

# BIRD IMPACT ASSESSMENT

## Geel Kop Grid Connection Infrastructure

**Basic Assessment for the proposed construction and operation of grid connection infrastructure for seven PV facilities near Upington in the Northern Cape Province**

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*Report prepared for:  
Geelkop Grid (Pty) Ltd*

*Report prepared by:  
Chris van Rooyen Consulting*

December 2020

## Specialist Expertise

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### Curriculum vitae: Chris van Rooyen

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

### Key Experience

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

### Professional affiliations

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

### Curriculum vitae: Albert Froneman

Profession/Specialisation : Avifaunal Specialist  
Highest Qualification : MSc (Conservation Biology)  
Nationality : South African  
Years of experience : 20 years

### Key Qualifications

Albert Froneman (Pr.Sci.Nat) has more than 20 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 (Registration Number 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

## **Specialist Declaration**

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I, Chris van Rooyen, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended), hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 not, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study 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.

Name of Specialist: Chris van Rooyen



Signature of the specialist: \_\_\_\_\_

Date: 7 December 2020

# Executive Summary

Geel Kop Grid (Pty) Ltd proposes the construction and operation of grid infrastructure which will facilitate the connection of six facility switching stations / substations to a collector switching station, and then a 132kV powerline will connect the collector switching station to the National Grid via the Upington Main Transmission Substation (MTS). The grid connection infrastructure comprises the following:

- Three switching stations:
  - GK Solar PV switching station;
  - Shrubland PV switching station; and
  - Karroid PV switching station.
- One collector switching station [Geel Kop collector substation (Alt 1) or Bushmanland PV collector switching station (Alt 2)];
- Four single or double circuit 33kV or 132kV lines from the switching stations / facility substations to the chosen collector switching station; and
- One double circuit 132kV power line from the chosen collector switching station to the Upington Main Transmission Substation (MTS).

## 1. Summary of Findings and Recommendations

It is estimated that a total of 203 bird species could potentially occur in the broader area – Appendix 2 provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring. Of the priority species potentially occurring in the broader area, 26 could potentially occur in the study area. Eight of these are South African Red List species, and three are globally Red listed.

The proposed project will have the following potential impacts on avifauna:

- Displacement due to disturbance associated with the construction of the substations/switching stations, grid connection and associated infrastructure.
- Electrocutions in the on-site substation/switching stations
- Collisions with the 132kV grid connection
- Displacement due to disturbance associated with the decommissioning of the substations/switching stations, grid connection and associated infrastructure.

### 1.1 Displacement due to disturbance associated with the construction of the substations/switching stations, grid connection and associated infrastructure.

Construction could impact on birds through temporary displacement due to disturbance, particularly for larger species. This could lead to breeding failure if the disturbance happens during a critical stage of the breeding cycle. The reporting rates for Red List species in the broader area are generally low, which is an indication that they are not regularly utilising the area for breeding. However, there is a possibility of disturbing of a breeding pair of ground nesting priority species during the construction of the substations/switching stations.

Species potentially at risk of displacement due to disturbance are the following:

- Karoo Korhaan
- Kori Bustard
- Secretarybird
- Northern Black Korhaan

- Namaqua Sandgrouse
- Spotted Eagle-owl
- Helmeted Guineafowl
- Ludwig's Bustard

**The impact is assessed to be Low before mitigation, and Very Low after mitigation.** The proposed mitigation measures are (1) construction activity should be restricted to the immediate footprint of the infrastructure (2) access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifauna (3) measures to control noise should be applied according to current best practice in the industry (4) maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum and (5) a walk-through must be conducted by the avifaunal specialist when the final pole positions have been determined, to assess whether there are any Red List species breeding in the vicinity of the final alignment, which could be displaced by the construction activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of construction activities.

## 1.2 Electrocutation of priority species

Electrocutation 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). There could be an electrocution risk to certain species, mostly raptors, but also some waterbirds, in the substation yard of the onsite substations/switching stations, and on some of the pole designs.

Species potentially at risk of electrocution in the substation yard and inverter station are the following:

- Barn Owl
- Black-headed Heron
- Booted Eagle
- Egyptian Goose
- Greater Kestrel
- Lanner Falcon
- Martial Eagle
- Southern Pale Chanting Goshawk
- Spotted Eagle-Owl
- Spur-winged Goose
- Steppe Buzzard
- Tawny Eagle
- Pied Crow
- Helmeted Guineafowl

**The impact is assessed to be Low before mitigation, and Very Low after mitigation.** With regards to the infrastructure within the yard, the hardware is too complex to recommend any mitigation for electrocution at this stage. It is instead recommended that if any impacts are recorded once operational, site specific mitigation should be applied reactively. It is recommended that the 7611/7622/T2002 intermediate pole is avoided.

## 1.3 Mortality of priority species due to collisions with the grid connection

Collisions with the earthwire are probably the biggest single threat posed by the proposed grid connection to priority species in the study area. Most heavily impacted upon heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004; Anderson 2001; Shaw 2013).

Species potentially at risk of collisions with the earthwire of the grid connection are the following:

- Black-headed Heron
- Booted Eagle
- Egyptian Goose
- Martial Eagle
- Spur-winged Goose
- Tawny Eagle
- Abdim's Stork
- Cattle Egret
- Karoo Korhaan
- Kori Bustard
- Ludwig's Bustard
- Secretarybird
- South African Shelduck
- White-faced Duck
- Yellow-billed Duck
- Northern Black Korhaan
- Namaqua Sandgrouse

**The impact is assessed to be Moderate before mitigation, and Low after mitigation.** The preferred alternative from an avifaunal impact perspective is Alternative 2 because it follows the existing McTaggerts/Oasis 132kV powerline. This will reduce the impact significantly because it restricts the length of line which will constitute a new impact from 35km to 19km. It is therefore recommended that this option is used.

However, should it not be possible to utilise this option due to technical reasons, Updated Alternative 1 could also be acceptable. The Updated Alternative 1 will run next to the proposed Aries 400kV, (should it eventually be built) for a substantial length, and then mostly along the busy N14 provincial road. It is thought that by placing two lines together, the birds will benefit from the combined increased profile of the two lines, making the obstacle more visible to the birds (APLIC 2012). It is furthermore likely that powerline sensitive species will avoid the vicinity of the N14, thereby reducing the risk of collisions with the powerline.

It is furthermore recommended that Eskom approved bird flight diverters be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.

#### **1.4 Displacement due to disturbance associated with the de-commissioning of the substations/switching stations, grid connection and associated infrastructure.**

De-commissioning could impact on birds through temporary displacement due to disturbance, particularly for larger species. This could lead to breeding failure if the disturbance happens during a critical stage of the breeding cycle. The reporting rates for Red List species in the broader area are generally low, which is an indication that they are not regularly utilising the area for breeding. However, there is a possibility of disturbing of a breeding pair of ground nesting priority species during the de-commissioning of the substations/switching stations.

Species potentially at risk of displacement due to disturbance are the following:

- Karoo Korhaan
- Kori Bustard
- Secretarybird
- Northern Black Korhaan
- Namaqua Sandgrouse
- Spotted Eagle-owl
- Helmeted Guineafowl
- Ludwig's Bustard

**The impact is assessed to be Low before mitigation, and Very Low after mitigation.** The proposed mitigation measures are (1) de-commissioning activity should be restricted to the immediate vicinity of the infrastructure (2) access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifauna (3) measures to control noise should be applied according to current best practice in the industry (4) maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum and (5) a walk-through must be conducted by the avifaunal specialist to assess whether there are any breeding Red List species which could be displaced by the de-commissioning activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of activities.

### 1.5 Cumulative impacts

The grid connection will add either 19km (Alternative 2) or 35km (Updated Alternative 1) high voltage line to the existing high voltage network within the 30km radius, depending which option is used. This, together with the planned grid connections of the other planned or constructed projects within the 30km radius, will result in a significant increase in the total length of the high voltage network in this area.

