Animal Species Impact Assessment

AVIFAUNAL IMPACT ASSESSMENT

PROPOSED GAMMA 400 kV GRIDLINE CORRIDOR

August 2022

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EXECUTIVE SUMMARY

1. BACKGROUND

Red Cap Energy (Pty) Ltd ('Red Cap') has received Environmental Authorisation for three wind farms and for a 400 kV grid corridor collectively known as Nuweveld Wind Farm Development, located close to Beaufort West in the Western Cape Province. Red Cap is also proposing to develop four additional wind farms and associated grid connections, known as the Hoogland Projects north and south of the Nuweveld complex, and the Hoogland grid connections will terminate at the Nuweveld Collector Substation.

To expand the capacity of the Eskom grid and improve the functionality of the grid in the area, an additional 400 kV grid connection of ~110km is required from the Nuweveld Collector Substation to the Gamma Substation, ~90 km to the east (the project). This additional line will improve functionality by creating a 400 kV ring-line between the Droërivier Substation, Gamma Substation and Nuweveld projects, and create opportunities for other renewable energy developments (such as the proposed Hoogland projects) to tie-into the grid either at the Nuweveld Collector Substation or along the new 400 kV line. A 300 m x 300 m expansion to the Gamma Substation (including transformers and other standard substation infrastructure) and access tracks for construction and maintenance of the line will also be required and form components of the project.

2. AVIFAUNA

The SABAP2 data indicates that a total of 187 bird species could potentially occur within the assessment corridor – Appendix 1 provides a comprehensive list of all the species. Of these, 53 species are classified as powerline sensitive species and eleven (11) of these 53 species are South African Red List species i.e. SCC. Of the SCC, eight (8) have SABAP2 reporting rates >2%, indicating medium to high potential of occurrence in the assessment corridor.

3. IMPACTS

The following potential impacts have been identified:

1.1 Construction Phase

- Displacement of avifauna due to disturbance associated with the construction of the proposed 400kV gridline, associated infrastructure and the Gamma Substation expansion; and
- Displacement due to habitat transformation associated with the construction of the proposed 400kV gridline, associated infrastructure and Gamma Substation expansion.

1.2 Operational Phase

- Collisions with the proposed 400kV gridline;

3.3 Decommissioning Phase

- The decommissioning of the gridline is unlikely in the medium to long term.

3.4 Cumulative Impacts

- Displacement due to disturbance associated with the construction of the 400kV gridline and Gamma Substation expansion;
- Displacement due to habitat transformation associated with the construction of the 400kV gridline and Gamma Substation expansion;
- Collisions with the proposed 400kV powerline;

4. DISCUSSION

4.1 Displacement of avifauna due to the disturbance associated with construction activities

The construction activities could impact on birds through displacement due to disturbance; this could lead to breeding failure if the displacement happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, but that is usually not practical given tight constriction schedules. Terrestrial bird species and birds breeding on the existing powerline infrastructure within the assessment corridor are most likely to be potentially affected by displacement due to disturbance.

The powerline sensitive SCC which are vulnerable to this impact in the assessment corridor are the following:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN

The pre- and post- mitigation impact is rated as **Low**. Recommended mitigation are as follows:

- Conduct an avifaunal walk-through of the final powerline alignment to identify priority species that may be breeding within the final footprint. If a SSC nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimizing the potential disturbance to the breeding birds during the construction period, if possible. This could include measures such as delaying some of the activities until after the breeding season.
- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access tracks and the construction of new tracks should be kept to a minimum.
- 1km infrastructure exclusion zones must be implemented around all Verreaux's Eagle nests, except nests on existing high voltage lines.
- 2.5km infrastructure exclusion zones must be implemented around all Martial Eagle nests except nests on existing high voltage lines.

In the case of SCC (eagle) nests on existing high voltage lines, the infrastructure no-go zone can be relaxed. It is preferable to place any new powerlines next to the existing powerline, even if this means temporary disturbance of a pair of breeding eagles. By placing the line next to an existing line, the creation of a new collision risk in a pristine area is avoided, the collision risk that the new line poses is also mitigated to some extent, and the habitat fragmentation is less severe. The short-term disturbance of the eagles is less detrimental than the long-term collision risk that the new powerline will pose in a pristine area.

4.2 Displacement of avifauna due to the habitat transformation associated with construction activities

Construction activities could impact on birds breeding, foraging and roosting in or in close proximity of the construction activities 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 planned expanded Gamma Substation is unavoidable. In the case of the 400kV gridline, the direct habitat transformation is limited to the pole footprints and the narrow access road/track under the powerline. The habitat in the assessment corridor is highly uniform from a bird impact perspective. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the proposed 400kV gridline is likely to be fairly minimal. However, the results of habitat transformation may be more subtle, whereas the actual footprint of the infrastructure may be small in absolute terms, the effects of the habitat fragmentation may be more significant. The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab *et al.* 2010).

The powerline sensitive SCC which are vulnerable to this impact in the assessment corridor are the following:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN

The pre- and post- mitigation impact is rated as **Low**. Recommended mitigation are as follows:

- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum to reduce the extent of habitat fragmentation.
- Vegetation clearance should be limited to what is absolutely necessary and the mitigation measures proposed by the vegetation specialist must be strictly implemented.
- Align the preferred route to be as close to existing powerlines as possible to minimise the effect of habitat fragmentation.

4.3 Electrocution mortality of avifauna

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. Relevant to the proposed 400kV gridline, the risk of the electrocution will be effectively zero due to the large clearances on the proposed 400kV tower designs, which cannot be bridged by even the largest species.

4.4 Collision mortality of avifauna

Collisions are arguably the biggest threat posed by high voltage powerlines 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 high voltage powerlines (Van Rooyen 2004, Anderson 2001).

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). 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 powerlines (Shaw 2013).

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

The powerline sensitive SCC which are vulnerable to this impact in the assessment corridor are the following:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN

The pre- mitigation impact is rated as **High** and the post-mitigation impact is rated as **Low**.
Recommended mitigation are as follows:

- Eskom approved Bird Flight Diverters must be fitted to the grid line where it transects areas of medium and high sensitivity (see sensitivity maps Figures 7 and 8), according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines)
- A 500m powerline exclusion zone must be implemented around dams >5 ha and irrigated agricultural lands to reduce the risk of powerline collisions of powerline sensitive species drawn to dams (especially Blue Cranes) and agricultural lands (Blue Cranes and Ludwig's Bustard). An exception to this is the dam situated at 31°48'16.44"S, 22°57'51.38"E. Routing the line around

this dam would traverse sensitive Riverine Rabbit habitat that also falls within a Northern Cape Critical Biodiversity Area. In this instance, it would be preferable to route the line through the exclusion zone and mark the line with LED type bird flight diverters to ensure visibility of the line during low light conditions, should the dam at any given time be used as a roost site by Blue Cranes.

5. CUMULATIVE IMPACTS

The proposed 400kV grid line equates to a maximum of 110km. Based on the information publicly available, the existing and planned high voltage lines within a 30km radius around the assessment corridor equates to approximately 600km (counting parallel lines as one). The proposed development will thus increase the total number of existing and planned high voltage lines by 18% in the area.

When viewed on its own, the contribution of the proposed 400kV gridline and substation expansion to the pre-mitigation cumulative collision and displacement impact on powerline sensitive avifauna of all the high voltage lines is considered **Medium**, but could be reduced to **Low** with mitigation. However, the combined pre-mitigation cumulative impact of all the existing and planned powerlines, including the planned Gamma 765kV gridline (approximately 710km), on powerline sensitive avifauna within a 35km radius, is considered to be **High** pre-mitigation for the collision risk, but could be reduced to **Medium** with mitigation. As far as displacement due to disturbance and habitat transformation is concerned, the cumulative impact of all the existing and planned high voltage lines, and substations, is assessed to be **Medium** pre-mitigation, but reducible to **Low** with appropriate mitigation.

6. CONCLUSION AND IMPACT STATEMENT

The expected pre-mitigation impacts of the proposed development range from **Low** to **High** significance and negative status. However, with appropriate mitigation, the post-mitigation significance of the identified impacts should be reduced to **Low** negative. No fatal flaws were discovered in the course of the investigation. It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 10 of the report) and the EMPr (Appendix 4) are strictly implemented.

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LIST OF FIGURES

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SPECIALIST DECLARATION

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

PROPOSED GAMMA 400kV GRID LINE CONSTRUCTION AND GAMMA SUBSTATION EXPANSION NEAR BEAUFORT WEST, WESTERN CAPE

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:				
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision 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			
Postal address:	PO Box 2676, Fourways, 2122			
Postal code:	2055	Cell:	0824549570	
Telephone:	0824549570	Fax:		
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Christiaan Stephanus 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

Name of Company: Afrimage Photography t/a Chris van Rooyen Consulting

23 August 2022

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Christiaan Stephanus 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 t/a Chris van Rooyen Consulting

Name of Company

22 August 2022

Date

Signature of the Commissioner of Oaths

23/08/2022.

Date

MAGRIETHA CORNELIA SCHOLTZ
COMMISSIONER OF OATHS
Suite 1, 5 Main Street
P.O. Box 1408
Plettenberg Bay 6600, South Africa
Practising Attorney R.S.A

Minimum report requirements listed in the protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020)

HIGH SENSITIVITY RATING FOR TERRESTRIAL ANIMAL SPECIES	
SITE SENSITIVITY VERIFICATION	
The site sensitivity verification must be undertaken by an environmental assessment practitioner or specialist.	Page 10
The site sensitivity verification must be undertaken through the use of: (a) a desk top analysis, using satellite imagery; (b) a preliminary on-site inspection; and (c) any other available and relevant information.	Section 4, Appendix 3
The outcome of the site sensitivity verification must be recorded in the form of a report that: (a) confirms or disputes the current use of the land and environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.; (b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and (c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.	Appendix 3
SPECIALIST ASSESSMENT & MINIMUM REPORT CONTENT REQUIREMENTS	
Contact details and relevant experience as well as the SACNASP Registration number of the specialist preparing the assessment including a curriculum vitae;	Page 11 & Appendix 5
A signed statement of independence by the specialist;	Page 11
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 8, Appendix 3
A description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant;	Section 3, Section 8, Appendix 5
A description of the mean density of observations/number of sample sites per unit area and the site inspection observations;	Section 8, Section 1
A description of the assumptions made and any uncertainties or gaps in knowledge or data;	Section 5
details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;	Section 3, Section 7, Appendix 3
the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;	n/a
The location of areas not suitable for development and to be avoided during construction where relevant;	Section 6
a discussion on the cumulative impacts;	Section 11
Impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Section 9 and Appendix 4

A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and	Section 13
A motivation must be provided if there were any development footprints identified as per paragraph 2.2.12 above that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate.	N/A

1. INTRODUCTION

Red Cap Energy (Pty) Ltd ('Red Cap') has received Environmental Authorisation for three wind farms and for a 400 kV grid corridor collectively known as Nuweveld Wind Farm Development, located close to Beaufort West in the Western Cape Province. The approved grid corridor links the Nuweveld projects to the Droërivier Substation ~65 km to the south of the wind farms (refer to **Error! Reference source not found.**).

Red Cap is also proposing to develop four additional wind farms and associated grid connections, known as the Hoogland Projects. The Hoogland Wind Farms are located north and south of the Nuweveld complex, and the Hoogland grid connections will terminate at the Nuweveld Collector Substation (refer to Figure 1) and are the subject of separate applications.

To expand the capacity of the Eskom grid and improve the functionality of the grid in the area, an additional 400 kV grid connection is required from the Nuweveld Collector Substation to the Gamma Substation, ~90 km to the east (the project). This additional line will improve functionality by creating a 400 kV ring-line between the Droërivier Substation, Gamma Substation and Nuweveld projects, and create opportunities for other wind farm developments (such as the proposed Hoogland projects) to tie-into the grid either at the Nuweveld Collector Substation or along the new 400 kV line. As such, the proposed new line will allow Eskom to release further renewable energy potential in an area that is becoming a renewable energy development node in South Africa, thereby helping to alleviate South Africa's power crisis.

A 300 m x 300 m expansion to the Gamma Substation (including transformers and other standard substation infrastructure) and access tracks for construction and maintenance of the line will also be required and form components of the project.

Chris van Rooyen Consulting has been appointed by Red Cap to undertake an avifaunal impact assessment study of the proposed project within a gridline corridor.

The project triggers activities listed in terms of the Environmental Impact Assessment Regulations, 2014, as amended. These activities require authorisation from the Department of Forestry, Fisheries and the Environment (DFFE), prior to commencement. An application for Environmental Authorisation (EA) will be submitted and informed by a Basic Assessment (BA) process as the project will lie wholly within a strategic transmission corridor[1] specifically identified for the placement of this infrastructure.

Specialist studies have been commissioned to verify the sensitivity and assess the impacts of the project under the Gazetted specialist protocols (GN R 320 and GN R 1150 of 2020).

See Figure 1 for a map indicating the locality of the proposed project.

[1] As per the requirements of Government Notice 113 of 16 February 2018 for transmission lines falling within a strategic transmission corridor.

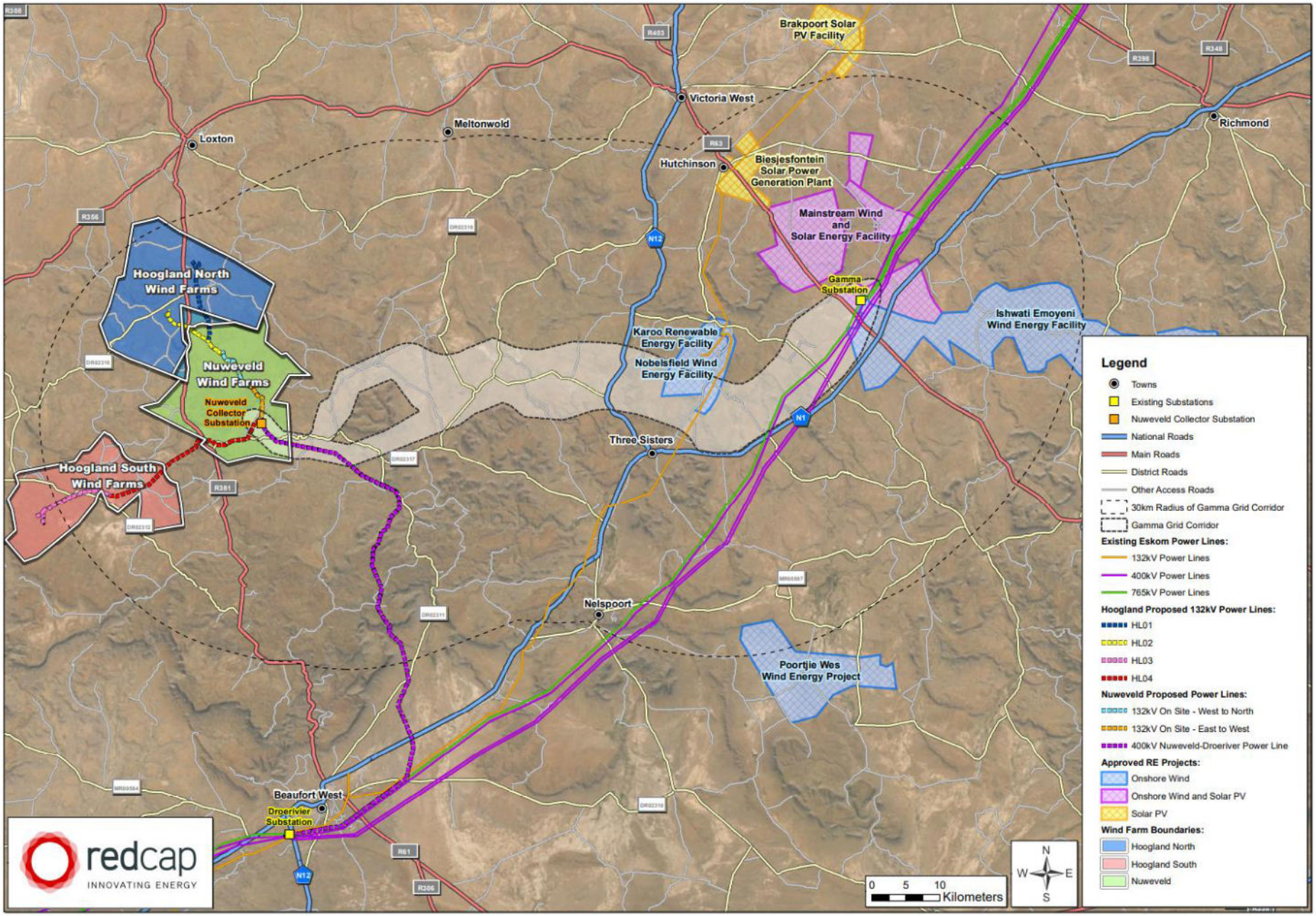


Figure 1: Locality map indicating the regional context of the proposed project.

2. PROJECT DECRIPTION

The 400 kV gridline would have a ≤ 55m wide servitude, which may be kept clear of taller vegetation (trees) and, where required and feasible, accommodate access tracks needed for construction and maintenance.

Lattice type pylons will be used for the project. Different lattice type pylon will be required along the gridline depending on the topography and span characteristics. Most of the pylons will be cross-rope suspension towers, with self-supporting towers being used at turn points, at steep slopes or where a very large distance needs to be spanned. The technical characteristics of these pylon types are briefly described below.

All pylon types would attach to concrete plinths and foundations of varying sizes depending on pylon type. Guy wires with concrete anchor blocks will also be required for providing additional support and to stabilise some of the pylons/ towers.

The footprints of the 400 kV towers are conservatively assumed to be 100 m^2 each. The average span of the 400 kV line will be 400 m.

Temporary laydown areas will be identified along the powerline route, with the main equipment and construction yards being based in one of the surrounding towns. It is anticipated that the total area required for the temporary laydown areas is up to 5 ha.

Existing access roads and tracks (upgraded to ± 2-4m wide where needed) will be used as far as possible and new access tracks would be established, where needed, outside of specialist identified No-Go areas – these would be 2-4 m wide (wider than 2m when side drains are needed or due to the topography).

2.1. Project Location

The Nuweveld Collector Substation is located north of Beaufort West in the Western Cape Province (refer to Figure 1). The Gamma Substation is located ~90 km to the east of the Nuweveld Collector Substation.

Although the gridline starts in the Western Cape (Central Karoo District Municipality and Beaufort West Local Municipality), portions of the line would traverse land in the Northern Cape (Pixley ka Seme District Municipality and Ubuntu Local Municipality).

2.2. Routing of Corridor

Electricity will be stepped-up to 400 kV at the Nuweveld Collector Substation for evacuation via the ~110 km Gamma Gridline to the existing Gamma Substation (as well as the approved Nuweveld Gridline to the Droërivier Substation to the south). The new gridline will form part of the national grid.

The route of the line must be pre-negotiated with the respective landowners, which includes obtaining in-principle agreements from the landowners that the line may go over their land. While every effort will be made to stick to the provisional route (following post-authorisation specialist micro-siting), deviations

of infrastructure within the route are possible to avoid potential additional No-Go areas (following post-authorisation specialist micro-siting).

Following a specialist assessment and landowner negotiations, a refined grid connection corridor, within which the line will be built, has been established – see Figure 2.

