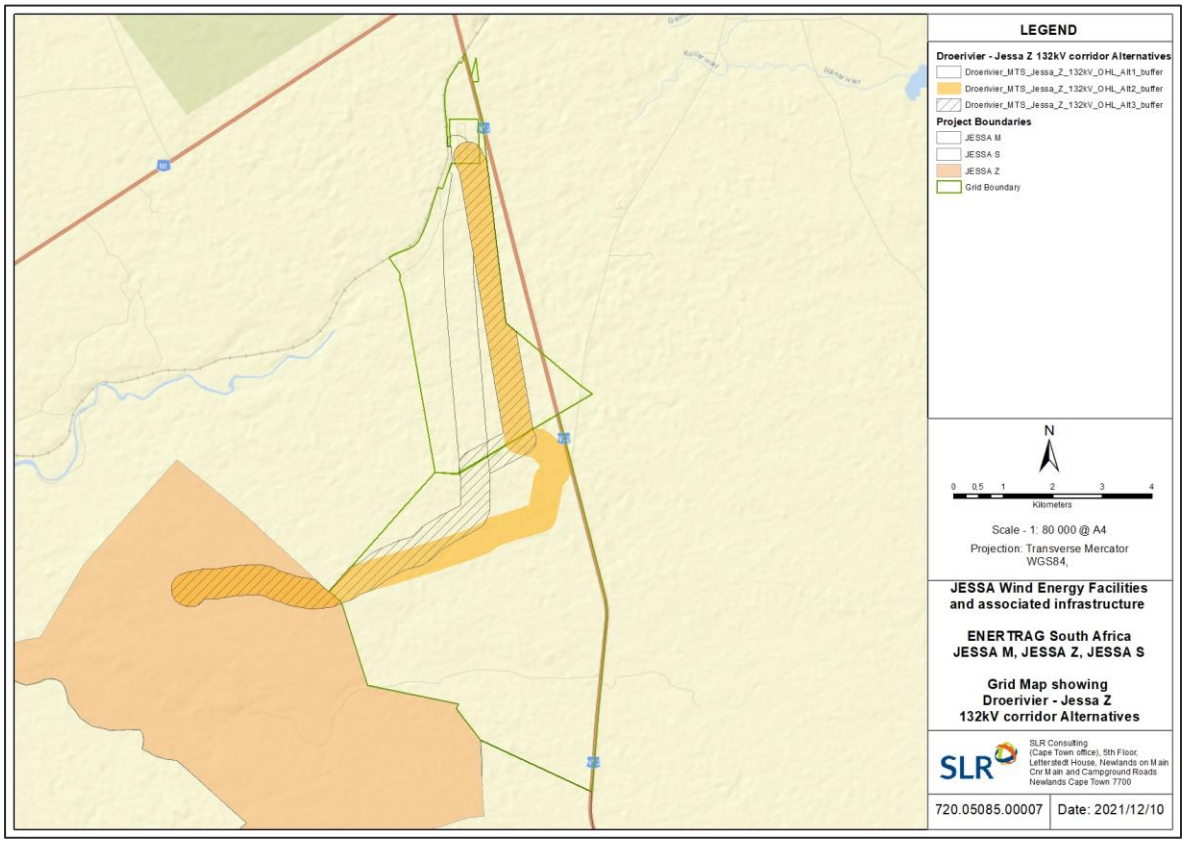

Figure 8: Powerline route alternatives to link proposed Jessa Z WEF project to existing Eskom Droërivier MTS

In addition to the powerline route alternatives to link the proposed Jessa WEF projects to the existing Eskom Droërivier MTS mentioned above, three 132kV WEF connecting grid corridors to link the respective Jessa WEF projects (i.e., Jessa M – Jessa S; Jessa Z – Jessa M and Jessa Z to Jessa S) have also been assessed and proposed for authorisation (see Figure 9 below). Powerline corridors with widths of 600m (i.e., 300m on either side of centre line) have been considered and assessed for these WEF connecting grid corridors as well, to allow flexibility when routing the proposed powerline within the authorised corridors.

It should be noted that the Grid Connection projects are intrinsically linked to the WEF projects and three WEF connecting grid corridors are required to ensure that the respective Jessa WEF projects connect to various collector substations, which will feed electricity generated by the WEF projects into the national grid via 132kV powerlines connecting to the Droërivier MTS (Figure 9). As such, all three WEF connecting grid corridors which were assessed will need to be authorised by the DFFE, to allow the respective Jessa WEF projects to connect to the national grid, should one of the proposed grid connection infrastructure projects not received EA.

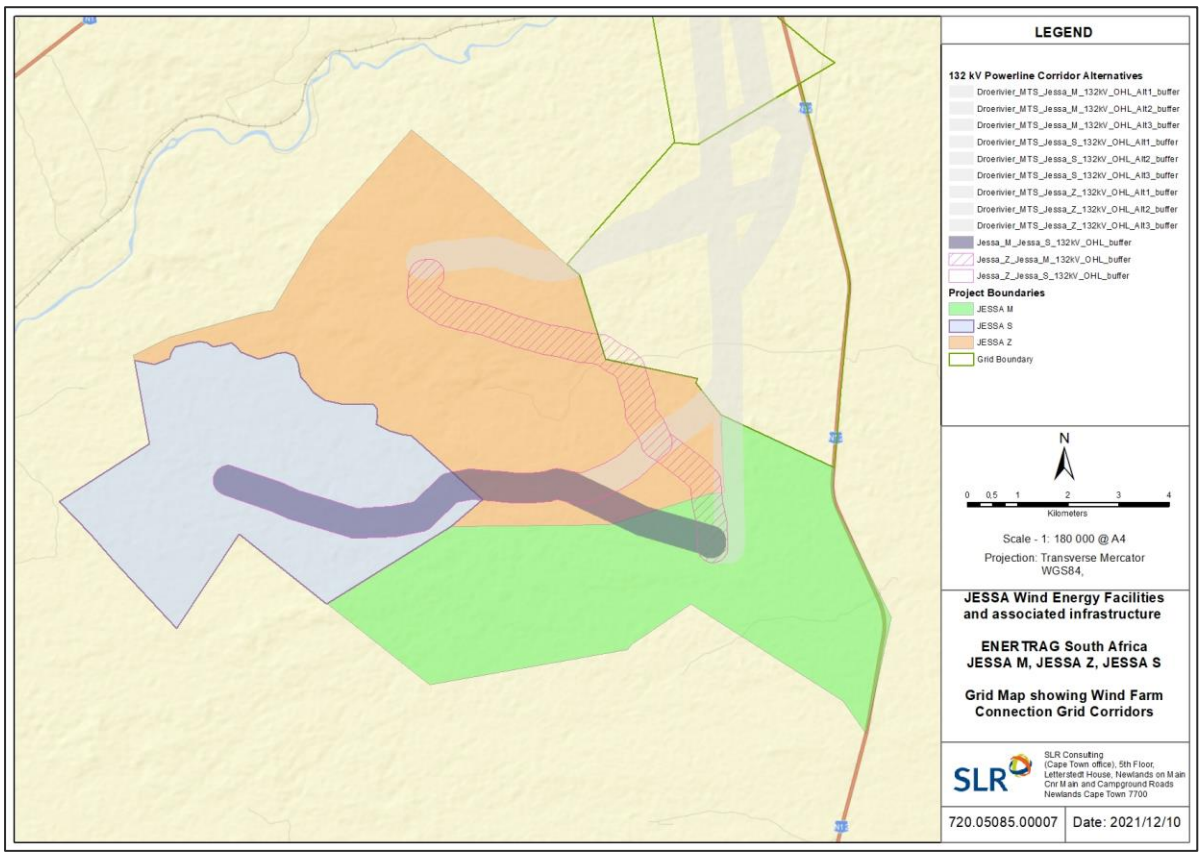

Figure 9: WEF connecting grid corridors to link proposed Jessa M, Jessa S and Jessa Z WEF projects

3.4 MTS expansion

As an alternative to connecting directly to the existing Eskom Droërivier MTS, ESA will explore the possible expansion of the MTS. A 20-30ha area was assessed for this purpose, over portion 10 of Farm Weltevreden which is located near the existing Eskom MTS.

4. LEGAL REQUIREMENT AND GUIDELINES

Table 3 below lists agreements and conventions which South Africa is party to, and which is directly relevant to the conservation of avifauna (BirdLife International, 2021).

Table 3: Agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: • The conservation of biological diversity • The sustainable use of the components of biological diversity • The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its	Global

	aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

4.1 National legislation

4.1.1 Constitution of the Republic of South Africa, 1996

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

(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
(i) prevent pollution and ecological degradation;
(ii) promote conservation; and
(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

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

The National Environmental Management Act (Act No. 107 of 1998) (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out several guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated.

NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

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

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

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act 10 of 2004, read in conjunction with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

4.2 Provincial legislation

4.2.1 Western Cape Nature Conservation Laws Amendment Act, 2000

This statute provides for the amendment of various laws on nature conservation in order to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board, which includes various regulations pertaining to wild animals, including avifauna.

4.3 Best Practice Guidelines

There are no published best practice guidelines currently applicable to the assessment of impacts of electricity infrastructure on avifauna.

5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

It should be noted that given the proposed grid connection projects' very similar avifaunal character, the information in the sections below is applicable for all three proposed Jessa grid connection projects.

5.1 Natural environment

The study area is located in the Nama Karoo biome, in the Lower Karoo Bioregion. The vegetation type is Gamka Karoo, which is one of most arid vegetation units of the Nama Karoo biome. It consists of undulating plains covered with dwarf spiny shrubland dominated by Karoo dwarf shrubs, with sparse low trees. Dense stands of drought-resistant grasses cover broad sandy bottomlands, especially after abundant rains (Mucina & Rutherford, 2006). The development area for the three grid connection projects contains a few ephemeral drainage lines which are characterised by sandy channels with *Vachellia* karoo shrubs and small trees growing on the edges, the largest being the Gamka River which bisects the northern part of the study area. This region is in the rain shadow of the Cape Fold Belt mountains in the south, with mean annual precipitation ranging from 100 – 240mm, mostly between December and April. Mean maximum and minimum monthly

temperatures in the town of Beaufort West are 38.7˚C and -3.2˚C for January (summer) and July (winter) respectively (Mucina & Rutherford, 2006). Strong north-westerly winds occur in winter (Mucina & Rutherford, 2006). The only longer-term surface water at the development area for the three grid connection projects consists of a couple of dams and boreholes with reservoirs. Drainage lines flow only briefly after good rains. The land is used for sheep and game farming.

5.2 Modified environment

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

The following avifaunal-relevant anthropogenic habitat modifications were recorded within the broader area for the three grid connection projects:

- **Water points:** The land use in the broader area for the three grid connection projects is mostly small stock and game farming. The entire area is divided into grazing camps, with associated boreholes and drinking troughs. In this arid environment, open water is a big draw card for birds which use the open water troughs to bath and drink.
- **Dams:** The study area for the three grid connection projects contains a few ground dams located in drainage lines. When these dams fill up after good rains, they contain standing surface water for several months, which attracts birds to bath and drink.
- **Transmission lines:** The study area for the three grid connection projects is bisected by the Droërivier – Proteus 1 400kV transmission line. The transmission towers are used by raptors for perching and roosting, as well as for breeding. Martial Eagle nests are present at Tower 15 (-32.460369°S; 22.534269°E) and Tower 18 (-32.471507°S; 22.535406°E) (see Appendix 2). The nests were not active during the pre-construction monitoring in 2020/21, but this may be the result of the prolonged drought in the region. The adults were observed incidentally in 2020 and in January 2022 the adults were twice observed on transmission towers within 2km of the nests, indicating that the territory is still active.

Appendix 3 provides a photographic record of the habitat in the study area for the three grid connection projects.

5.3 Important Bird Areas (IBAs)

The Karoo National Park Important Bird Area (IBA) SA102 is the closest IBA, and its southern border is located approximately 3.5km north of the Droërivier MTS (Marnewick *et al.,* 2015). **The proposed grid connection projects are not expected to have any impact on the avifauna in this IBA due to the distance from the respective project sites.**

5.4 The DFFE National Screening Tool

The study area and immediate environment for the three grid connection projects is classified as **Medium to High** sensitivity for avifauna according to the Terrestrial Animal Species theme (**Figure 10**)[2]. The development site for the three grid connection projects contains confirmed habitat for species of conservation concern

[2] It should be noted that there is no Avian theme for powerlines in the screening tool.

(SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020), namely listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable. The occurrence of SCC was confirmed during the surveys i.e., Ludwig's Bustard (Globally and Regionally Endangered) and Martial Eagle (Globally and Regionally Endangered) was recorded in the study area. Based on these criteria, the study area classification of **High** sensitivity for avifauna for the three grid connection projects is confirmed.

See Appendix 9 for the Site Sensitivity Verification report.