The cumulative impact of the increase in the total length of high voltage lines, particularly mortality due to collisions, is rated as **Moderate, and Low after mitigation.**

#### Overall impact significance rating

Impact	Rating pre-mitigation	Rating post-mitigation
Displacement due to disturbance associated with the construction of the substations/switching stations, grid connection and associated infrastructure.	Low (4)	Very Low (5)
Electrocutions in the onsite substation/switching station yard or grid connection poles.	Low (4)	Very Low (5)
Mortality of priority species due to collisions with the 132kV grid connection.	Moderate (3)	Low (4)
Displacement due to disturbance associated with the de-commissioning of the substations/switching stations, grid connection and associated infrastructure.	Low (4)	Very Low (5)
Cumulative impacts	Moderate (3)	Low (4)
<b>Average:</b>	<b>Moderate (3.6)</b>	<b>Low – Very Low (4.6)</b>

## Final Specialist Statement and Authorisation Recommendation

In terms of an average, the pre-mitigation significance of all potential impacts identified in this specialist study is assessed as halfway between **Low** and **Moderate**, and the post-mitigation significance is assessed as Low to Very Low, leaning more towards **Very Low** (i.e. average of 4.6, as shown in Table 5 above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the EMPr (Appendix 4) are strictly implemented.

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## List of Abbreviations

BA	Basic Assessment
BFD	Bird Flight Diverters
BLSA	BirdLife South Africa
DEFF	Department of Environmental Affairs and Forestry
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EWT	Endangered Wildlife Trust
IBA	Important Bird Area
SABAP 2	Southern African Bird Atlas Project 2

## Glossary

Definitions	
Broader area	The area covered by the SABAP 2 pentads where the proposed development is located.
Study area	A 5km radius around the proposed grid connection corridor alternatives
Priority species	Species which are susceptible to negative interactions with electricity infrastructure due to their morphology and/or behaviour.
Pentad Grid	A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude

## COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS (AS AMENDED)

Requirements of Appendix 6 – GN R982	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain-	Pg. 2 - 3
a) details of-	
i. the specialist who prepared the report; and	
ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Pg.3
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 and 2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1 and 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 4 and Section 6
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 4 and Appendix 4
g) an identification of any areas to be avoided, including buffers;	Section 4 and Appendix 4
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	n/a
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6 and Section 10
k) any mitigation measures for inclusion in the EMPr;	Appendix 4
l) any conditions for inclusion in the environmental authorisation;	Appendix 4
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Appendix 4
n) a reasoned opinion-	Section 10 and Section 11
i. whether the proposed activity, activities or portions thereof should be authorised;	
(iiA) regarding the acceptability of the proposed activity or activities; and	
ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 2
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a
q) any other information requested by the competent authority.	n/a
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	n/a

# BIRD IMPACT ASSESSMENT

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Geel Kop Grid (Pty) Ltd proposes the construction and operation of grid connection infrastructure for the seven PV facilities near Upington in the Northern Cape Province. The grid connection infrastructure comprises the following:

- Three switching stations:
  - GK Solar PV switching station;
  - Shrubland PV switching station; and
  - Karroid PV switching station.
- One collector switching station [Geel Kop collector switching station (Alt 1) or Bushmanland PV collector switching station (Alt 2)];
- Four single or double circuit 33kV or 132kV lines from the switching stations / facility substations to the chosen collector switching station; and
- One double circuit 132kV power line from the chosen collector switching station to the Upington Main Transmission Substation (MTS).

Additional associated infrastructure will also be required for the Geel Kop grid connection solution, including access roads, feeder bays (inclusive of line bays, busbars, bussection and protection equipment), switching stations, a fibre and optical ground wire (OPGW) layout, insulation and assembly structures.

The grid connection infrastructure will be developed within a 300m wide grid connection corridor. The distance from Geel Kop Collector Substation to the Upington MTS is approximately 19km. The entire grid corridor which includes all the overhead lines running between the switching stations/facility substations adds up to 35km.

This report presents the Bird Impact Assessment that was prepared by Chris van Rooyen Consulting as part of the Basic Assessment (BA) Process for the proposed construction of the grid connection.

## **1. Introduction and Methodology**

### **1.1 Scope, Purpose and Objectives of this Specialist Report**

The objectives of the report are to investigate the potential impacts of the proposed grid connection on avifauna in order to assess whether the project is fatally flawed from an avifaunal impact perspective and, if not, what mitigation measures should be implemented to reduce the potential impacts.

### **1.2 Terms of Reference**

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

- Describe the affected environment from an avifaunal perspective;
- Discuss gaps in baseline data and other limitations;
- List and describe the expected impacts;
- Assess and evaluate the potential impacts;
- Recommend mitigation measures to reduce the impact of the expected impacts; and
- Provide a reasoned opinion as to whether the proposed development should proceed or not.

### 1.3 Assessment Details

Type of Specialist Investigation	Bird Impact Assessment Study: Solar PV and grid connection
Date of Specialist Site Investigation	25 February – 03 March 2020
Season	Mid-Summer
Relevance of Season	The fieldwork was timed to take place after a period of exceptional rains, resulting in optimal conditions.

## 2. Approach and Methodology

The survey methodology took into account the best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al.* 2017), adapted for the specific situation<sup>1</sup>. This was sufficiently detailed to be used for the grid connection as well.

- On-site surveys were conducted at the study area from 25 - 29 February and again from 02 - 03 March 2020 (7 days in total) in the following manner:
  - Twenty-one walk transects were identified within the study area, totalling 1km each, covering all the major habitat types.
  - Each transect was counted twice over a period of 7 days.
  - The observer recorded all species on both sides of the walk transect. The observer stopped at regular intervals to scan the environment with binoculars.
  - The following variables were recorded:
    - Species;
    - Number of birds;
    - Date;
    - Start time and end time;
    - Estimated distance from transect (m);
    - Wind direction;
    - Wind strength (estimated Beaufort scale 1 - 7);
    - Weather (sunny; cloudy; partly cloudy; rain; mist);
    - Temperature (cold; mild; warm; hot);
    - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground.
- All incidental sightings of priority species in and around the study area were also recorded.
- A total of 16 focal points (FPs) were identified consisting of 15 natural pans and one borehole within the study area and counted once in the course of 7 days.

See Appendix 1 for a map of the study area, showing the location of transects and focal points used for purposes of the surveys.

### 2.1 Information Sources

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (<http://sabap2.adu.org.za/>), in order to ascertain which species occur in the pentads where the proposed project is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'x 5'). Each pentad is approximately 8 x 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a block of 15 pentads, within which the

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<sup>1</sup> It was decided to implement one extended survey in the peak season to take advantage of the optimal conditions, instead of doing an additional survey in sub-optimal conditions.

proposed development is located, henceforth called the broader area<sup>2</sup>. The SABAP2 data covers the period 2007 to 2020.

- A classification of the vegetation types in the study area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- 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 (2020.1) IUCN Red List of Threatened Species).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth © 2020) 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 study area relative to National Protected Areas, National Protected Areas Expansion Strategy (NPEAS) focus areas and Critical Biodiversity Areas in the Northern Cape.
- The DEFF National Screening Tool was used to determine the assigned avian sensitivity of the study area.
- The Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (Solar and Wind SEA) was consulted to determine what level of avifaunal sensitivity is assigned to the study area (CSIR 2015).

## 2.2 Assumptions, Knowledge Gaps and Limitations

- A total of 176 SABAP 2 full protocol lists had been completed for the broader area where the proposed project is located (i.e. bird listing surveys lasting a minimum of two hours each). In addition, 97 ad hoc protocol lists (i.e. bird listing surveys lasting less than two hours but still giving useful data) and 486 incidental sightings were also recorded. The SABAP2 data was therefore regarded as a good indicator of the avifauna which could occur in the study area, and it was further supplemented by data collected during the on-site surveys.
- The focus of the study is primarily on the potential impacts on powerline priority species.
- Powerline priority species are defined as species which are susceptible to negative interactions with electricity infrastructure due to their morphology and/or behaviour.
- The assessment of impacts is based on the baseline environment as it exists at the study area when the surveys were conducted.
- Cumulative impacts include all proposed and existing renewable energy projects within a 30km radius around the study areas.
- 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 study area was defined as a 2km buffer around the proposed grid connection infrastructure.

See Figures 1 for the lay-out of the proposed grid connection, showing the three alternatives.

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<sup>2</sup> The relevant pentads are 2825\_2050, 2825\_2055, 2825\_2100, 2825\_2105, 2825\_2110, 2830\_2050, 2830\_2055, 2830\_2100, 2830\_2105, 2830\_2110, 2835\_2050, 2835\_2055, 2835\_2100, 2835\_2105, 2835\_2110.