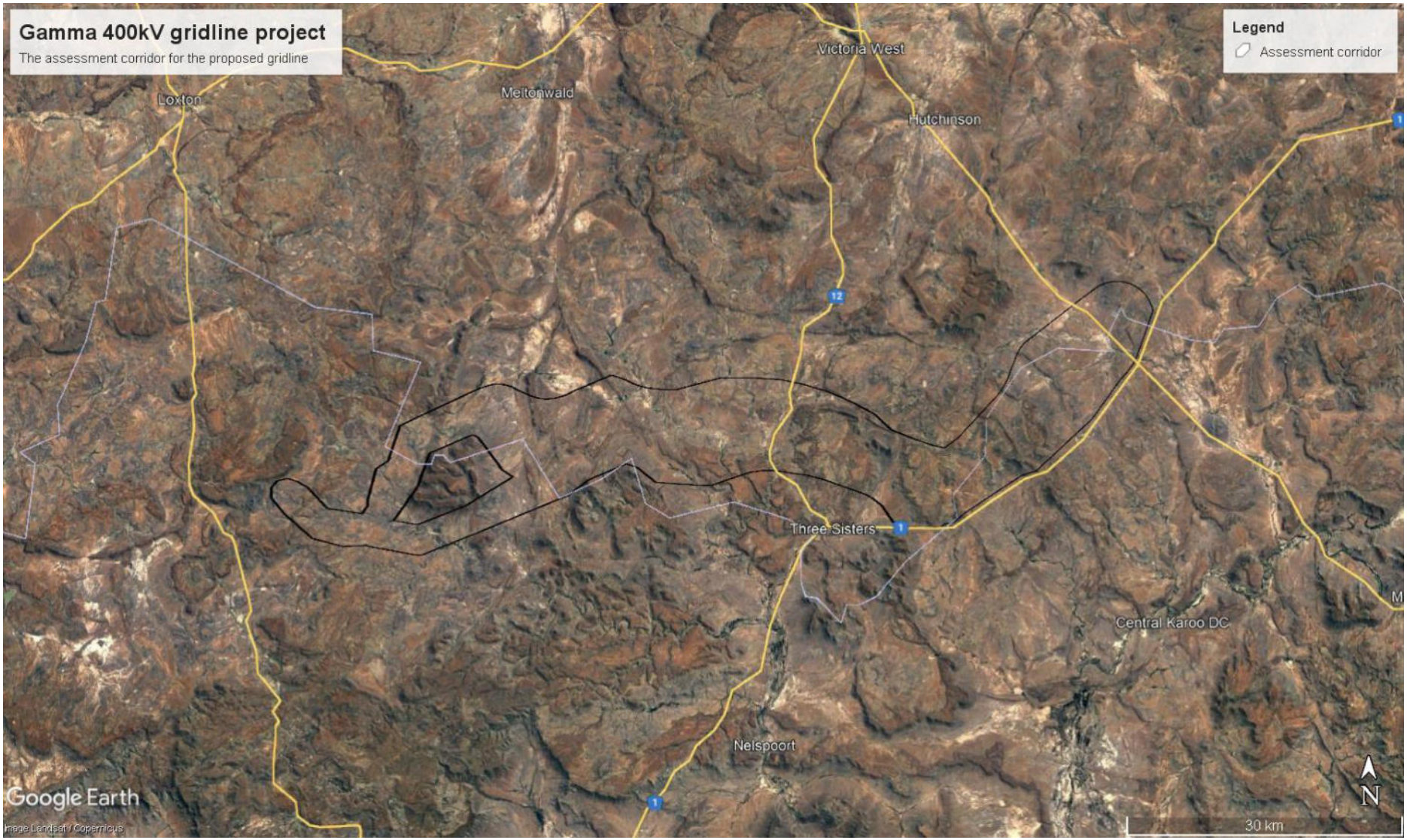
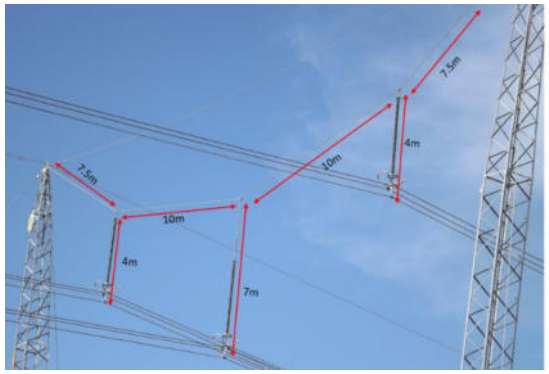
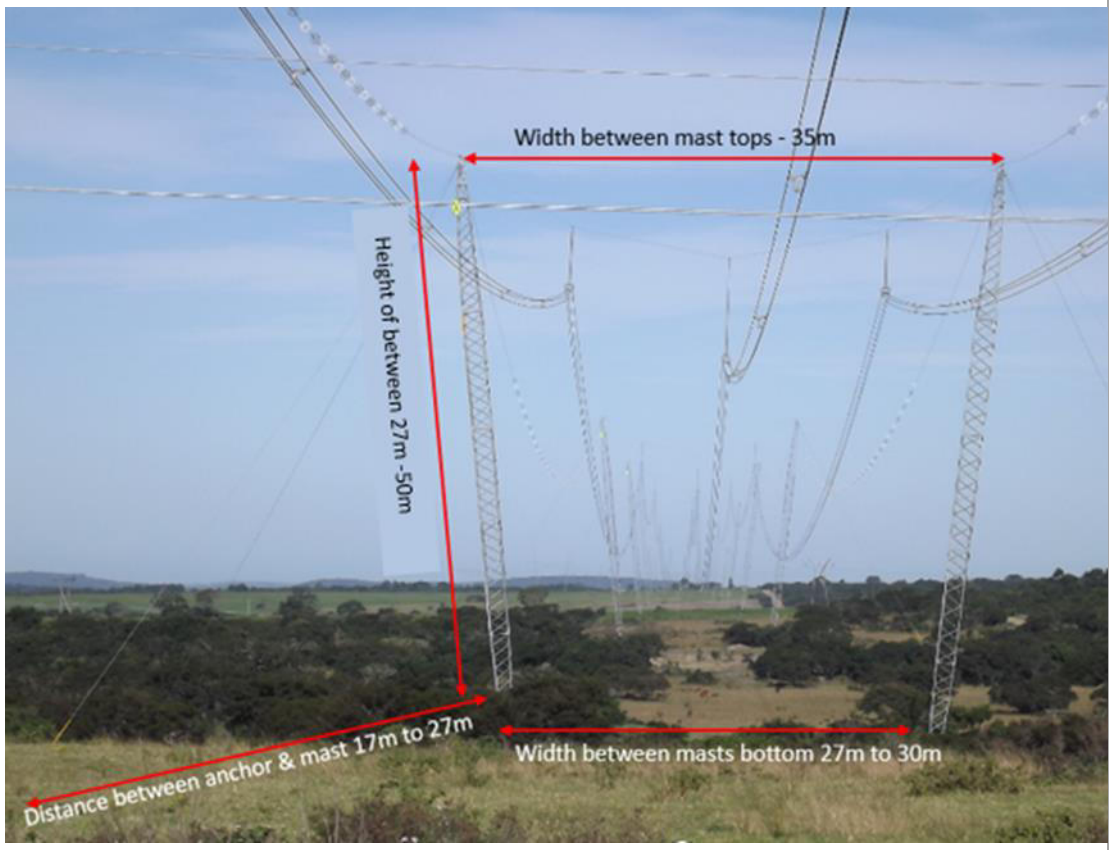


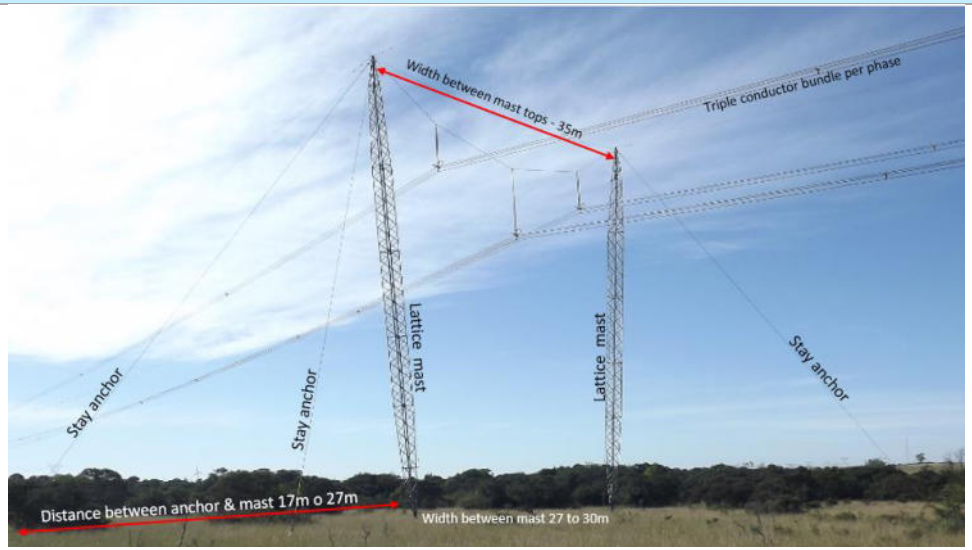
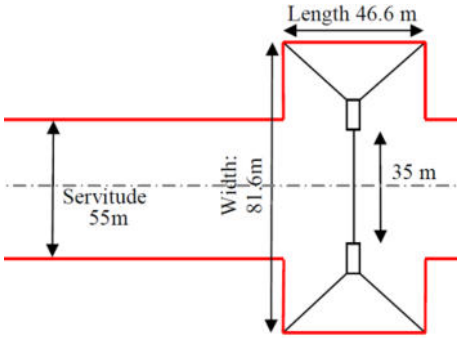
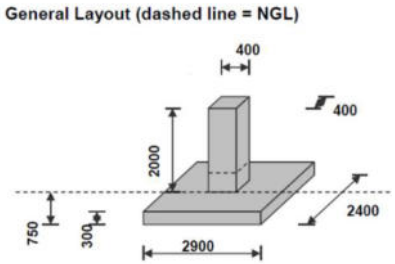
Figure 2: Proposed corridor for Gamma Grid Connection

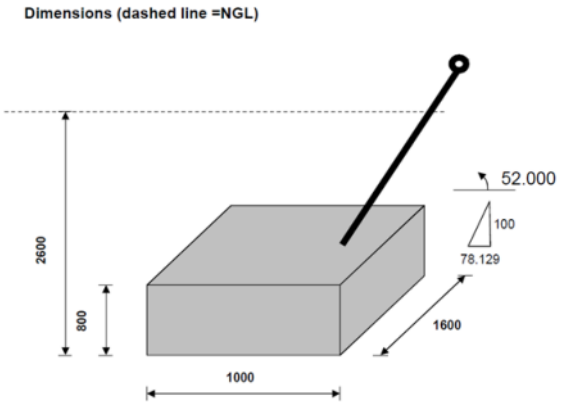
2.3 Grid Connection Components

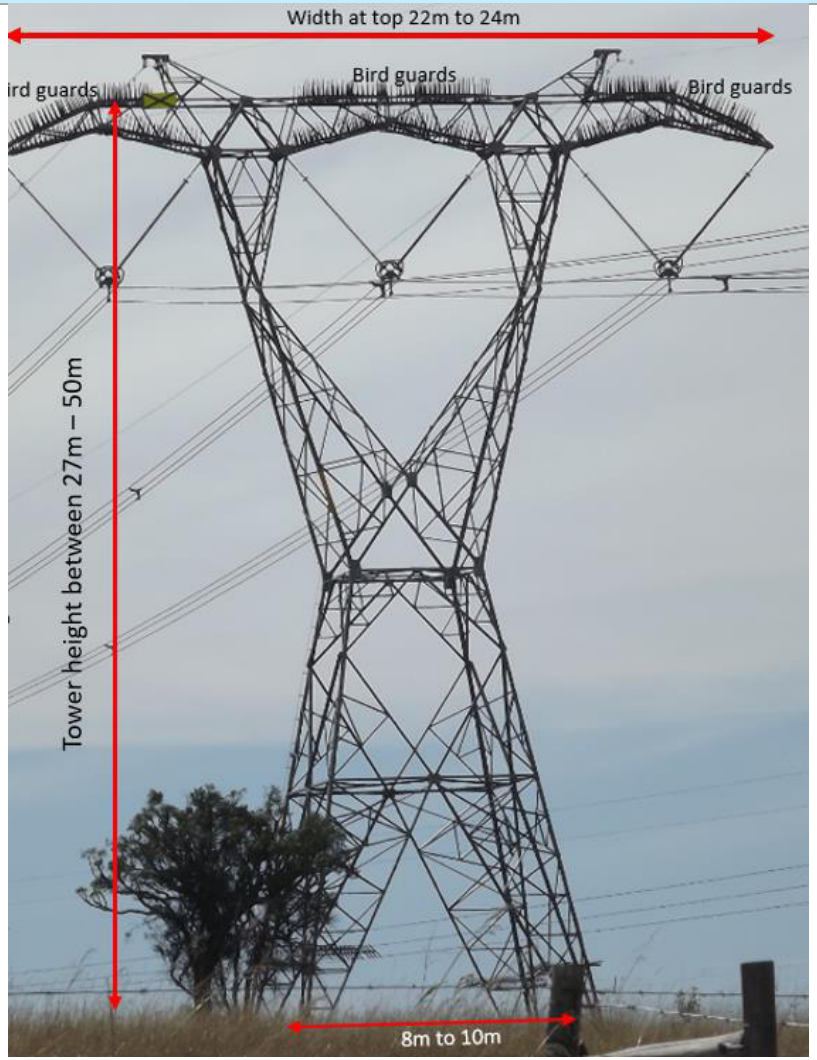
2.3.1 Pylon Types

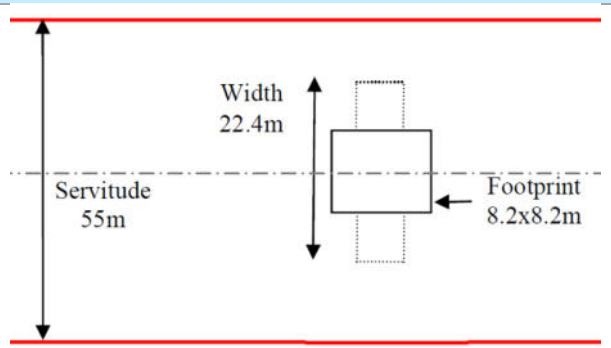
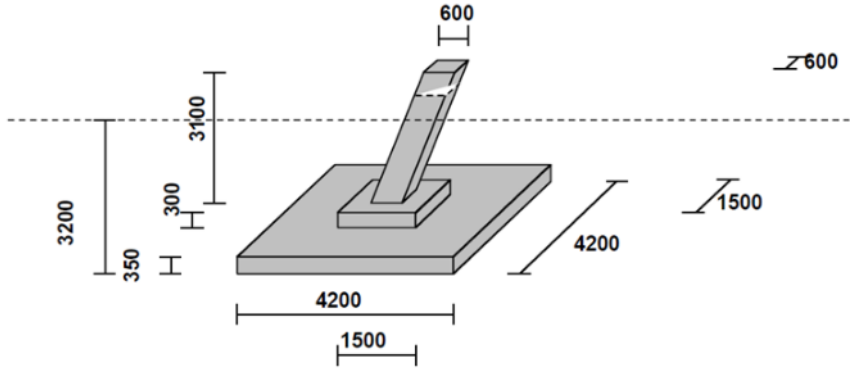
Lattice type pylons are required for the overhead line. Different pylon types will be required at different areas depending on the topography and span characteristics. **Error! Reference source not found.** below provides a description of the types being considered with the majority likely to be the Cross-Rope Suspension Tower, with self-supporting towers only being used at turn points in the alignment.

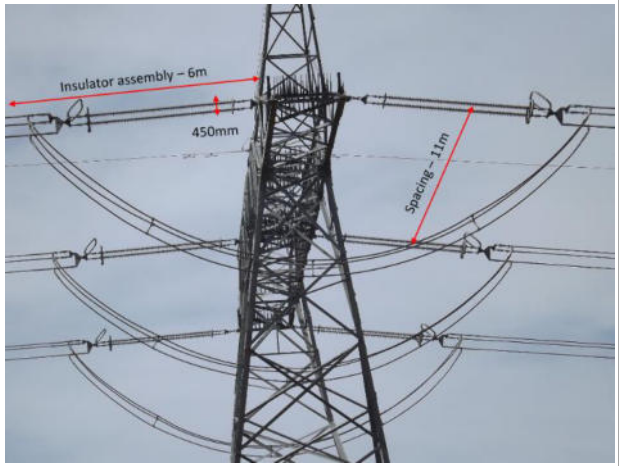
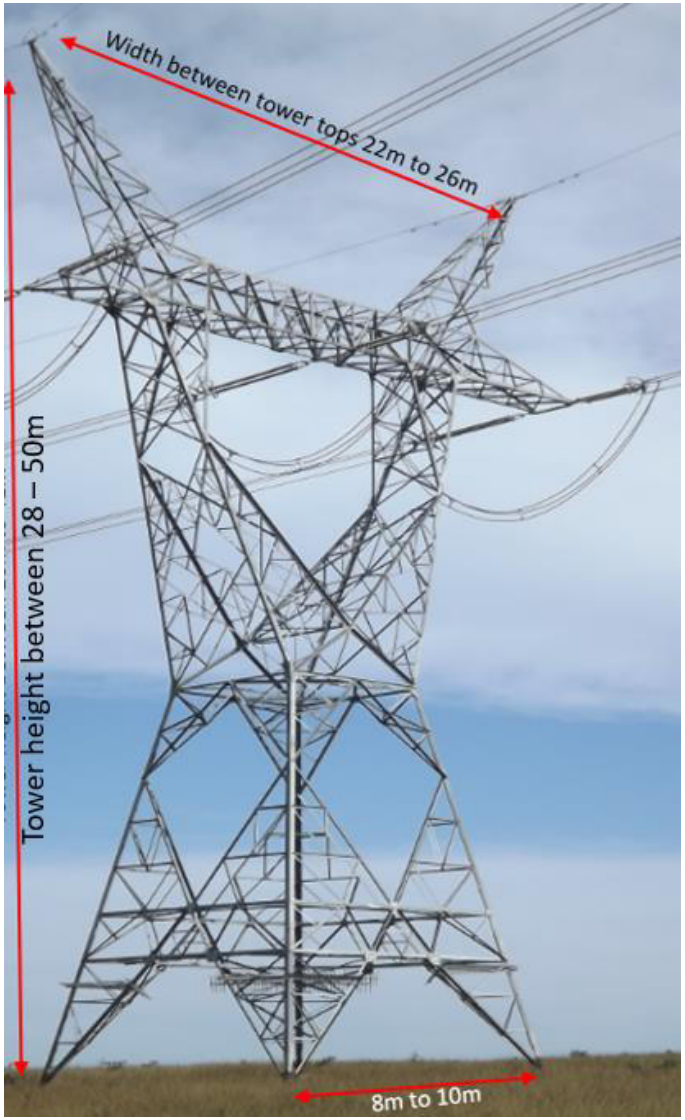
	Tower Type	Description and purpose	Illustration
1.	400kV Intermediate or Suspension Tower. **<u>Option 1:</u>** Cross-Rope Suspension Tower **<u>Option 1:</u>**	The tower consists of two main lattice supports with a steel cross rope between the tower tops. The two main lattice supports are supported each with 2 x guyed anchors. The structure is design to support the conductor weight as well as the wind loading specifications. The conductors are supported on insulators from the steel cross rope support as illustrated below:  This tower type is for general use as an intermediate/suspension tower between angle strain points along the alignment and it is also the preferred option due to the smaller size and cost effectiveness. This structure will also be the most common structure used at an estimated 70% to 80% of the total number of structures on the line. Tower heights: 27m to 50 m Tower width: 28m to 35m	**Front View of the tower:**  **Side View of the tower:**

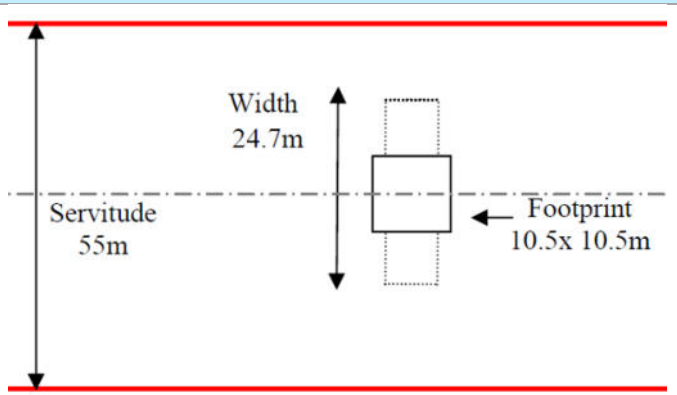
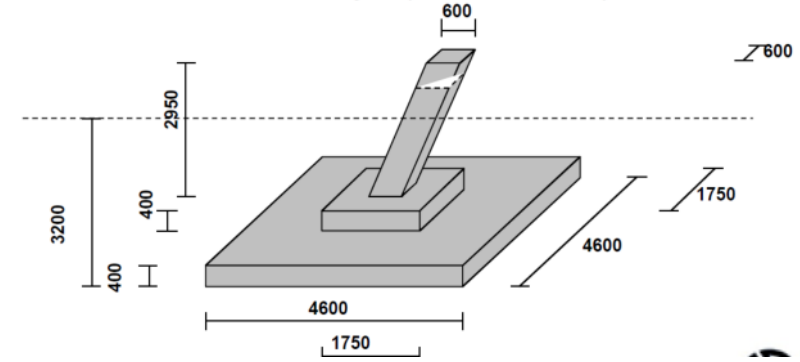
	Tower Type	Description and purpose	Illustration
	Cross-Rope Suspension Tower (*Continue*)	Tower footprint: The footprint of the tower is determined by the distances between the outer anchors supporting the structure – in general the stays positioned 17m to 27m from the tower masts at an angle. This forms a square with estimated distances as per the illustration. Typical Foundation sizes: **1)** Typical Tower mast foundation **2)** Typical Anchor or Stay foundation	   

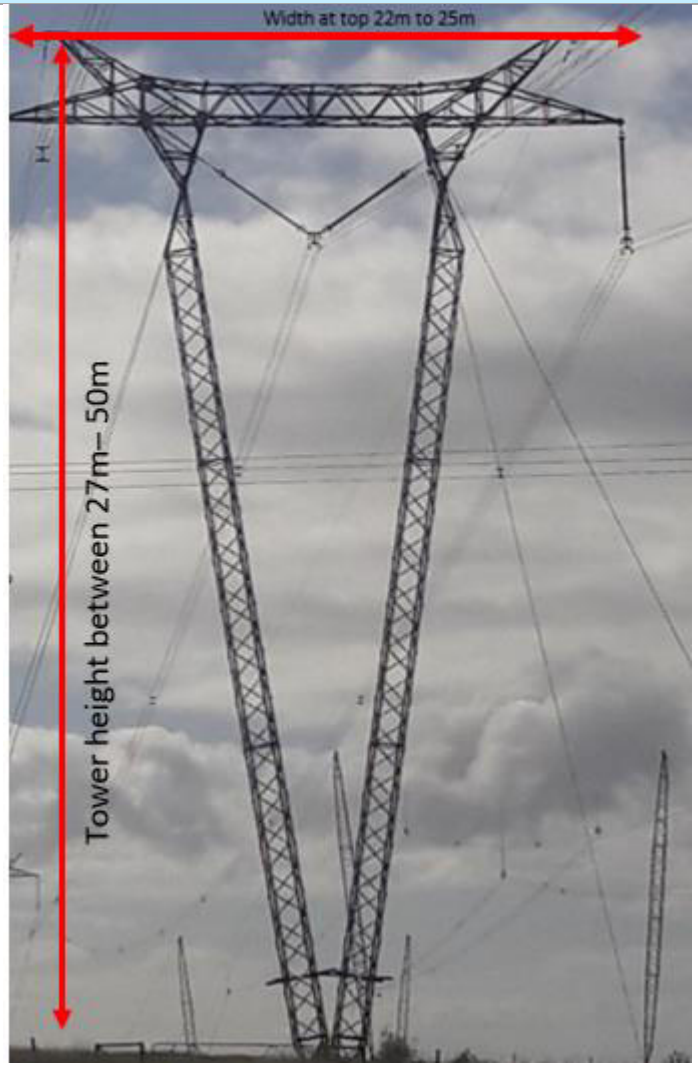
	Tower Type	Description and purpose	Illustration
			 
2.	400kV Intermediate or Suspension Tower. **<u>Option 2:</u>** Self-Supporting Suspension Tower.	The tower consists of a self-supporting lattice structure design with 4 x tower legs. The insulators are supported from a steel lattice cross-arm as indicated in the illustration. The tower is fully supported by the 4 x leg foundations and do not have any guyed anchors. The structure is design to support the conductor weight as well as the wind loading specifications.	**Front View of the tower:**

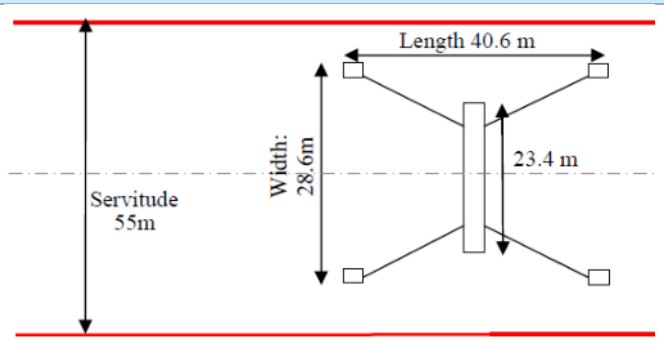
	Tower Type	Description and purpose	Illustration
	<u>Option 2:</u> Self-Supporting Suspension Tower. (*Continue*)	Average Tower footprint size: The footprint of the tower is determined by the distances between the outer legs on the ground which are supporting the tower Typical Tower Leg foundation size:	

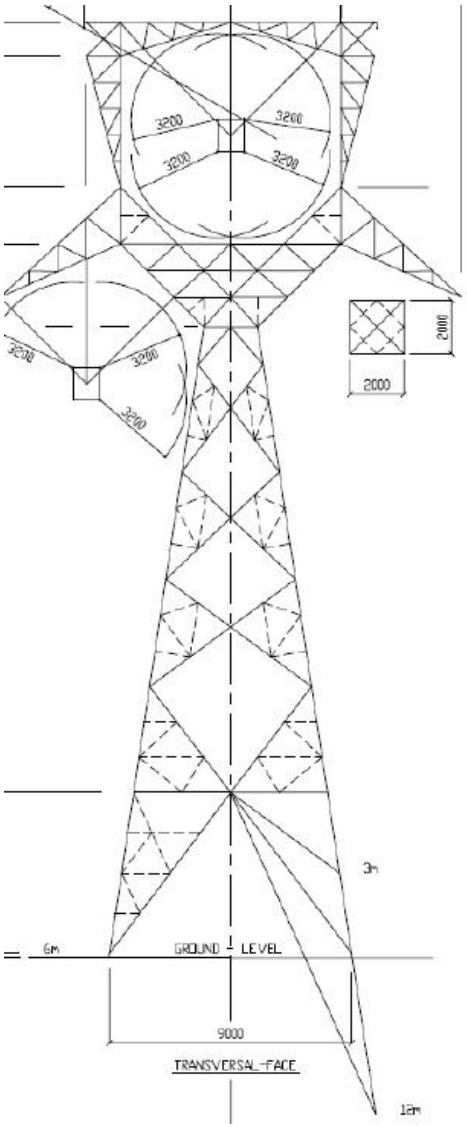
	Tower Type	Description and purpose	Illustration
			  Plan View General Layout (dashed line = NGL) 

	Tower Type	Description and purpose	Illustration
3.	400kV Inline and Angle Strain Self-Supporting Tower	The tower consists of a self-supporting lattice structure design with 4 x tower legs. The insulators are supported from a steel lattice cross-arm as indicated below:  The tower is fully supported by the 4 x leg foundations and do not have any guyed anchors. The structure is design to support the conductor tensions associated with the conductor weight and span lengths as well as the wind loading specifications.	**Front View of the tower:** 

	Tower Type	Description and purpose	Illustration
	400kV Inline and Angle Strain Self-Supporting Tower (*continue*)	Average Tower footprint size: The footprint of the tower is determined by the distances between the outer legs on the ground which are supporting the strain tower. Typical Tower Leg foundation size:	  Plan View General Layout (dashed line = NGL) 

	Tower Type	Description and purpose	Illustration
4.	400kV Intermediate or Suspension Tower. Guyed V-Type Tower	The tower consists of a main lattice triangle shape steel support tower that is installed on a centre foundation and supported by 4 x guyed anchors on the side. The structure is design to support heavier conductor weights and can be used where longer spans are required. Also have a smaller footprint than the intermediate cross rope tower. Tower centre foundations and 4 x guy anchor foundations similar to the cross-rope tower foundations illustrated under Item 1.	