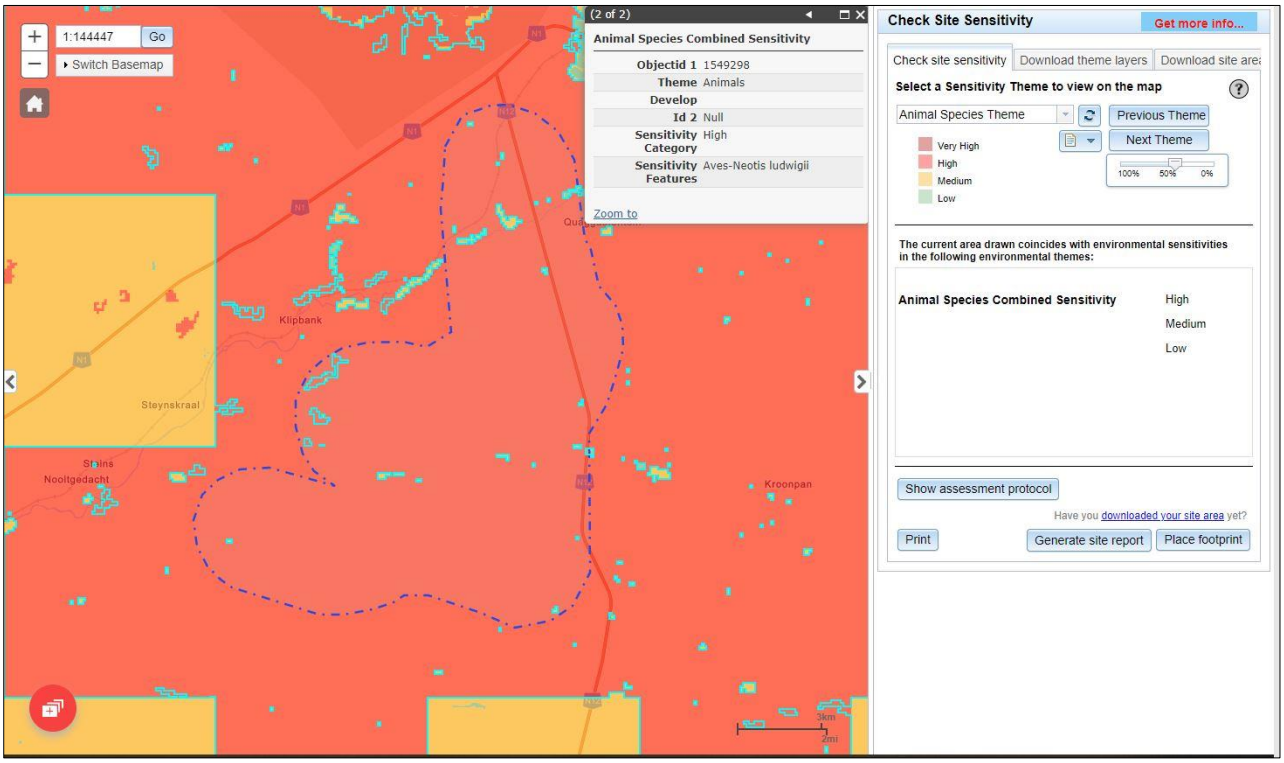

Figure 10: The classification of the development site for the three grid connection projects according to the animal species theme for powerline developments in the DFFE National Screening Tool.

5.5 National Protected Areas

The closest protected areas to the centre of the proposed application sites are Karoo National Park (3.5km from Droërivier MTS) and the Steenbokkie Private Nature Reserve (10km from Droërivier MTS). **The avifauna in these protected areas is not expected to be impacted by the proposed grid connection projects, due to the distance from the project sites.**

5.6 Avifauna in the study area

It is estimated that a total of 196 bird species could potentially occur in the broader area for the three grid connection projects. Please refer to Appendix 4 which provides a comprehensive list of all the species in the broader area for the three grid connection projects. Of these, 61 species are classified as priority species for powerline developments.

Table 4 below list all the priority species **with a medium to high chance of regular occurrence in the study area for the three grid connection projects** and the possible impact on the respective species by the proposed grid connection projects.

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

Table 4: Powerline priority species recorded in the broader area for the three grid connection projects with a medium to high chance of occurring in the study area. Red List species are shaded in red.

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	SA status	Recorded during surveys (four surveys over 12 months)	Likelihood of occurrence in the study area	Powerline - Collision	Displacement: Disturbance associated with the construction of the OHL	Displacement: Habitat transformation in the substation
Blue Crane	*Grus paradisea*	8.70	2.34	VU	NT		M	x		x
Booted Eagle	*Hieraaetus pennatus*	1.74	1.56	-	-	x	M			x
Cape Crow	*Corvus capensis*	33.91	13.28	-	-	x	H			
Egyptian Goose	*Alopochen aegyptiaca*	46.96	13.28	-	-	x	M	x		
Greater Kestrel	*Falco rupicoloides*	9.57	2.34	-	-	x	H			x
Hadada Ibis	*Bostrychia hagedash*	46.96	7.81	-	-	x	M	x		
Helmeted Guineafowl	*Numida meleagris*	25.22	2.34	-	-	x	H		x	x
Jackal Buzzard	*Buteo rufofuscus*	5.22	0.78	-	-		H			x
Karoo Korhaan	*Eupodotis vigorsii*	59.13	28.13	-	NT	x	H	x	x	x
Kori Bustard	*Ardeotis kori*	5.22	0.00	NT	NT	x	M	x	x	x
Lanner Falcon	*Falco biarmicus*	0.87	0.00	-	VU		M			x
Ludwig's Bustard	*Neotis ludwigii*	11.30	3.13	EN	EN	x	H	x	x	x
Martial Eagle	*Polemaetus bellicosus*	6.09	2.34	EN	EN	x	H		x	x
Pale Chanting Goshawk	*Melierax canorus*	35.65	11.72	-	-	x	H			x
Pied Crow	*Corvus albus*	61.74	39.06	-	-	x	H			
Rock Kestrel	*Falco rupicolus*	15.65	5.47	-	-	x	M			x
South African Shelduck	*Tadorna cana*	43.48	5.47	-	-	x	M	x		
Spotted Eagle-Owl	*Bubo africanus*	6.09	0.78	-	-		H	x	x	x
Verreaux's Eagle	*Aquila verreauxii*	2.61	1.56	-	VU	x	M	x		x

6. SPECIALIST FINDINGS AND ASSESSMENT OF IMPACTS

The proposed Jessa M, Jessa S and Jessa Z grid connection projects will have several potential impacts on priority avifauna, which include the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the switching / collector substations and the extension of the Droërivier MTS, in the construction phase.
- Collisions with the overhead line in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

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

The above-mentioned impacts on avifauna are discussed in the sections below.

6.1 Electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen, 2004). The electrocution risk is largely determined by the pole/tower design. In the case of the proposed powerlines for the three Jessa grid connection projects, no electrocution risk is envisaged because the proposed design of the 132kV lines, namely the steel monopole and self-supporting lattice structures, should not pose an electrocution threat to any of the priority species which are likely to occur in the study area for the three grid connection projects.

6.2 Collisions

Collisions are the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen, 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen, 2004; Anderson, 2001). In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with transmission lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC, 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes

and bustards usually the most numerous reported victims (Bevanger, 1998; Rubolini et al., 2005; Jenkins et al., 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger, 1998; Janss, 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the lower-resolution, and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw, 2010; Martin, 2011; Martin et al., 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger, 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson, 1978; Anderson, 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g., Brown et al., 1987; Henderson et al., 1996).

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

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

From incidental record keeping by the Endangered Wildlife Trust (EWT), it is possible to give a measure of what species are generally susceptible to powerline collisions in South Africa (see Figure 11 below).

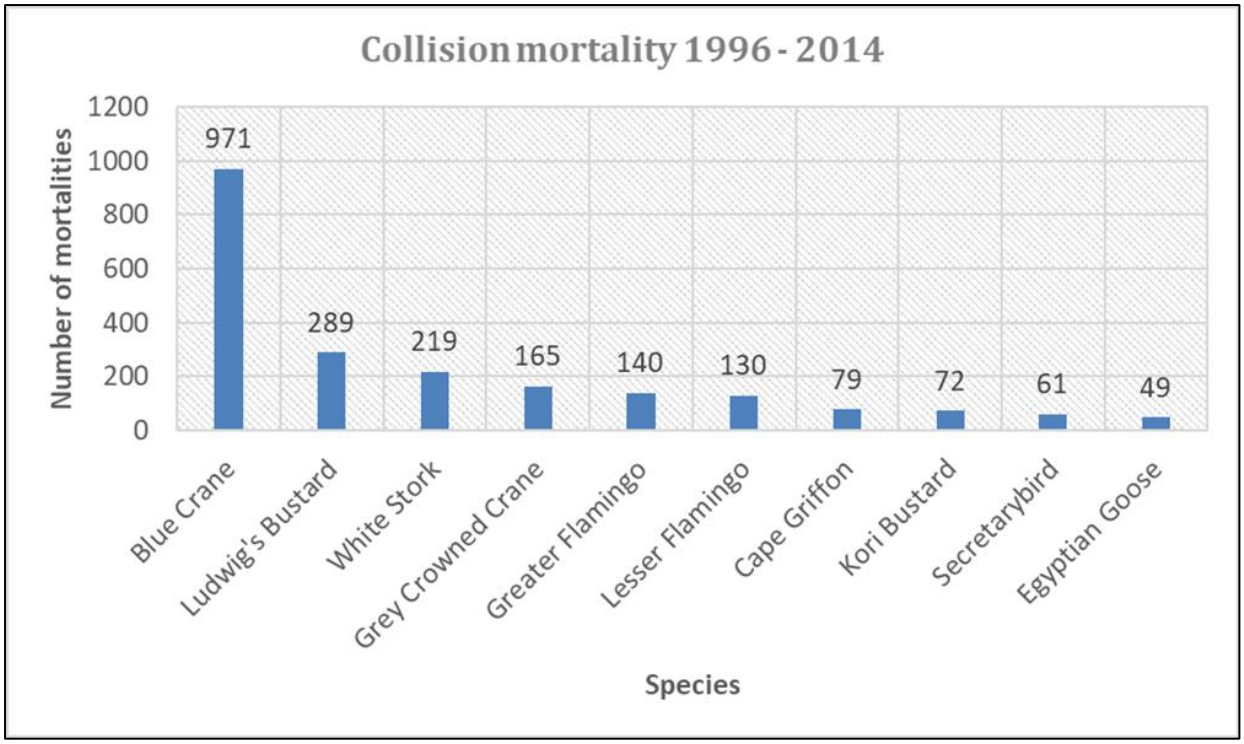

Figure 11: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom / Endangered Wildlife Trust (EWT) Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

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

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and powerline configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e., whether they are able to see obstacles such as powerlines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is key to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw, 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with powerlines i.e. Kori Bustards, Blue Cranes and White Storks (*Ciconia ciconia)*. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane

(pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35°, respectively, are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (A*ccipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes, and are also known to be vulnerable to powerline collisions.

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

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

The priority species which are potentially vulnerable to this impact in the study area for the three grid connection projects are the following:

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	SA status	Recorded during	Likelihood of occurrence
Blue Crane	*Grus paradisea*	8.70	2.34	VU	NT		M
Egyptian Goose	*Alopochen aegyptiaca*	46.96	13.28	-	-	x	M
Hadada Ibis	*Bostrychia hagedash*	46.96	7.81	-	-	x	M
Karoo Korhaan	*Eupodotis vigorsii*	59.13	28.13	-	NT	x	H

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	SA status	Recorded during	Likelihood of occurrence
Kori Bustard	*Ardeotis kori*	5.22	0.00	NT	NT	x	M
Ludwig's Bustard	*Neotis ludwigii*	11.30	3.13	EN	EN	x	H
South African Shelduck	*Tadorna cana*	43.48	5.47	-	-	x	M
Spotted Eagle-Owl	*Bubo africanus*	6.09	0.78	-	-		H
Verreaux's Eagle	*Aquila verreauxii*	2.61	1.56	-	VU	x	M

6.3 Displacement due to habitat destruction

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

- Site clearance and preparation;
- Construction of the infrastructure (i.e., the switching / collector substation, OHL and service road);
- Transportation of personnel, construction material and equipment to the project sites, and personnel away from the sites;
- Removal of vegetation for the proposed switching / collector substation and stockpiling of topsoil and cleared vegetation; and
- Excavations for infrastructure.

These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed switching / collector substations through **transformation of habitat**, 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 / collector substation yard for the three grid connection projects is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing powerlines, very little (if any) vegetation clearing will be required in the powerline servitudes. The habitat in the study area for the three grid connection projects is extensive, very uniform and largely untransformed from a bird impact perspective; therefore, the loss of a few hectares of habitat for priority species due to direct habitat transformation associated with the construction of the proposed switching / collector substations is likely to have a low impact on them. The species most likely to be more heavily impacted would be small, common, non-Red Data species which happen to be resident in those few hectares of Karoo habitat.

The priority species which are potentially vulnerable to this impact in the study area for the three grid connection projects are the following:

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	SA status	Recorded during surveys	Likelihood of occurrence
Blue Crane	*Grus paradisea*	8.70	2.34	VU	NT		M
Booted Eagle	*Hieraaetus pennatus*	1.74	1.56	-	-	x	M
Greater Kestrel	*Falco rupicoloides*	9.57	2.34	-	-	x	H
Helmeted Guineafowl	*Numida meleagris*	25.22	2.34	-	-	x	H
Jackal Buzzard	*Buteo rufofuscus*	5.22	0.78	-	-		H
Karoo Korhaan	*Eupodotis vigorsii*	59.13	28.13	-	NT	x	H
Kori Bustard	*Ardeotis kori*	5.22	0.00	NT	NT	x	M

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	SA status	Recorded during surveys	Likelihood of occurrence
Lanner Falcon	*Falco biarmicus*	0.87	0.00	-	VU		M
Ludwig's Bustard	*Neotis ludwigii*	11.30	3.13	EN	EN	x	H
Martial Eagle	*Polemaetus bellicosus*	6.09	2.34	EN	EN	x	H
Pale Chanting Goshawk	*Melierax canorus*	35.65	11.72	-	-	x	H
Rock Kestrel	*Falco rupicolus*	15.65	5.47	-	-	x	M
Spotted Eagle-Owl	*Bubo africanus*	6.09	0.78	-	-		H
Verreaux's Eagle	*Aquila verreauxii*	2.61	1.56	-	VU	x	M

6.4 Displacement due to disturbance

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through **disturbance**; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and (possibly) the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle. Large terrestrial species and some species of raptors are most likely to be affected by displacement due to disturbance.

It has already been mentioned that there is an active Martial Eagle territory with nests on Tower 15 (-32.460369°S; 22.534269°E) and Tower 18 (-32.471507° S; 22.535406°E) of the Droërivier Proteus 1 400kV HV line. All the proposed grid connection options for the three grid connection projects are located between 0 - 1.6km of a nest. The risk of the birds being temporary displaced due to disturbance by the construction activities for the three grid connection projects are very high, unless mitigated.

The priority species which are potentially vulnerable to this impact in the study area for the three grid connection projects are listed below.