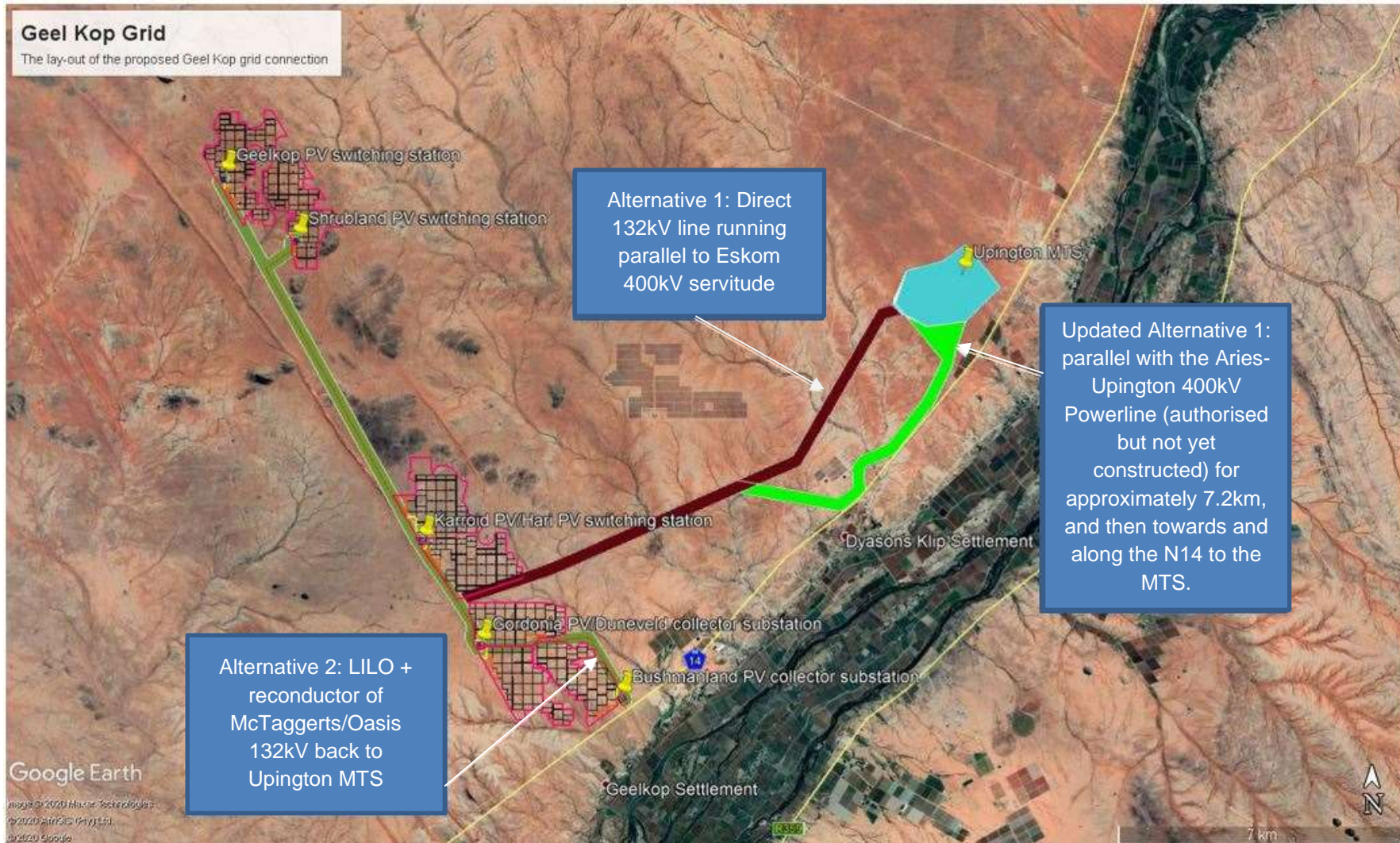


Figure 1: The location of the proposed Geel Kop grid connection. Alternative 1 (parallel to an existing 110m wide 400 kV Eskom servitude) was screened out early on in the BA process due to conflicting land use activities on the RE Farm 628. Updated Alternative 1 (preferred) will run parallel with the Aries-Upington 400kV Powerline (authorised but not yet constructed) for approximately 7.2km, and then towards and along the N14 to the MTS. The line extends from the proposed Geel Kop Collector Switching Station. Alternative 2 involves a Loop-In and Loop-Out (LILO) connection into the existing 132 kV McTaggerts/Oasis powerline, with a reconductoring of the existing 132kV powerline back to the Upington MTS. The LILO point of connection is proposed to take place at the SE corner of the property adjacent to the Bushmanland PV Substation.

### 2.3 Consultation Processes Undertaken

The landowner was briefly consulted with regard to the birds occurring on the property.

### 3. Description of Project Aspects relevant to Avifaunal Impacts

The following aspects of the project is relevant to avifaunal impacts:

<b>Site Details</b>	<p>The preferred grid connection corridor alignment crosses the following properties:</p> <ul style="list-style-type: none"> <li>• Remaining Extent Farm Geel Kop 456</li> <li>• Portion 5 of Farm Bloemsmond 455</li> <li>• Portion 14 of Farm Bloemsmond 455</li> <li>• Remainder of Farm Dyasonsklip 454</li> <li>• Portion 35 of Farm Mc Taggarts Camp 453</li> <li>• Remaining Extent Farm Mc Taggarts Camp Suid 636</li> <li>• Remainder of Farm 638 Tungsten Lodge</li> <li>• Olyvenhouts Drift Settlement Agricultural Holding, Holding Number 1080, Portion 0</li> </ul>	
<b>Grid connection</b>	Substation to which project will connect.	The Geel Kop grid connection infrastructure will facilitate the connection of seven PV facilities to a collector switching station, and then a 132kV powerline will connect the collector switching station to the National Grid via the Upington Main Transmission Substation (MTS).
	Capacity of facility switching stations	<p>Three facility switching stations are required for the Geel Kop grid connection infrastructure:</p> <ul style="list-style-type: none"> <li>• GK Solar PV switching station: up to 132kV capacity.</li> <li>• Shrubland PV switching station: up to 132kV capacity.</li> <li>• Karroid PV switching station: up to 132kV capacity</li> </ul>
	Collector switching station	<p>One collector switching station:</p> <ul style="list-style-type: none"> <li>• Geel Kop collector switching station (Alt 1); or</li> <li>• Bushmanland PV collector switching station (Alt 2);</li> </ul>
<b>Power line/s</b>	Number of overhead power lines required	<p>Five overhead power lines are required for the Geel Kop grid connection infrastructure:</p> <ul style="list-style-type: none"> <li>• a single or double circuit 33kV or 132kV power line linking GK Solar PV switching station and Shrubland PV switching station</li> <li>• a single or double circuit 33kV or 132kV power line linking Shrubland PV switching station and Karroid PV switching station/ Hari PV facility substation.</li> <li>• a single or double circuit 33kV or 132kV power line linking Karroid PV switching station / Hari PV facility substation and Geel Kop collector switching station</li> <li>• a single or double circuit 33kV or 132kV power line linking Geel Kop collector switching station and Bushmanland PV facility substation/ collector switching station</li> <li>• a double circuit 132kV line from the Geel Kop collector switching station to the Upington MTS.</li> </ul> <p>There are two alternative routes to link the collector switching station to the Upington MTS:</p>



		<p><b>Alt 1<sup>3</sup>:</b></p> <ul style="list-style-type: none"> <li>A double circuit 132kV line from the Geel Kop collector substation to the Upington MTS, running parallel to the Eskom Aries-Upington 400kV 110m servitude.</li> </ul> <p><b>Updated Alt 1 (preferred):</b></p> <ul style="list-style-type: none"> <li>A double circuit 132KV powerline from Geel Kop collector switching station to the Upington MTS. This powerline will run parallel with the Aries-Upington 400kV Powerline (authorised but not yet constructed) for approximately 7.2km, then towards and along the N14 to the MTS.</li> </ul> <p><b>Alt 2:</b></p> <ul style="list-style-type: none"> <li>A loop in loop out (LILO) from the Bushmanland PV facility substation into the McTaggerts/Oasis 132kV powerline, and reconducted as a double circuit 132kV line back to the Upington MTS.</li> </ul>
	Voltage of overhead power lines	33kV or 132kV
	Height of the Power Line	<32m
	Servitude Width	Maximum of 31m – 36m.
<b>Auxiliary Infrastructure</b>		
<b>Other infrastructure</b>	Additional Infrastructure	<ul style="list-style-type: none"> <li>access tracks/roads</li> <li>laydown areas</li> </ul>
	Details of access roads	<p>The access roads will not exceed 8m in width. Access to the grid connection infrastructure will be possible via existing roads in close vicinity to the infrastructure. Apart from these existing roads, the proposed Geel Kop solar PV facilities will contain access roads that can also be used to access the infrastructure.</p> <p>Formal roads will not be constructed underneath the power lines for maintenance purposes; access for maintenance purposes will be limited to jeep tracks.</p>
	Extent of areas required for laydown of materials and equipment	Approximately 1- 2 ha of laydown areas will be required (Laydown areas will not exceed 2ha).