	Tower Type	Description and purpose	Illustration
			

	Tower Type	Description and purpose	Illustration
5.	Transposition Tower. Required in the case where phasing needs to be swopped along the line.	The tower consists of a self-supporting lattice structure with 4 x tower legs. The insulators are supported from a steel lattice delta type cross-arm/beam as indicated in the illustration. The tower is supported by the 4 x legs with foundations and do not have any guyed anchors. The tower is only used in the case where conductor phasing needs to be swopped around. Normally maximum of 3 x towers required across a distance >100km. Tower foundations similar to the strain lattice tower foundations illustrated under Item 3 above.	 

2.3.2 Access

The site can be accessed via the well-established existing road network in the area. Access to the west would be via Beaufort West or Loxton using the R381, and access to the central and eastern portions of the corridor would be from the N1 and N12 via Three Sisters. Figure 1 shows the existing road network in the area.

Existing access roads and tracks (upgraded to ±2-4 m wide where needed) will be used for construction and maintenance as far as possible and new access tracks would also be ±2-4m wide. These tracks would avoid steep areas and drainage lines and rather use existing roads/tracks to cross these features as far as possible.

Access tracks would be upgraded or established during the construction phase to enable access for the construction of the pylons and stringing of the lines. In certain areas, such as when the line spans over a sensitive watercourse, goes up very steep slopes, or spans an ecologically sensitive area, the service track will not run parallel to the line but will be routed to access the specific pylons (i.e. areas that are rated as 'high environmental sensitivity' will be avoided where possible). These tracks would not be rehabilitated as they would continue to provide access for maintenance and management purposes and will be maintained throughout the life of the project.

It is conservatively assumed that the total area required for the access tracks is up to 46 ha (i.e. assuming the new tracks are required for the entire length of the powerline, which is unlikely).

2.3.3 Temporary areas

During construction, temporary laydown areas will be identified along the powerline route, with the main construction yards being located along the alignment or in one of the surrounding towns. It is anticipated that the total area required for the temporary laydown areas is up to 5 ha.

2.3.4 Gamma Substation Expansion

A 300 m x 300 m expansion to the Gamma Substation (including transformers and other standard substation infrastructure) and access tracks for construction and maintenance of the line will also be required and form components of the project.

2.3.5 Summary of components and disturbance footprints

Table 1 1 below sets out the total disturbance footprint for the project.

Table 1: Summary of the components and approximate areas of impact within the Gamma Grid Connection Corridor

Component	Description	Ha
Substation Infrastructure	300 m x 300 m expansion to the Gamma Substation (including transformers and other standard substation infrastructure)	9 ha (permanent)
Overhead lines and pylons	There will be a 400 kV overhead line supported by mostly lattice structure pylons. The spans (distance between pylons) on the pylons are on average 400 m. Each pylon is conservatively assumed to have a footprint of 100 m^2	110 km 2.75 ha (permanent)
Access roads and tracks	Existing access roads and tracks (upgraded to ± 2-4 m wide where needed) will be used as far as possible and new access tracks would be created where needed (±2-4 m wide).	46 ha (permanent)
Temporary areas	Temporary laydown areas will be identified along the alignment, with the main equipment and construction yards being located along the alignment or based in one of the surrounding towns. It is anticipated that the total area required for the temporary laydown areas is up to 5 ha.	5 ha (temporary)
Total disturbance footprint:	**Temporary**	**5 ha**
Total disturbance footprint:	**Permanent**	**57.75 ha**

2.4 Timeframes

Construction is likely to commence no earlier than about 1 year after the issuing of an EA (if approved).

The construction period for the project would be between 18 – 24 months. On completion the gridline would be ceded to Eskom and become part of the National Grid infrastructure, thus it is unlikely that it would be decommissioned.

2.5 Alternatives

A comprehensive iterative design process has been undertaken to inform the location of the refined grid connection corridor, including No-Go areas within the corridor.

Integrating the screening and assessment of environmental and social constraints alongside the technical components of the project, early in a project lifecycle, allowed for the reduction in risks to the project and supports the application of the mitigation hierarchy by demonstrating the avoidance and minimisation of impacts.

However, the project will be assessed against the '**No-Go' alternative**. The 'No-Go' alternative is the option of not constructing the project where the status quo would prevail.

3 TERMS OF REFERENCE

The terms of reference for this assessment report are as follows:

- Describe the affected environment from an avifaunal perspective;
- Discuss gaps in baseline data and other limitations;
- Describe and discuss the expected impacts associated with the proposed development;
- Perform an assessment of the potential impacts using the prescribed impact rating methodology;
- Compile a risk map indicating the avifaunal sensitivities (Low, Medium, High and Very High/No-Go) in the assessment corridor, and
- Recommend mitigation measures to reduce the significance of the expected impacts.

4. SOURCES OF INFORMATION

Table 2 sets out the information sources that were consulted to conduct this study.

Table 2: Information sources used to compile the bird impact assessment report

Data / Information	Source	Date	Type	Description
South African Protected Areas Database (SAPAD)	Department of Forestry, Fisheries and the Environment (DFFE)	2022 Q1	Spatial	Spatial delineation of protected areas in South Africa. Updated quarterly
Atlas of Southern African Birds 1 (SABAP1)	University of Cape Town	1987-1991	Spatial, reference	SABAP1, which took place from 1987-1991. Used primarily as resource for habitat classifications.
South African Bird Atlas Project 2 (SABAP2)	University of Cape Town	June 2022	Spatial, database	SABAP2 is the follow-up project to the SABAP1. The second bird atlas project started on 1 July 2007 and is still growing. The project aims to map the distribution and relative abundance of birds in southern Africa. Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the

Data / Information	Source	Date	Type	Description
				pentads where the assessment corridor is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'' × 5'). Each pentad is approximately 8 × 7.6 km. To get a more representative impression of the birdlife, a consolidated data set of 44 pentads was obtained for all pentads which intersect with the assessment corridor, as well those a number of neighbouring pentads with similar habitat characteristics (Figure 3). The decision to include multiple pentads around the assessment corridor was influenced by the fact that the pentads within which the proposed assessment corridor is located have relatively few completed full protocol surveys. The additional pentads and their data augment the bird distribution data. A total of 136 full protocol lists (i.e. bird listing surveys lasting a minimum of two hours each) and 319 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed to date for the 44 pentads within which the assessment corridor is located. The SABAP2 data is regarded as a reliable reflection of the avifauna which occurs in the area and is supplemented with data collected during the site visit and data collected during pre-construction monitoring at several renewable energy projects in Karoo habitat.
National Vegetation Map	South African National Biodiversity Institute (SANBI) (BGIS)	2018	Spatial	The National Vegetation Map Project (VEGMAP) is a large collaborative project established to classify, map and sample the vegetation of South Africa, Lesotho and Swaziland.
Red Data Book of Birds of South Africa, Lesotho and Swaziland	BirdLife South Africa	2015	Reference	The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland is an updated and peer-reviewed conservation status assessment of the 854 bird species occurring in South Africa undertaken in collaboration between BirdLife South Africa, the Animal Demography Unit of the University of Cape Town, and the SANBI.
International Union for Conservation of Nature (IUCN) Red List of Threatened Species (2021.3)	IUCN	2022.1	Online reference source	Established in 1964, the IUCN's Red List of Threatened Species is the world's most comprehensive information source on the global extinction risk status of animal, fungus and plant species.
Important Bird and Biodiversity Areas of South Africa	BirdLife South Africa	2015	Reference work	Important Bird and Biodiversity Areas (IBAs), as defined by BirdLife International, constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using

Data / Information	Source	Date	Type	Description
				globally standardised, quantitative and scientifically agreed criteria.
The National Screening Tool	Department of Forestry, Fisheries and the Environment (DFFE)	May 2022	Spatial	The National Web based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an application for environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations 2014, as amended to screen their proposed site for any environmental sensitivity.
Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020)	NEMA	2020	Regulations	Prescribe protocols in respect of specific environmental themes (i.e. Terrestrial Animal Species and Terrestrial Plant Species) for the assessment of, as well as the minimum report content requirements on, the environmental impacts for activities requiring environmental authorisation. The Terrestrial Animal Species protocol is the relevant protocol for avifauna in relation to powerline impacts.
Guidelines for the Implementation of the Terrestrial Flora & Terrestrial Fauna Species Protocols for EIAs in South Africa produced by the South African National Biodiversity Institute on behalf of the Department of Environment, Forestry and Fisheries (2020)	South African National Biodiversity Institute (SANBI) (BGIS)	2020	Guidelines	The purpose of the Species Environmental Assessment Guideline is to provide background and context to the assessment and minimum reporting criteria contained within the Terrestrial Animal and Plant Species Protocols; as well as to provide guidance on sampling and data collection methodologies for the different taxonomic groups that are represented in the respective protocols. This guideline is intended for specialist studies undertaken for activities that have triggered a listed and specified activity in terms of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as identified by the EIA Regulations, 2014 (as amended) and Listing Notices 1-3.
Pre-construction monitoring and screening reports from several wind and solar projects in the Karoo	Chris van Rooyen Consulting	2020 - 2022	Monitoring reports	The internal reports generated as part of avifaunal pre-construction monitoring at the wind and solar facilities in similar habitat. These are a valuable source of information on species variety, abundance and nests.
The Endangered Wildlife Trust 's database on raptor nests on powerlines in the Karoo.	Endangered Wildlife Trust	2022	Spatial	The data collected by the Endangered Wildlife Trust through helicopter surveys of Eskom powerlines in the Karoo is a valuable source of information on the locality of Martial, Tawny and Verreaux's Eagle nests.
The South African National Land Cover 2018 dataset (updated 2020)	Department of Forestry, Fisheries and the Environment (DFFE)	2020	Spatial	The new South African National Land-Cover 2018 dataset has been generated from 20-meter multi-seasonal Sentinel 2 satellite imagery. The imagery used represents the full temporal range of available imagery acquired by Sentinel 2 during the period 01 January 2018 to 31 December 2018. The SANLC 2018 dataset is based primarily on the new gazetted land-cover classification standard (SANS 19144-2) with 73 classes of information and is comparable, with the previous 1990 and 2013-14 South African National Land-Cover (SANLC) datasets.
The South African Renewable Energy EIA Application Database (REEA)	Department of Forestry, Fisheries and the Environment (DFFE)	First Quarter of 2022	Spatial	The latest South African Renewable Energy EIA Application Data contains spatial data for renewable energy applications for environmental authorisation. It includes spatial and

Data / Information	Source	Date	Type	Description
				attribute information for both active (in process and with valid authorisations) and non-active (lapsed or replaced by amendments) applications.
Google Earth	Google	July 2022	Spatial	Google Earth's imagery is displayed on a digital globe, which displays the planet's surface using a single composited image. The imagery is retrieved from satellites or aircraft. This is achieved by combining multiple sets of imagery taken from Landsat 7 to eliminate clouds and diagonal gaps, creating a single "mosaic" image. Google now uses a myriad of sources to provide imagery in a higher quality and with greater frequency. Imagery is hosted on Google's servers, which are contacted by the application when opened, requiring an Internet connection. Imagery resolution ranges from 15 meters of resolution to 15 centimetres.
Data collected during a field inspection of the assessment corridor through a vehicular and a helicopter survey.	Chris van Rooyen Consulting	12 – 13 July 2022	Spatial	Images of the habitat types and coordinates of Red List species nests recorded during the survey, and a list of powerline sensitive species recorded incidentally during the two-day field visit.
Habitat Suitability Models	BirdLife South Africa	April 2022	Spatial	Habitat Suitability Models (HSM) were obtained from BirdLife South Africa for Black Stork, Blue Crane, Ludwig's Bustard, Secretarybird and Verreaux's Eagle (BLSA 2022). The HSM consists of a grid of 90m x 90m and a score of 0 – 3 for each grid cell was assigned, indicating habitat suitability for the specific species. These were superimposed on the assessment corridor to assess the suitability of the corridor for a specific species.

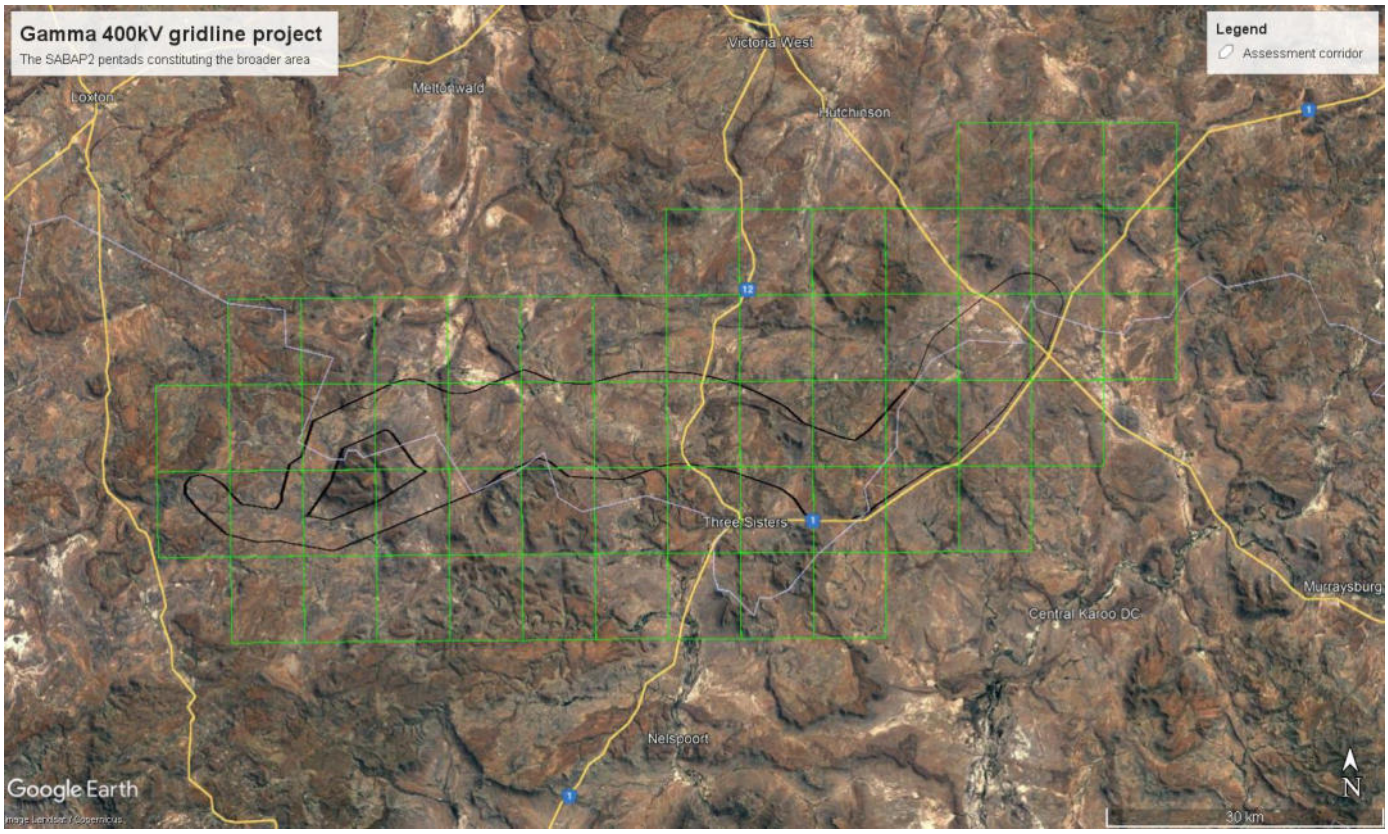


Figure 3: Location of the 44 South African Bird Atlas Project 2 (SABAP2) pentad grid cells (green squares) that were considered for the proposed development.

5. ASSUMPTIONS AND LIMITATIONS

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

- The focus of this assessment is primarily on the potential impacts of the proposed development on powerline sensitive species. Powerline sensitive species are defined as those species which could potentially be impacted by powerline collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Powerline sensitive species are defined as species which could potentially be impacted by powerline collisions or electrocutions, based on their morphology:
    - Larger birds, particularly raptors and vultures, are more vulnerable to electrocution as they are more likely to bridge the gaps between electrical components than smaller birds.
    - Large terrestrial species and certain waterbirds with high wing loading are less manoeuvrable than smaller species and are therefore more likely to collide with overhead lines.
- Powerline sensitive species include both Species of Conservation Concern (SCC) as defined by the *Species Environmental Assessment Guideline: Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa (2020)* i.e. those species listed on the IUCN Red List of Threatened Species or South Africa's National Red List website as Critically Endangered, Endangered, Vulnerable, Near Threatened and Data Deficient, as well as some non-threatened species.
- The assessment of impacts is based on the baseline environment as it currently exists in the study area.
- Cumulative impacts include all wind energy facility (WEF) and solar energy facility (SEF) (PV) projects, grid connections and existing transmission and distribution powerline for which information could be sourced in the public domain, within a 30km radius that currently have open applications or have been approved by the Competent Authority as per the 2022 Q1 database from the DFFE.

- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The potential Project Area of Impact (PAOI) was defined as the assessment corridor, as provided by the applicant.

6. LEGISLATIVE CONTEXT

There is no legislation pertaining specifically to the impact of electrical infrastructure on avifauna.

6.1 Agreements and conventions

Table 3 below lists agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna[2].

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 aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global

[2] (BirdLife International (2022) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa.

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

6.2 National legislation

6.2.1 Constitution of the Republic of South Africa, 1996

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

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

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

  (i) prevent pollution and ecological degradation;

  (ii) promote conservation; and

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

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

The National Environmental Management Act 107 of 1998, as amended, (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated. NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment or basic assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

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.

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

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

6.3 Provincial Legislation

6.3.1 Northern Cape

The current legislation applicable to the conservation of fauna and flora in the Northern Cape is the Northern Cape Nature Conservation Act No 9 of 2009. It provides for the sustainable utilisation of wild animals, aquatic biota and plants; the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; describes offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; provides for the issuing of permits and other authorisations; and provides for matters connected therewith.

6.3.2 Western Cape

The Western Cape Nature Conservation Laws Amendment Act, 2000 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.

6.4 Species Assessment Guidelines

The *Species Environmental Assessment Guideline* provides background and context to the assessment and minimum reporting criteria contained within the Terrestrial Animal and Plant Species Protocols; as well as to provide guidance on sampling and data collection methodologies for the different taxonomic groups that are represented in the respective protocols. This guideline is intended for specialist studies undertaken for activities that have triggered a listed and/or specified activity in terms of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as identified by the EIA Regulations, 2014 (as amended) and Listing Notices 1-3.

7. BASELINE ASSESSMENT

The landscape character of the corridor is typical of the Great Karoo and comprises sections of plains and open valleys with dispersed drainage systems and rougher terrain including mesas (table type mountains/hills), koppies, rocky ridges, outcrops and plateaus. The most prominent mesa is the Perdeberg, situated towards the western end of the corridor, which rises to a height of 1791m a.s.l. The current land use along the corridor is characterised by large agricultural holdings with mostly low-density livestock and game grazing being the main land use. Dry climatic conditions are such that cropping is very limited and is restricted to valley bottoms often near or around farmsteads.

7.1 DFFE National Screening Tool (July 2022)

The assessment corridor (i.e the PAOI) is classified as **MEDIUM and HIGH** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme (Figure 3).

The High classification is linked to the potential occurrence of species of conservation concern (SCC) namely:

- Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered),
- Black Stork *Ciconia nigra* (Regionally Vulnerable),
- Verreaux's Eagle *Aquila verreauxii* (Regionally Vulnerable), and
- Lanner Falcon *Falco biarmicus* (Regionally Vulnerable).

The Medium classification is linked to:

- Caspian Tern *Hydroprogne caspia* (Regionally Vulnerable),
- Ludwig's Bustard,
- Verreaux's Eagle, and
- Black Stork.