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	SA status	Recorded during surveys	Likelihood of occurrence
Helmeted Guineafowl	*Numida meleagris*	25.22	2.34	-	-	x	H
Karoo Korhaan	*Eupodotis vigorsii*	59.13	28.13	-	NT	x	H
Kori Bustard	*Ardeotis kori*	5.22	0.00	NT	NT	x	M
Ludwig's Bustard	*Neotis ludwigii*	11.30	3.13	EN	EN	x	H
Martial Eagle	*Polemaetus bellicosus*	6.09	2.34	EN	EN	x	H
Spotted Eagle-Owl	*Bubo africanus*	6.09	0.78	-	-		H

7. THE IDENTIFICATION AND ASSESSMENT OF POTENTIAL IMPACTS

As mentioned, the proposed Jessa M, Jessa S and Jessa Z grid connection projects will have several potential impacts on priority avifauna, which include the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the switching / collector substations and the extension of the Droërivier MTS, in the construction phase.
- Collisions with the overhead line in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

The potential impacts on avifauna identified in the course of the study for the three grid connection projects are assessed in the tables below. The impact criteria are explained in Appendix 5.

It should be noted that the identified potential impacts on avifauna discussed and rated below are identical for all three proposed Jessa grid connection projects.

7.1 Construction Phase

- Displacement of priority species due to disturbance associated with the construction of the Jessa M, Jessa Z and Jessa S 132kV grid connections and switching / collector substations, as well the extension of the Droërivier MTS.

Issue	Displacement of avifauna	
Description of Impact		
Displacement of priority species due to disturbance associated with the construction of the Jessa M, Jessa Z and Jessa S 132kV grid connections and switching / collector substations, as well the extension of the Droërivier MTS.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Possible / frequent
Significance	Medium -	Very Low -
Degree to which impact can be reversed	**High** - The impact will be mitigated through natural processes after the completion of the construction activities, and through the application of mitigation measures	
Degree to which impact may cause irreplaceable loss of resources	**Low** - It is unlikely that the impact will result in the irreplaceable loss of resources	
Degree to which impact can be mitigated	**High** in the case of the Martial Eagle nests, through the timing of the construction activities to fall outside the breeding season.	
Mitigation actions		

The following measures are recommended:	(1) Construction activity to be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area to be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust to be applied according to current best practice in the industry. (3) The avifaunal specialist must conduct an inspection to see if the Martial Eagle nest on Tower 15 (-32.460369°S; 22.534269°E) or Tower 18 (-32.471507° S 22.535406°E) of the Droërivier- Proteus 1 400kV HV line is active. If the nest is not active, the construction activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the construction period. This could include measures such as delaying some of the construction activities until after the breeding season.	
Monitoring		
The following monitoring is recommended:	None	
Cumulative impacts		
Nature of cumulative impacts	Displacement of priority species due to disturbance associated with construction of the three grid connection infrastructure projects will be a feature of all the proposed renewable energy projects within a 35km radius around the grid connection projects. However, the South African Renewable Energy EIA Application Database (REEA) available at the time (2021 Q3) shows only five authorised renewable energy projects within 35km of the application sites, namely the Beaufort West Solar Power Plant Site 1, 2, 3, Beaufort West Photovoltaic Park and 19MW PV Solar Facility on Portion 1 of Steenrotsfontein 168.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

- Displacement of priority species due to habitat transformation associated with the construction of the Jessa M, Jessa Z and Jessa S 132kV grid connections and switching / collector substations, as well as the extension of the Droërivier MTS.

Issue	Displacement of avifauna	
Description of Impact		
Displacement of priority species due to habitat transformation associated with the construction of the Jessa M, Jessa Z and Jessa S 132kV grid connections and switching / collector substations, as well as the extension of the Droërivier MTS.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Probable	Possible / frequent
Significance	Medium -	Low -
Degree to which impact can be reversed	**Medium** - The impact will be mitigated through natural processes after the de-commissioning, and through the application of mitigation measures. However, the impact will persist for the duration of the operational life of electricity infrastructure.	

Degree to which impact may cause irreplaceable loss of resources	**Low** - It is unlikely that priority species will be displaced entirely, but lower densities are expected.	
Degree to which impact can be mitigated	**Low** - Mitigation options are limited.	
Mitigation actions		
The following measures are recommended:	1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state (where possible) after construction. (2) Construction of new roads only to be considered if existing roads cannot be upgraded. (3) The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.	
Monitoring		
The following monitoring is recommended:	None	
Cumulative impacts		
Nature of cumulative impacts	Displacement of priority species due to habitat transformation associated with construction of the three grid connection infrastructure projects will be a feature of all the proposed renewable energy projects within a 35km radius around the grid connection projects. However, the South African Renewable Energy EIA Application Database (REEA) available at the time (2021 Q3) shows only five authorised renewable energy projects within 35km of the application sites, namely the Beaufort West Solar Power Plant Site 1, 2, 3, Beaufort West Photovoltaic Park and 19MW PV Solar Facility on Portion 1 of Steenrotsfontein 168.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.2 Operational Phase

- Mortality due to collisions with the Jessa M, Jessa Z and Jessa S 132kV grid connections.

Issue	Mortality of priority avifauna	
Description of Impact		
Mortality due to collisions with the Jessa M, Jessa Z and Jessa S 132kV grid connections		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Probable	Possible / frequent
Significance	Medium -	Low -
Degree to which impact can be reversed	**Medium** - The impact will be mitigated through natural processes after the de-commissioning, and through the application of mitigation measures. However, the impact will persist for the duration of the operational life of the grid connection projects, even with mitigation.	
Degree to which impact may cause irreplaceable loss of resources	**Low** - The impact can be mitigated to some extent through the use of anti-collision devices, but mortalities will still take place. However, it should not lead to irreplaceable loss of resources.	

Degree to which impact can be mitigated	**Medium -** The impact can be mitigated to some extent through the use of anti-collision devices.	
Mitigation actions		
The following measures are recommended:	(1) An avifaunal specialist must conduct a site walk through of final pole positions prior to construction to determine where BFDs are required. (2) BFDs must be installed, as per the instructions of the specialist, following the walk through. (3) The operational monitoring programme must include regular monitoring (i.e., quarterly) of the powerlines for collision mortalities. (4) If additional collision hot-spots are identified during quarterly monitoring, these sections must be marked with BFDs to reduce the collision risk.	
Monitoring		
The following monitoring is recommended:	The operational monitoring programme must include regular monitoring (i.e., quarterly) of the powerlines for collision mortalities. If additional collision hot-spots are identified during quarterly monitoring, these sections must be marked with BFDs to reduce the collision risk.	
Cumulative impacts		
Nature of cumulative impacts	The collision mortality of priority species on associated infrastructure could be a feature of all the proposed renewable energy projects within a 35km radius around the grid connection projects, depending on the length of medium voltage overhead lines which is planned. However, the South African Renewable Energy EIA Application Database (REEA) available at the time (2021 Q3) shows only five authorised renewable energy projects within 35km of the application sites, namely the Beaufort West Solar Power Plant Site 1, 2, 3, Beaufort West Photovoltaic Park and 19MW PV Solar Facility on Portion 1 of Steenrotsfontein 168.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	Medium -

7.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning (dismantling) of the Jessa M, Jessa Z and Jessa S 132kV grid connections and associated switching / collector substations.

Issue	Displacement of avifauna	
Description of Impact		
Displacement due to disturbance associated with the decommissioning (dismantling) of the of the 132kV grid connections and associated switching / collector substations.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Possible / frequent
Significance	Low -	Very Low -
Degree to which impact can be reversed	**High** - The impact will be mitigated through natural processes after the completion of the decommissioning activities, and through the application of mitigation measures	

Degree to which impact may cause irreplaceable loss of resources	**Low** - It is unlikely that the impact will result in the irreplaceable loss of resources	
Degree to which impact can be mitigated	**High** in the case of the Martial Eagle nests, through the implementation of an appropriate buffer zone around the nests.	
Mitigation actions		
The following measures are recommended:	(1) Decommissioning activity to be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area to be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust to be applied according to current best practice in the industry. (3) The avifaunal specialist must conduct an inspection to see if the Martial Eagle nest on Tower 15 (-32.460369°S; 22.534269°E) or Tower 18 (-32.471507° S; 22.535406°E) of the Droërivier- Proteus 1 400kV HV line is active. If the nest is not active, the decommissioning activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the decommissioning period. This could include measures such as delaying some of the activities until after the breeding season.	
Monitoring		
The following monitoring is recommended:	None	
Cumulative impacts		
Nature of cumulative impacts	Displacement of priority species due to disturbance associated with decommissioning of the renewable energy projects and associated infrastructure will be a feature of all the proposed renewable energy projects within a 35km radius around the project. However, the South African Renewable Energy EIA Application Database (REEA) available at the time (2021 Q3) shows only five authorised renewable energy projects within 35km of the application site, namely the Beaufort West Solar Power Plant Site 1, 2, 3, Beaufort West Photovoltaic Park and 19MW PV Solar Facility on Portion 1 of Steenrotsfontein 168.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.4 The identification of environmental sensitivities

The following environmental sensitivities were identified from an avifaunal perspective for the proposed Jessa grid connection projects:

7.4.1 High sensitivity: Surface water – line marking required.

Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon and Secretarybird, as well as many non-priority species, including several waterbirds. Drainage lines, when flowing, also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Powerlines that are placed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. Mitigation in the form of bird flight diverters is required to mark these sections of line, which is be identified by way of a walk-through by the avifaunal specialist once the tower positions have been finalised.

7.4.2 High sensitivity: Seasonal No disturbance buffer: Breeding Red Data species nests.

Transmission lines are an important breeding substrate for raptors in the Karoo, due to the lack of large trees (Jenkins *et al.,* 2013). It has already been mentioned that there is an active Martial Eagle territory with two nests (on Tower 15 (-32.460369°S; 22.534269°E) and Tower 18 (-32.471507°S; 22.535406°E) on the Droërivier Proteus 1 400kV HV line. All the proposed grid connection options for the three grid connection projects are located between 0 - 1.6km of a nest. The risk of the birds being temporary displaced due to disturbance by the construction activities is very high, unless mitigated. It is recommended that a temporary 2.5km no disturbance buffer zone is implemented around a nest, **if the nest is found to be active at the start of the construction period**. No construction activity is to take place in this zone between May and November, which is the breeding season for the birds.

See Figure 12 for a map indicating the temporary no disturbance buffer around an active nest.

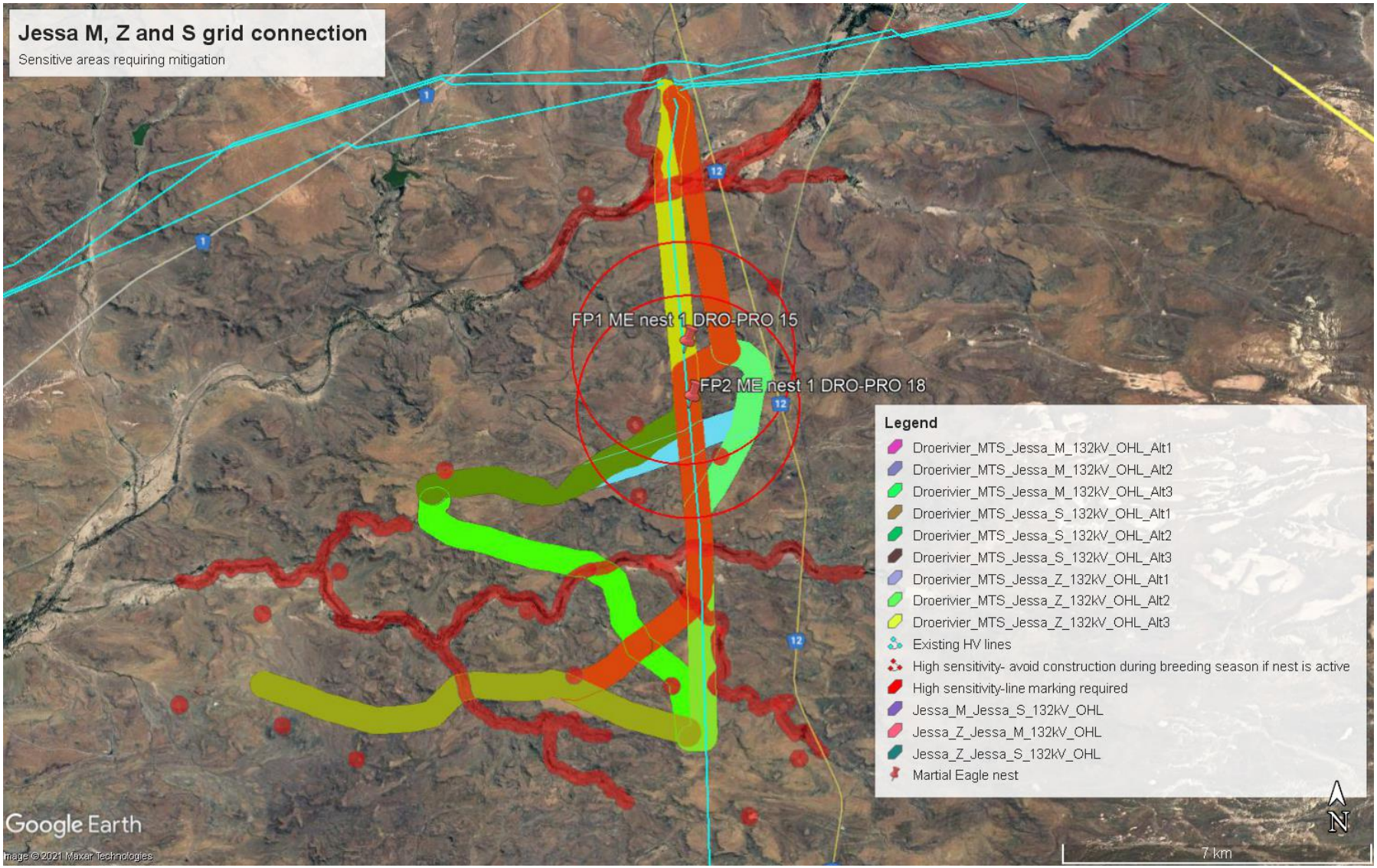

Figure 12: Proposed temporary no disturbance buffer around an active nest in the breeding season (May – November).

7.5 Cumulative impacts

In relation to an activity, cumulative impact 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 be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities" (NEMA EIA Reg GN R982 of 2014). The assessment of cumulative effects therefore needs to consider all approved renewable energy facilities (REFs) within a 35km radius of the proposed grid connection project sites.