## 4. Description of the Receiving Environment

### 4.1 Baseline Environmental Description

#### 4.1.1 Important Bird Areas

There are no Important Bird Areas (IBA) within a 65km radius around the proposed development. It is therefore highly unlikely that the proposed development will have a negative impact on any IBA.

<sup>3</sup> Screened out early on in the BA process due to conflicting land use activities on the RE Farm 628.

#### 4.1.2 Critical Biodiversity Area (CBA)

The majority of the study area does not fall within habitat which is classified as a CBA but is classified as Other Natural Areas and Ecological Support Areas. Only the Bushmanland PV collector switching station and a short section of powerline would fall within an area which is classified as a CBA.

#### 4.1.3 DEFF National Screening Tool

The DEFF National Screening Tool classifies study area as low sensitive from an animal theme perspective. It does not provide for a separate avifaunal theme for distribution lines or substations. The classification is medium sensitive for avifauna as far as the proposed PV facilities are concerned.

#### 4.1.4 National Protected Areas Expansion Strategy (NPEAS) focus areas

The study area does not form part of an NPEAS focus area.

#### 4.1.5 Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (Solar and Wind SEA)

The majority of the study area is classified as “unknown area of medium importance” for avifauna in the Solar and Wind SEA. Three rocky outcrops in the study area is classified as “high importance” based on the potential for Verreaux’s Eagle to breed on them. However, no Verreaux’s Eagles were observed during the 7 days of fieldwork and the outcrops did not contain any nests, because these three outcrops do not offer suitable breeding substrate for the species. No Verreaux’s Eagles were recorded by any of the SABAP2 surveys in the broader area either.

#### 4.1.6 Habitat classes

Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (Harrison *et al.* 1997). The description of the vegetation types occurring in the study area largely follows the classification system presented in the Atlas of southern African birds (Harrison *et al.* 1997). The criteria used to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data. The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present and is not an exhaustive list of plant species present.

Whilst the distribution and abundance of the bird species in the study area are mostly associated with natural vegetation, as this comprises virtually all the habitat, it is also necessary to examine external modifications to the environment that might have relevance for priority species. Anthropogenic avifaunal-relevant habitat modifications which could potentially influence the avifaunal community that were recorded in or close to the study area are boreholes with water troughs, providing accessible surface water. These are discussed in more detail below.

- Biomes and vegetation types

The study area is situated on a vast, flat plain, with the only topographically notable features being a number of rocky outcrops situated in the north-western part of the study area. The study area is located in the interface between the Nama Karoo Biome and the Savanna Biome but is predominantly Nama Karoo Biome. Two types of vegetation intermingle in the study area, namely Bushmanland Arid

Grassland and Kalahari Karroid Shrubland (see Figures 2 and 3). Bushmanland Arid Grassland consists of grassland dominated by white grasses (*Stipagrostis* species) giving this vegetation type the character of semidesert 'steppe' in years of high rainfall. In places low shrubs change the vegetation structure, particularly in drainage lines. In years of abundant rainfall rich displays of annual herbs can be expected (Mucina & Rutherford, 2006). Kalahari Karroid Shrubland occurs in flat gravelly areas in the study area. The land-use in the study area is livestock farming.



**Figure 2: Bushmanland Arid Grassland in the study area.**



**Figure 3: Kalahari Karroid Shrubland in the study area with one of the rocky outcrops in the study area in the distance.**

The climate in the Upington area is arid, with high summer temperatures and mild winters. Average rainfall is around 180mm per year. Table 1 below displays the average temperatures and rainfall for Upington ([climate-data.org](http://climate-data.org)).

**Table 1: Annual temperatures and precipitation at Upington (climate-data.org)**

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	26.2	25.6	23.7	19.3	14.8	11.8	11.5	13.1	17	20.1	23	25.2
Min. Temperature (°C)	17.8	17.7	15.9	11.2	6.2	3.1	2.5	3.9	7.6	11.1	14.2	16.7
Max. Temperature (°C)	34.6	33.6	31.5	27.5	23.4	20.5	20.6	22.4	26.4	29.2	31.9	33.8
Avg. Temperature (°F)	79.2	78.1	74.7	66.7	58.6	53.2	52.7	55.6	62.6	68.2	73.4	77.4
Min. Temperature (°F)	64.0	63.9	60.6	52.2	43.2	37.6	36.5	39.0	45.7	52.0	57.6	62.1
Max. Temperature (°F)	94.3	92.5	88.7	81.5	74.1	68.9	69.1	72.3	79.5	84.6	89.4	92.8
Precipitation / Rainfall (mm)	23	31	39	22	12	4	2	3	4	9	15	16

- Surface water

Surface water is of specific importance to avifauna in this semi-arid environment. The study area contains a number of open water troughs that provide drinking water to livestock. Open water troughs are important sources of surface water and could potentially be used extensively by various bird species, including large raptors, to drink and bath. There is also a number of small ephemeral pans in the study area. Due to the good rains that the study area experienced immediately preceding the surveys, several pans held water (see Figure 4). Pans are attractive to various bird species, including large raptors, to drink and bath. Pans could also serve as an attraction to waterbirds when they contain water.



**Figure 4: An ephemeral pan in the study area**

## 4.2. Avifauna

### 4.2.1 Southern African Bird Atlas 2

The SABAP 2 data indicate that a total of 203 bird species could potentially occur in the broader area – Appendix 2 provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring. Of the priority species potentially occurring in the broader area, 25 could potentially occur in the study area (see Section 4 for definition of a priority species), 8 of these are South African Red List species, and 5 are globally Red listed. The probability of a priority species occurring in the study area is indicated in Table 2.

Table 2 lists all the priority species that could potentially be impacted by the proposed grid connection infrastructure. The following abbreviations and acronyms are used:

EN = Endangered  
VU = Vulnerable  
NT = Near threatened  
LC = Least concern

### 4.2.2 Pre-construction surveys

On-site surveys were conducted from 25 - 29 February and again from 02 - 03 March 2020 (7 days in total). Please see Section 2 for details of the methodology used in the surveys.

- Species diversity and abundance

The abundance of priority species recorded during the walk transects and focal points are displayed in Figure 5 and 6. A total of 291 individual birds were counted at the 16 focal points in the course of the surveys.

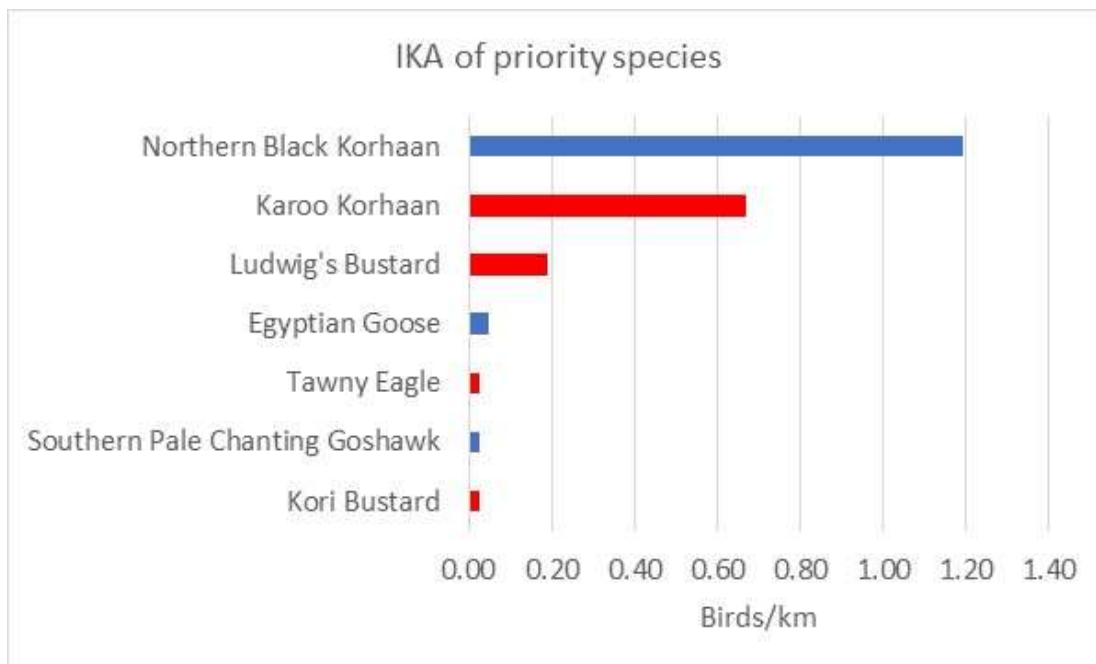


Figure 5: Index of kilometric abundance (IKA) for all priority species recorded by means of walk transects during the surveys in the study area, conducted in February and March 2020. Red List species are indicated in red bars.