Verreaux's Eagle, Tawny Eagle *Aquila rapax* (Regionally Endangered), Ludwig's Bustard, Blue Crane and Karoo Korhaan *Eupodotis vigorsii* (Regionally Near threatened) were recorded during the field inspection in 12-13 July 2022. In addition, the assessment corridor contains breeding Martial Eagle *Polemaetus bellicosus* (Globally and Regionally Endangered) and habitat for Secretarybird *Sagittarius serpentarius* (Globally Endangered, Regionally Vulnerable). Based on aforementioned information, a classification of **HIGH** sensitivity for avifauna for the assessment corridor is therefore suggested.

See Appendix 3 for the Site Sensitivity Verification (SSV) Report.

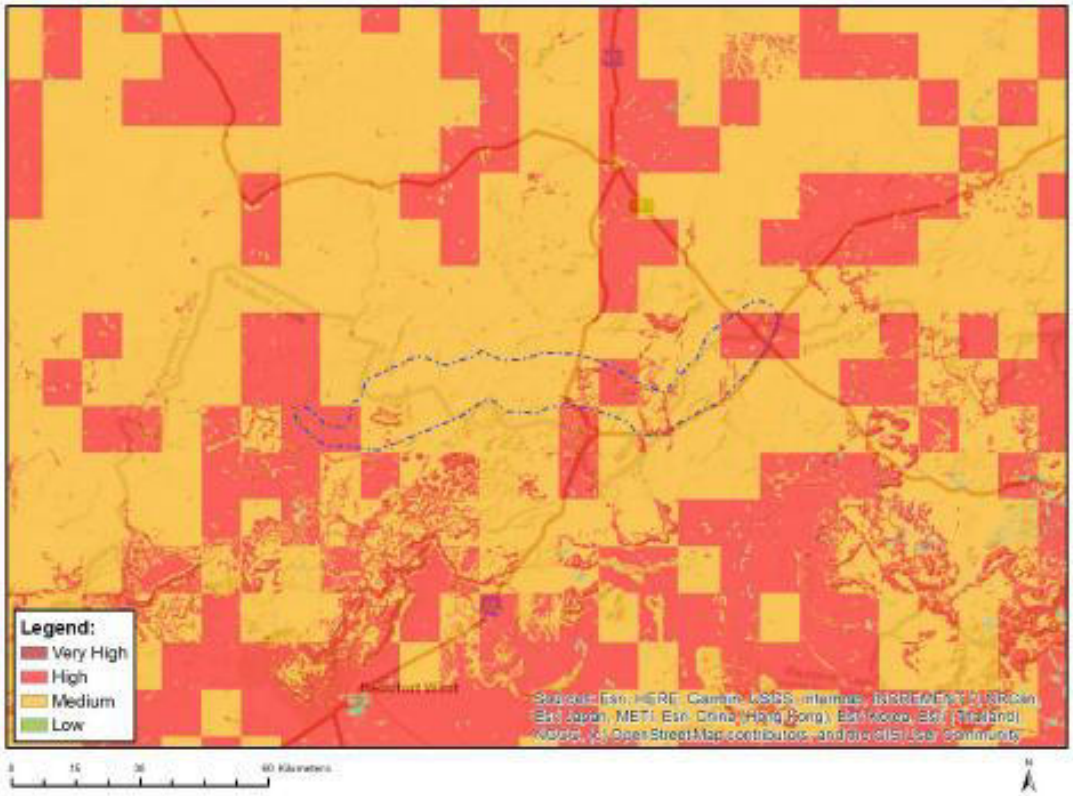
7.2 Protected Areas

The assessment corridor does not overlap with any protected areas. The closest protected area to the assessment corridor, is the Karoo National Park which is located approximately 30km south of the assessment corridor at its closest point. The Gamma gridline is not expected to impact on the avifauna in the Karoo National Park due to the distance from the proposed project.

7.3 Important Bird Areas (IBAs)

The assessment corridor does not overlap with any Important Bird Areas (IBAs). The closest IBA to the assessment corridor, is the Karoo National Park (IBA SA102) which is located approximately 30km south of the assessment corridor at its closest point. The Gamma gridline is not expected to impact on the avifauna in the Karoo National Park due to the distance from the proposed project.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Ciconia nigra
High	Aves-Neotis ludwigii
High	Aves-Falco biarmicus
High	Aves-Aquila verreauxii
High	Mammalia-Bunolagus monticularis
Low	Subject to confirmation
Medium	Aves-Hydroprogne caspia
Medium	Aves-Neotis ludwigii
Medium	Aves-Aquila verreauxii
Medium	Aves-Ciconia nigra
Medium	Mammalia-Bunolagus monticularis
Medium	Reptilia-Chersobius boulengeri

Figure 4: The National Web-Based Environmental Screening Tool map of the assessment corridor, indicating sensitivities for the Terrestrial Animal Species theme. The High sensitivity classification is linked to Ludwig's Bustard *Neotis ludwigii,* Verreaux's Eagle *Aquila verreauxii,* Lanner Falcon *Falco biarmicus* and Black Stork *Ciconia nigra*. The medium classification is linked to Caspian Tern *Hydropreogne caspia*, Ludwig's Bustard, Verreaux's Eagle and Black Stork.

7.4 Biomes and vegetation types

The assessment corridor is located within the Nama Karoo biome, in the Upper Karoo Bioregion (SANBI 2018). Two main vegetation types are found in the assessment corridor, the dominant one being Eastern Upper Karoo, which is found on the plains and Upper Karoo Hardeveld occurring on the ridges (SANBI 2018). Eastern Upper Karoo is dominated by dwarf *mycrophyllus* shrubs, with white grasses of the genera *Aristida* and *Eragrostis*. On the steep slopes, mountain ridges and koppies, Upper Karoo Hardeveld is found which is characterised by dwarf Karoo scrub with drought tolerant grasses of genera such as *Aristida*, *Eragrostis* and *Stipagrostis* (SANBI 2018). The assessment corridor contains several large earth dams.

7.5 Climate

The Three Sisters area is semi-arid with extreme temperature ranges. Mean annual precipitation averages around 214mm (meteoblue.com). The least amount of rainfall occurs in July with an average of 6mm. In February, the precipitation reaches its peak, with an average of 30mm. The temperatures are highest on average in January, at around 30 °C with hot days up to 36°C. At 15 °C daytime average, July is the coldest month of the year, with the temperature dropping as low as -13° at night (meteoblue.com).

7.6 Bird habitats

Whilst the distribution and abundance of the bird species in the development area are typical of the broad vegetation type, it is also necessary to examine bird habitats in more detail as it may influence the distribution and behaviour of priority species. These are discussed in more detail below. The powerline sensitive species most likely associated with the various bird habitat features are listed in Table 4.

7.6.0 Nama Karoo

The majority of the vegetation in the assessment corridor consists of a mixture of grassland and shrub vegetation, punctuated by rugged relief. Although not remarkably rich in species or endemism, the flora and fauna of the region are remarkably adapted to the region's climatic extremes. The powerline sensitive species that could use this habitat are listed below:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN
Black Harrier	*Circus maurus*	1.6	0.00	EN	EN
Common Buzzard	*Buteo buteo*	4	3.31	-	-

Cape Crow	*Corvus capensis*	21.6	15.75	-	-
Pied Crow	*Corvus albus*	63.2	33.15	-	-
Spotted Eagle-Owl	*Bubo africanus*	5.6	0.55	-	-
Western Cattle Egret	*Bubulcus ibis*	2.4	0.00	-	-
Pale Chanting Goshawk	*Melierax canorus*	40	9.67	-	-
Helmeted Guineafowl	*Numida meleagris*	12.8	1.38	-	-
Black-headed Heron	*Ardea melanocephala*	8.8	0.55	-	-
Greater Kestrel	*Falco rupicoloides*	8	3.31	-	-
Lesser Kestrel	*Falco naumanni*	0	0.28	-	-
Rock Kestrel	*Falco rupicolus*	43.2	4.42	-	-
Black-winged Kite	*Elanus caeruleus*	7.2	0.00	-	-
Northern Black Korhaan	*Afrotis afraoides*	4	1.11	-	-
Western Barn Owl	*Tyto alba*	0.8	0.00	-	-

7.6.1 Drainage woodland

Trees and taller woody shrubs are restricted mostly to watercourses and include *Vachellia karroo, Diospyros lycioides, Grewia robusta, Searsia lancea,* and *Tamarix usneoides* (Palmer and Hoffman 1997). This habitat provides suitable foraging and nesting substrate for a number of woodland associated species, as well as some of the raptors. The powerline sensitive species that could use this habitat are listed below:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN
Common Buzzard	*Buteo buteo*	4	3.31	-	-
Cape Crow	*Corvus capensis*	21.6	15.75	-	-
Pied Crow	*Corvus albus*	63.2	33.15	-	-
Spotted Eagle-Owl	*Bubo africanus*	5.6	0.55	-	-
Gabar Goshawk	*Micronisus gabar*	8	0.00	-	-
Pale Chanting Goshawk	*Melierax canorus*	40	9.67	-	-
Helmeted Guineafowl	*Numida meleagris*	12.8	1.38	-	-
African Harrier-Hawk	*Polyboroides typus*	4	0.28	-	-
Hadada Ibis	*Bostrychia hagedash*	40.8	4.70	-	-
Rock Kestrel	*Falco rupicolus*	43.2	4.42	-	-
Black-winged Kite	*Elanus caeruleus*	7.2	0.00	-	-
Western Barn Owl	*Tyto alba*	0.8	0.00	-	-

7.6.2 Surface water

Dams and ephemeral drainage lines and associated wetlands are sources of surface water in the assessment corridor and are important for most of the avifauna for drinking, bathing and in some instances foraging. During winter, flocks of Blue Crane roost in dams, arriving at dusk and departing again before sunrise. Large raptors such as Martial Eagle, Tawny Eagle and Verreaux's Eagle use the dams and drainage lines for bathing and drinking. The powerline sensitive species that could use this habitat are listed below:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN
Black Harrier	*Circus maurus*	1.6	0.00	EN	EN
Hamerkop	*Scopus umbretta*	12	0.28	-	-
Common Buzzard	*Buteo buteo*	4	3.31	-	-
Jackal Buzzard	*Buteo rufofuscus*	40	8.56	-	-
Red-knobbed Coot	*Fulica cristata*	4	0.28	-	-
Reed Cormorant	*Microcarbo africanus*	8	0.55	-	-
White-breasted Cormorant	*Phalacrocorax lucidus*	0.8	0.00	-	-
Cape Crow	*Corvus capensis*	21.6	15.75	-	-
Pied Crow	*Corvus albus*	63.2	33.15	-	-
African Darter	*Anhinga rufa*	0.8	0.00	-	-
African Black Duck	*Anas sparsa*	4	0.28	-	-
White-faced Whistling Duck	*Dendrocygna viduata*	0.8	0.00	-	-
Yellow-billed Duck	*Anas undulata*	19.2	1.38	-	-
African Fish Eagle	*Haliaeetus vocifer*	0.8	0.55	-	-
Booted Eagle	*Hieraaetus pennatus*	4.8	1.93	-	-
Spotted Eagle-Owl	*Bubo africanus*	5.6	0.55	-	-
Little Egret	*Egretta garzetta*	0.8	0.00	-	-
Western Cattle Egret	*Bubulcus ibis*	2.4	0.00	-	-
Egyptian Goose	*Alopochen aegyptiaca*	42.4	6.08	-	-
Spur-winged Goose	*Plectropterus gambensis*	8	0.28	-	-
Gabar Goshawk	*Micronisus gabar*	8	0.00	-	-
Pale Chanting Goshawk	*Melierax canorus*	40	9.67	-	-
Little Grebe	*Tachybaptus ruficollis*	6.4	0.28	-	-
Helmeted Guineafowl	*Numida meleagris*	12.8	1.38	-	-
African Harrier-Hawk	*Polyboroides typus*	4	0.28	-	-
Black-headed Heron	*Ardea melanocephala*	8.8	0.55	-	-
Grey Heron	*Ardea cinerea*	12.8	0.83	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	9.6	1.93	-	-
Hadada Ibis	*Bostrychia hagedash*	40.8	4.70	-	-
Common Moorhen	*Gallinula chloropus*	2.4	0.00	-	-
African Openbill	*Anastomus lamelligerus*	0.8	0.00	-	-
Western Barn Owl	*Tyto alba*	0.8	0.00	-	-
White-necked Raven	*Corvus albicollis*	32.8	7.73	-	-
South African Shelduck	*Tadorna cana*	33.6	5.80	-	-
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0.8	0.28	-	-
African Spoonbill	*Platalea alba*	8.8	0.83	-	-
White Stork	*Ciconia ciconia*	0	0.55	-	-
Red-billed Teal	*Anas erythrorhyncha*	5.6	0.00	-	-

7.6.3 Mesas (table type mountains/hills), koppies, rocky ridges, outcrops and plateaus

The assessment corridor contains many mesas, koppies, rocky ridges, outcrops and plateaus. The most prominent mesa is Perdeberg in the west of the assessment corridor, but there are several more koppies, ridges and outcrops scattered throughout the corridor. These landscape features are important for several powerline sensitive species as nesting and foraging areas including Verreaux's Eagle, Black Stork and Jackal Buzzard. The powerline sensitive species that could use this habitat are listed below:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Hamerkop	*Scopus umbretta*	12	0.28	-	-
Jackal Buzzard	*Buteo rufofuscus*	40	8.56	-	-
Booted Eagle	*Hieraaetus pennatus*	4.8	1.93	-	-
Rock Kestrel	*Falco rupicolus*	43.2	4.42	-	-
White-necked Raven	*Corvus albicollis*	32.8	7.73	-	-

7.6.4 Agricultural lands

Relevant to this project, cultivation is limited to a few agricultural lands within the assessment corridor. Arable or cultivated land represents a significant feeding area for many bird species in any landscape, but perhaps more so in arid environments. The opening up of the soil surface, and land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten by birds or attract insects which are in turn eaten by birds. Agricultural areas are of specific importance to Blue Crane and Ludwig's Bustard (Shaw 2013). The powerline sensitive species that could use this habitat are listed below:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN
Common Buzzard	*Buteo buteo*	4	3.31	-	-
Jackal Buzzard	*Buteo rufofuscus*	40	8.56	-	-
Cape Crow	*Corvus capensis*	21.6	15.75	-	-
Pied Crow	*Corvus albus*	63.2	33.15	-	-
Western Cattle Egret	*Bubulcus ibis*	2.4	0.00	-	-
Egyptian Goose	*Alopochen aegyptiaca*	42.4	6.08	-	-
Spur-winged Goose	*Plectropterus gambensis*	8	0.28	-	-

Helmeted Guineafowl	*Numida meleagris*	12.8	1.38	-	-
Black-headed Heron	*Ardea melanocephala*	8.8	0.55	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	9.6	1.93	-	-
Hadada Ibis	*Bostrychia hagedash*	40.8	4.70	-	-
Lesser Kestrel	*Falco naumanni*	0	0.28	-	-
Rock Kestrel	*Falco rupicolus*	43.2	4.42	-	-
Black-winged Kite	*Elanus caeruleus*	7.2	0.00	-	-
Western Barn Owl	*Tyto alba*	0.8	0.00	-	-
White Stork	*Ciconia ciconia*	0	0.55	-	-

7.6.5 Alien trees

The development area is largely devoid of large trees, except for alien trees which have been planted in homestead areas. Although stands of *Eucalyptus* are strictly speaking invader species, they have become important refuges for some powerline sensitive species which use them for roosting and nesting. The powerline sensitive species that could use this habitat are listed below:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN
Hamerkop	*Scopus umbretta*	12	0.28	-	-
Common Buzzard	*Buteo buteo*	4	3.31	-	-
Jackal Buzzard	*Buteo rufofuscus*	40	8.56	-	-
Reed Cormorant	*Microcarbo africanus*	8	0.55	-	-
White-breasted Cormorant	*Phalacrocorax lucidus*	0.8	0.00	-	-
Cape Crow	*Corvus capensis*	21.6	15.75	-	-
Pied Crow	*Corvus albus*	63.2	33.15	-	-
African Fish Eagle	*Haliaeetus vocifer*	0.8	0.55	-	-
Booted Eagle	*Hieraaetus pennatus*	4.8	1.93	-	-
Spotted Eagle-Owl	*Bubo africanus*	5.6	0.55	-	-
Western Cattle Egret	*Bubulcus ibis*	2.4	0.00	-	-
Egyptian Goose	*Alopochen aegyptiaca*	42.4	6.08	-	-
Spur-winged Goose	*Plectropterus gambensis*	8	0.28	-	-
Gabar Goshawk	*Micronisus gabar*	8	0.00	-	-
Pale Chanting Goshawk	*Melierax canorus*	40	9.67	-	-
Helmeted Guineafowl	*Numida meleagris*	12.8	1.38	-	-
African Harrier-Hawk	*Polyboroides typus*	4	0.28	-	-
Black-headed Heron	*Ardea melanocephala*	8.8	0.55	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	9.6	1.93	-	-
Hadada Ibis	*Bostrychia hagedash*	40.8	4.70	-	-
Greater Kestrel	*Falco rupicoloides*	8	3.31	-	-
Lesser Kestrel	*Falco naumanni*	0	0.28	-	-
Rock Kestrel	*Falco rupicolus*	43.2	4.42	-	-

Black-winged Kite	*Elanus caeruleus*	7.2	0.00	-	-
Western Barn Owl	*Tyto alba*	0.8	0.00	-	-
White-necked Raven	*Corvus albicollis*	32.8	7.73	-	-
White Stork	*Ciconia ciconia*	0	0.55	-	-

7.6.6 High voltage lines

The following high voltage lines transect the assessment corridor:

- Droërivier Hydra 3 400kV
- Droërivier Hydra 1 400kV
- Gamma Hydra 1 765kV
- Gamma Perseus 1 765kV
- Droërivier Hydra 2 400kV
- Gamma Kappa 1 765kV
- Kromrivier Traction Nobelsfontein 1 132 kV

High voltage lines are an important breeding substrate for raptors in the Karoo, due to the lack of large trees (Jenkins *et al.* 2013). Both Verreaux's Eagle and Martial Eagle have been recorded breeding on high voltage lines in the assessment corridor. The powerline sensitive species that could use this habitat are listed below:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN
Common Buzzard	*Buteo buteo*	4	3.31	-	-
Jackal Buzzard	*Buteo rufofuscus*	40	8.56	-	-
Cape Crow	*Corvus capensis*	21.6	15.75	-	-
Pied Crow	*Corvus albus*	63.2	33.15	-	-
Egyptian Goose	*Alopochen aegyptiaca*	42.4	6.08	-	-
Spur-winged Goose	*Plectropterus gambensis*	8	0.28	-	-
Pale Chanting Goshawk	*Melierax canorus*	40	9.67	-	-
Helmeted Guineafowl	*Numida meleagris*	12.8	1.38	-	-
Black-headed Heron	*Ardea melanocephala*	8.8	0.55	-	-
Hadada Ibis	*Bostrychia hagedash*	40.8	4.70	-	-
Greater Kestrel	*Falco rupicoloides*	8	3.31	-	-
Lesser Kestrel	*Falco naumanni*	0	0.28	-	-
Rock Kestrel	*Falco rupicolus*	43.2	4.42	-	-
Black-winged Kite	*Elanus caeruleus*	7.2	0.00	-	-
White-necked Raven	*Corvus albicollis*	32.8	7.73	-	-
White Stork	*Ciconia ciconia*	0	0.55	-	-

See Appendix 2 for photographic record of habitat features in the assessment corridor.

8. AVIFAUNA IN THE STUDY AREA

8.1. South African Bird Atlas Project 2

The SABAP2 data indicates that a total of 187 bird species could potentially occur within the assessment corridor – Appendix 1 provides a comprehensive list of all the species. Of these, 53 species are classified as powerline sensitive species and eleven (11) of these powerline sensitive species are South African Red List species i.e. SCC. Of the SCC, eight (8) have SABAP2 reporting rates >2%, indicating medium to high potential of occurrence in the assessment corridor.

Table 2 below lists all the priority species and the possible impact on the respective species by the proposed development. The following abbreviations and acronyms are used:

- EN = Endangered
- VU = Vulnerable
- NT = Near threatened

Table 4: Powerline sensitive species potentially occurring within the assessment corridor.

Species name	Scientific name	SABAP2 reporting rates		Status			Recorded during field survey 12-13 July 2022	Habitat							Potential impacts[3]		
		SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status	Endemic (SA)		Nama Karoo grassland and shrub	Drainage woodland	Surface water (dams and drainage lines)	Mesas, ridges and koppies	Agricultural lands	Alien trees	High voltage lines	Powerline - Collision	Displacement - Disturbance (breeding)	Displacement - Habitat transformation
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU		x	x		x			x		x	x	x
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU		x			x	x		x	x	x	x	
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU		x			x	x	x	x	x		x	
Black Stork	*Ciconia nigra*	4	0.28	-	VU					x	x		x	x	x	x	
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT			x	x	x					x		x
Blue Crane	*Grus paradisea*	28	8.84	VU	NT		x	x		x					x	x	x
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT		x	x							x	x	x
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN			x				x			x	x	x
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN			x	x	x		x	x	x		x	
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN		x	x	x	x		x	x	x		x	
Black Harrier	*Circus maurus*	1.6	0.00	EN	EN	x		x		x							
African Black Duck	*Anas sparsa*	4	0.28	-	-					x					x		
African Darter	*Anhinga rufa*	0.8	0.00	-	-					x					x		
African Fish Eagle	*Haliaeetus vocifer*	0.8	0.55	-	-					x			x			x	
African Harrier-Hawk	*Polyboroides typus*	4	0.28	-	-				x	x			x			x	
African Openbill	*Anastomus lamelligerus*	0.8	0.00	-	-					x					x		
African Sacred Ibis	*Threskiornis aethiopicus*	9.6	1.93	-	-		x			x		x	x		x	x	
African Spoonbill	*Platalea alba*	8.8	0.83	-	-					x					x		
Black-headed Heron	*Ardea melanocephala*	8.8	0.55	-	-			x		x		x	x	x	x	x	
Black-winged Kite	*Elanus caeruleus*	7.2	0.00	-	-			x	x			x	x	x		x	
Booted Eagle	*Hieraaetus pennatus*	4.8	1.93	-	-					x	x		x			x	

[3] Electrocution has been screened out as a potential impact because the large clearances on a 400kV line precludes any possibility of electrocution.