The following approved renewable energy applications have been identified within a 35km radius of the grid connection project sites:

Development	Approximate Distance
Beaufort West Solar Power Plant Site 1 - 14/12/16/3/3/2/772 as amended	10km
Beaufort West Solar Power Plant Site 2 - 14/12/16/3/3/2/773 as amended	10km
Beaufort West Solar Power Plant Site 3 - 14/12/16/3/3/2/774 as amended	10km
Beaufort West Photovoltaic Park - 12/12/20/2286 as amended	20km
19MW PV Solar Facility on Portion 1 of Steenrotsfontein 168 - 12/12/20/2133 as amended	8km

It should be noted that the following applications for EA which were identified within a 35km radius of the proposed project site have been withdrawn and/or have lapsed:

- Proposed wind and solar facility on Farm Lombaardskraal, Farm 330, Beaufort West, Western Cape (14/12/16/3/3/2/406);
- Proposed PV solar plants on three (3) properties, Beaufort West, Western Cape (14/12/16/3/3/2/324; 14/12/16/3/3/2/325; 14/12/16/3/3/2/326 & 14/12/16/3/3/2/327); and
- Proposed 300MW PV solar energy facility on the Farm Streenrotsfontein near Beaufort West, Western Cape (12/12/20/2441).

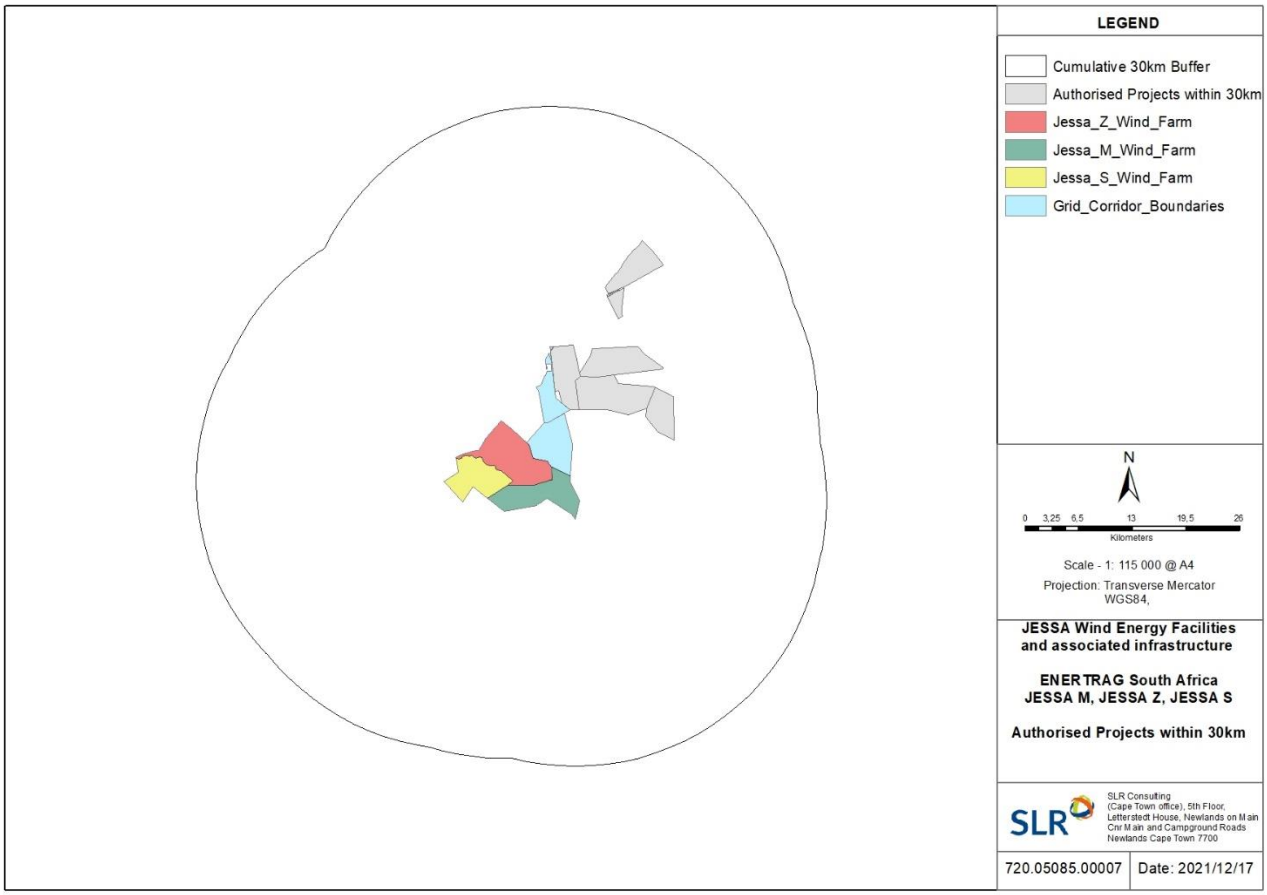

Figure 13: Renewable energy projects authorised within a 35km radius around the Jessa cluster.

The four proposed renewable energy projects that were considered within a 35km radius of the three proposed Jessa grid connection developments are shown in Figure 13. No operational renewable energy facilities were identified. The authorised projects were identified using the latest (Q3 2021) Renewable Energy EIA Application Database for South Africa from the Department of Fisheries, Forestry and Environment (DFFE), in conjunction with information provided by Independent Power Producers (IPPs) operating in the broader region. It should be noted that this list is based on information available at the time of writing this report and as such, there may be other renewable energy projects proposed within the study area for the three Jessa grid connection projects. All of these projects require overhead grid connections, but information on the length of these grid connections could not be attained in all instances, therefore assumptions were made on the expected length of some of the connections, based on the distance from the Eskom grid infrastructure. There are several HV lines feeding into the existing Eskom Droërivier MTS, of which ~ 270km is contained in the 35km radius around the three Jessa grid connection projects. The sum total of all the existing and planned HV lines in the 35km radius amounts to ~ 415km (assuming that the aforementioned solar developments will each contribute a maximum of ~15km i.e., ~60km in total), of which the proposed Jessa M, Jessa Z and Jessa S grid connection projects constitute a maximum of ~ 85km, or ~ 20%. The contribution of the Jessa M, Jessa Z and Jessa S grid connections to the cumulative impact of all the grid connections and existing HV lines is thus moderate.

However, the planned grid connections for renewable energy projects as a group constitute ~35% of the planned and existing HV network in the 35km radius around the grid connection project sites. The contribution of all three Jessa grid connection projects to the cumulative impact of the HV lines in the 35km radius, which

is mainly collision mortality of priority species with the powerlines, is therefore **medium to high**, and the total amount of existing and planned HV lines in the 35km radius, namely ~415km, is high as well. The cumulative collision impact of all three Jessa grid connection projects and existing HV lines in the 35km radius is assessed to be **high** pre-mitigation but should be reduced to **medium** post-mitigation.

7.6 Conditions for inclusion in the Environmental Management Programme (EMPr)

Please see Appendix 8 for the monitoring requirements to be included in the EMPrs for the grid connection projects. The monitoring requirements are applicable to all three proposed Jessa grid connection projects.

8. COMPARATIVE ASSESSMENT OF ALTERNATIVES

As mentioned in section 3.3, a site area (up to approx. 30ha) was assessed for the switching station portion of the substation and connection of the associated powerlines which form part of each grid connection project. Based on the findings of the avifaunal assessment, no fatal flaws or highly sensitive and/or 'no-go' areas were identified within the above-mentioned site area. The area proposed for the placement of the the switching station portion of the substation and connection of the associated powerlines (which form part of each grid connection project) is therefore deemed acceptable for authorisation, provided the recommended mitigation measures are implemented and strictly enforced.

132kV powerline route alternatives (to link each proposed Jessa WEF project to existing Eskom Droërivier MTS) and 132kV WEF connecting grid corridors (to link respective Jessa WEF projects i.e., Jessa M – Jessa S; Jessa Z – Jessa M and Jessa Z to Jessa S) have also been assessed for each grid connection project. Powerline corridors with widths of 600m (i.e., 300m on either side of centre line) have been assessed for the above-mentioned alternatives, to allow flexibility when routing the proposed powerlines within the authorised corridors (see section 3.3).

In addition to the above, a 20-30ha area was assessed for the potential expansion of the existing Eskom Droërivier MTS (as an alternative to connecting directly to the MTS).

Refer to section 8.2. below for confirmation regarding the preferred alternative(s) for the above-mentioned powerline route alternatives and potential MTS expansion. As mentioned in section 3.3, all three WEF connecting grid corridors will need to be authorised by the DFFE, to allow the respective Jessa WEF projects to connect to the national grid, should one of the proposed grid connection infrastructure projects not received EA.

8.1 'No-Go' Alternative

The 'no-go' alternative is the option of not constructing the three Jessa wind facilities (part of separate respective applications / BA processes and assessed in standalone Avifauna report) and associated grid connection infrastructure projects, where the *status quo* of the current status and/or activities on the project sites would prevail. This alternative would result in no additional impact on the receiving environment.

Should the 'no-go' alternative be considered, there would be no impact on the existing environmental baseline and no benefits to the local economy and affected communities. The alternative also bears the opportunity

cost of missed socio-economic benefits to the local community that would otherwise realise from establishing the farms which form part of the project sites. The option of not developing also entails that the bid to provide renewable/clean energy to the national grid and contribute to meeting the country's energy demands will be forfeited.

However, from a strictly avifaunal perspective, the 'no-go' alternative will result in the current *status quo* being maintained. The low human population in the area is definitely advantageous to sensitive avifauna, especially Red Data species. The 'no-go' option would eliminate any additional impact on the ecological integrity of the proposed grid connection development sites, as far as avifauna is concerned.

8.2 Preferred Alternative

8.2.1 Jessa M

The impacts associated with all three proposed grid options for the respective grid connection projects are essentially identical, therefore all three alternatives will be acceptable from an avifaunal perspective. However, Grid Corridor Alternative 1 for the powerline route alternatives which link the proposed Jessa M WEF project to the existing Eskom Droërivier MTS is preferred, due to it running next to an existing HV line all the way. The reasoning behind it is as follows:

- Placing the new line as far as possible next to an existing transmission line should reduce the risk of collisions, because it creates a more visible obstacle to birds and the resident birds, particularly breeding adults, are used to an obstacle in that geographic location and may have learnt to avoid it (Shaw, 2013; APLIC, 2012; Sundar & Choudhury, 2005).

8.2.2 Jessa Z

The impacts associated with all three proposed grid options for the respective grid connection projects are essentially identical, therefore all three alternatives will be acceptable from an avifaunal perspective. However, Grid Corridor Alternative 1 for the powerline route alternatives which link the proposed Jessa Z WEF project to the existing Eskom Droërivier MTS is preferred, due to it running next to an existing HV line for about 60% of the way. The reasoning behind it is as follows:

- Placing the new line as far as possible next to an existing transmission line should reduce the risk of collisions, because it creates a more visible obstacle to birds and the resident birds, particularly breeding adults, are used to an obstacle in that geographic location and may have learnt to avoid it (Shaw, 2013; APLIC, 2012; Sundar & Choudhury, 2005).

8.2.3 Jessa S

The impacts associated with all three proposed grid options for the respective grid connection projects are essentially identical, therefore all three alternatives will be acceptable from an avifaunal perspective. However, Grid Corridor Alternative 1 for the powerline route alternatives which link the proposed Jessa S WEF project to the existing Eskom Droërivier MTS is preferred, due to it running next to an existing HV line for about 60% of the way. The reasoning behind it is as follows:

- Placing the new line as far as possible next to an existing transmission line should reduce the risk of collisions, because it creates a more visible obstacle to birds and the resident birds, particularly breeding adults, are used to an obstacle in that geographic location and may have learnt to avoid it (Shaw, 2013; APLIC, 2012; Sundar & Choudhury, 2005).

8.2.4 MTS Expansion

The 20-30ha area assessed for the potential expansion of the existing Eskom Droërivier MTS was found to be acceptable from an avifauna perspective, as no fatal flaws or highly sensitive / 'no-go' areas were identified. This is applicable for all three grid connection projects.

9. CONCLUSION AND SUMMARY

The proposed Jessa M, Jessa S and Jessa Z grid connection projects will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the switching / collector substations and the extension of the Droërivier MTS, in the construction phase,
- Collisions with the overhead line in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

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

Construction activities impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and (possibly) the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle. Large terrestrial species and some species of raptors are most likely to be affected by displacement due to disturbance. There is an active Martial Eagle territory with two nests (on Tower 15 (-32.460369°S; 22.534269°E) or Tower 18 (-32.471507°S; 22.535406°E) on the Droërivier Proteus 1 400kV HV line. All the proposed grid connection options for the respective Jessa grid connection projects are located between 0 - 1.6km of a nest. The risk of the birds being temporary displaced due to disturbance by the construction activities are very high, unless mitigated. The impact is rated as **medium** pre-mitigation and **very low** post-mitigation for all three Jessa grid connection projects.

9.2 Displacement due to habitat transformation in the switching / collector substations and the extension of the Droërivier MTS in the construction phase

Construction activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed switching / collector substations for the three grid connection projects, through transformation of

habitat, 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 / collector substation yard for each respective grid connection project is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing powerlines, very little if any vegetation clearing will be required in the powerline servitudes for the grid connection projects. The habitat in the study area for the three grid connection projects is extensive, very uniform and largely untransformed from a bird impact perspective; therefore, the loss of a few hectares of habitat for priority species due to direct habitat transformation associated with the construction of the proposed switching / collector substation for the three grid connection projects, including the extension of the existing Droërivier MTS, is likely to have a low impact on them. The species most likely to be more heavily impacted would be small, common, non-Red Data species which happen to be resident in those few hectares of Karoo habitat. The impact is rated as **medium** pre-mitigation and **low** post-mitigation for all three Jessa grid connection projects.

9.3 Mortality caused by the collisions with the overhead line in the operational phase

The grid connection projects could potentially pose a collision risk to various species, particularly large terrestrial species, including Red Data species such as Ludwig's Bustard, Blue Crane, Karoo Korhaan and Secretarybird, as well as various waterbirds when the dams are full and the drainage lines contain water. The impact is rated as **medium** pre-mitigation and **low** post-mitigation for all three Jessa grid connection projects.