Table 2: Priority species which could potentially occur in the study area (excluding vagrants). Red listed species are shaded in red.

Species	Taxonomic name	SABAP2 full protocol reporting rate	Status			Occurrence		Habitat			Impact of grid connection		
			Red List Global	Red List Regional	Endemic/near endemic - South Africa	Probability of occurrence	Recorded during surveys	Arid shrubland and	Arid grassland	Surface water: Pans	Displacement: Disturbance grid construction	Collision with the 132kV grid connection	Electrocutions Electrical hardware
Abdim's Stork	<i>Ciconia abdimii</i>	9.66	LC	NT		Low		x		x	x	x	
Barn Owl	<i>Tyto alba</i>	19.89				High		x	x		x		x
Black-headed Heron	<i>Ardea melanocephala</i>	29.55				High			x	x		x	x
Booted Eagle	<i>Aquila pennatus</i>	6.25				High		x	x	x		x	x
Cattle Egret	<i>Bubulcus ibis</i>	61.36				Low		x	x	x		x	
Egyptian Goose	<i>Alopochen aegyptiacus</i>	59.66				High	x			x		x	x
Greater Kestrel	<i>Falco rupicoloides</i>	3.98				High		x	x				x
Karoo Korhaan	<i>Eupodotis vigorsii</i>	35.23	LC	NT		Very high	x	x	x		x	x	
Kori Bustard	<i>Ardeotis kori</i>	5.11	NT	NT		High	x	x	x	x	x	x	
Lanner Falcon	<i>Falco biarmicus</i>	10.80	LC	VU		High		x	x	x			x
Ludwig's Bustard	<i>Neotis ludwigii</i>	3.41	EN	EN		Medium	x	x			x	x	
Martial Eagle	<i>Polemaetus bellicosus</i>	2.27	VU	EN		High		x	x	x		x	x
Secretarybird	<i>Sagittarius serpentarius</i>	1.14	VU	VU		Medium		x	x	x	x	x	
South African Shelduck	<i>Tadorna cana</i>	22.73				Medium				x		x	
Southern Pale Chanting Goshawk	<i>Melierax canorus</i>	15.34				Very high	x	x	x	x			x
Spotted Eagle-owl	<i>Bubo africanus</i>	2.27				High	x	x	x	x	x		x
Spur-winged Goose	<i>Plectropterus gambensis</i>	18.18				Medium				x		x	x
Steppe Buzzard	<i>Buteo vulpinus</i>	2.27				Low		x	x	x			x
Tawny Eagle	<i>Aquila rapax</i>	0.00	VU	EN		High	x	x	x	x		x	x
White-faced Duck	<i>Dendrocygna viduata</i>	13.64				Low				x		x	
Yellow-billed Duck	<i>Anas undulata</i>	9.66				Low				x		x	
Northern Black Korhaan	<i>Afrotis afraoides</i>	34.09				Very high	x	x	x		x	x	
Pied Crow	<i>Corvus albus</i>	33.52				Very high	x	x	x	x			x
Helmeted Guineafowl	<i>Numida meleagris</i>	46.59				Low		x	x		x		x
Namaqua Sandgrouse	<i>Pterocles namaqua</i>	47.16				Very high	x	x	x	x	x	x	

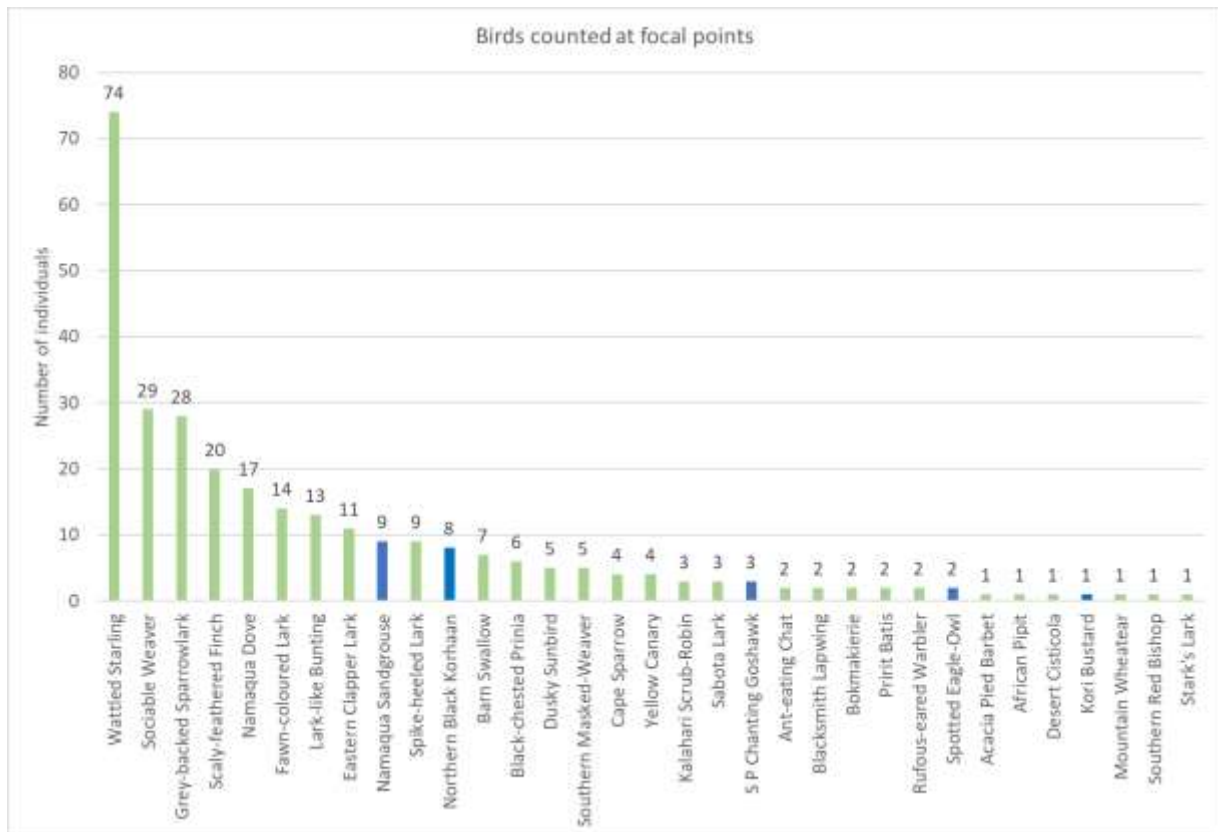


Figure 6: The variety and number of birds counted at focal points in the study area. Priority species are indicated in blue.

#### 4.3 Identification of Environmental Sensitivities

The entire study area can be classified as medium to high sensitivity from a potential powerline interaction perspective, due to the fact that it is largely untransformed and potentially supports up to 26 priority species, eight of which are Red Listed.

### 5. Issues, Risks and Impacts

#### 5.1 Summary of Issues identified during the Project Notification Phase

No issues were raised pertaining to avifauna during the Project Notification Phase.

#### 5.2 Identification of Potential Impacts/Risks

The potential impacts identified during the BA are:

##### 5.2.1 Construction Phase

- Displacement due to disturbance associated with the construction of the substations/switching stations, grid connection and associated infrastructure.

##### 5.2.2 Operational Phase

- Electrocutions in the on-site substation/switching stations
- Collisions with the 132kV grid connection

### 5.2.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the substations/switching stations, grid connection and associated infrastructure.