Species name	Scientific name	SABAP2 reporting rates		Status			Recorded during field survey 12-13 July 2022	Habitat							Potential impacts[3]		
		SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status	Endemic (SA)		Nama Karoo grassland and shrub	Drainage woodland	Surface water (dams and drainage lines)	Mesas, ridges and koppies	Agricultural lands	Alien trees	High voltage lines	Powerline - Collision	Displacement - Disturbance (breeding)	Displacement - Habitat transformation
Cape Crow	*Corvus capensis*	21.6	15.75	-	-			x	x	x		x	x	x		x	
Common Buzzard	*Buteo buteo*	4	3.31	-	-			x	x	x		x	x	x			
Common Moorhen	*Gallinula chloropus*	2.4	0.00	-	-					x							
Egyptian Goose	*Alopochen aegyptiaca*	42.4	6.08	-	-		x			x		x	x	x	x	x	
Gabar Goshawk	*Micronisus gabar*	8	0.00	-	-				x	x			x			x	
Greater Kestrel	*Falco rupicoloides*	8	3.31	-	-			x					x	x		x	
Grey Heron	*Ardea cinerea*	12.8	0.83	-	-		x			x					x	x	
Hadada Ibis	*Bostrychia hagedash*	40.8	4.70	-	-		x		x	x		x	x	x	x	x	
Hamerkop	*Scopus umbretta*	12	0.28	-	-		x			x	x		x		x	x	
Helmeted Guineafowl	*Numida meleagris*	12.8	1.38	-	-			x	x	x		x	x	x		x	
Jackal Buzzard	*Buteo rufofuscus*	40	8.56	-	-	x	x			x	x	x	x	x		x	
Lesser Kestrel	*Falco naumanni*	0	0.28	-	-			x				x	x	x			
Little Egret	*Egretta garzetta*	0.8	0.00	-	-					x					x		
Little Grebe	*Tachybaptus ruficollis*	6.4	0.28	-	-					x					x		
Northern Black Korhaan	*Afrotis afraoides*	4	1.11	-	-			x							x	x	x
Pale Chanting Goshawk	*Melierax canorus*	40	9.67	-	-		x	x	x	x			x	x		x	
Pied Crow	*Corvus albus*	63.2	33.15	-	-		x	x	x	x		x	x	x		x	
Red-billed Teal	*Anas erythrorhyncha*	5.6	0.00	-	-					x					x		
Red-knobbed Coot	*Fulica cristata*	4	0.28	-	-					x					x		
Reed Cormorant	*Microcarbo africanus*	8	0.55	-	-					x			x		x		
Rock Kestrel	*Falco rupicolus*	43.2	4.42	-	-		x	x	x		x	x	x	x		x	
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0.8	0.28	-	-					x						x	

Species name	Scientific name	SABAP2 reporting rates		Status			Recorded during field survey 12-13 July 2022	Habitat							Potential impacts[3]		
		SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status	Endemic (SA)		Nama Karoo grassland and shrub	Drainage woodland	Surface water (dams and drainage lines)	Mesas, ridges and koppies	Agricultural lands	Alien trees	High voltage lines	Powerline - Collision	Displacement - Disturbance (breeding)	Displacement - Habitat transformation
South African Shelduck	*Tadorna cana*	33.6	5.80	-	-		x			x					x		
Spotted Eagle-Owl	*Bubo africanus*	5.6	0.55	-	-			x	x	x			x		x	x	
Spur-winged Goose	*Plectropterus gambensis*	8	0.28	-	-					x		x	x	x	x		
Western Barn Owl	*Tyto alba*	0.8	0.00	-	-			x	x	x		x	x		x	x	
Western Cattle Egret	*Bubulcus ibis*	2.4	0.00	-	-			x		x		x	x		x		
White Stork	*Ciconia ciconia*	0	0.55	-	-					x		x	x	x	x		
White-breasted Cormorant	*Phalacrocorax lucidus*	0.8	0.00	-	-					x			x		x		
White-faced Whistling Duck	*Dendrocygna viduata*	0.8	0.00	-	-					x					x		
White-necked Raven	*Corvus albicollis*	32.8	7.73	-	-		x			x	x		x	x		x	
Yellow-billed Duck	*Anas undulata*	19.2	1.38	-	-					x					x		

8.2 On-site surveys

A single winter survey was conducted on 12 - 13 July 2022 within the assessment corridor, using a 4x4 vehicle and a helicopter survey. A concerted effort was made to cover the whole corridor and to record the primary bird habitats that are present within the proposed development study area.

The site visit produced a list of 17 powerline sensitive species (Table 4), covering both the assessment corridor and to a limited extent, the surrounding area. The onsite survey, pre-construction surveys for renewable energy facilities and the EWT powerline surveys were used to compile a list of SCC nest sites within and close to the assessment corridor, i.e. Martial Eagle and Verreaux's Eagle nests (Figure 5).

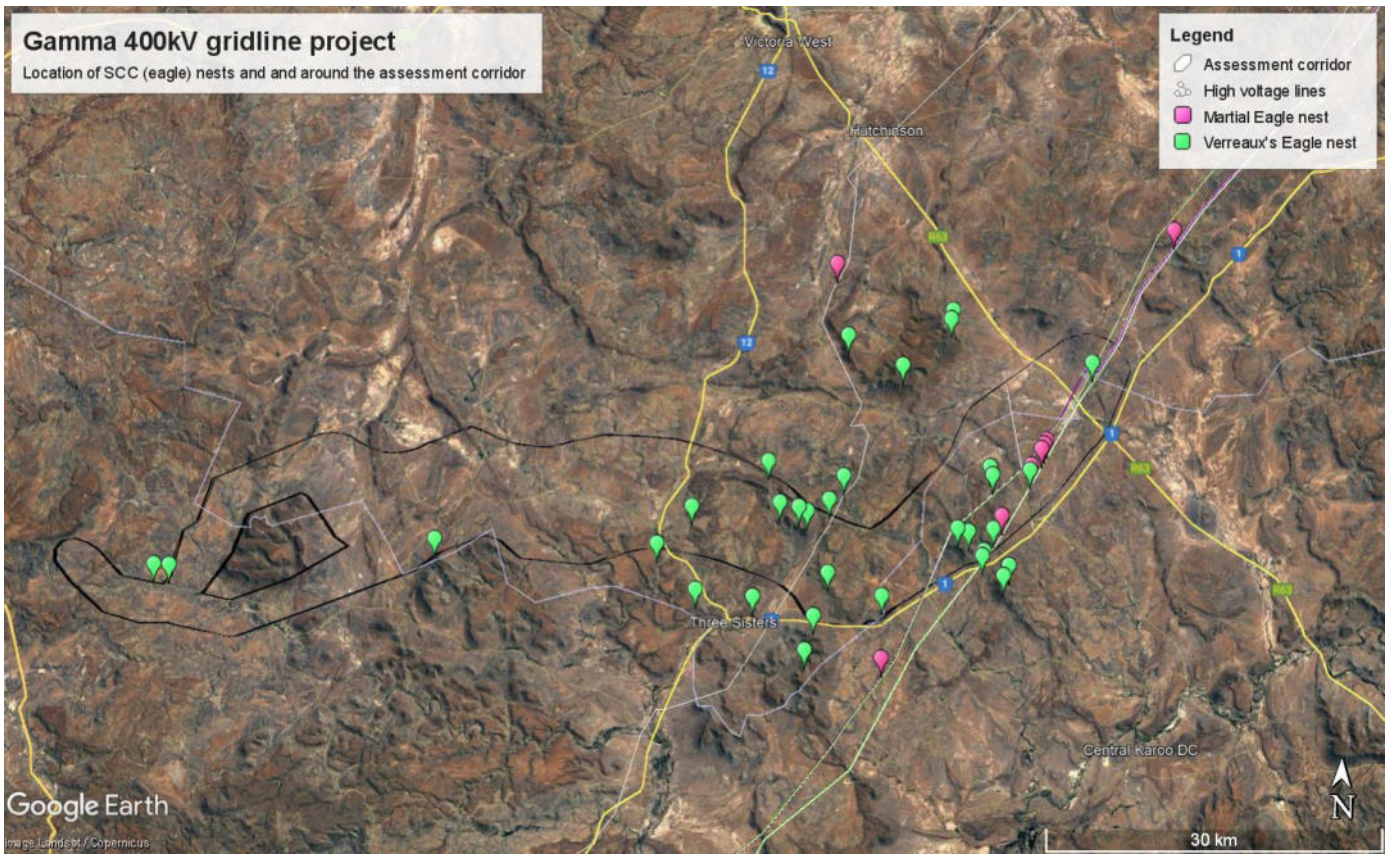


Figure 5: The location of known SCC nests in and around the assessment corridor.

9. IMPACT ASSESSMENT

9.1 General

Negative impacts on avifauna by electricity infrastructure generally take two (2) 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).

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. Relevant to the proposed 400kV gridline, the risk of the electrocution will be effectively zero due to the large clearances on the proposed 400kV tower designs, which cannot be bridged by even the largest species. Avifaunal electrocution has therefore not been assessed as an impact of the project.

Displacement due to habitat destruction and disturbance associated with the construction of the electricity infrastructure and other associated infrastructure is another impact that could potentially impact on avifauna.

The following potential impacts have been identified:

9.1.1 Construction Phase

- Displacement of avifauna due to disturbance associated with the construction of the proposed 400kV gridline, associated infrastructure and the Gamma Substation expansion; and
- Displacement due to habitat transformation associated with the construction of the proposed 400kV gridline, associated infrastructure and Gamma Substation expansion.

9.1.2 Operational Phase

- Collisions with the proposed 400kV gridline.

9.1.3 Decommissioning Phase

- The decommissioning of the gridline is unlikely in the medium to long term.

9.1.4 Cumulative Impacts

- Displacement due to disturbance associated with the construction of the 400kV gridline and Gamma Substation expansion;
- Displacement due to habitat transformation associated with the construction of the 400kV gridline and Gamma Substation expansion; and
- Collisions with the proposed 400kV powerline.

9.2 Displacement due to disturbance

The construction activities will constitute the following:

- Site clearance and preparation;
- Excavations for infrastructure;
- Construction of the infrastructure (i.e. the access roads, temporary laydown areas, substation expansion and the 400kV gridline); and
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site.

The above-mentioned activities could impact on birds through displacement due to disturbance; this could lead to breeding failure if the displacement happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, but that is usually not practical given tight constriction schedules. Terrestrial species and birds breeding on the existing powerline infrastructure within the assessment corridor are most likely to be potentially affected by displacement due to disturbance.

The powerline sensitive species which are vulnerable to this impact in the assessment corridor are the following:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN
African Fish Eagle	*Haliaeetus vocifer*	0.8	0.55	-	-
African Harrier-Hawk	*Polyboroides typus*	4	0.28	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	9.6	1.93	-	-
Black-headed Heron	*Ardea melanocephala*	8.8	0.55	-	-
Black-winged Kite	*Elanus caeruleus*	7.2	0.00	-	-
Booted Eagle	*Hieraaetus pennatus*	4.8	1.93	-	-
Cape Crow	*Corvus capensis*	21.6	15.75	-	-
Egyptian Goose	*Alopochen aegyptiaca*	42.4	6.08	-	-
Gabar Goshawk	*Micronisus gabar*	8	0.00	-	-
Greater Kestrel	*Falco rupicoloides*	8	3.31	-	-
Grey Heron	*Ardea cinerea*	12.8	0.83	-	-
Hadada Ibis	*Bostrychia hagedash*	40.8	4.70	-	-
Hamerkop	*Scopus umbretta*	12	0.28	-	-
Helmeted Guineafowl	*Numida meleagris*	12.8	1.38	-	-
Jackal Buzzard	*Buteo rufofuscus*	40	8.56	-	-
Northern Black Korhaan	*Afrotis afraoides*	4	1.11	-	-
Pale Chanting Goshawk	*Melierax canorus*	40	9.67	-	-
Pied Crow	*Corvus albus*	63.2	33.15	-	-
Rock Kestrel	*Falco rupicolus*	43.2	4.42	-	-
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0.8	0.28	-	-
Spotted Eagle-Owl	*Bubo africanus*	5.6	0.55	-	-
Western Barn Owl	*Tyto alba*	0.8	0.00	-	-
White-necked Raven	*Corvus albicollis*	32.8	7.73	-	-

9.3 Displacement due to habitat transformation

During the construction of powerlines, service roads (vehicle tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. These activities could impact on birds breeding, foraging and roosting in or in close proximity of the construction activities 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 planned expanded Gamma Substation is unavoidable. In the case of the 400kV gridline, the direct habitat transformation is limited to the pole footprints and the narrow access tracks under the powerline. The habitat in the assessment corridor is highly uniform from a bird impact perspective. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the proposed 400kV gridline is likely to be fairly minimal.

However, the results of habitat transformation may be more subtle, whereas the actual footprint of the infrastructure may be small in absolute terms, the effects of the habitat fragmentation may be more significant. Sometimes Great Bustard can be seen close to or under power lines, but a study done in Spain (Lane *et al.* 2001 as cited by Raab *et al.* 2009) indicates that the total observation of Great Bustard flocks was significantly higher further from power lines than at control points. Shaw (2013) found that Ludwig's Bustard generally avoids the immediate proximity of roads within a 500m buffer. Bidwell (2004) found that Blue Cranes select nesting sites away from roads. This means that power lines and roads also cause loss and fragmentation of the habitat used by the population in addition to the potential direct mortality. The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab *et al.* 2010). It has been shown that fragmentation of natural grassland in Mpumalanga (in that case by afforestation) has had a detrimental impact on the densities and diversity of grassland species (Alan *et al.* 1997).

The powerline sensitive species which are vulnerable to this impact in the assessment corridor are the following:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN
Northern Black Korhaan	*Afrotis afraoides*	4	1.11	-	-

9.4 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. Relevant to the proposed 400kV gridline, the risk of the electrocution will be effectively zero due to the large clearances on the proposed 400kV tower designs, which cannot be bridged by even the largest species.

9.5 Collisions

Collisions are arguably the biggest threat posed by high voltage powerlines 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 high voltage powerlines (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 powerlines is complex and problems are often localised. While any bird flying near a powerline 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 powerlines, 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. Powerlines 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 powerlines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 2012).

The technical aspects of powerline design and siting also play a big part in collision risk. Grouping similar powerlines 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 powerlines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown et al. 1987, Faanes 1987, Alonso et al. 1994a, Bevanger 1994)."

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to powerline collisions in South Africa (Figure 6).

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). 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 powerlines (Shaw 2013).

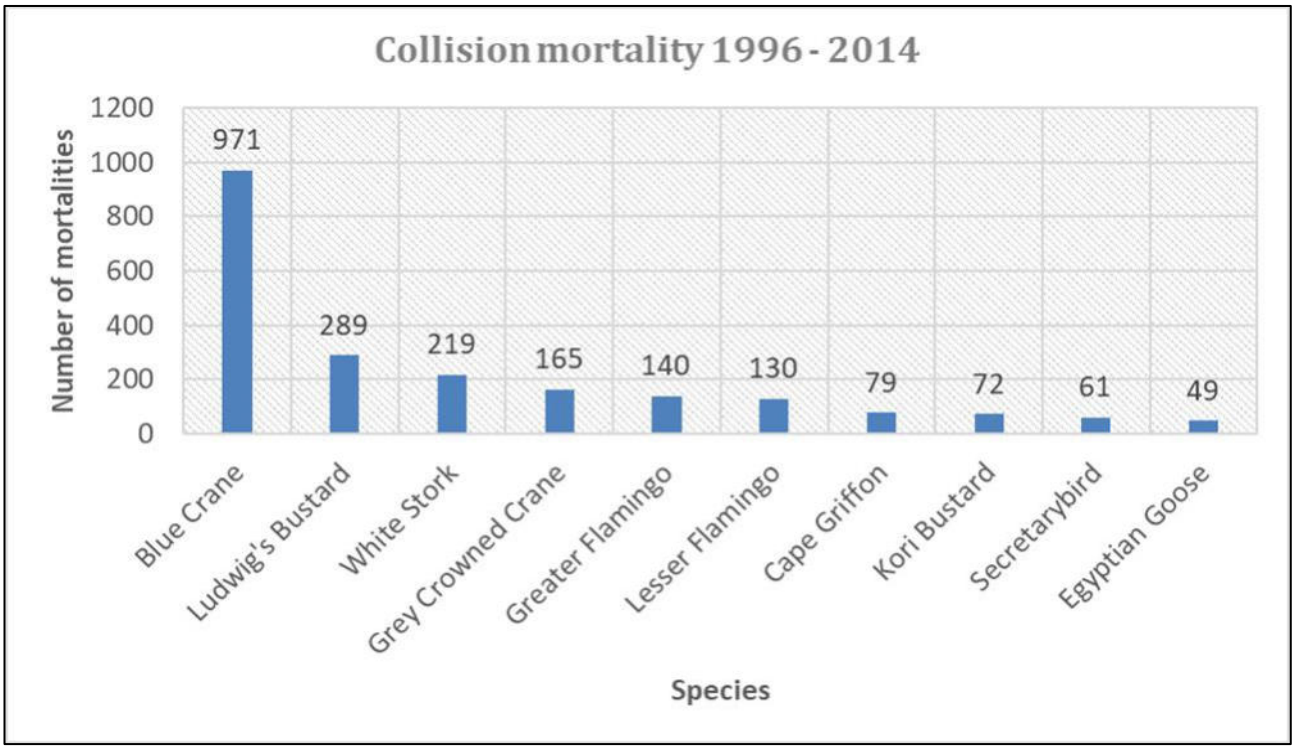


Figure 6: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and 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. 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 powerlines. 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 Endangered Wildlife Trust (EWT) and Eskom tested the effectiveness of two types of line markers in reducing powerline collision mortalities of large birds on three 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, with a 92% reduction in mortality, and large birds in general with a 56% reduction in mortality, but not for bustards, including the endangered Ludwig's Bustard. The two different marking devices were approximately equally effective, namely spirals and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw *et al*. 2017).

The powerline sensitive species which are vulnerable to this impact in the assessment corridor are the following:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
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Black Stork	*Ciconia nigra*	4	0.28	-	VU
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN
African Black Duck	*Anas sparsa*	4	0.28	-	-
African Darter	*Anhinga rufa*	0.8	0.00	-	-
African Openbill	*Anastomus lamelligerus*	0.8	0.00	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	9.6	1.93	-	-
African Spoonbill	*Platalea alba*	8.8	0.83	-	-
Black-headed Heron	*Ardea melanocephala*	8.8	0.55	-	-
Egyptian Goose	*Alopochen aegyptiaca*	42.4	6.08	-	-
Grey Heron	*Ardea cinerea*	12.8	0.83	-	-
Hadada Ibis	*Bostrychia hagedash*	40.8	4.70	-	-
Hamerkop	*Scopus umbretta*	12	0.28	-	-
Little Egret	*Egretta garzetta*	0.8	0.00	-	-
Little Grebe	*Tachybaptus ruficollis*	6.4	0.28	-	-
Northern Black Korhaan	*Afrotis afraoides*	4	1.11	-	-
Red-billed Teal	*Anas erythrorhyncha*	5.6	0.00	-	-
Red-knobbed Coot	*Fulica cristata*	4	0.28	-	-
Reed Cormorant	*Microcarbo africanus*	8	0.55	-	-
South African Shelduck	*Tadorna cana*	33.6	5.80	-	-
Spotted Eagle-Owl	*Bubo africanus*	5.6	0.55	-	-
Spur-winged Goose	*Plectropterus gambensis*	8	0.28	-	-
Western Barn Owl	*Tyto alba*	0.8	0.00	-	-
Western Cattle Egret	*Bubulcus ibis*	2.4	0.00	-	-
White Stork	*Ciconia ciconia*	0	0.55	-	-
White-breasted Cormorant	*Phalacrocorax lucidus*	0.8	0.00	-	-

White-faced Whistling Duck	*Dendrocygna viduata*	0.8	0.00	-	-
Yellow-billed Duck	*Anas undulata*	19.2	1.38	-	-

10. IMPACT RATING

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

10.1 Determination of Significance of Impacts

For each predicted impact, certain criteria are applied to establish the likely significance of the impact, firstly in the case of no mitigation being applied and then with the most effective mitigation measure(s) in place.

These criteria include the intensity (size or degree scale), which also includes the nature of impact, being either a positive or negative impact; the duration (temporal scale); and the extent (spatial scale). These numerical ratings are used in an equation whereby the consequence of the impact can be calculated. Consequence is calculated as follows:

Consequence = type x (intensity + duration + extent)

To calculate the significance of an impact, the probability (or likelihood) of that impact occurring is applied to the consequence. The tables below show the rankings of these variables, and defines each of the rating categories.

Table 5: Assessment criteria for the evaluation of impacts

Criteria	Numeric Rating	Category	Description
Duration	1	Immediate	Impact will self-remedy immediately
	2	Brief	Impact will not last longer than 1 year
	3	Short term	Impact will last between 1 and 5 years
	4	Medium term	Impact will last between 5 and 10 years
	5	Long term	Impact will last between 10 and 15 years
	6	On-going	Impact will last between 15 and 20 years
	7	Permanent	Impact may be permanent, or in excess of 20 years
Extent	1	Very limited	Limited to specific isolated parts of the site
	2	Limited	Limited to the site and its immediate surroundings
	3	Local	Extending across the site and to nearby settlements
	4	Municipal area	Impacts felt at a municipal level
	5	Regional	Impacts felt at a regional level
	6	National	Impacts felt at a national level
	7	International	Impacts felt at an international level
Intensity	1	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
	2	Very low	Natural and/ or social functions and/ or processes are slightly altered

Criteria	Numeric Rating	Category	Description
	3	Low	Natural and/ or social functions and/ or processes are somewhat altered
	4	Moderate	Natural and/ or social functions and/ or processes are moderately altered
	5	High	Natural and/ or social functions and/ or processes are notably altered
	6	Very high	Natural and/ or social functions and/ or processes are majorly altered
	7	Extremely high	Natural and/ or social functions and/ or processes are severely altered
Probability	1	Highly unlikely / None	Expected never to happen
	2	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
	3	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
	4	Probable	Has occurred here or elsewhere and could therefore occur
	5	Likely	The impact may occur
	6	Almost certain / Highly probable	It is most likely that the impact will occur
	7	Certain / Definite	There are sound scientific reasons to expect that the impact will definitely occur

Based on the consequence and probability of the impact occurring, the impact would fall into a significance category of very low (1 – 35), low (36 – 72), medium (73 – 108) or high (109 – 147) as described in Table 6.

Table 6: Interpretation of significance

Interpretation of 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 experienced on the receiving environment, but natural or socio-economic processes are likely to continue. 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 may not necessarily be required.
Insignificant		Any effects are beneath the levels of perception and inconsequential, therefore not requiring any consideration.

When assessing impacts, broader considerations are also considered, including the level of confidence in the assessment rating; the reversibility of the impact; and the irreplaceability of the resource as set out in **Error! R eference source not found.**7 – 9.