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

The impact is likely to be similar in nature and extent to the construction phase for all three Jessa grid connection projects.

9.5 Cumulative impacts

Four proposed renewable energy projects were considered within a 35km radius of the three proposed Jessa grid connection developments. No operational renewable energy facilities were identified. The authorised projects were identified using the latest (Q3 2021) Renewable Energy EIA Application Database for South Africa from the DFFE, in conjunction with information provided by IPPs operating in the broader region. It should be noted that this list is based on information available at the time of writing this report and as such, there may be other renewable energy projects proposed within the study area for the three Jessa grid connection projects. All of these projects require overhead grid connections, but information on the length of these grid connections could not be attained in all instances, therefore assumptions were made on the expected length of some of the connections, based on the distance from the Droërivier MTS. There are several HV lines feeding into the existing Eskom Droërivier MTS, of which ~ 270km is contained in the 35km radius around the three Jessa grid connection projects. The sum total of all the existing and planned HV lines in the 35km radius amounts to ~ 415km (assuming that the aforementioned solar developments will each contribute a maximum of ~15km i.e., ~60km in total), of which the proposed Jessa M, Jessa Z and Jessa S grid connection projects constitute a maximum of ~ 85km, or ~ 20%. The contribution of the Jessa M, Jessa Z and Jessa S grid connection projects to the cumulative impact of all the grid connections and existing HV lines is thus moderate.

However, the planned grid connections for renewable energy projects as a group constitute ~35% of the planned and existing HV network in the 35km radius around the grid connection project sites. The contribution of all three Jessa grid connection projects to the cumulative impact of the HV lines in the 35km radius, which is mainly collision mortality of priority species with the powerlines, is therefore **medium to high**, and the total amount of existing and planned HV lines in the 35km radius, namely ~415km, is high as well. The cumulative collision impact of all three Jessa grid connection projects and existing HV lines in the 35km radius is assessed to be **high** pre-mitigation but should be reduced to **medium** post-mitigation.

Table 5 below summarises the expected impacts of the three proposed Jessa grid connection projects and proposes mitigation measures per impact.

Table 5: Overall Impact Significance for the Jessa M, Jessa S and Jessa Z grid connection projects (Pre- and Post-Mitigation)

Nature of impact and Phase	Overall Impact Significance (Pre -Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction Phase			
Displacement due to disturbance	Medium Negative	(1) Construction activity to be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area to be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust to be applied according to current best practice in the industry. (3) The avifaunal specialist must conduct an inspection to see if the Martial Eagle nest on Tower 15 (-32.460369°S; 22.534269°E) or Tower 18 (-32.471507°S; 22.535406°E) of the Droërivier-Proteus 1 400kV HV line is active. If the nest is not active, the construction activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the construction period. This could include measures such as delaying some of the construction activities until after the breeding season.	Very low Negative
Displacement due to habitat transformation	Medium Negative	1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state, where possible, after construction. (2) Construction of new roads must only be considered if existing roads cannot be upgraded. (3) The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.	Low Negative
Operational Phase			
Collisions with the overhead grid connection	Medium Negative	(1) An avifaunal specialist must conduct a site walk-through of final pole positions prior to construction, to determine where BFDs are required.	Low Negative

		(2) BFDs must be installed, as per the instructions of the specialist following the walk-through. (3) The operational monitoring programme must include regular monitoring (i.e., quarterly) of the powerlines for collision mortalities. (4) If additional collision hot-spots are identified during quarterly monitoring, these sections must be marked with BFDs to reduce the collision risk.	
Decommissioning Phase			
Displacement due to disturbance	Medium Negative	(1) Decommissioning activity to be restricted to the immediate footprint of the infrastructure, as far as possible. Access to the remainder of the area to be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust to be applied according to current best practice in the industry. (3) The avifaunal specialist must conduct an inspection to see if the Martial Eagle nest on Tower 15 (-32.460369°S; 22.534269°E) or Tower 18 (-32.471507°S; 22.535406°E) of the Droërivier-Proteus 1 400kV HV line is active. If the nest is not active, the decommissioning activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the decommissioning period. This could include measures such as delaying some of the activities until after the breeding season.	Low Negative
Cumulative Impacts			
Cumulative impacts	Medium Negative	Implement all the mitigation measures applicable to avifauna in specialist studies compiled for the four (4) renewable energy grid connections within a 35km radius around the project, and this report (where applicable and practically possible).	Low Negative

9.6 Conclusion and Impact Statement

The proposed Jessa M, Jessa Z and Jessa S grid connection projects will have a moderate impact on avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation. None of the proposed corridor options for each of the respective grid connection projects are fatally flawed, but Corridor Option 1 is preferred for all three Jessa grid connection projects. In addition, the area assessed for the potential expansion of the existing Eskom Droërivier MTS was found to be acceptable from an avifauna perspective. The proposed grid connection developments are therefore supported, provided the mitigation measures listed in this report are strictly implemented.

10. REFERENCES

- ALONSO, J. A. AND ALONSO, J. C. 1999 Collision of birds with overhead transmission lines in Spain. Pp. 57–82 in Ferrer, M. and Janss, G. F. E., eds. Birds and power lines: Collision, electrocution and breeding. Madrid, Spain: Quercus.Google Scholar
- ANIMAL DEMOGRAPHY UNIT. 2021. The southern African Bird Atlas Project 2. University of Cape Town. http://sabap2.adu.org.za.
- 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.
- BARRIENTOS R, PONCE C, PALACIN C, MARTÍN CA, MARTÍN B, ET AL. 2012. Wire marking results in a small but significant reduction in avian mortality at power lines: A BACI Designed Study. PLoS ONE 7(3): e32569. doi:10.1371/journal.pone.0032569.
- BARRIENTOS, R., ALONSO, J.C., PONCE, C., PALACÍN, C. 2011. Meta-Analysis of the effectiveness of marked wire in reducing avian collisions with power lines. Conservation Biology 25: 893-903.
- BEAULAURIER, D.L. 1981. Mitigation of bird collisions with transmission lines. Bonneville Power Administration. U.S. Dept. of Energy.
- BERNARDINO, J., BEVANGER, K., BARRIENTOS, R., DWYER, J.F. MARQUES, A.T., MARTINS, R.C., SHAW, J.M., SILVA, J.P., MOREIRA, F. 2018. Bird collisions with power lines: State of the art and priority areas for research. https://doi.org/10.1016/j.biocon.2018.02.029. Biological Conservation 222 (2018) 1 – 13.
- ENDANGERED WILDLIFE TRUST. 2014. Central incident register for powerline incidents. Unpublished data.
- 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. Proceedings of the 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, 44:23-27.
- HOCKEY, P.A.R., DEAN, W.R.J, AND RYAN, P.G. 2005. Robert's Birds of Southern Africa, seventh edition. Trustees of the John Voelcker Bird Book Fund, Cape Town.
- JENKINS, A. & SMALLIE, J. 2009. Terminal velocity: the end of the line for Ludwig's Bustard? Africa Birds and Birding. Vol 14, No 2.
- JENKINS, A., DE GOEDE, J.H. & VAN ROOYEN, C.S. 2006. Improving the products of the Eskom Electric Eagle Project. Unpublished report to Eskom. Endangered Wildife Trust.
- JENKINS, A.R., DE GOEDE, J.H., SEBELE, L. & DIAMOND, M. 2013. Brokering a settlement between eagles and industry: sustainable management of large raptors nesting on power infrastructure. Bird Conservation International 23: 232-246.

- 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.
- KOOPS, F.B.J. & DE JONG, J. 1982. Vermindering van draadslachtoffers door markering van hoogspanningsleidingen in de omgeving van Heerenveen. Electrotechniek 60 (12): 641 – 646.
- Kruckenberg, H. & Jaene, J. 1999. Zum Einfluss eines Windparks auf die Verteilung weidender Bläßgänse im Rheiderland (Landkreis Leer, Niedersachsen). Natur Landsch. 74: 420–427.
- 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. Proceedings of the 5th World Conference on Birds of Prey and Owls. August 4-8,1998. Midrand, South Africa.
- KRUGER, R. 1999. Towards solving raptor electrocutions on Eskom Distribution Structures in South Africa. Bloemfontein (South Africa): University of the Orange Free State. (M. Phil. Mini-thesis)
- LEDGER, J. 1983. Guidelines for Dealing with Bird Problems of Transmission Lines and Towers. Eskom Test and Research Division. (Technical Note TRR/N83/005).
- LEDGER, J.A. & ANNEGARN H.J. 1981. Electrocution Hazards to the Cape Vulture (*Gyps coprotheres*) in South Africa. Biological Conservation 20:15-24.
- LEDGER, J.A. 1984. Engineering Solutions to the Problem of Vulture Electrocutions on Electricity Towers. The Certificated Engineer, 57:92-95.
- 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), Sept. 13-15, 1992. Electric Power Research Institute.
- MARTIN, G., SHAW, J., SMALLIE J. & DIAMOND, M. 2010. Bird's eye view – How birds see is key to avoiding power line collisions. Eskom Research Report. Report Nr: RES/RR/09/31613.
- MUCINA. L. & RUTHERFORD, M.C. (EDS) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- RAAB, R., SPAKOVSZKY, P., JULIUS, E., SCHÜTZ, C. & SCHULZE, C. 2010. Effects of powerlines on flight behaviour of the West-Pannonian Great Bustard *Otis tarda* population. Bird Conservation International. Birdlife International.
- 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.
- SHAW, J.M., PRETORIUS, M.D., GIBBONS, B., MOHALE, O., VISAGIE, R., LEEUWNER, J.L.& RYAN, P.G. 2017. The effectiveness of line markers in reducing power line collisions of large terrestrial birds at De Aar, Northern Cape. Eskom Research, Testing and Development. Research Report. RES/RR/17/1939422.
- SPORER, M.K., DWYER, J.F., GERBER, B.D, HARNESS, R.E, PANDEY, A.K. 2013. Marking Power Lines to Reduce Avian Collisions Near the Audubon National Wildlife Refuge, North Dakota. Wildlife Society Bulletin 37(4):796–804; 2013; DOI: 10.1002/wsb.329
- TAYLOR, M.R., PEACOCK F, & WANLESS R.W (eds.) 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg, South Africa.
- VAN ROOYEN, C.S. & LEDGER, J.A. 1999. Birds and utility structures: Developments in southern Africa. Pp 205-230, in Ferrer, M. & G.F.M. Janns. (eds.). Birds and Power lines. Quercus, Madrid (Spain). Pp 238.
- 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.
- VAN ROOYEN, C.S. 1998. Raptor mortality on power lines in South Africa. Proceedings of the 5th World Conference on Birds of Prey and Owls. Midrand (South Africa), Aug.4 – 8, 1998.

- VAN ROOYEN, C.S. 1999. An overview of the Eskom-EWT Strategic Partnership in South Africa. EPRI Workshop on Avian Interactions with Utility Structures Charleston (South Carolina), Dec. 2-3 1999.
- Van Rooyen, C.S. 2000. An overview of Vulture Electrocutions in South Africa. Vulture News, 43: 5-22. (Vulture Study Group, Johannesburg, South Africa).

- VAN ROOYEN, C.S. 2000. An overview of Vulture Electrocutions in South Africa. Vulture News, 43: 5-22. (Vulture Study Group, Johannesburg, South Africa).

- VAN ROOYEN, C.S. 2004. 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. 2007. Eskom-EWT Strategic Partnership: Progress Report April-September 2007. Endangered Wildlife Trust, Johannesburg.
- VAN ROOYEN, C.S. VOSLOO, H.F. & R.E. HARNESS. 2002. Eliminating bird streamers as a cause of faulting on transmission lines in South Africa. Proceedings of the IEEE 46th Rural Electric Power Conference. Colorado Springs (Colorado), May. 2002.
- VERDOORN, G.H. 1996. Mortality of Cape Griffons Gyps coprotheres and African Whitebacked Vultures *Pseudogyps africanus* on 88kV and 132kV power lines in Western Transvaal, South Africa, and mitigation measures to prevent future problems. Proceedings of the 2nd International Conference on Raptors: Urbino (Italy), Oct. 2-5, 1996.