### 5.2.4 Cumulative Impacts

- Electrocutions in on-site substation/switching stations
- Collisions with the 132kV grid connection

## 6. Impact Assessment

### 6.1 Introduction

Negative impacts on birds by electricity infrastructure generally take two principal 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). Birds also impact on the infrastructure through nesting and streamers, which can cause interruptions in the electricity supply (Van Rooyen *et al.* 2002). During the construction phase of power lines and substations, displacement of birds can also happen due to disturbance and habitat transformation.

### 6.2 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 design of the electrical hardware. There could be an electrocution risk to certain species, mostly raptors, but also some waterbirds, in the substation yard of the onsite substations/switching stations. This is however unlikely to be a major problem to the larger Red Listed species, as it is not envisaged that they will frequently perch in the substation/switching station.

Species potentially at risk of electrocution in the substation yard and inverter station are the following:

- Barn Owl
- Black-headed Heron
- Booted Eagle
- Egyptian Goose
- Greater Kestrel
- Lanner Falcon
- Martial Eagle
- Southern Pale Chanting Goshawk
- Spotted Eagle-Owl
- Spur-winged Goose
- Steppe Buzzard
- Tawny Eagle
- Steppe Buzzard
- Pied Crow
- Helmeted Guineafowl



As far as the actual pole design is concerned, the risk of electrocutions is low. With clearances of about 1.5m upwards between the phases and the earthed and live components, it will be difficult for any bird to bridge the air gap and cause a short circuit. Only the largest species are likely to be at risk of any sort, and that is likely to only be the case if Martial Eagle, which is the largest species which is likely to occur with any regularity, decides to land on one of the stand-off insulators of a 7611/7622/T2002 intermediate pole, and manages to bridge the gap between the dead-end of the insulator and earthed steel pole as it lands or takes off again. The Martial Eagle as a wingspan of up to 2.4m (Hockey *et al.* 2005), which is longer than the approximate 1.5m length of the stand-off insulator. The risk of a Martial Eagle electrocuting itself on a pole in this manner is low but cannot be ruled out completely. In the case of the other proposed intermediate pole designs, the risk is lower due to the design of the insulators.

### 6.3.2 Collisions

Collisions are probably the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004; Shaw 2013). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004; Anderson 2001; Shaw 2013).

In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with power lines:

“The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini *et al.* 2005, Jenkins *et al.* 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Jans 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 low-resolution and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin *et al.* 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown *et al.* 1987, Henderson *et al.* 1996).

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

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude or locating them along other features such as tree lines, are

both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins *et al.* 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown *et al.* 1987, Faanes 1987, Bevanger 1994)."

As mentioned by Shaw (2013) in the extract above, several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is essential to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, 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 power lines. These findings have applicability to species outside of these families especially raptors (*Accipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes and are also known to be vulnerable to power line collisions.

Thus visual field topographies which have evolved primarily to meet visual challenges associated with foraging may render certain bird species particularly vulnerable to collisions with human artefacts, such as power lines and wind turbines that extend into the otherwise open airspace above their preferred habitats. For these species placing devices upon power lines to render them more visible may have limited success since no matter what the device the birds may not see them. It may be that in certain situations it may be necessary to distract birds away from the obstacles, or encourage them to land nearby (for example by the use of decoy models of conspecifics, or the provision of sites attractive for roosting) since increased marking of the obstacle cannot be guaranteed to render it visible if the visual field configuration prevents it being detected. Perhaps most importantly, the results indicate that collision mitigation may need to vary substantially for different collision prone species, taking account of species specific behaviours, habitat and foraging preferences, since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all (Martin & Shaw 2010).

Despite evidence that line marking might be ineffective for some species due to differences in visual fields and behaviour, or have only a small reduction in mortality in certain situations for certain species, particularly bustards (Martin & Shaw 2010; Barrientos *et al.* 2012; Shaw 2013), it is generally accepted that marking a line with PVC spiral type Bird Flight Diverters (BFDs) can reduce the collision mortality rates (Sporer *et al.* 2013; Barrientos *et al.* 2012, Alonso & Alonso 1999; Koops & De Jong 1982). Regardless of statistical significance, a slight mortality reduction may be very biologically relevant in

areas, species or populations of high conservation concern (e.g. Ludwig's Bustard) (Barrientos *et al.* 2012). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. A study 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 in bird collisions. At unmarked lines, there were 0.21 deaths/1000 birds (n = 339,830) that flew among lines or over lines. At marked lines, the mortality rate was 78% lower (n = 1,060,746) (Barrientos *et al.* 2011). Koops and De Jong (1982) found that the spacing of the BFDs were critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5 metres, whereas using the same devices at 10 metre intervals only reduces the mortality by 57%. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important, as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

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

A potential impact of the proposed 132kV power lines is collisions with the earth wire. Quantifying this impact in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are susceptible to powerline collisions (see Figure 7). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

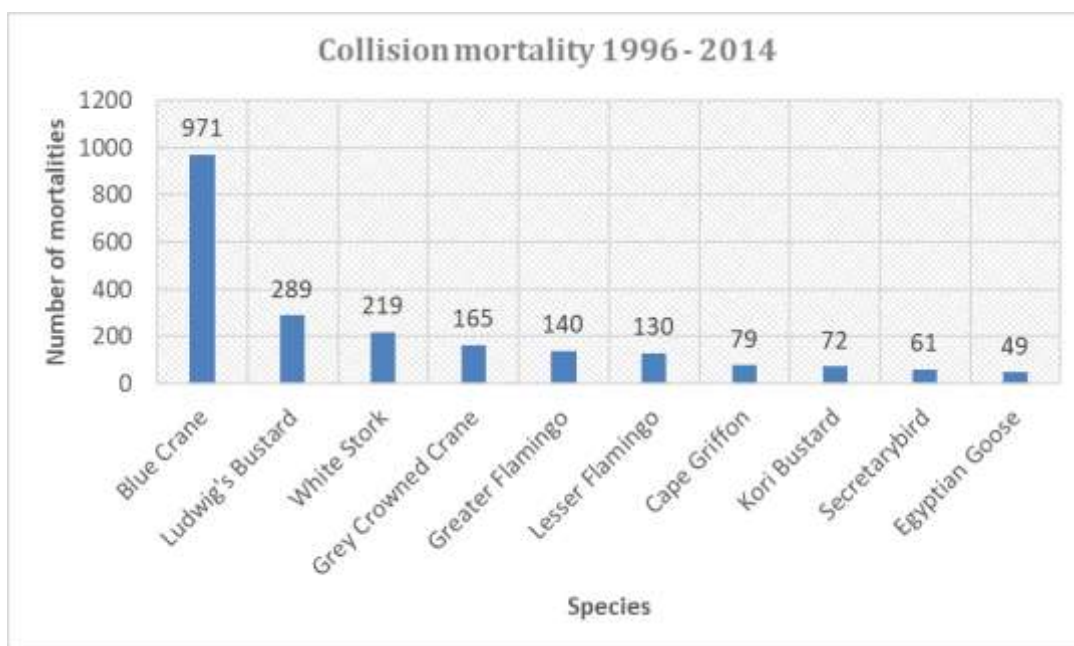


Figure 7: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data 2014)

Species potentially at risk of collisions with the 132kV grid connection are the following:

- Black-headed Heron
- Booted Eagle
- Egyptian Goose
- Martial Eagle
- Spur-winged Goose
- Tawny Eagle
- Abdim's Stork
- Cattle Egret
- Karoo Korhaan
- Kori Bustard
- Ludwig's Bustard
- Secretarybird
- South African Shelduck
- White-faced Duck
- Yellow-billed Duck
- Northern Black Korhaan
- Namaqua Sandgrouse

### 6.3.3 *Displacement due to disturbance associated with the construction and de-commissioning of the 132kV grid connection*

Construction and de-commissioning activities could impact on birds through temporary displacement due to disturbance, particularly for larger species. This could lead to breeding failure if the disturbance happens during a critical stage of the breeding cycle. The reporting rates for Red List species in the broader area are generally low, which is an indication that they are not regularly utilising the area for breeding. However, there is a possibility of disturbing of a breeding pair of ground nesting priority species during the construction or de-commissioning of the substations/switching stations.