Table 7: Definition of confidence ratings

Category	Description
Low	Judgement is based on intuition
Medium	Determination is based on common sense and general knowledge
High	Substantive supportive data exists to verify the assessment

Table 8: Definition of reversibility ratings

Category	Description
Low	The affected environment will not be able to recover from the impact - permanently modified
Medium	The affected environment will only recover from the impact with significant intervention
High	The affected environmental will be able to recover from the impact

Table 9: Definition of irreplaceability ratings

Category	Description
Low	The resource is not damaged irreparably or is not scarce
Medium	The resource is damaged irreparably but is represented elsewhere
High	The resource is irreparably damaged and is not represented elsewhere

10.2 Impact Assessment

The impact assessments are summarised in the Tables 10-12 below.

10.2.1 Construction Phase

Table 10: Displacement of powerline sensitive avifauna due to disturbance

Project phase	**Construction**			
Impact	Displacement of powerline sensitive species due to disturbance			
Description of impact	Displacement of powerline sensitive species due to disturbance associated with construction of the proposed 400kV gridline and expansion of the Gamma Substation.			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	•Conduct an avifaunal walk-through of the final powerline alignment to identify priority species that may be breeding within the final footprint. If a SSC nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimizing the potential disturbance to the breeding birds during the construction period, if possible. This could include measures such as delaying some of the activities until after the breeding season •Construction activity should be restricted to the immediate footprint of the infrastructure. •Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. •Measures to control noise and dust should be applied according to current best practice in the industry. •Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. •1km infrastructure exclusion zones must be implemented around all Verreaux's Eagle nests, except nests on existing high voltage lines. •2.5km infrastructure exclusion zones must be implemented around all Martial Eagle nests except nests on existing high voltage lines.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	impact will last between 1 and 5 years	Short term	impact will last between 1 and 5 years
Extent	Limited	Limited to the site and its immediate surroundings	Limited	Limited to the site and its immediate surroundings
Intensity	Very high	Natural and/ or social functions and/ or processes are majorly altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	Medium	Determination is based on common sense and general knowledge	Medium	Determination is based on common sense and general knowledge
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Low - negative**		**Low - negative**	
Comment on significance	In the case of SCC (eagle) nests on existing high voltage lines, the infrastructure no-go zone can be relaxed. It is preferable to place any new powerlines next to the existing powerline, even if this means temporary disturbance of a pair of breeding eagles. By placing the line next to an existing line, the creation of a new collision risk in a pristine area is avoided, the collision risk that the new line poses is also mitigated to some extent, and tha habitat fragmentation is less severe. The short term disturbance of the eagles is less detrimental than the long-term collision risk that the new powerline will pose in a pristine area.			

Table 11: Displacement of powerline sensitive avifauna due to habitat transformation

Project phase	**Construction**			
Impact	Displacement of powerline sensitive species due to habitat transformation			
Description of impact	Displacement of powerline sensitive species due to habitat transformation associated with construction of the proposed 400kV gridline and expansion of the Gamma Substation.			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	•Construction activity should be restricted to the immediate footprint of the infrastructure. •Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum to reduce the extent of habitat fragmentation. •Vegetation clearance should be limited to what is absolutely necessary and the mitigation measures proposed by the vegetation specialist must be strictly implemented. •Where technically possible, proposed gridline should run parallel to an existing high voltage line for as much as possible to reduce the impact of habitat fragmentation.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Limited	Limited to the site and its immediate surroundings	Limited	Limited to the site and its immediate surroundings
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Likely	The impact may occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Low - negative**		**Low - negative**	

10.2.2 Operational Phase

Table 12: Mortality of powerline sensitive avifauna due to collisions with the 400kV gridline

Project phase	**Operation**			
Impact	Mortality of powerline sensitive species due to collision with the proposed gridline			
Description of impact	Mortality of powerline sensitive species due to collision with the earthwire of the proposed gridline			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	••Eskom approved Bird Flight Diverters must be fitted to the grid line where it transects areas of medium and high sensitivity (see sensitivity map), according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines) •A 500m powerline exclusion zone must be implemented around dams >5 ha and irrigated agricultural lands to reduce the risk of powerline collisions of powerline sensitive species drawn to dams (especially Blue Cranes) and agricultural lands (Blue Cranes and Ludwig's Bustard). An exception to this is the dam situated at 31°48'16.44"S, 22°57'51.38"E. Routing the line around this dam would traverse sensitive riverine rabbit habitat that also falls within a Northern Cape Critical Biodiversity Area. In this instance, it would be preferable to route the line through the exclusion zone and mark the line with LED type bird flight diverters to ensure visibility of the line during low light conditions, should the dam at any given time be used as a roost site by Blue Cranes.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Local	Extending across the site and to nearby settlements	Local	Extending across the site and to nearby settlements
Intensity	Very high	Natural and/ or social functions and/ or processes are majorly altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Likely	The impact may occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Medium	The resource is damaged irreparably but is represented elsewhere
Significance	**High - negative**		**Low - negative**	

10.3 Cumulative impacts

The International Finance Corporation (IFC) (2012) defines Cumulative Impact Analysis (CIA) as a process of (a) analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environmental and social external drivers on the chosen VECs over time, and (b) proposing tangible measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible.

As standard impact assessment considers project impacts with existing stressors (i.e. the change to the baseline environmental or social condition), the key task for CIA is to ascertain how the potential impacts of a proposed development might combine, cumulatively, with the potential / future impacts of the other anticipated or ongoing human activities and other natural stressors (such as droughts or extreme climatic events).

The nearest operational wind farm from the site is the Noblesfontein Wind Farm located to the north of the corridor. The South African Renewable Energy EIA Application Database (REEA) ("REEA_OR_2022_Q1") shows several renewable energy projects (and associated electrical grid connections) authorised or in process within 30 km of the refined corridor.

These projects include (see Figure 1):

- Biesiespoort PV Facility (east of Nobelsfontein);
- Modderfontein Wind Energy Facility (south of Nobelsfontein)[4];
- Mainstream Wind and Solar Energy Facility (north and northwest of the Gamma Substation);
- Aurora Power Solutions (APS) Betelgeuse PV Solar Project Four (east of the Gamma Substation);
- Umsinde Emoyeni Wind Energy Facility Phase 2 (east of APS Betelgeuse PV Solar Project Four);
- Ishwati Emoyeni Wind Energy Facility (east of Umsinde Emoyeni Wind Energy Facility Phase 2); and
- Great Karoo Renewable Energy Cluster (north-east of Gamma Substation)

Red Cap is also proposing to develop four additional wind farms and associated grid connections, known as the Hoogland Projects. The Hoogland wind farms are located north and south of the Nuweveld complex, and the Hoogland grid connections will terminate at the Nuweveld Collector Substation (refer to Figure 1**Error! Reference s ource not found.**).

In terms of existing High Voltage lines in the area, the Kromrivier Traction Nobelsfontein 1 132 kV line traverses the assessment corridor near Three Sisters, and in the east the assessment corridor follows the routing of the Gamma Kappa 1 765 kV and the Droërivier Hydra 2 400 kV powerlines. Another 765 kV line is proposed by Eskom in this corridor. Further to the east, the Hydra Droërivier 1 and the Droërivier Hydra 3 400 kV lines also fall within the assessment corridor (see Figure 1).

The proposed 400kV grid line equates to a maximum of 110km. Based on the information publicly available, the existing and planned high voltage lines within a 30km radius around the assessment corridor equates to approximately 600km (counting parallel lines as one). The proposed development will thus increase the total number of existing and planned high voltage lines by 18%.

[4] Red Cap has been advised that the Modderfontein Project will not proceed as the EA for this project has lapsed.

When viewed on its own, the contribution of the proposed 400kV gridline and substation expansion to the pre-mitigation cumulative collision and displacement impact on powerline sensitive avifauna of all the high voltage lines is considered MEDIUM (negative), but could be reduced to LOW (negative) with mitigation. However, the combined pre-mitigation cumulative impact of all the existing and planned powerlines, including the planned Gamma 400kV gridline (all approximately 710km in total length), on powerline sensitive avifauna within a 35km radius, is considered to be HIGH (negative) pre-mitigation for the collision risk, but could be reduced to MEDIUM (negative) with mitigation. As far as displacement due to disturbance and habitat transformation is concerned, the cumulative impact of all the existing and planned high voltage lines, and substations, is assessed to be MEDIUM (negative) pre-mitigation, but reducible to LOW (negative) with appropriate mitigation.

The cumulative impact assessments are summarised in the Tables 13-15 below.

Table 13: Cumulative impacts – displacement of powerline sensitive avifauna due to disturbance

Project phase	**Construction**			
Impact	Displacement of powerline sensitive species due to disturbance			
Description of impact	Displacement of powerline sensitive species due to disturbance associated with construction of the proposed 400kV gridline and expansion of the Gamma Substation, and all the other planned grid connections and substations within a 35km radius around the assessment corridor.			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	•Construction activity should be restricted to the immediate footprint of the infrastructure. •Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. •Measures to control noise and dust should be applied according to current best practice in the industry. •Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. •Exclusion zones must be implemented around all Verreaux's Eagle and Martial Eagle nests, except nests on existing high voltage lines.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Short term	impact will last between 1 and 5 years	Short term	impact will last between 1 and 5 years
Extent	Municipal area	Impacts felt at a municipal level	Municipal area	Impacts felt at a municipal level
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Likely	The impact may occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	High	The affected environmental will be able to recover from the impact	High	The affected environmental will be able to recover from the impact
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Medium - negative**		**Low - negative**	
Comment on significance	In the case of SCC (eagle) nests on existing high voltage lines, the infrastructure no-go zone can be relaxed. It is preferable to place any new powerlines next to the existing powerline, even if this means temporary disturbance of a pair of breeding eagles. By placing the line next to an existing line, the creation of a new collision risk in a pristine area is avoided, the collision risk that the new line poses is also mitigated to some extent, and tha habitat fragmentation is less severe. The short term disturbance of the eagles is less detrimental than the long-term collision risk that the new powerline will pose in a pristine area.			

Table 14: Cumulative impacts – displacement of powerline sensitive avifauna due to habitat transformation

Project phase	**Construction**			
Impact	Displacement of powerline sensitive species due to habitat transformation			
Description of impact	Displacement of powerline sensitive species due to habitat transfomation associated with construction of the proposed 400kV gridline and expansion of the Gamma Substation, and all the other planned grid connections and substations within a 35km radius around the assessment corridor.			
Mitigatability	Medium	Mitigation exists and will notably reduce significance of impacts		
Potential mitigation	•Construction activity should be restricted to the immediate footprint of the infrastructure. •Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum to reduce the extent of habitat fragmentation. •Vegetation clearance should be limited to what is absolutely necessary and the mitigation measures proposed by the vegetation specialist must be strictly implemented. •Where technically possible, proposed gridline should run parallel to an existing high voltage line for as much as possible to reduce the impact of habitat fragmentation.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Municipal area	Impacts felt at a municipal level	Municipal area	Impacts felt at a municipal level
Intensity	High	Natural and/ or social functions and/ or processes are notably altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Almost certain / Highly probable	It is most likely that the impact will occur	Probable	The impact has occurred here or elsewhere and could therefore occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Low	The resource is not damaged irreparably or is not scarce	Low	The resource is not damaged irreparably or is not scarce
Significance	**Medium - negative**		**Low - negative**	

Table 15: Cumulative impacts – mortality of powerline sensitive avifauna due to powerline collisions

Project phase	Operation			
Impact	Mortality of powerline sensitive species due to collision with the proposed gridline			
Description of impact	Mortality of powerline sensitive species due to collision with the earthwire of the proposed 400kV gridline and all planned and existing high voltage liens within a 35km radius			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts		
Potential mitigation	•Eskom approved Bird Flight Diverters must be fitted to the grid line where it transects areas of medium and high sensitivity, according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines) •Powerline exclusion zones must be implemented around dams >5 ha and irrigated agricultural lands to reduce the risk of powerline collisions of powerline sensitive species drawn to dams (especially Blue Cranes) and agricultural lands (Blue Cranes and Ludwig's Bustard). In instances where it would be preferable to route the line within 500m of a major dam or irrigated land due to ecological reasons, the line must be marked with Bird Flight Diverters. In the case of dams that could be used as roost sites by Blue Cranes, LED type bird flight diverters must be used to ensure visibility of the line during low light conditions.			
Assessment	**Without mitigation**		**With mitigation**	
Nature	Negative		Negative	
Duration	Permanent	Impact may be permanent, or in excess of 20 years	Permanent	Impact may be permanent, or in excess of 20 years
Extent	Municipal area	Impacts felt at a municipal level	Municipal area	Impacts felt at a municipal level
Intensity	Very high	Natural and/ or social functions and/ or processes are majorly altered	Moderate	Natural and/ or social functions and/ or processes are moderately altered
Probability	Certain / definite	There are sound scientific reasons to expect that the impact will definitely occur	Likely	The impact may occur
Confidence	High	Substantive supportive data exists to verify the assessment	High	Substantive supportive data exists to verify the assessment
Reversibility	Medium	The affected environment will only recover from the impact with significant intervention	Medium	The affected environment will only recover from the impact with significant intervention
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Medium	The resource is damaged irreparably but is represented elsewhere
Significance	**High - negative**		**Medium - negative**	

11. SENSITIVITY MAP

11.1. Methodology to compile risk map

The following methods were employed to compile an avifaunal risk map:

- The Southern African Bird Atlas 2 (SABAP2) data was obtained for the assessment corridor (see Table 1). From this a consolidated species list was compiled by pooling all the data of birds with a reporting rate of 2% or higher.

- The list of powerline sensitive avifauna was refined to a list of global and regional Red Data priority species, using the latest IUCN Red List (2022.1) and South African Red Data Book of Birds (2015). The final list is as follows:

    - Black Stork
    - Blue Crane
    - Karoo Korhaan
    - Lanner Falcon
    - Ludwig's Bustard
    - Martial Eagle
    - Secretarybird
    - Verreaux's Eagle

These species were used as indicator species in compiling the avifaunal risk map in the screening corridor.

- Bird distribution and key sensitivity features (habitats) were identified within the study area using various data sources:
    - Habitat Suitability Models (HSM) were obtained from BirdLife South Africa for Black Stork, Blue Crane, Ludwig's Bustard, Secretarybird and Verreaux's Eagle (BLSA 2022). The HSM consists of a grid of 90m x 90m and a score of 0 – 3 for each grid cell was assigned, indicating habitat suitability for the specific species. The classes were classified as follows: 0-1 = Low, 2 = Medium, 3 = High. These were superimposed on the assessment corridor to assess the suitability of the corridor for a specific species.
    - No HSM was available for Karoo Korhaan, therefore the HSM for Ludwig's Bustard was substituted for Karoo Korhaan as the species share similar habitat preferences. The same approach was followed for Lanner Falcon, with Verreaux's Eagle substituting for Lanner Falcon. In the case of the latter, we additionally assumed high likelihood of occurrence within 750m of a transmission line and medium likelihood of occurrence between 750m and 1km. This was based on the known breeding and roosting behaviour of the species – often breed in abandoned crow nests and even eagle nests on transmission lines.
    - HSM for Martial Eagle was also not available. For Martial Eagles we assumed a high likelihood of occurrence within 2.5km from an existing transmission line, and a medium likelihood of occurrence between 2.5km and 3.5km from a transmission line. Beyond 3.5km we assumed a low likelihood of occurrence. This is based on known breeding and roosting behaviour.
    - The South African National Land-Cover Dataset (DFFE 2020) was used to identify two key sensitivity features namely (1) dams of 5 hectares or larger, and (2) irrigated pivots – these features were each buffered by 500m to reduce the risk of powerline collisions. Both these landscape features are important for Blue Cranes – dams are used by flocks of Blue Cranes to roost in, and they congregate in flocks on irrigated lands to forage. Irrigated lands are also important for Ludwig's Bustard.
    - The location of eagle nests was obtained from the Endangered Wildlife Trust and various pre-construction renewable energy projects which overlaps with the assessment corridor. Verreaux's Eagle nests were buffered by 1km and Martial Eagle nests by 2.5km to reduce the risk of displacement due to disturbance.

- Existing Eskom transmission lines were included as a sensitivity feature because they are the main breeding and roosting substrate for Martial Eagles in the Karoo and are also often used by Verreaux's Eagles and Lanner Falcons for the same purpose.

- The probability of the respective impacts (disturbance, habitat transformation and collision) affecting a species was scored for each priority species to arrive at a species-specific probability score for each impact. Probabilities for the respective impacts occurring was scored according to the below scale:

  - 0 = the impact is highly unlikely to occur
  - 1 = the impact is unlikely to occur
  - 2 = the impact could possibly occur
  - 3 = the impact will most likely occur

- The likelihood of a specific species occurring in the screening corridor was scored as follows:

  - 0 = highly unlikely to occur
  - 1 = unlikely to occur
  - 2 = could possibly occur
  - 3 = will most likely occur

- The significance of the impacts per species was calculated by adding the scores for collision *(c),* disturbance *(d),* habitat transformation *(h),* and likelihood of occurrence *(l)* to arrive at an impact significance rating *(S)* for each species. *(S) = (c) + (d) + (h) + (l)*

- A Red Data weighted score was assigned for each Red Data category as follows:

  - Near threatened = 1
  - Vulnerable = 2
  - Endangered = 3

- The species-specific impact significance rating *(S)* was multiplied by a weighted Red Data status score *(w)* for each priority species to arrive at a species-specific sensitivity rating *(SR)* for each species (*SR) = (S) x (w)*

Species	Regional Status	SABAP2 full protocol reporting rate %	Weight (*w*)	Impact - collision (*c*)	Impact - disturbance/displacement (*d*)	Impact - habitat transformation/displacement (*h*)	Likelihood of occurrence (*l*)	Impact significance (*S*) = (*c*)+(*d*)+(*h*)+(*l*)	Species sensitivity rating (*SR*) = (*w*) x (*S*)
Black Stork	Vulnerable	4%	2	1	1	0	0	2	**4**
Blue Crane	Near Threatened	28%	1	3	1	0	3	7	**7**
Karoo Korhaan	Near Threatened	40%	1	1	1	0	3	5	**5**
Lanner Falcon	Vulnerable	4%	2	0	2	0	1	3	**6**
Ludwig's Bustard	Endangered	10.40%	3	3	1	0	3	7	**21**
Martial Eagle	Endangered	8%	3	0	2	0	2	4	**12**
Secretarybird	Vulnerable	4%	3	2	1	0	1	4	**12**
Verreaux's Eagle	Vulnerable	26.40%	2	0	1	0	3	4	**8**
Ratings									
Low	0								
Medium	1								
High	2								
Very High	3								

- A species-specific risk rating *(RR)* was calculated for each 90m x 90m grid call by multiplying the sensitivity rating with the HSM class for that species. *(RR) = (SR) x HSM class*

- An aggregated sensitivity rating *(ASR*) was calculated for each grid cell by summing the individual species-specific sensitivity ratings (*RR*) for each grid cell. *ASR = Σ(RR)*

- A quantile distribution scheme was used to classify the *ASR* for the whole assessment corridor into three classes: Orange = High, Yellow = Medium, White = Low. An additional class, Red = Very High/No-Go was added for specific features namely:

    - (1) 1km buffer around Verreaux's Eagle nests
    - (2) 2.5km buffer around Martial Eagle nests[5]

[5] An exception to the No-Go areas are nests on existing high voltage lines. All eagle nests on high voltage lines were classified as High and not No-Go (Very High) (See Table 10 for an explanation).

- (3) 500m powerline exclusion buffer around dams >5 ha (roads allowed)
- (4) 500m powerline exclusion buffer around irrigated pivots (roads allowed).

Figures 7 and 8 show the risk map for the grid connection and roads respectively.