APPENDIX 1: SPECIALIST CV

Curriculum vitae: Chris van Rooyen

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

Key Experience

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

Key Project Experience

Bird Impact Assessment Studies and avifaunal monitoring for wind-powered generation facilities:

1. Eskom Klipheuwel Experimental Wind Power Facility, Western Cape
2. Mainstream Wind Facility Jeffreys Bay, Eastern Cape (EIA and monitoring)
3. Biotherm, Swellendam, (Excelsior), Western Cape (EIA and monitoring)
4. Biotherm, Napier, (Matjieskloof), Western Cape (pre-feasibility)
5. Windcurrent SA, Jeffreys Bay, Eastern Cape (2 sites) (EIA and monitoring)
6. Caledon Wind, Caledon, Western Cape (EIA)
7. Innowind (4 sites), Western Cape (EIA)
8. Renewable Energy Systems (RES) Oyster Bay, Eastern Cape (EIA and monitoring)
9. Oelsner Group (Kerriefontein), Western Cape (EIA)
10. Oelsner Group (Langefontein), Western Cape (EIA)
11. InCa Energy, Vredendal Wind Energy Facility Western Cape (EIA)
12. Mainstream Loeriesfontein Wind Energy Facility (EIA and monitoring)
13. Mainstream Noupoort Wind Energy Facility (EIA and monitoring)
14. Biotherm Port Nolloth Wind Energy Facility (Monitoring)
15. Biotherm Laingsburg Wind Energy Facility (EIA and monitoring)
16. Langhoogte Wind Energy Facility (EIA)
17. Vleesbaai Wind Energy Facility (EIA and monitoring)
18. St. Helena Bay Wind Energy Facility (EIA and monitoring)
19. Electrawind, St Helena Bay Wind Energy Facility (EIA and monitoring)
20. Electrawind, Vredendal Wind Energy Facility (EIA)
21. SAGIT, Langhoogte and Wolseley Wind Energy facilities
22. Renosterberg Wind Energy Project – 12-month preconstruction avifaunal monitoring project
23. De Aar – North (Mulilo) Wind Energy Project – 12-month preconstruction avifaunal monitoring

project

24. De Aar – South (Mulilo) Wind Energy Project – 12-month bird monitoring
25. Namies – Aggenys Wind Energy Project – 12-month bird monitoring
26. Pofadder - Wind Energy Project – 12-month bird monitoring
27. Dwarsrug Loeriesfontein - Wind Energy Project – 12-month bird monitoring
28. Waaihoek – Utrecht Wind Energy Project – 12-month bird monitoring
29. Amathole – Butterworth Utrecht Wind Energy Project – 12-month bird monitoring & EIA specialist
30. Phezukomoya and San Kraal Wind Energy Projects 12-month bird monitoring & EIA specialist study (Innowind)
31. Beaufort West Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
32. Leeuwdraai Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
33. Sutherland Wind Energy Facility 12-month bird monitoring (Mainstream)
34. Maralla Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
35. Esizayo Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
36. Humansdorp Wind Energy Facility 12-month bird monitoring & EIA specialist study (Cennergi)
37. Aletta Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
38. Eureka Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
39. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
40. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
41. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
42. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
43. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
44. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
45. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
46. Dassieklip Wind Energy Facility 3 years post-construction monitoring (Biotherm)
47. Loeriesfontein 2 Wind Energy Facility 2 years post-construction monitoring (Mainstream)
48. Khobab Wind Energy Facility 2 years post-construction monitoring (Mainstream)
49. Excelsior Wind Energy Facility 18 months construction phase monitoring (Biotherm)
50. Boesmansberg Wind Energy Facility 12-months pre-construction bird monitoring (juwi)
51. Mañhica Wind Energy Facility, Mozambique, 12-months pre-construction monitoring (Windlab)
52. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
53. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO).
54. Jessa M, S and Z and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
55. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
56. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
57. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
58. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
59. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
60. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
61. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
62. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
63. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
64. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
65. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
66. Pofadder Wind Energy Facility, Northren Cape, Screening Report (Atlantic Energy)

67. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
68. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
69. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment Studies for Solar Energy Plants:

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

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV
14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project

29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation
37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV

88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV
94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
118. Matla-Glockner 400kV
119. Delmas North 44kV
120. Houwhoek 11kV Refurbishment
121. Clau-Clau 132kV
122. Ngwedi-Silwerkrans 134kV
123. Nieuwehoop 400kV walk-through
124. Booysendal 132kV Switching Station
125. Tarlton 132kV
126. Medupi - Witkop 400kV walk-through
127. Germiston Industries Substation
128. Sekgame 132kV
129. Botswana – South Africa 400kV Transfrontier Interconnector
130. Syferkuil – Rampheri 132kV
131. Queens Substation and associated 132kV powerlines
132. Oranjemond 400kV Transmission line
133. Aries – Helios – Juno walk-down
134. Kuruman Phase 1 and 2 Wind Energy facilities 132kV Grid connection
135. Transnet Thaba 132kV

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

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Somerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm

Blesbokfontein)

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

Professional affiliations

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

Curriculum vitae: Albert Froneman

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

Key Qualifications

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

KEY PROJECT EXPERIENCE

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

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

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

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

Bird Impact Assessment studies and / or GIS analysis:

1. Aviation Bird Hazard Assessment Study for the proposed Madiba Bay Leisure Park adjacent to Port Elizabeth Airport.
2. Extension of Runway and Provision of Parallel Taxiway at Sir Seretse Khama Airport, Botswana Bird / Wildlife Hazard Management Specialist Study
3. Maun Airport Improvements Bird / Wildlife Hazard Management Specialist Study

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

Geographic Information System analysis & maps

1. ESKOM Power line Makgalakwena EIA – GIS specialist & map production
2. ESKOM Power line Benficosa EIA – GIS specialist & map production

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

Professional affiliations

- South African Council for Natural Scientific Professions (SACNASP) registered Professional Natural Scientist (reg. nr 400177/09) – specialist field: Zoological Science. Registered since

2009.

- Southern African Wildlife Management Association - Member
- Zoological Society of South Africa - Member

APPENDIX 2: PRE-CONSTRUCTION MONITORING PROTOCOL

1. OBJECTIVES

The objective of the pre-construction monitoring at the proposed Jessa M, Jessa S and Jessa Z WEF (including grid connections) was to gather baseline data over a period of four seasons on the following aspects pertaining to avifauna:

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

2. METHODS

One set of guidelines were applicable:

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

The wind guidelines are applicable to all wind energy facilities which require environmental authorisation. The wind guidelines require a minimum of four site visits a year, and the solar guidelines require a minimum of two surveys for a medium sensitive site.

Wind priority species were identified using the latest (November 2014) BirdLife SA (BLSA) list of priority species for wind farms.

We did not foresee the regular occurrence of Verreaux's Eagle, Cape Vulture or Black Harriers at the respective WEF sites, which would have necessitated the application of species-specific guidelines.

The monitoring surveys were conducted at the proposed WEF sites and a control site by two field monitors from 04 – 10 August 2020, 21 – 29 September 2020 and 30 November 2020 – 6 December 2020, and 8 – 11 March 2021.

Monitoring was conducted in the following manner:

- One drive transect was identified totalling 13.4km on the development sites and one drive transect in the control site with a total length of 10.02km.
- Two monitors travelling slowly (± 10km/h) in a vehicle recorded all birds on both sides of the transect. The observers stopped at regular intervals (every 500m) to scan the environment with binoculars. Drive transects were counted three times per sampling session.
- In addition, 6 walk transects of 1km each were identified at the development sites, and two at the control site. These transects were counted 4 times per sampling season. All birds were recorded during walk transects.
- The following variables are recorded:
  - Species
  - Number of birds

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

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

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

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

A total of three potential focal points (FPs) of bird activity were identified and monitored. The focal points were as follows:

- FP1: Martial Eagle nest on Tower 15 of the 1 Droërivier - Protheus 400kV (-32.460369°S; 22.534269°E)
- FP2: Martial Eagle nest on Tower 18 of the 1 Droërivier – Protheus 400kV (-32.471507°S; 22.535406°E)
- FP3: Earth dam (32.554370°S; 22.551020°E)

Figure 1 below indicates the proposed turbine and control areas where monitoring is taking place.

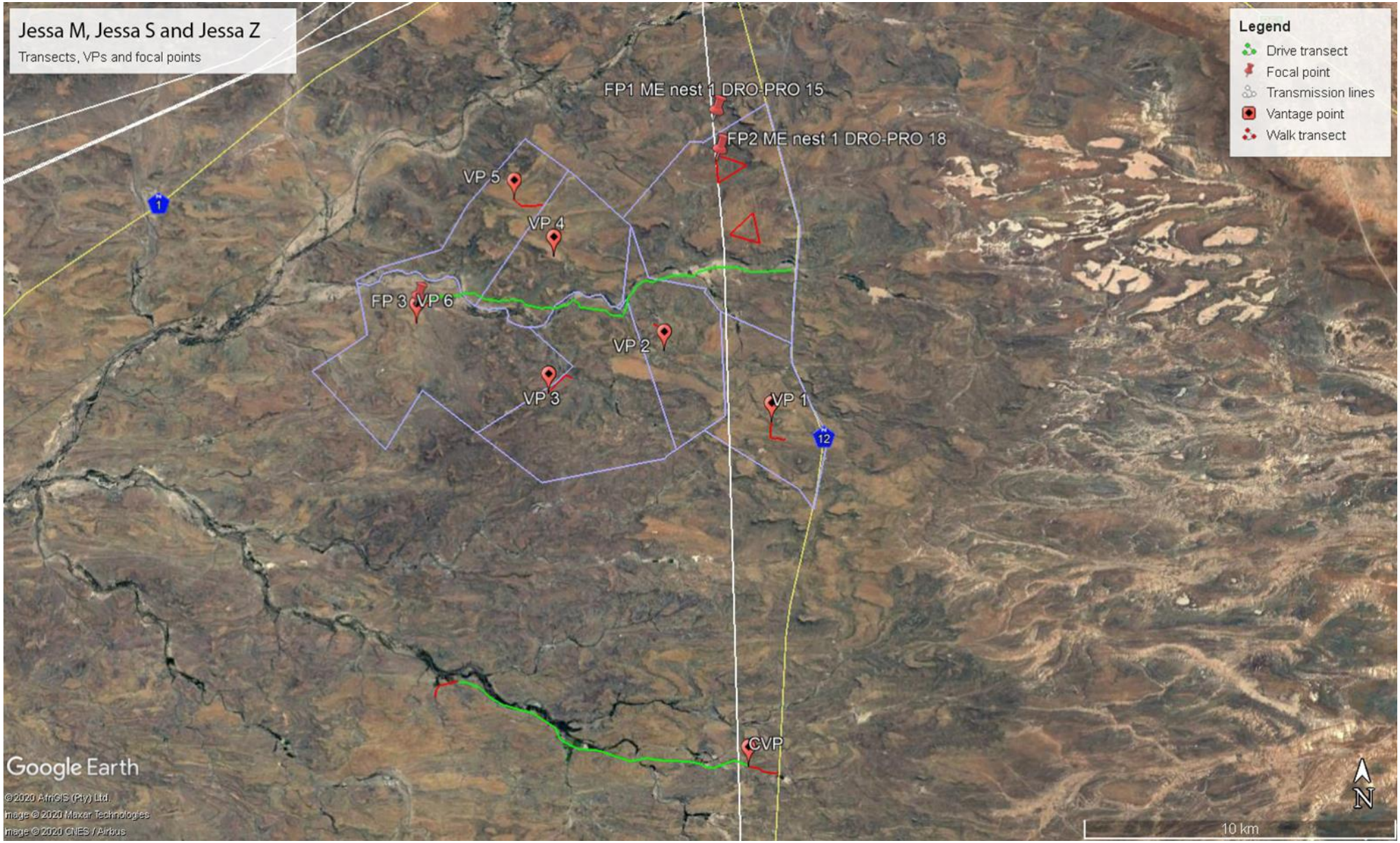

Figure 1: Area where monitoring was performed, with position of VPs, focal points, drive transects, walk transects and land parcels (**purple** polygon). The area to the south of the land parcels is the control area.

APPENDIX 3: BIRD HABITAT

Figure 1: Gamka Karoo

Figure 2: High voltage line with a Martial Eagle nest

Figure 3: Borehole and small earth dam

Figure 4: Gamka River

APPENDIX 4: SPECIES LIST FOR THE BROADER AREA

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status
Bokmakierie	*Telophorus zeylonus*	61.7	5.5	-	-
Hamerkop	*Scopus umbretta*	6.1	0.8	-	-
Neddicky	*Cisticola fulvicapilla*	0.9	0.0	-	-
Ruff	*Calidris pugnax*	4.3	0.0	-	-
Secretarybird	*Sagittarius serpentarius*	0.9	0.0	EN	VU
Bar-throated Apalis	*Apalis thoracica*	9.6	0.0	-	-
Pied Avocet	*Recurvirostra avosetta*	14.8	1.6	-	-
Acacia Pied Barbet	*Tricholaema leucomelas*	76.5	14.1	-	-
Pririt Batis	*Batis pririt*	52.2	7.0	-	-
European Bee-eater	*Merops apiaster*	7.8	0.0	-	-
Southern Red Bishop	*Euplectes orix*	40.0	3.1	-	-
African Red-eyed Bulbul	*Pycnonotus nigricans*	74.8	14.1	-	-
Cape Bunting	*Emberiza capensis*	43.5	11.7	-	-
Lark-like Bunting	*Emberiza impetuani*	59.1	22.7	-	-
Kori Bustard	*Ardeotis kori*	5.2	0.0	NT	NT
Ludwig's Bustard	*Neotis ludwigii*	11.3	3.1	EN	EN
Common Buzzard	*Buteo buteo*	3.5	0.0	-	-
Jackal Buzzard	*Buteo rufofuscus*	5.2	0.8	-	-
Black-headed Canary	*Serinus alario*	18.3	3.9	-	-
Black-throated Canary	*Crithagra atrogularis*	24.3	0.8	-	-
Cape Canary	*Serinus canicollis*	0.9	0.8	-	-
White-throated Canary	*Crithagra albogularis*	67.8	11.7	-	-
Yellow Canary	*Crithagra flaviventris*	35.7	10.2	-	-
Ant-eating Chat	*Myrmecocichla formicivora*	20.9	0.8	-	-
Familiar Chat	*Oenanthe familiaris*	57.4	10.2	-	-
Karoo Chat	*Emarginata schlegelii*	74.8	34.4	-	-
Sickle-winged Chat	*Emarginata sinuata*	7.0	2.3	-	-
Tractrac Chat	*Emarginata tractrac*	9.6	4.7	-	-
Desert Cisticola	*Cisticola aridulus*	0.9	0.0	-	-
Grey-backed Cisticola	*Cisticola subruficapilla*	28.7	1.6	-	-
Levaillant's Cisticola	*Cisticola tinniens*	8.7	0.0	-	-
Zitting Cisticola	*Cisticola juncidis*	0.9	0.0	-	-
Red-knobbed Coot	*Fulica cristata*	9.6	0.0	-	-
Reed Cormorant	*Microcarbo africanus*	3.5	0.0	-	-
White-breasted Cormorant	*Phalacrocorax lucidus*	5.2	0.0	-	-