Priority species potentially at risk of temporary displacement due to disturbance are the following:

- Karoo Korhaan
- Kori Bustard
- Secretarybird
- Northern Black Korhaan
- Namaqua Sandgrouse
- Spotted Eagle-owl
- Helmeted Guineafowl
- Ludwig's Bustard

## 6.4 **Cumulative impacts**

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects therefore needs to consider all renewable energy developments within at least a 30km radius of the proposed site. The locality of renewable projects which are planned, authorised or have been constructed already are displayed in Figure 8 and listed in Appendix 3.

The grid connection will add between 19km (Alternative 2) or 35km (Updated Alternative 1) high voltage line to the existing high voltage network within the 30km radius, depending which alternative is used. This, together with the planned grid connections of the other planned or constructed projects within the

30km radius, will result in a significant increase in the total length of the high voltage network in this area. The cumulative impact of the increase in the total length of high voltage lines, particularly mortality due to collisions, is rated as **moderate**.

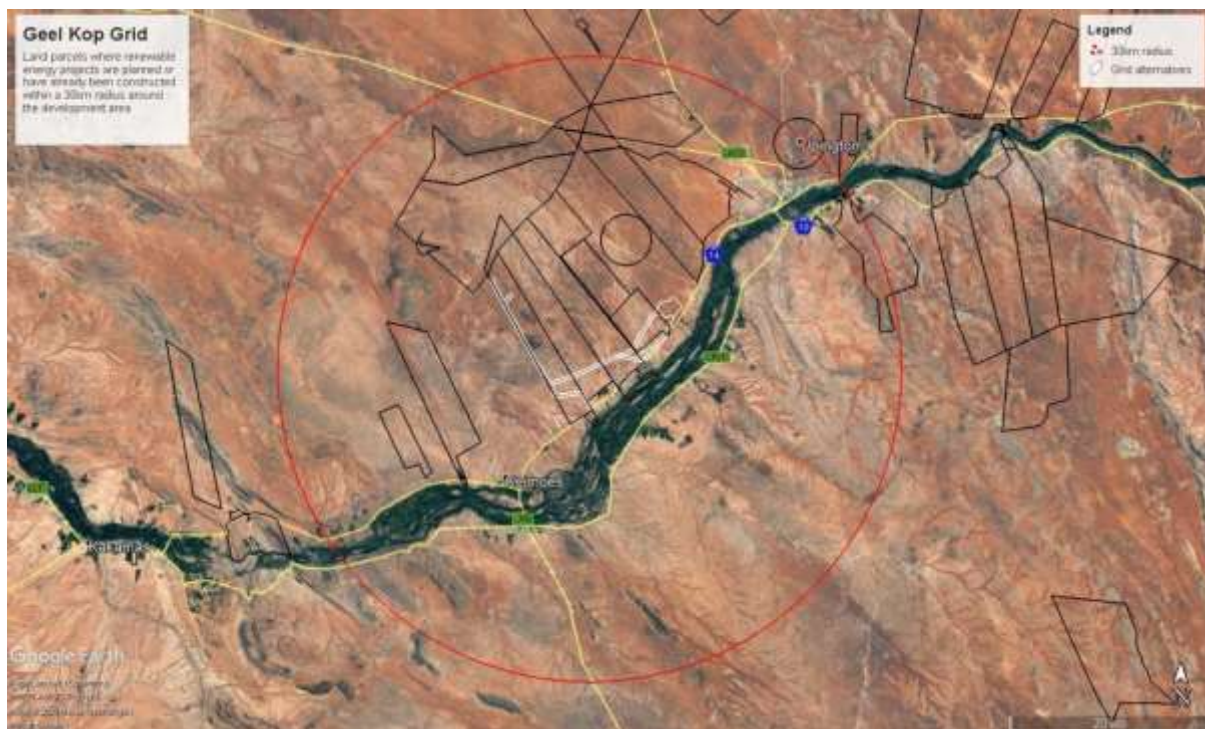


Figure 8: Map showing location of land parcels with planned or constructed solar energy projects within a 30km radius around the study area.

## 6.5 No-go option

The no-go option will result in no additional impacts on avifauna and will result in the ecological status quo being maintained (as described in Section 4 of this report), which will be to the advantage of the avifauna.

## 6.6 Potential Impacts during the Construction Phase

<b>Aspect/Activity</b>	Displacement of priority species due to construction activities associated with the substations/switching stations and 132kV grid infrastructure
<b>Type of Impact (i.e. Impact Status)</b>	Direct
<b>Potential Impact</b>	Temporary displacement of priority species. Potential priority species which could be affected are: <ul style="list-style-type: none"> <li>▪ Karoo Korhaan</li> <li>▪ Kori Bustard</li> <li>▪ Secretarybird</li> <li>▪ Northern Black Korhaan</li> <li>▪ Namaqua Sandgrouse</li> <li>▪ Spotted Eagle-owl</li> <li>▪ Helmeted Guineafowl</li> <li>▪ Ludwig's Bustard</li> </ul>
<b>Status</b>	Negative
<b>Mitigation Required</b>	<ul style="list-style-type: none"> <li>▪ Construction activity should be restricted to the immediate footprint of the infrastructure.</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifauna.</li> <li>▪ Measures to control noise should be applied according to current best practice in the industry.</li> <li>▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.</li> <li>▪ A walk-through must be conducted by the avifaunal specialist when the final pole positions have been determined, to assess whether there are any Red List species breeding in the vicinity of the final alignment, which could be displaced by the construction activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of construction activities.</li> </ul>
<b>Impact Significance (Pre-Mitigation)</b>	Low (Level 4)
<b>Impact Significance (Post-Mitigation)</b>	Very Low (Level 5)
<b>I&amp;AP Concern</b>	No

## 6.7 Potential Impacts during the Operational Phase

<b>Aspect/Activity</b>	Electrocution on the 132kV poles, and in the onsite substations/switching stations
<b>Type of Impact (i.e. Impact Status)</b>	Direct
<b>Potential Impact</b>	<p>Electrocution of priority species. Potential priority species which could be affected are:</p> <ul style="list-style-type: none"> <li>▪ Spotted Eagle-owl</li> <li>▪ Helmeted Guineafowl</li> <li>▪ Barn Owl</li> <li>▪ Black-headed Heron</li> <li>▪ Booted Eagle</li> <li>▪ Egyptian Goose</li> <li>▪ Martial Eagle</li> <li>▪ Spur-winged Goose</li> <li>▪ Tawny Eagle</li> <li>▪ Greater Kestrel</li> <li>▪ Lanner Falcon</li> <li>▪ Southern Pale Chanting Goshawk</li> <li>▪ Steppe Buzzard</li> <li>▪ Pied Crow</li> </ul>
<b>Status</b>	Negative
<b>Mitigation Required</b>	<ul style="list-style-type: none"> <li>▪ With regards to the infrastructure within the yard, the hardware is too complex to recommend any mitigation for electrocution at this stage. It is instead recommended that if any impacts are recorded once operational, site specific mitigation should be applied reactively.</li> <li>▪ It is recommended that the 7611/7622/T2002 intermediate pole is avoided.</li> </ul>
<b>Impact Significance (Pre-Mitigation)</b>	Low (Level 4)
<b>Impact Significance (Post-Mitigation)</b>	Very Low (Level 5)
<b>I&amp;AP Concern</b>	No

<b>Aspect/Activity</b>	Mortality of priority species due to collisions with the 132kV grid connection
<b>Type of Impact (i.e. Impact Status)</b>	Direct
<b>Potential Impact</b>	<p>Mortality of priority species. Potential priority species which could be affected are:</p> <ul style="list-style-type: none"> <li>▪ Black-headed Heron</li> <li>▪ Booted Eagle</li> <li>▪ Egyptian Goose</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Martial Eagle</li> <li>▪ Spur-winged Goose</li> <li>▪ Tawny Eagle</li> <li>▪ Karoo Korhaan</li> <li>▪ Kori Bustard</li> <li>▪ Secretarybird</li> <li>▪ Northern Black Korhaan</li> <li>▪ Namaqua Sandgrouse</li> <li>▪ Ludwig's Bustard</li> <li>▪ Abdim's Stork</li> <li>▪ Cattle Egret</li> <li>▪ South African Shelduck</li> <li>▪ White-faced Duck</li> <li>▪ Yellow-billed Duck</li> </ul>
<b>Status</b>	Negative
<b>Mitigation Required</b>	<ul style="list-style-type: none"> <li>• The preferred alternative from an avifaunal impact perspective is Alternative 2, because it follows the existing McTaggerts/Oasis 132kV powerline. This will reduce the impact significantly because it restricts the length of line which will constitute a new impact from 35km to 19km. It is therefore recommended that this alternative is used<sup>4</sup>.</li> <li>• Eskom approved bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.</li> </ul>
<b>Impact Significance (Pre-Mitigation)</b>	Moderate (Level 3)
<b>Impact Significance (Post-Mitigation)</b>	Low (Level 4)
<b>I&amp;AP Concern</b>	No