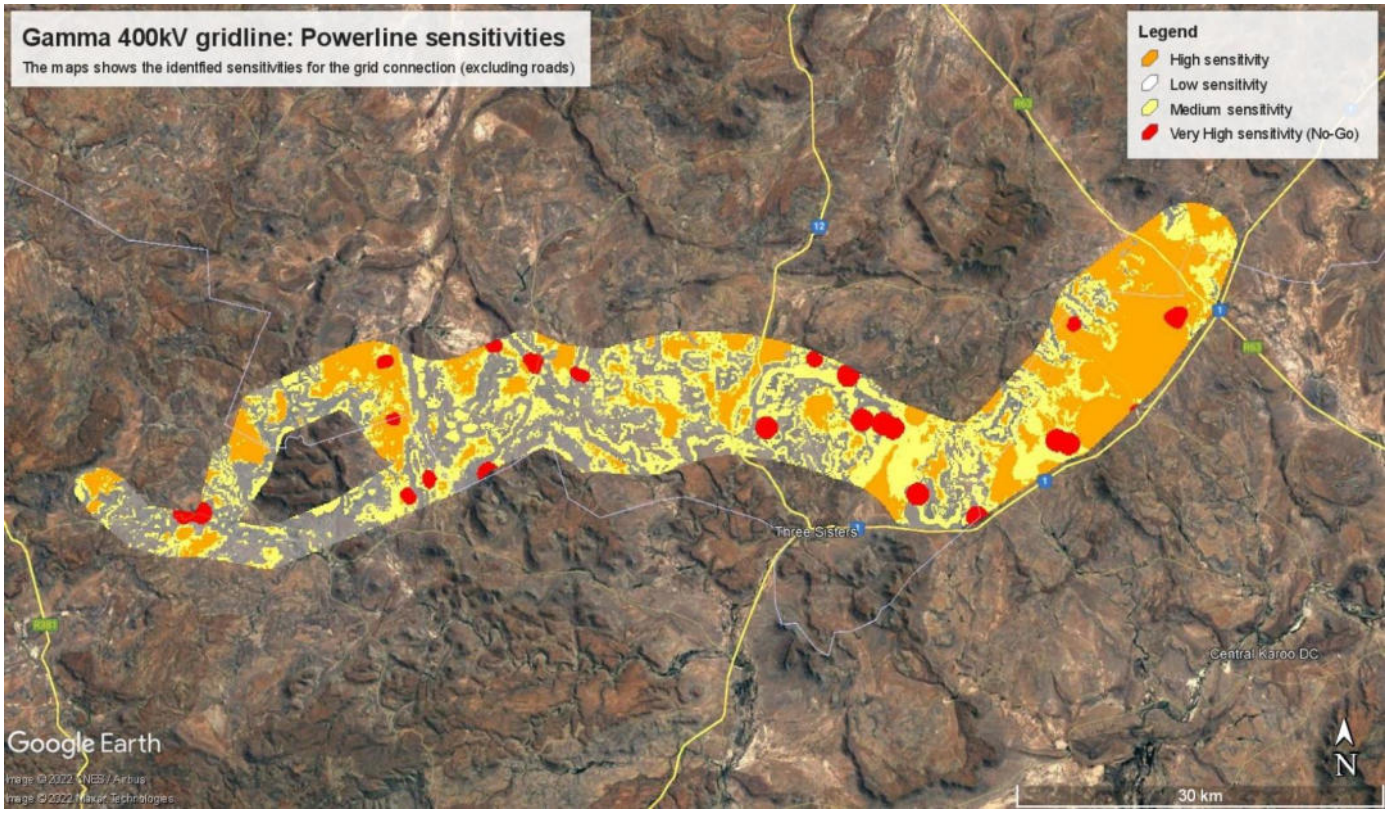

Figure 7: The risk map for the grid connection (excluding associated roads)

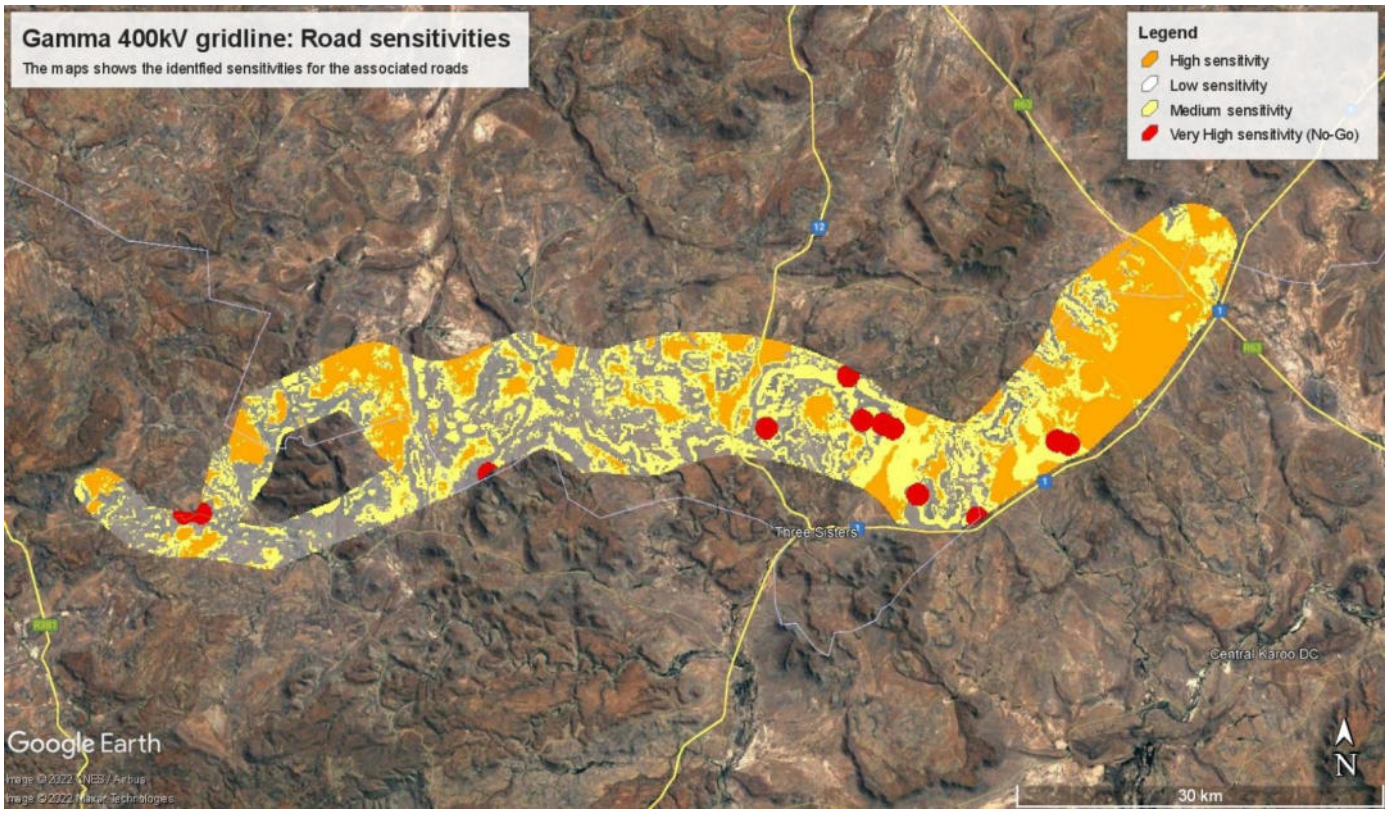

Figure 8: The risk map for the associated roads

12. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

Refer to Appendix 4 for a description of the key mitigation and monitoring recommendations for each applicable impact identified for all phases of the project.

13. NO-GO ALTERNATIVE

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

14. CONCLUSION AND SUMMARY

The SABAP2 data indicates that a total of 187 bird species could potentially occur within the assessment corridor – Appendix 1 provides a comprehensive list of all the species. Of these, 53 species are classified as powerline sensitive species and eleven (11) are South African Red List species i.e. SCC. Of the SCC, eight (8) have SABAP2 reporting rates >2%, indicating medium to high potential of occurrence in the assessment corridor.

14.1. Impacts

The following potential impacts have been identified:

14.1.1 Construction Phase

- Displacement of avifauna due to disturbance associated with the construction of the proposed 400kV gridline, associated infrastructure and the Gamma Substation expansion; and
- Displacement due to habitat transformation associated with the construction of the proposed 400kV gridline, associated infrastructure and Gamma Substation expansion.

14.1.2 Operational Phase

- Collisions with the proposed 400kV gridline;

14.1.3 Decommissioning Phase

- The decommissioning of the gridline is unlikely in the medium to long term.

14.1.4 Cumulative Impacts

- Displacement due to disturbance associated with the construction of the 400kV gridline and Gamma Substation expansion;
- Displacement due to habitat transformation associated with the construction of the 400kV gridline and Gamma Substation expansion;
- Collisions with the proposed 400kV powerline;

14.2. Discussion

14.2.1 Displacement of avifauna due to the disturbance associated with construction activities

The construction activities could impact on birds through displacement due to disturbance; this could lead to breeding failure if the displacement happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, but that is usually not practical given tight constriction schedules. Terrestrial bird species and birds breeding on the existing powerline infrastructure within the assessment corridor are most likely to be potentially affected by displacement due to disturbance.

The powerline sensitive SCC which are vulnerable to this impact in the assessment corridor are the following:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN

The pre- and post- mitigation impact is rated as **Low**. Recommended mitigation are as follows:

- Conduct an avifaunal walk-through of the final powerline alignment to identify priority species that may be breeding within the final footprint. If a SSC nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimizing the potential disturbance to the breeding birds during the construction period, if possible. This could include measures such as delaying some of the activities until after the breeding season
- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to the generic EMPr for overhead power line development.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- 1km infrastructure exclusion zones must be implemented around all Verreaux's Eagle nests, except nests on existing high voltage lines.
- 2.5km infrastructure exclusion zones must be implemented around all Martial Eagle nests except nests on existing high voltage lines.

In the case of SCC (eagle) nests on existing high voltage lines, the infrastructure no-go zone can be relaxed. It is preferable to place any new powerlines next to the existing powerline, even if this means temporary disturbance of a pair of breeding eagles. By placing the line next to an existing line, the creation of a new collision risk in a pristine area is avoided, the collision risk that the new line poses is also mitigated to some extent, and the habitat fragmentation is

less severe. The short-term disturbance of the eagles is less detrimental than the long-term collision risk that the new powerline will pose in a pristine area.

14.2.2 Displacement of avifauna due to the habitat transformation associated with construction activities

Construction activities could impact on birds breeding, foraging and roosting in or in close proximity of the construction activities 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 planned expanded Gamma Substation is unavoidable. In the case of the 400kV gridline, the direct habitat transformation is limited to the pole footprints and the narrow access road/track under the powerline. The habitat in the assessment corridor is highly uniform from a bird impact perspective. The loss of habitat a relatively small quantity of the habitat for priority species due to direct habitat transformation associated with the construction of the proposed 400kV gridline is likely to be fairly minimal. However, the results of habitat transformation may be more subtle, whereas the actual footprint of the infrastructure may be small in absolute terms, the effects of the habitat fragmentation may be more significant. The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab *et al.* 2010).

The powerline sensitive SCC which are vulnerable to this impact in the assessment corridor are the following:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN

The pre- and post- mitigation impact is rated as **Low**. Recommended mitigation are as follows:

- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum to reduce the extent of habitat fragmentation.
- Vegetation clearance should be limited to what is absolutely necessary and the mitigation measures proposed by the vegetation specialist must be strictly implemented.

14.2.3 Electrocution mortality of avifauna

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. Relevant to the proposed 400kV gridline, the risk of the electrocution will be effectively zero due to the large clearances on the proposed 400kV tower designs, which cannot be bridged by even the largest species.

14.2.4 Collision mortality of avifauna

Collisions are arguably the biggest threat posed by high voltage powerlines 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 high voltage powerlines (Van Rooyen 2004, Anderson 2001).

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). 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 powerlines (Shaw 2013).

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

The powerline sensitive SCC which are vulnerable to this impact in the assessment corridor are the following:

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN

The pre- mitigation impact is rated as **High** and the post-mitigation impact is rated as **Low**. Recommended mitigation are as follows:

- Eskom approved Bird Flight Diverters must be fitted to the grid line where it transects areas of medium and high sensitivity (see sensitivity maps Figures 7 and 8), according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines)
- A 500m powerline exclusion zone must be implemented around dams >5 ha and irrigated agricultural lands to reduce the risk of powerline collisions of powerline sensitive species drawn to dams (especially Blue Cranes)

and agricultural lands (Blue Cranes and Ludwig's Bustard). An exception to this is the dam situated at 31°48'16.44"S, 22°57'51.38"E. Routing the line around this dam would traverse sensitive Riverine Rabbit habitat that also falls within a Northern Cape Critical Biodiversity Area. In this instance, it would be preferable to route the line through the exclusion zone and mark the line with LED type bird flight diverters to ensure visibility of the line during low light conditions, should the dam at any given time be used as a roost site by Blue Cranes.

14.3. Cumulative impacts

The proposed 400kV grid line equates to a maximum of 110km. Based on the information publicly available, the existing and planned high voltage lines within a 35km radius around the assessment corridor equates to approximately 600km (counting parallel lines as one). The proposed development will thus increase the total number of existing and planned high voltage lines by 18%.

When viewed on its own, the contribution of the proposed 400kV gridline and substation expansion to the pre-mitigation cumulative collision and displacement impact on powerline sensitive avifauna of all the high voltage lines is considered **Medium**, but could be reduced to **Low** with mitigation. However, the combined pre-mitigation cumulative impact of all the existing and planned powerlines, including the planned Gamma 400kV gridline (approximately 710km), on powerline sensitive avifauna within a 35km radius, is considered to be **High** pre-mitigation for the collision risk, but could be reduced to **Medium** with mitigation. As far as displacement due to disturbance and habitat transformation is concerned, the cumulative impact of all the existing and planned high voltage lines, and substations, is assessed to be **Medium** pre-mitigation, but reducible to **Low** with appropriate mitigation.

14.4. Conclusion and Impact Statement

The expected pre-mitigation impacts of the proposed development range from **Low** to **High** significance and negative status. However, with appropriate mitigation, the post-mitigation significance of the identified impacts should be reduced to **Low** negative (see Tables 10 - 12). No fatal flaws were discovered in the course of the investigation. It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 10 of the report) and repeated in the EMPr (Appendix 4) are strictly implemented.

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APPENDIX 1: SABAP 2 SPECIES LIST FOR THE ASSESSMENT CORRIDOR AND SURROUNDINGS

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Acacia Pied Barbet	*Tricholaema leucomelas*	54.4	8.01	-	-
African Black Duck	*Anas sparsa*	4	0.28	-	-
African Black Swift	*Apus barbatus*	4	0.00	-	-
African Darter	*Anhinga rufa*	0.8	0.00	-	-
African Fish Eagle	*Haliaeetus vocifer*	0.8	0.55	-	-
African Harrier-Hawk	*Polyboroides typus*	4	0.28	-	-
African Hoopoe	*Upupa africana*	16	1.38	-	-
African Openbill	*Anastomus lamelligerus*	0.8	0.00	-	-
African Pipit	*Anthus cinnamomeus*	16	1.93	-	-
African Red-eyed Bulbul	*Pycnonotus nigricans*	69.6	13.26	-	-
African Reed Warbler	*Acrocephalus baeticatus*	11.2	1.11	-	-
African Rock Pipit	*Anthus crenatus*	10.4	1.38	NT	NT
African Sacred Ibis	*Threskiornis aethiopicus*	9.6	1.93	-	-
African Spoonbill	*Platalea alba*	8.8	0.83	-	-
African Stonechat	*Saxicola torquatus*	4.8	1.93	-	-
Alpine Swift	*Tachymarptis melba*	12.8	0.00	-	-
Ant-eating Chat	*Myrmecocichla formicivora*	44.8	14.09	-	-
Barn Swallow	*Hirundo rustica*	25.6	7.46	-	-
Bar-throated Apalis	*Apalis thoracica*	0.8	0.00	-	-
Black Harrier	*Circus maurus*	1.6	0.00	EN	EN
Black Stork	*Ciconia nigra*	4	0.28	-	VU
Black-chested Prinia	*Prinia flavicans*	0.8	0.55	-	-
Black-eared Sparrow-Lark	*Eremopterix australis*	10.4	1.11	-	-
Black-headed Canary	*Serinus alario*	17.6	6.63	-	-
Black-headed Heron	*Ardea melanocephala*	8.8	0.55	-	-
Blacksmith Lapwing	*Vanellus armatus*	29.6	0.83	-	-
Black-throated Canary	*Crithagra atrogularis*	16.8	3.59	-	-
Black-winged Kite	*Elanus caeruleus*	7.2	0.00	-	-
Black-winged Stilt	*Himantopus himantopus*	6.4	0.55	-	-
Blue Crane	*Grus paradisea*	28	8.84	VU	NT
Bokmakierie	*Telophorus zeylonus*	62.4	8.01	-	-
Booted Eagle	*Hieraaetus pennatus*	4.8	1.93	-	-
Brown-hooded Kingfisher	*Halcyon albiventris*	3.2	0.00	-	-
Brown-throated Martin	*Riparia paludicola*	20.8	2.49	-	-
Buffy Pipit	*Anthus vaalensis*	0.8	0.00	-	-
Cape Bunting	*Emberiza capensis*	45.6	5.80	-	-
Cape Canary	*Serinus canicollis*	3.2	0.28	-	-
Cape Crow	*Corvus capensis*	21.6	15.75	-	-
Cape Penduline Tit	*Anthoscopus minutus*	16.8	1.11	-	-
Cape Robin-Chat	*Cossypha caffra*	44	3.87	-	-
Cape Sparrow	*Passer melanurus*	69.6	16.85	-	-
Cape Turtle Dove	*Streptopelia capicola*	63.2	11.88	-	-
Cape Wagtail	*Motacilla capensis*	53.6	12.15	-	-
Cape Weaver	*Ploceus capensis*	3.2	0.00	-	-
Cape White-eye	*Zosterops virens*	38.4	5.25	-	-
Capped Wheatear	*Oenanthe pileata*	8	0.83	-	-
Cardinal Woodpecker	*Dendropicos fuscescens*	3.2	0.28	-	-
Chat Flycatcher	*Melaenornis infuscatus*	27.2	4.97	-	-
Chestnut-vented Warbler	*Curruca subcoerulea*	35.2	2.21	-	-
Cinnamon-breasted Bunting	*Emberiza tahapisi*	1.6	0.55	-	-
Cinnamon-breasted Warbler	*Euryptila subcinnamomea*	0.8	0.00	-	-

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Common Buzzard	*Buteo buteo*	4	3.31	-	-
Common Greenshank	*Tringa nebularia*	2.4	0.00	-	-
Common House Martin	*Delichon urbicum*	0.8	0.00	-	-
Common Moorhen	*Gallinula chloropus*	2.4	0.00	-	-
Common Ostrich	*Struthio camelus*	2.4	0.28	-	-
Common Quail	*Coturnix coturnix*	0.8	0.00	-	-
Common Starling	*Sturnus vulgaris*	4.8	0.28	-	-
Common Waxbill	*Estrilda astrild*	20.8	3.31	-	-
Crowned Lapwing	*Vanellus coronatus*	8	0.28	-	-
Desert Cisticola	*Cisticola aridulus*	3.2	0.28	-	-
Diederik Cuckoo	*Chrysococcyx caprius*	4	0.55	-	-
Double-banded Courser	*Rhinoptilus africanus*	1.6	0.00	-	-
Dusky Sunbird	*Cinnyris fuscus*	33.6	2.76	-	-
Eastern Clapper Lark	*Mirafra fasciolata*	20	2.76	-	-
Egyptian Goose	*Alopochen aegyptiaca*	42.4	6.08	-	-
European Bee-eater	*Merops apiaster*	6.4	1.66	-	-
Fairy Flycatcher	*Stenostira scita*	17.6	1.38	-	-
Familiar Chat	*Oenanthe familiaris*	55.2	7.18	-	-
Fiscal Flycatcher	*Melaenornis silens*	36	3.31	-	-
Fork-tailed Drongo	*Dicrurus adsimilis*	6.4	0.28	-	-
Gabar Goshawk	*Micronisus gabar*	8	0.00	-	-
Greater Double-collared Sunbird	*Cinnyris afer*	0.8	0.00	-	-
Greater Kestrel	*Falco rupicoloides*	8	3.31	-	-
Greater Striped Swallow	*Cecropis cucullata*	42.4	7.46	-	-
Grey Heron	*Ardea cinerea*	12.8	0.83	-	-
Grey Tit	*Melaniparus afer*	8.8	3.59	-	-
Grey-backed Cisticola	*Cisticola subruficapilla*	49.6	3.87	-	-
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	25.6	2.76	-	-
Grey-winged Francolin	*Scleroptila afra*	8	1.11	-	-
Ground Woodpecker	*Geocolaptes olivaceus*	1.6	0.00	NT	LC
Hadada Ibis	*Bostrychia hagedash*	40.8	4.70	-	-
Hamerkop	*Scopus umbretta*	12	0.28	-	-
Helmeted Guineafowl	*Numida meleagris*	12.8	1.38	-	-
House Sparrow	*Passer domesticus*	35.2	6.08	-	-
Jackal Buzzard	*Buteo rufofuscus*	40	8.56	-	-
Karoo Chat	*Emarginata schlegelii*	41.6	8.84	-	-
Karoo Eremomela	*Eremomela gregalis*	3.2	1.11	-	-
Karoo Korhaan	*Eupodotis vigorsii*	40	4.70	-	NT
Karoo Lark	*Calendulauda albescens*	8.8	0.55	-	-
Karoo Long-billed Lark	*Certhilauda subcoronata*	48	8.29	-	-
Karoo Prinia	*Prinia maculosa*	55.2	5.25	-	-
Karoo Scrub Robin	*Cercotrichas coryphoeus*	71.2	10.22	-	-
Karoo Thrush	*Turdus smithi*	38.4	7.73	-	-
Kittlitz's Plover	*Charadrius pecuarius*	0.8	0.28	-	-
Kori Bustard	*Ardeotis kori*	0	0.28	NT	NT
Lanner Falcon	*Falco biarmicus*	4	2.21	-	VU
Large-billed Lark	*Galerida magnirostris*	22.4	2.76	-	-
Lark-like Bunting	*Emberiza impetuani*	68.8	14.09	-	-
Laughing Dove	*Spilopelia senegalensis*	34.4	6.63	-	-
Layard's Warbler	*Curruca layardi*	32	1.93	-	-
Lesser Kestrel	*Falco naumanni*	0	0.28	-	-
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	2.4	0.28	-	-

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
Levaillant's Cisticola	*Cisticola tinniens*	17.6	0.28	-	-
Little Bittern	*Ixobrychus minutus*	0	0.28	-	-
Little Egret	*Egretta garzetta*	0.8	0.00	-	-
Little Grebe	*Tachybaptus ruficollis*	6.4	0.28	-	-
Little Stint	*Calidris minuta*	0.8	0.00	-	-
Little Swift	*Apus affinis*	21.6	6.63	-	-
Long-billed Crombec	*Sylvietta rufescens*	15.2	0.83	-	-
Long-billed Pipit	*Anthus similis*	1.6	0.00	-	-
Ludwig's Bustard	*Neotis ludwigii*	10.4	2.21	EN	EN
Malachite Kingfisher	*Corythornis cristatus*	3.2	0.00	-	-
Malachite Sunbird	*Nectarinia famosa*	22.4	1.38	-	-
Martial Eagle	*Polemaetus bellicosus*	8	3.59	EN	EN
Mountain Wheatear	*Myrmecocichla monticola*	47.2	7.46	-	-
Namaqua Dove	*Oena capensis*	20.8	1.66	-	-
Namaqua Sandgrouse	*Pterocles namaqua*	12.8	0.00	-	-
Namaqua Warbler	*Phragmacia substriata*	24.8	1.66	-	-
Neddicky	*Cisticola fulvicapilla*	10.4	0.28	-	-
Nicholson's Pipit	*Anthus nicholsoni*	23.2	0.83	-	-
Northern Black Korhaan	*Afrotis afraoides*	4	1.11	-	-
Orange River White-eye	*Zosterops pallidus*	1.6	0.00	-	-
Pale Chanting Goshawk	*Melierax canorus*	40	9.67	-	-
Pale-winged Starling	*Onychognathus nabouroup*	35.2	5.80	-	-
Pied Avocet	*Recurvirostra avosetta*	7.2	1.38	-	-
Pied Crow	*Corvus albus*	63.2	33.15	-	-
Pied Kingfisher	*Ceryle rudis*	1.6	0.00	-	-
Pied Starling	*Lamprotornis bicolor*	46.4	15.47	-	-
Pin-tailed Whydah	*Vidua macroura*	3.2	1.11	-	-
Plain-backed Pipit	*Anthus leucophrys*	2.4	0.00	-	-
Pririt Batis	*Batis pririt*	17.6	1.66	-	-
Quailfinch	*Ortygospiza atricollis*	0.8	0.00	-	-
Red-billed Firefinch	*Lagonosticta senegala*	1.6	0.00	-	-
Red-billed Quelea	*Quelea quelea*	4	0.55	-	-
Red-billed Teal	*Anas erythrorhyncha*	5.6	0.00	-	-
Red-capped Lark	*Calandrella cinerea*	8	0.83	-	-
Red-eyed Dove	*Streptopelia semitorquata*	21.6	2.76	-	-
Red-faced Mousebird	*Urocolius indicus*	23.2	1.38	-	-
Red-headed Finch	*Amadina erythrocephala*	4.8	1.66	-	-
Red-knobbed Coot	*Fulica cristata*	4	0.28	-	-
Red-winged Starling	*Onychognathus morio*	25.6	5.80	-	-
Reed Cormorant	*Microcarbo africanus*	8	0.55	-	-
Rock Dove	*Columba livia*	2.4	0.28	-	-
Rock Kestrel	*Falco rupicolus*	43.2	4.42	-	-
Rock Martin	*Ptyonoprogne fuligula*	60	5.52	-	-
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0.8	0.28	-	-
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	0.8	0.00	-	-
Rufous-eared Warbler	*Malcorus pectoralis*	64	10.77	-	-
Sabota Lark	*Calendulauda sabota*	20	1.38	-	-
Scaly-feathered Weaver	*Sporopipes squamifrons*	5.6	0.00	-	-
Secretarybird	*Sagittarius serpentarius*	4	1.11	EN	VU
Short-toed Rock Thrush	*Monticola brevipes*	2.4	0.00	-	-
Sickle-winged Chat	*Emarginata sinuata*	23.2	5.80	-	-
South African Cliff Swallow	*Petrochelidon spilodera*	1.6	1.38	-	-