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status
Double-banded Courser	*Rhinoptilus africanus*	4.3	6.3	-	-
Blue Crane	*Grus paradisea*	8.7	2.3	VU	NT
Long-billed Crombec	*Sylvietta rufescens*	24.3	2.3	-	-
Cape Crow	*Corvus capensis*	33.9	13.3	-	-
Pied Crow	*Corvus albus*	61.7	39.1	-	-
Diederik Cuckoo	*Chrysococcyx caprius*	11.3	0.0	-	-
African Darter	*Anhinga rufa*	1.7	0.0	-	-
Cape Turtle Dove	*Streptopelia capicola*	76.5	20.3	-	-
Laughing Dove	*Spilopelia senegalensis*	69.6	12.5	-	-
Namaqua Dove	*Oena capensis*	42.6	13.3	-	-
Red-eyed Dove	*Streptopelia semitorquata*	11.3	0.0	-	-
Rock Dove	*Columba livia*	0.0	0.8	-	-
Fork-tailed Drongo	*Dicrurus adsimilis*	0.9	0.0	-	-
African Black Duck	*Anas sparsa*	10.4	0.8	-	-
Maccoa Duck	*Oxyura maccoa*	5.2	0.0	VU	NT
White-faced Whistling Duck	*Dendrocygna viduata*	0.9	0.0	-	-
Yellow-billed Duck	*Anas undulata*	20.9	0.0	-	-
African Fish Eagle	*Haliaeetus vocifer*	1.7	0.0	-	-
Booted Eagle	*Hieraaetus pennatus*	1.7	1.6	-	-
Brown Snake Eagle	*Circaetus cinereus*	0.9	0.0	-	-
Martial Eagle	*Polemaetus bellicosus*	6.1	2.3	EN	EN
Verreaux's Eagle	*Aquila verreauxii*	2.6	1.6	-	VU
Spotted Eagle-Owl	*Bubo africanus*	6.1	0.8	-	-
Little Egret	*Egretta garzetta*	1.7	0.0	-	-
Western Cattle Egret	*Bubulcus ibis*	4.3	0.0	-	-
Karoo Eremomela	*Eremomela gregalis*	6.1	1.6	-	-
Yellow-bellied Eremomela	*Eremomela icteropygialis*	28.7	10.9	-	-
Lanner Falcon	*Falco biarmicus*	0.9	0.0	-	VU
Peregrine Falcon	*Falco peregrinus*	0.9	0.0	-	-
Red-headed Finch	*Amadina erythrocephala*	3.5	0.8	-	-
Red-billed Firefinch	*Lagonosticta senegala*	7.8	0.8	-	-
Southern Fiscal	*Lanius collaris*	67.8	12.5	-	-
Greater Flamingo	*Phoenicopterus roseus*	2.6	0.0	-	NT
Chat Flycatcher	*Melaenornis infuscatus*	34.8	7.0	-	-
Fairy Flycatcher	*Stenostira scita*	48.7	7.8	-	-
Fiscal Flycatcher	*Melaenornis silens*	53.9	7.0	-	-
Spotted Flycatcher	*Muscicapa striata*	0.9	0.0	-	-

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status
Egyptian Goose	*Alopochen aegyptiaca*	47.0	13.3	-	-
Spur-winged Goose	*Plectropterus gambensis*	10.4	0.0	-	-
Gabar Goshawk	*Micronisus gabar*	2.6	0.0	-	-
Pale Chanting Goshawk	*Melierax canorus*	35.7	11.7	-	-
Black-necked Grebe	*Podiceps nigricollis*	1.7	0.0	-	-
Little Grebe	*Tachybaptus ruficollis*	6.1	0.8	-	-
Common Greenshank	*Tringa nebularia*	10.4	2.3	-	-
Helmeted Guineafowl	*Numida meleagris*	25.2	2.3	-	-
Black Harrier	*Circus maurus*	1.7	0.0	EN	EN
African Harrier-Hawk	*Polyboroides typus*	0.9	0.0	-	-
Black-crowned Night Heron	*Nycticorax nycticorax*	3.5	0.0	-	-
Black-headed Heron	*Ardea melanocephala*	13.0	0.0	-	-
Grey Heron	*Ardea cinerea*	19.1	0.0	-	-
Lesser Honeyguide	*Indicator minor*	1.7	0.0	-	-
African Hoopoe	*Upupa africana*	27.0	0.0	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	19.1	4.7	-	-
Glossy Ibis	*Plegadis falcinellus*	2.6	0.0	-	-
Hadada Ibis	*Bostrychia hagedash*	47.0	7.8	-	-
Greater Kestrel	*Falco rupicoloides*	9.6	2.3	-	-
Lesser Kestrel	*Falco naumanni*	2.6	0.0	-	-
Rock Kestrel	*Falco rupicolus*	15.7	5.5	-	-
Brown-hooded Kingfisher	*Halcyon albiventris*	21.7	0.8	-	-
Giant Kingfisher	*Megaceryle maxima*	3.5	0.0	-	-
Malachite Kingfisher	*Corythornis cristatus*	5.2	1.6	-	-
Pied Kingfisher	*Ceryle rudis*	5.2	0.0	-	-
Black-winged Kite	*Elanus caeruleus*	5.2	0.0	-	-
Karoo Korhaan	*Eupodotis vigorsii*	59.1	28.1	-	NT
Southern Black Korhaan	*Afrotis afra*	1.7	0.0	VU	VU
Blacksmith Lapwing	*Vanellus armatus*	59.1	14.1	-	-
Crowned Lapwing	*Vanellus coronatus*	9.6	3.9	-	-
Karoo Lark	*Calendulauda albescens*	4.3	3.1	-	-
Karoo Long-billed Lark	*Certhilauda subcoronata*	75.7	26.6	-	-
Large-billed Lark	*Galerida magnirostris*	16.5	5.5	-	-
Red-capped Lark	*Calandrella cinerea*	19.1	7.0	-	-
Sabota Lark	*Calendulauda sabota*	10.4	2.3	-	-
Spike-heeled Lark	*Chersomanes albofasciata*	38.3	17.2	-	-

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status
Banded Martin	*Riparia cincta*	0.9	0.0	-	-
Brown-throated Martin	*Riparia paludicola*	24.3	1.6	-	-
Rock Martin	*Ptyonoprogne fuligula*	63.5	17.2	-	-
Common Moorhen	*Gallinula chloropus*	1.7	0.0	-	-
Red-faced Mousebird	*Urocolius indicus*	49.6	6.3	-	-
Speckled Mousebird	*Colius striatus*	2.6	0.0	-	-
White-backed Mousebird	*Colius colius*	60.9	5.5	-	-
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	8.7	0.8	-	-
Common Ostrich	*Struthio camelus*	27.0	3.9	-	-
Western Barn Owl	*Tyto alba*	0.9	0.0	-	-
Speckled Pigeon	*Columba guinea*	52.2	9.4	-	-
African Pipit	*Anthus cinnamomeus*	27.0	4.7	-	-
Buffy Pipit	*Anthus vaalensis*	0.9	0.0	-	-
Long-billed Pipit	*Anthus similis*	0.9	0.0	-	-
Nicholson's Pipit	*Anthus nicholsoni*	6.1	0.8	-	-
Plain-backed Pipit	*Anthus leucophrys*	0.9	1.6	-	-
Kittlitz's Plover	*Charadrius pecuarius*	22.6	1.6	-	-
Three-banded Plover	*Charadrius tricollaris*	47.8	7.8	-	-
Southern Pochard	*Netta erythrophthalma*	1.7	0.0	-	-
Karoo Prinia	*Prinia maculosa*	75.7	8.6	-	-
Common Quail	*Coturnix coturnix*	0.9	0.0	-	-
Red-billed Quelea	*Quelea quelea*	9.6	0.8	-	-
White-necked Raven	*Corvus albicollis*	8.7	3.1	-	-
Cape Robin-Chat	*Cossypha caffra*	65.2	3.9	-	-
Namaqua Sandgrouse	*Pterocles namaqua*	27.8	14.1	-	-
Common Sandpiper	*Actitis hypoleucos*	2.6	0.0	-	-
Curlew Sandpiper	*Calidris ferruginea*	2.6	0.0	NT	LC
Marsh Sandpiper	*Tringa stagnatilis*	0.9	0.0	-	-
Wood Sandpiper	*Tringa glareola*	0.9	0.0	-	-
Karoo Scrub Robin	*Cercotrichas coryphoeus*	72.2	18.0	-	-
South African Shelduck	*Tadorna cana*	43.5	5.5	-	-
Cape Shoveler	*Spatula smithii*	7.8	0.0	-	-
Cape Sparrow	*Passer melanurus*	82.6	25.8	-	-
House Sparrow	*Passer domesticus*	51.3	9.4	-	-
Southern Grey-headed Sparrow	*Passer diffusus*	18.3	2.3	-	-
Black-eared Sparrow-Lark	*Eremopterix australis*	9.6	3.9	-	-
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	20.0	6.3	-	-

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status
African Spoonbill	*Platalea alba*	13.9	0.0	-	-
Cape Spurfowl	*Pternistis capensis*	10.4	0.0	-	-
Common Starling	*Sturnus vulgaris*	5.2	0.8	-	-
Pale-winged Starling	*Onychognathus nabouroup*	2.6	0.0	-	-
Pied Starling	*Lamprotornis bicolor*	26.1	3.9	-	-
Red-winged Starling	*Onychognathus morio*	3.5	0.0	-	-
Wattled Starling	*Creatophora cinerea*	20.0	0.0	-	-
Black-winged Stilt	*Himantopus himantopus*	20.0	3.9	-	-
Little Stint	*Calidris minuta*	8.7	0.0	-	-
Black Stork	*Ciconia nigra*	6.1	0.8	-	VU
White Stork	*Ciconia ciconia*	4.3	0.8	-	-
Yellow-billed Stork	*Mycteria ibis*	2.6	0.0	-	EN
Dusky Sunbird	*Cinnyris fuscus*	27.0	3.9	-	-
Malachite Sunbird	*Nectarinia famosa*	20.9	1.6	-	-
Southern Double-collared Sunbird	*Cinnyris chalybeus*	21.7	0.8	-	-
Barn Swallow	*Hirundo rustica*	35.7	5.5	-	-
Greater Striped Swallow	*Cecropis cucullata*	49.6	6.3	-	-
Pearl-breasted Swallow	*Hirundo dimidiata*	0.9	0.8	-	-
White-throated Swallow	*Hirundo albigularis*	27.8	3.1	-	-
African Black Swift	*Apus barbatus*	5.2	0.0	-	-
Alpine Swift	*Tachymarptis melba*	6.1	1.6	-	-
Common Swift	*Apus apus*	0.9	0.8	-	-
Little Swift	*Apus affinis*	30.4	2.3	-	-
White-rumped Swift	*Apus caffer*	32.2	3.9	-	-
Southern Tchagra	*Tchagra tchagra*	1.7	0.0	-	-
Cape Teal	*Anas capensis*	12.2	0.8	-	-
Red-billed Teal	*Anas erythrorhyncha*	13.0	1.6	-	-
Whiskered Tern	*Chlidonias hybrida*	2.6	0.0	-	-
White-winged Tern	*Chlidonias leucopterus*	0.9	0.0	-	-
Spotted Thick-knee	*Burhinus capensis*	14.8	1.6	-	-
Karoo Thrush	*Turdus smithi*	56.5	5.5	-	-
Short-toed Rock Thrush	*Monticola brevipes*	0.9	0.0	-	-
Cape Penduline Tit	*Anthoscopus minutus*	5.2	1.6	-	-
Grey Tit	*Melaniparus afer*	12.2	1.6	-	-
Cape Wagtail	*Motacilla capensis*	68.7	14.8	-	-
African Reed Warbler	*Acrocephalus baeticatus*	17.4	1.6	-	-

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status
Chestnut-vented Warbler	*Curruca subcoerulea*	64.3	10.2	-	-
Layard's Warbler	*Curruca layardi*	16.5	3.1	-	-
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	11.3	0.0	-	-
Marsh Warbler	*Acrocephalus palustris*	0.9	0.0	-	-
Namaqua Warbler	*Phragmacia substriata*	45.2	1.6	-	-
Rufous-eared Warbler	*Malcorus pectoralis*	60.0	15.6	-	-
Willow Warbler	*Phylloscopus trochilus*	0.0	1.6	-	-
Common Waxbill	*Estrilda astrild*	33.0	0.8	-	-
Cape Weaver	*Ploceus capensis*	0.9	0.8	-	-
Scaly-feathered Weaver	*Sporopipes squamifrons*	5.2	2.3	-	-
Southern Masked Weaver	*Ploceus velatus*	79.1	18.0	-	-
Capped Wheatear	*Oenanthe pileata*	7.8	0.8	-	-
Mountain Wheatear	*Myrmecocichla monticola*	28.7	5.5	-	-
Cape White-eye	*Zosterops virens*	53.0	2.3	-	-
Pin-tailed Whydah	*Vidua macroura*	9.6	0.0	-	-
Cardinal Woodpecker	*Dendropicos fuscescens*	9.6	0.0	-	-

APPENDIX 5: ASSESSMENT CRITERIA

The impacts of the proposed developments (during the Pre-Construction, Construction, Operation and Decommissioning phases) are to be assessed and rated according to the methodology described below, which was developed by SLR to align with the requirements of the EIA Regulations, 2014 (as amended).

The criteria used to assess both the impacts and the method of determining the significance of the impacts is outlined in the table below. This method complies with the method provided in the EIA guideline document (GN 654 of 2010). **Part A** provides the definitions of the criteria and the approach for determining impact consequence (combining intensity, extent and duration). In **Part B**, a matrix is applied to determine this impact consequence. In **Part C**, the consequence rating is considered together with the probability of occurrence in order to determine the overall significance of each impact. Lastly, the interpretation of the impact significance is provided in **Part D**.

Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA		
Determination of CONSEQUENCE	**Consequence is a function of intensity, spatial extent and duration**	
Determination of SIGNIFICANCE	**Significance is a function of consequence and probability**	
Criteria for ranking of the INTENSITY of environmental impacts	**Very High**	Severe change, disturbance or degradation caused to receptors. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required.
	High	Prominent change, or large degree of modification, disturbance or degradation caused to receptors or which may affect a large proportion of receptors, possibly entire species or community.
	Medium	Moderate change, disturbance or discomfort caused to receptors and/or which may affect a moderate proportion of receptors.
	Low	Minor (slight) change, disturbance or nuisance caused to receptors which is easily tolerated without intervention, or which may affect a small proportion of receptors.
	Very Low	Negligible change, disturbance or nuisance caused to receptors which is barely noticeable or may have minimal effect on receptors or affect a limited proportion of the receptors.
Criteria for ranking the DURATION of impacts	**Very Short-term**	The duration of the impact will be < 1 year or may be intermittent.
	Short-term	The duration of the impact will be between 1 - 5 years.
	Medium-term	The duration of the impact will be Medium-term between, 5 to 10 years.
	Long-term	The duration of the impact will be Long-term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity).
	Permanent	The duration of the impact will be permanent
Criteria for ranking the EXTENT of impacts	**Site**	Impact is limited to the immediate footprint of the activity and immediate surrounds within a confined area.
	Local	Impact is confined to within the project site / area and its nearby surroundings.
	Regional	Impact is confined to the region, e.g., coast, basin, catchment, municipal region, district, etc.
	National	Impact may extend beyond district or regional boundaries with national implications.
	International	Impact extends beyond the national scale or may be transboundary.