Species name	Scientific name	SABAP2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status
South African Shelduck	*Tadorna cana*	33.6	5.80	-	-
Southern Double-collared Sunbird	*Cinnyris chalybeus*	15.2	1.11	-	-
Southern Fiscal	*Lanius collaris*	54.4	6.35	-	-
Southern Grey-headed Sparrow	*Passer diffusus*	16.8	1.66	-	-
Southern Masked Weaver	*Ploceus velatus*	61.6	13.54	-	-
Southern Red Bishop	*Euplectes orix*	13.6	2.49	-	-
Southern Tchagra	*Tchagra tchagra*	0.8	0.00	-	-
Speckled Mousebird	*Colius striatus*	1.6	0.00	-	-
Speckled Pigeon	*Columba guinea*	44.8	5.52	-	-
Spike-heeled Lark	*Chersomanes albofasciata*	30.4	5.80	-	-
Spotted Eagle-Owl	*Bubo africanus*	5.6	0.55	-	-
Spotted Thick-knee	*Burhinus capensis*	1.6	0.28	-	-
Spur-winged Goose	*Plectropterus gambensis*	8	0.28	-	-
Tawny Eagle	*Aquila rapax*	1.6	1.93	VU	EN
Three-banded Plover	*Charadrius tricollaris*	29.6	1.38	-	-
Tractrac Chat	*Emarginata tractrac*	1.6	0.00	-	-
Verreaux's Eagle	*Aquila verreauxii*	26.4	5.80	-	VU
Wattled Starling	*Creatophora cinerea*	8.8	0.00	-	-
Western Barn Owl	*Tyto alba*	0.8	0.00	-	-
Western Cattle Egret	*Bubulcus ibis*	2.4	0.00	-	-
White Stork	*Ciconia ciconia*	0	0.55	-	-
White-backed Mousebird	*Colius colius*	48.8	5.80	-	-
White-breasted Cormorant	*Phalacrocorax lucidus*	0.8	0.00	-	-
White-faced Whistling Duck	*Dendrocygna viduata*	0.8	0.00	-	-
White-necked Raven	*Corvus albicollis*	32.8	7.73	-	-
White-rumped Swift	*Apus caffer*	12.8	1.66	-	-
White-throated Canary	*Crithagra albogularis*	43.2	7.18	-	-
White-throated Swallow	*Hirundo albigularis*	16.8	1.11	-	-
Yellow Canary	*Crithagra flaviventris*	9.6	3.31	-	-
Yellow-bellied Eremomela	*Eremomela icteropygialis*	17.6	3.31	-	-
Yellow-billed Duck	*Anas undulata*	19.2	1.38	-	-
Zitting Cisticola	*Cisticola juncidis*	0.8	0.00	-	-

APPENDIX 2: HABITAT WITHIN THE ASSESSMENT CORRIDOR

Figure 1: Typical Nama Karoo shrubland which comprises the vast majority of the study area.

Figure 2: An ephemeral drainage line.

Figure 3: A large dam in the assessment corridor

Figure 4: Woodland associated with a drainage line in the assessment corridor

Figure 5: Rocky ridges and mesas in the assessment corridor

Figure 6: An example of stands of alien trees in the assessment corridor

Figure 7: An active Verreaux's Eagle nest on existing HV powerlines within the assessment corridor

APPENDIX 3: SITE SENSITIVITY VERIFICATION REPORT

1. INTRODUCTION

In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations [4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended], various aspects of the proposed 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. In accordance with GN 320 (20 March 2020)[6] and GN 1150 (30 October 2020)of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project areas as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool). Chris van Rooyen, in association with Albert Froneman, as avifaunal specialists, have been commissioned to verify the sensitivity of the assessment corridor under these specialist protocols.

Figure 1: Locality map indicating the location of the assessment corridor near Three Sisters, Northern Cape Province.

2. SITE SENSITIVITY VERIFICATION METHODOLOGY

The following information sources were consulted to compile this report:

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the proposed development is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5' × 5'). Each pentad

[6] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation

is approximately 8 × 7.6 km. To get a more representative impression of the birdlife, a consolidated data set of 44 pentads was obtained for all pentads which intersect with the assessment corridor, as well those a number of neighbouring pentads with similar habitat characteristics. The decision to include multiple pentads around the assessment corridor was influenced by the fact that the pentads within which the proposed assessment corridor is located have relatively few completed full protocol surveys. The additional pentads and their data augment the bird distribution data. A total of 136 full protocol lists (i.e. bird listing surveys lasting a minimum of two hours each) and 319 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed to date for the 44 pentads within which the assessment corridor is located. The SABAP2 data is regarded as a reliable reflection of the avifauna which occurs in the area and is supplemented with data collected during the site visit and data collected during pre-construction monitoring at several renewable energy projects in Karoo habitat.

- A classification of the vegetation types in the assessment corridor was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (SANBI 2018).
- 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, Lesotho and Swaziland (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 latest (2022.1) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015; http://www.birdlife.org.za/conservation/important-bird-areas) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth © 2022) was used in order to view the broader area on a landscape level and to help identify bird habitat on the ground.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the assessment corridor relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the assessment corridor (July, 2022).
- Primary avifaunal diversity and habitat data was collected during a single, two-day site visit conducted on 12 - 13 July 2022. Data was collected by means of incidental counts from a vehicle and helicopter.

3. OUTCOME OF SITE SENSITIVITY VERIFICATION

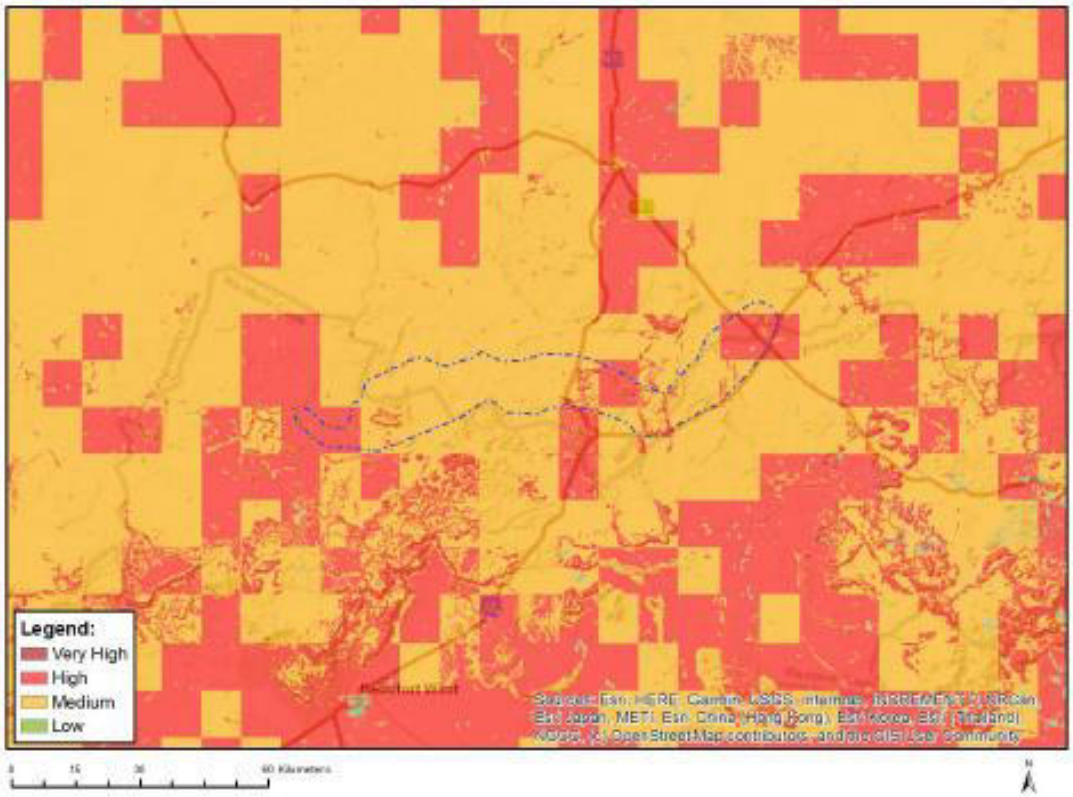
The assessment corridor is classified as **MEDIUM and HIGH** sensitivity for terrestrial animals according to the Terrestrial Animal Species Theme (Figure 2). The High classification is linked to the potential occurrence of species of conservation concern (SCC) namely Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered), Black Stork *Ciconia nigra* (Regionally Vulnerable), Verreaux's Eagle *Aquila verreauxii* (Regionally Vulnerable), and Lanner Falcon *Falco biarmicus* (Regionally Vulnerable). The Medium classification is linked to Caspian Tern *Hydroprogne caspia* (Regionally Vulnerable), Ludwig's Bustard, Verreaux's Eagle and Black Stork.

Verreaux's Eagle, Tawny Eagle *Aquila rapax* (Regionally Endangered), Ludwig's Bustard, Blue Crane and Karoo Korhaan *Eupodotis vigorsii* (Regionally Near threatened) were recorded during the field inspection in 12-13 July 2022. In addition, the assessment corridor contains breeding Martial Eagle *Polemaetus bellicosus* (Globally and Regionally Endangered) and habitat for Secretarybird *Sagittarius serpentarius* (Globally Endangered, Regionally Vulnerable).

4. CONCLUSION

Based on aforementioned information, a classification of **HIGH** sensitivity for avifauna for the assessment corridor is suggested.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Ciconia nigra
High	Aves-Neotis ludwigii
High	Aves-Falco biarmicus
High	Aves-Aquila verreauxii
High	Mammalia-Bunolagus monticularis
Low	Subject to confirmation
Medium	Aves-Hydroprogne caspia
Medium	Aves-Neotis ludwigii
Medium	Aves-Aquila verreauxii
Medium	Aves-Ciconia nigra
Medium	Mammalia-Bunolagus monticularis
Medium	Reptilia-Chersobius boulengeri

Figure 2: The National Web-Based Environmental Screening Tool map of the assessment corridor, indicating sensitivities for the Terrestrial Animal Species theme. The High sensitivity classification is linked to Ludwig's Bustard *Neotis ludwigii*, Verreaux's Eagle *Aquila verreauxii*, Lanner Falcon *Falco biarmicus* and Black Stork *Ciconia nigra*. The medium classification is linked to Caspian Tern *Hydropreogne caspia*, Ludwig's Bustard, Verreaux's Eagle and Black Stork.

APPENDIX 4: ENVIRONMENTAL MANAGEMENT PROGRAMME						
Design Phase						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for implementation	Responsible person	Frequency	Evidence of compliance
– Implement no disturbance buffer zones for selective powerline sensitive SCC nests	Project Developer	• 1km infrastructure exclusion zones must be implemented around all Verreaux's Eagle nests, except nests on existing high voltage lines. • 2.5km infrastructure exclusion zones must be implemented around all Martial Eagle nests except nests on existing high voltage lines. • In the case of SCC (eagle) nests on existing high voltage lines, the infrastructure no-go zone can be relaxed. The short-term disturbance of the eagles is less detrimental than the long-term collision risk that the new powerline will pose in a pristine area. • A 500m powerline exclusion zone must be implemented around dams >5 ha and irrigated agricultural lands to reduce the risk of powerline collisions of powerline sensitive species drawn to dams (especially Blue Cranes) and agricultural lands (Blue Cranes and Ludwig's Bustard). **This is not applicable to roads.** An exception to the powerline exclusion zone is the dam situated at 31°48'16.44"S, 22°57'51.38"E. Routing the line around this dam would traverse sensitive riverine rabbit habitat that also falls within a Northern Cape Critical Biodiversity Area. In this instance, it would be	Design phase	Project Developer	Once-off during design phase	Written approval of the final powerline routing by the avifaunal specialist.

		preferable to route the line through the exclusion zone and mark the line with LED type bird flight diverters to ensure visibility of the line during low light conditions, should the dam at any given time be used as a roost site by Blue Cranes. • Maximum use of existing roads, where possible. New roads only to be constructed if existing roads cannot be utilised. • Where technically possible, the proposed gridline should run parallel to an existing high voltage line for as much as possible to reduce the impact of habitat fragmentation.				
Construction phase						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for implementation	Responsible person	Frequency	Evidence of compliance
– Minimize the noise and movement associated with the construction activities at the development footprint to reduce the risk of displacement of avifauna.	Project manager/ECO Avifaunal specialist	• Conduct an avifaunal walk-through of the final switching station layout and powerline alignment to identify priority species that may be breeding within the final footprint. If an SSC nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimizing the potential disturbance to the breeding birds during the construction period, if possible. This could include measures such as delaying some of the activities until after the breeding season, provided the construction schedule can accommodate it.	Construction phase	Project manager/ECO	• Walk-through: Once-off at least one month before construction starts • Other actions: Monthly	ECO records and audit reports

		• Driving must be restricted to the designated roads. • Measures to control noise and dust must be implemented according to the generic EMPr for overhead power line development • Access to the property outside of the designated construction areas to be strictly controlled.				
– Restrict the construction activities to the development footprint as much as possible to reduce the risk of excessive degradation and transformation of the habitat.	Project manager/ECO	• The recommendations in the vegetation specialist report must be strictly implemented	Construction phase	Project manager/ECO	Ongoing	ECO records and audit reports
– Mark selected sections of the overhead powerline with Eskom approved Bird Flight Diverters (BFDs) to reduce collision mortality of avifauna.	Project manager/ECO	• Eskom approved Bird Flight Diverters must be fitted to the grid line where it transects areas of medium and high sensitivity (see sensitivity map), according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines) • In the case of the dam situated at 31°48'16.44"S, 22°57'51.38"E it would be preferable to route the line through the exclusion zone and mark the line with LED type bird flight diverters to ensure visibility of the line during low light conditions, should the dam at any given time be used as a roost site by Blue Cranes. This is to avoid disturbance of sensitive Riverine Rabbit habitat and a Critical Biodiversity Area.	Construction phase	Project manager/ECO	Once-off when the earth wires are strung	ECO records and audit reports

Operational Phase						
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible person	Method of implementation	Timeframe for implementation	Responsible person	Frequency	Evidence of compliance
– Maintenance of LED flappers for the operational lifetime of the gridline.	Owner of the gridline	Check and if required maintain/repair/replace the LED type bird flight diverters at the dam situated at 31°48'16.44"S, 22°57'51.38"E where the powerline is routed through the proposed avifaunal exclusion zone.	Operational phase	Owner of the gridline	Annually	Audit report by avifaunal specialist

APPENDIX 5: CURRICILUM VITAE

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	20 years
SACNASP Reg Nr:	:	Registered Professional Natural Scientist (reg. nr 400177/09) – specialist field: Zoological Science

Key Qualifications

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

Key Project Experience

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

1. Jeffrey's Bay Wind Farm – 12-months preconstruction avifaunal monitoring project
2. Oysterbay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
3. Ubuntu Wind Energy Project near Jeffrey's Bay – 12-months preconstruction avifaunal monitoring project
4. Bana-ba-Pifu Wind Energy Project near Humansdorp – 12-months preconstruction avifaunal monitoring project
5. Excelsior Wind Energy Project near Caledon – 12-months preconstruction avifaunal monitoring project
6. Laingsburg 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 Utrecht 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. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
28. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
29. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
30. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
31. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
32. Mañhica Wind Energy Facility 12-month bird monitoring & EIA specialist study (Windlab)
33. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
34. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre- construction monitoring (ABO). Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
35. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
36. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
37. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
38. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
39. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
40. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
41. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
42. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
43. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
44. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
45. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
46. Pofadder Wind Energy Facility, Northren Cape, Screening Report (Atlantic Energy)
47. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
48. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
49. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment studies and / or GIS analysis:

1. Aviation Bird Hazard Assessment Study for the proposed Madiba Bay Leisure Park adjacent to Port Elizabeth Airport.
2. Extension of Runway and Provision of Parallel Taxiway at Sir Seretse Khama Airport, Botswana Bird / Wildlife Hazard Management Specialist Study
3. Maun Airport Improvements Bird / Wildlife Hazard Management Specialist Study
4. Bird Impact 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
19. Avifaunal Impact Scoping & EIA Study - Renosterberg Wind Farm and Solar PV site
20. Bird Impact Assessment Study - Proposed 60 year Ash Disposal Facility near to the Kusile Power Station
21. Avifaunal pre-feasibility assessment for the proposed Montrose dam, Mpumalanga
22. Bird Impact Assessment Study – Proposed ESKOM Phantom Substation near Knysna, Western Cape
23. Habitat sensitivity map for Denham's Bustard, Blue Crane and White-bellied Korhaan in the Kouga Municipal area of the Eastern Cape Province
24. Swaziland Civil Aviation Authority – Sikhuphe International Airport – Bird hazard management assessment
25. Avifaunal monitoring – extension of Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
26. Avifaunal Specialist Study – Rooikat Hydro Electric Dam – Hope Town, Northern Cape
27. The Stewards Pan Reclamation Project – Bird Impact Assessment study
28. Airports Company South Africa – Avifaunal Specialist Consultant – Airport Bird and Wildlife Hazard Mitigation

Geographic Information System analysis & maps

1. ESKOM Power line Makgalakwena EIA – GIS specialist & map production
2. ESKOM Power line 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. Proposed Heilbron filling station EIA – GIS specialist & map production
30. ESKOM Lebatlhane EIA – GIS specialist & map production
31. ESKOM Pienaars River CNC EIA – GIS specialist & map production
32. ESKOM Lemara Phiring Ohrigstad EIA – GIS specialist & map production
33. ESKOM Pelly-Warmbad EIA – GIS specialist & map production
34. ESKOM Rosco-Bracken EIA – GIS specialist & map production
35. ESKOM Ermelo-Uitkoms EIA – GIS specialist & map production
36. ESKOM Wisani bridge EIA – GIS specialist & map production
37. City of Tswane – New bulkfeeder pipeline projects x3 Map production
38. ESKOM Lebohang Substation and 132kV Distribution Power Line Project Amendment GIS specialist & map production
39. ESKOM Geluk Rural Powerline GIS & Mapping
40. Eskom Kimberley Strengthening Phase 4 Project GIS & Mapping
41. ESKOM Kwaggafontein - Amandla Amendment Project GIS & Mapping
42. ESKOM Lephalale CNC – GIS Specialist & Mapping
43. ESKOM Marken CNC – GIS Specialist & Mapping
44. ESKOM Lethabong substation and powerlines – GIS Specialist & Mapping
45. ESKOM Magopela- Pitsong 132kV line and new substation – GIS Specialist & Mapping

Professional affiliations

South African Council for Natural Scientific Professions (SACNASP) registered Professional Natural Scientist (reg. nr 400177/09) – specialist field: Zoological Science. Registered since 2009.

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	26 years

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.

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. Koup 1 and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
55. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
56. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
57. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
58. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
59. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
60. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
61. 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).
70. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 24 months operational phase monitoring (Mainstream).
71. Great Karoo Wind Energy Facility, Richmond, Northern Cape, 12 months pre-construction monitoring, African Green Ventures.
72. Ezelsjacht Wind Energy Facility, De Doorns, Western Cape, 12-months pre-construction monitoring Mainstream Renewable Power.
73. Canopus Wind Energy Facility, Laingsburg, Western Cape, 12-months pre-construction monitoring WKN Windcurrent.
74. Kangnas Wind Energy Facility, Aggeneys, Northern Cape, 24-months operational monitoring, Mainstream Renewable Power.
75. Taaibosch Wind Energy Facility, Lime Acres, Northern Cape, 12-months pre-construction monitoring, Enertrag SA
76. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
77. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
78. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
79. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
80. Kappa Solar PV facility, Touwsrivier, Western Cape, pre-construction monitoring (Veroniva)
81. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
82. Pofadder Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
83. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
84. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
85. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).
86. Iphiko Wind Energy facilities, Laingsburg, Western Cape, screening and pre- construction monitoring (G7 Energies)
87. Kangnas Wind Energy Facility, Northern Cape, Operational Phase 2 years avifaunal monitoring (Mainstream)
88. Perdekraal East Wind Energy Facility, Northern Cape, Operational Phase 2 years avifaunal monitoring (Mainstream)
89. Aberdeen 1, 2 & Aberdeen Kudu (3&4) Wind Energy Facilities, Eastern Cape, 12- month pre-construction monitoring (Atlantic Renewable Energy Partners)
90. Loxton / Beaufort West Wind Energy Facilities, Northern Cape, 12-month pre- construction monitoring (Genesis Eco-Energy Developments)
91. Ermelo & Volksrust Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)

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
23. Aardvark Solar PV facility, Copperton, Northern Cape, 12-month pre-construction monitoring (ABO)
24. Bestwood Solar PV facility, Kathu, Northern Cape, pre-construction monitoring (AMDA)
25. Boundary Solar PV facility, Kimberley, Northern Cape, Site sensitivity verification
26. Rinkhals PV 1 – 6 Solar PV Facility, Kimberley, Northern 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. Section: Springs To Leandra –"Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek N17 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.

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

PROPOSED GAMMA 400kV GRID LINE CONSTRUCTION AND GAMMA SUBSTATION EXPANSION NEAR BEAUFORT WEST, WESTERN CAPE

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:				
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision 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			
Postal address:	PO Box 2676, Fourways, 2122			
Postal code:	2055	Cell:	0824549570	
Telephone:	0824549570	Fax:		
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Christiaan Stephanus 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

Name of Company: Afrimage Photography t/a Chris van Rooyen Consulting

23 August 2022

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Christiaan Stephanus 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 t/a Chris van Rooyen Consulting

Name of Company

22 August 2022

Date

Signature of the Commissioner of Oaths

23/08/2022.

Date

MAGRIETHA CORNELIA SCHOLTZ
COMMISSIONER OF OATHS
Suite 1, 5 Main Street
P.O. Box 1408
Plettenberg Bay 6600, South Africa
Practising Attorney R.S.A