PART B: DETERMINING CONSEQUENCE						
		EXTENT				
		Site	Local	Regional	National	International
Intensity- Very Low						
DURATION	Permanent	Low	Low	Medium	Medium	High
	Long-term	Low	Low	Low	Medium	Medium
	Medium-term	Very Low	Low	Low	Low	Medium
	Short-term	Very low	Very Low	Low	Low	Low
	Very Short-term	Very low	Very Low	Very Low	Low	Low
Intensity -Low						
DURATION	Permanent	Medium	Medium	Medium	High	High
	Long-term	Low	Medium	Medium	Medium	High
	Medium-term	Low	Low	Medium	Medium	Medium
	Short-term	Low	Low	Low	Medium	Medium
	Very Short-term	Very low	Low	Low	Low	Medium
Intensity- Medium						
DURATION	Permanent	Medium	High	High	High	Very High
	Long-term	Medium	Medium	Medium	High	High
	Medium-term	Medium	Medium	Medium	High	High
	Short-term	Low	Medium	Medium	Medium	High
	Very Short-term	Low	Low	Low	Medium	Medium
Intensity -High						
DURATION	Permanent	High	High	High	Very High	Very High
	Long-term	Medium	High	High	High	Very High
	Medium-term	Medium	Medium	High	High	High
	Short-term	Medium	Medium	Medium	High	High
	Very Short-term	Low	Medium	Medium	Medium	High
Intensity - Very High						
DURATION	Permanent	High	High	Very High	Very High	Very High
	Long-term	High	High	High	Very High	Very High
	Medium-term	Medium	High	High	High	Very High
	Short-term	Medium	Medium	High	High	High

	Very Short-term	**Low**	**Medium**	**Medium**	**High**	**High**
		Site	Local	Regional	National	International
		EXTENT				

PART C: DETERMINING SIGNIFICANCE						
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Probable	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Possible/ frequent	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
	Conceivable	**Insignificant**	**Very Low**	**Low**	**Medium**	**High**
	Unlikely/ improbable	**Insignificant**	**Insignificant**	**Very Low**	**Low**	**Medium**
		Very Low	Low	Medium	High	Very High
		CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE		
Very High -	Very High +	Represents a key factor in decision-making. In the case of adverse effects, the impact would be considered a fatal flaw unless mitigated to lower significance.
High -	High +	These beneficial or adverse effects are considered to be very important considerations and are likely to be material for the decision-making process. In the case of negative impacts, substantial mitigation will be required.
Medium -	Medium +	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such issues may become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor. In the case of negative impacts, mitigation will be required.
Low -	Low +	These beneficial or adverse effects may be raised as localised issues. They are unlikely to be critical in the decision-making process but could be important in the subsequent design of the project. In the case of negative impacts, some mitigation is likely to be required.
Very Low -	Very Low +	These beneficial or adverse effects will not have an influence on the decision, neither will they need to be taken into account in the design of the project. In the case of negative impacts, mitigation is not necessarily required.
Insignificant		Any effects are beneath the levels of perception and inconsequential, therefore not requiring any consideration.

APPENDIX 6: ENVIRONMENTAL MANAGEMENT PLAN FOR THE JESSA M, JESSA Z AND JESSA S GRID CONNECTION PROJECTS

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
None					

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and must apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint. 6. The avifaunal specialist must conduct an inspection	1. Implementation of the CEMPr) Oversee activities to ensure tha the CEMPr is implemented an enforced via site audits an inspections. Report and recor any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		to see if the Martial Eagle nest on Tower 15 (-32.460369°S; 22.534269°E) or Tower 18 (-32.471507°S; 22.535406°E) of the Droërivier- Proteus 1 400kV HV line is active. If the nest is not active, the construction activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the construction period. This could include measures such as delaying some of the construction activities until after the breeding season.			
Avifauna: Mortality due to collision with the 132kV OHL					
Mortality of avifauna due to collisions with the 132kV OHL.	Reduction of avian collision mortality	Demarcate sections of the OHL to be marked with Eskom approved Bird Flight Diverters (BFDs).	1. Walk-through by avifauna specialist. 2. Fit Eskom approved Bird Fligh Diverters on the earthwire at the demarcated sections of the OHL.	1. Once-off 2. Once-off	1. Contractor 2. Contractor and ECO

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to habitat transformation in the switching / collector substations					
Total or partial displacement of avifauna due to habitat transformation associated with the	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented, where possible, by an appropriately qualified	1. Develop a Habitat Restoration Plan (HRP) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record	1. Appointment of rehabilitation specialist to develop HRP. 2. Site inspections to monitor progress of HRP.	1. Once-off 2. Once a year 3. As and when required	1. Facility operator

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
vegetation clearance in the development footprint.	rehabilitation specialist, according to the recommendations of the botanical specialist study.	and report any non-compliance.	3. Adaptive management to ensure HRP goals are met.		
Avifauna: Mortality of avifauna due to collision with the 132kV OHL					
Mortality of avifauna due to collisions with the 132kV OHL.	Reduction of avian collision mortality	1. Monitor the collision mortality on the OHL. 2. Apply additional BFDs if collision hotspots are discovered.	1. Avifaunal specialist to conduct quarterly inspections of the OHL for a period of two years. 2. Apply additional BFDs if collision hotspots are discovered.	1. Quarterly 2. As and when required	1. Facility operator

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to disturbance					
The noise and movement associated with the decommissioning activities will be a source of disturbance, which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Decommissioning EMPr.	A site-specific Decommissioning EMPr (EMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and must apply good environmental practice during decommissioning. The EMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads during the decommissioning phase and the construction of new roads must be kept to a minimum, as far as practical; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint. 6. The avifaunal specialist must conduct an inspection to see if the Martial Eagle nest on Tower 15 (-32.460369°S; 22.534269°E) and Tower 18 (-32.471507°S; 22.535406°E) of	1. Implementation of the EMPr Oversee activities to ensure tha the EMPr is implemented an enforced via site audits an inspections. Report and recor any non-compliance. 2. Ensure that decommissioning personnel are made aware of the impacts relating to off-road driving. 3. Access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the decommissioning area is demarcated clearly and that personnel are made aware of these demarcations. Monitor	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		the Droërivier- Proteus 1 400kV HV line is active. If the nest is not active, the decommissioning activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the decommissioning period. This could include measures such as delaying some of the activities until after the breeding season.	via site inspections and report non-compliance.		

APPENDIX 7: SITE SENSITIVITY VERIFICATION

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

1 INTRODUCTION

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

2 SITE SENSITIVITY VERIFICATION

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

- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the Animal Demography Unit of the University of Cape Town (ADU 2021), as a means to ascertain which species occurs within the broader area i.e., within a block consisting of 12 pentads. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 115 full protocol lists (i.e., surveys lasting a minimum of two hours each) have been completed for this area. In addition, 128 ad hoc protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.,* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.,* 2005).
- The global threatened status of all priority species was determined by consulting the (2021.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the respective application sites for the grid connection projects was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.,* 1997) and the National Vegetation Map (2012 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford, 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.,* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2021) was used in order to view the broader area on a landscape level and to help identify sensitive bird habitat.

- Priority species for powerline development were defined as species which could potentially be impacted by powerline collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Species classes which fall under these categories are raptors, large terrestrial birds, waterbirds and crows.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed grid connection project sites relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the respective application sites.
- The primary source of information on avifaunal diversity, abundance and flight patterns at the study area were the results of a pre-construction programme conducted over four seasons (August, September, November, December 2020 and March 2021) at the proposed Jessa M, Jessa S and Jessa Z grid connection project application sites. The primary methods of data capturing were walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see Appendix 3 for a detailed explanation of the monitoring methods).
- Information gained from pre-construction monitoring at potential WEF sites in proximity and in similar habitat to the current project sites (namely the Beaufort West WEF, Trakas WEF, Koup 1 and 2 WEFs and Kwagga 1, 2 and 3 WEFs) assisted in providing a comprehensive picture of avifaunal abundance and diversity in the greater area, including the current study area for three grid connection projects.

3 OUTCOME OF SITE SENSITIVITY VERIFICATION

The proposed grid connection project and control sites are located in Gamka Karoo, which is one of most arid vegetation units of the Nama Karoo biome. It consists of undulating plains covered with dwarf spiny shrubland dominated by Karoo dwarf shrubs, with sparse low trees. Dense stands of drought-resistant grasses cover broad sandy bottomlands, especially after abundant rains (Mucina & Rutherford, 2006). The study area for the three grid connection projects contains a few ephemeral drainage lines, the biggest of which is the Gamka River (which bisects the northern part of the study area), which are characterised by sandy channels with *Vachellia karoo* shrubs and small trees growing on the edges. This region is in the rain shadow of the Cape Fold Belt mountains in the south, with mean annual precipitation ranging from 100 – 240mm, mostly between December and April. Mean maximum and minimum monthly temperatures in the town of Beaufort West are 38.7˚C and -3.2˚C for January (summer) and July (winter) respectively (Mucina & Rutherford, 2006). Strong north-westerly winds occur in winter (Mucina & Rutherford, 2006). The only longer-term surface water at the study area for the three grid connection projects consists of a couple of dams and boreholes with reservoirs. Drainage lines flow only briefly after good rains. The land is used for sheep and game farming.

The following Red Data powerline priority species could occur regularly at the respective application sites:

- Lanner Falcon *Falco biarmicus* (Regional status Vulnerable)
- Secretarybird *Sagittarius serpentarius* (Regional and Global status Endangered)
- Karoo Korhaan *Eupodotis vigorsii* (Regional status Near-threatened)

- Kori Bustard *Ardeotis kori* (Regional and Global status Near-threatened)
- Ludwig's Bustard *Neotis ludwigii* (Regional and Global status Endangered)
- Martial Eagle *Polemaetus bellicosus* (Regional and Global status Endangered)

4 NATIONAL ENVIRONMENTAL SCREENING TOOL

The study area and immediate environment for the three grid connection projects is classified as Medium to High sensitivity for avifauna according to the Terrestrial Animal Species theme[3]. The development site for the three grid connection projects contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020), namely listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered or Vulnerable. The occurrence of SCC was confirmed during the surveys i.e., Ludwig's Bustard (Globally and Regionally Endangered) and Martial Eagle (Globally and Regionally Endangered) was recorded in the study area. Based on these criteria, the study area classification of **High** sensitivity for avifauna for the three grid connection projects is confirmed (see Figure 1).

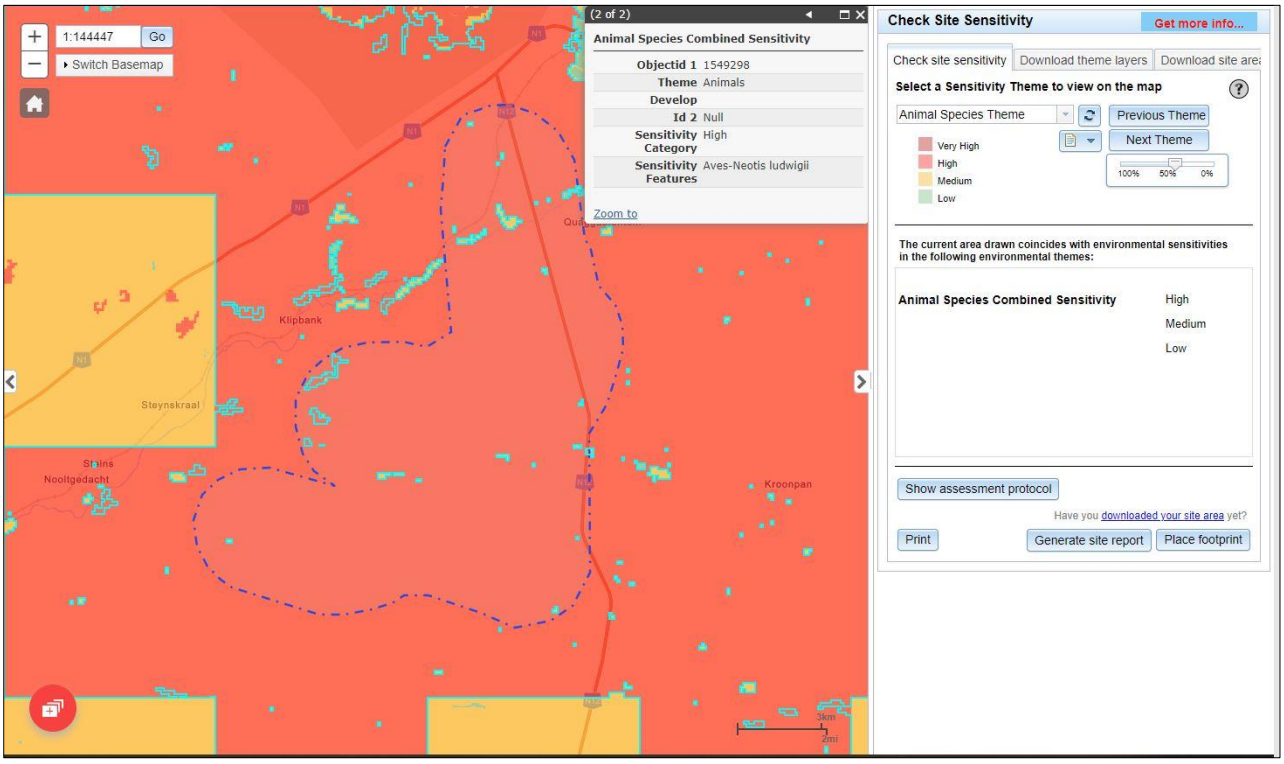

Figure 1: The classification of the development site for the three grid connection projects according to the avian theme for powerline development in the DFFE National Screening Tool.

[3] It should be noted that there is no Avian theme for powerlines in the screening tool.

5 CONCLUSION

The proposed classification of High Sensitivity for all three grid connection projects was confirmed during the subsequent pre-construction surveys which were conducted over four seasons in 2020 and 2021.