## 6.8 Potential Impacts during the Decommissioning Phase

<b>Aspect/Activity</b>	Displacement of priority species due to de-commissioning activities associated with the substations/switching stations and 132kV grid infrastructure
<b>Type of Impact (i.e. Impact Status)</b>	Direct
<b>Potential Impact</b>	<p>Temporary displacement of priority species. Potential priority species which could be affected are:</p> <ul style="list-style-type: none"> <li>▪ Karoo Korhaan</li> <li>▪ Kori Bustard</li> <li>▪ Secretarybird</li> <li>▪ Northern Black Korhaan</li> <li>▪ Namaqua Sandgrouse</li> <li>▪ Spotted Eagle-owl</li> <li>▪ Helmeted Guineafowl-owl</li> <li>▪ Ludwig's Bustard</li> </ul>
<b>Status</b>	Negative
<b>Mitigation Required</b>	<ul style="list-style-type: none"> <li>▪ De-commissioning activities should be restricted to the immediate footprint of the infrastructure.</li> <li>▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifauna.</li> </ul>

<sup>4</sup> However, should it not be possible to utilise this option due to technical reasons, Updated Alternative 1 could also be acceptable. Updated Alternative 1 will run next to the proposed Aries 400kV, (should it eventually be built) for a substantial length, and then mostly along the busy N14 provincial road. It is thought that by placing two lines together, the birds will benefit from the combined increased profile of the two lines, making the obstacle more visible to the birds (APLIC 2012). It is furthermore likely that powerline sensitive species will avoid the vicinity of the N14, thereby reducing the risk of collisions with the powerline.

	<ul style="list-style-type: none"> <li>▪ Measures to control noise should be applied according to current best practice in the industry.</li> <li>▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.</li> <li>▪ A walk-through must be conducted by the avifaunal specialist to assess whether there are any breeding Red List species, which could be displaced by the de-commissioning activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of activities.</li> </ul>
<b>Impact Significance (Pre-Mitigation)</b>	Low (Level 4)
<b>Impact Significance (Post-Mitigation)</b>	Very Low (Level 5)
<b>I&amp;AP Concern</b>	No

## 6.9 Cumulative Impacts

<b>Aspect/Activity</b>	The incremental impact of the proposed grid connection on priority avifauna, added to the impacts of other past, present or reasonably foreseeable future activities.
<b>Type of Impact (i.e. Impact Status)</b>	Direct
<b>Potential Impact</b>	<ul style="list-style-type: none"> <li>▪ Displacement due to disturbance associated with the construction and de-commissioning of the 132kV grid connection and associated infrastructure</li> <li>▪ Electrocutions in the poles, onsite substation/ switching station.</li> <li>▪ Collisions with the 132kV grid connection</li> </ul>
<b>Status</b>	Negative
<b>Mitigation Required</b>	Please refer to all the proposed mitigation measures as listed in the preceding tables in Section 6 for all the impacts and all the phases
<b>Impact Significance (Pre-Mitigation)</b>	Moderate (3)
<b>Impact Significance (Post-Mitigation)</b>	Low (2)
<b>I&amp;AP Concern</b>	None to date

## 7. Impact Assessment Tables

The assessment of impacts and recommendation of mitigation measures as discussed above are collated in Tables 1 to 4 below. An explanation of the assessment criteria is provided in Appendix 5.



**Table 1: Impact Assessment Summary Table for the Construction Phase**

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Construction of the 132kV grid connection	The noise and movement associated with the construction activities of the substations/switching stations will be a source of disturbance which would lead to the displacement of avifauna from the area.	Negative	Site specific	Short term	Moderate	Very likely	high	Low	<ul style="list-style-type: none"> <li>▪ Construction activity should be restricted to the immediate footprint of the infrastructure.</li> <li>▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifauna.</li> <li>▪ Measures to control noise should be applied according to current best practice in the industry.</li> <li>▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.</li> <li>▪ A walk-through must be conducted by the avifaunal specialist when the final pole positions have been determined, to assess whether there are any Red List species breeding in the vicinity of the final alignment, which could be displaced by the construction activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of construction activities.</li> </ul>	Low (4)	Very Low (5)	Very Low (5)	High

**Table 2: Impact Assessment Summary Table for the Operational Phase**

Operational Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
The 132kV poles and on-site substation/switching stations could be a source of electrocutions of priority species	Electrocution of priority species.	Direct	Local	Long term	Moderate	Unlikely	High	Low	<ul style="list-style-type: none"> <li>With regards to the infrastructure within the yard, the hardware is too complex to recommend any mitigation for electrocution at this stage. It is instead recommended that if any impacts are recorded once operational, site specific mitigation should be applied reactively.</li> <li>It is recommended that the 7611/7622/T2002 intermediate pole is avoided.</li> </ul>	Low (4)	Very Low (5)	Very Low (5)	High

The 132kV grid connection could be a source of collision mortality of priority species	Mortality of priority species due to collisions with the 132kV grid connection.	Direct	Local	Long term	Substantial	Likely	High	Low	<ul style="list-style-type: none"> <li>▪ The preferred alternative from an avifaunal impact perspective is Alternative 2, because it follows the existing McTaggerts/Oasis 132kV powerline. This will reduce the impact significantly because it restricts the length of line which will constitute a new impact from 35km to 19km. It is therefore recommended that this alternative is used<sup>5</sup>.</li> <li>▪ Eskom approved bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.</li> </ul>	Moderate (3)	Low (4)	Low (4)	Medium
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<sup>5</sup> However, should it not be possible to utilise this option due to technical reasons, Updated Alternative 1 could also be acceptable. Updated Alternative 1 will run next to the proposed Aries 400kV, (should it eventually be built) for a substantial length, and then mostly along the busy N14 provincial road. It is thought that by placing two lines together, the birds will benefit from the combined increased profile of the two lines, making the obstacle more visible to the birds (APLIC 2012). It is furthermore likely that powerline sensitive species will avoid the vicinity of the N14, thereby reducing the risk of collisions with the powerline.

**Table 3: Impact Assessment Summary Table for the Decommissioning Phase**

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
De-commissioning of the 132kV grid connection	The noise and movement associated with the de-commissioning activities of the substations/switching stations will be a source of disturbance which would lead to the displacement of avifauna from the area.	Negative	Site specific	Short term	Moderate	Very likely	high	Low	<ul style="list-style-type: none"> <li>De-commissioning activities should be restricted to the immediate footprint of the infrastructure.</li> <li>Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifauna.</li> <li>Measures to control noise should be applied according to current best practice in the industry.</li> <li>Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.</li> <li>A walk-through must be conducted by the avifaunal specialist to assess whether there are any breeding Red List species breeding, which could be displaced by the de-commissioning activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of activities.</li> </ul>	Low (4)	Very Low (5)	Very Low (5)	High

**Table 4: Cumulative Impact Assessment Summary Table**

Cumulative Impacts (Construction, Operational and Decommissioning Phases)													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
The incremental impact of the proposed grid connection on priority avifauna, added to the impacts of other past, present or reasonably foreseeable future activities.	<ul style="list-style-type: none"> <li>▪ Displacement due to disturbance associated with the construction and de-commissioning of the 132kV grid connection and associated infrastructure</li> <li>▪ Electrocutions in the poles, onsite substation/ switching station.</li> <li>▪ Collisions with the 132kV grid connection</li> </ul>	Direct	Local	Long term	Substantial	Very likely	High	Low	See all the proposed mitigation measures as listed in the preceding tables in Section 6 for all the impacts and all the phases	Moderate (3)	Low (4)	Low (4)	Medium

## 7.1 Impact Assessment Summary

Table 3 below provides an indication of the overall impact significance with the implementation of mitigation measures for the various phases.

**Table 3: Overall Impact Significance (Post Mitigation)**

Phase	Overall Impact Significance
Construction	Very Low (Level 5)
Operational	Very Low (Level 5) to Low (Level 4))
Decommissioning	Very Low (Level 5)
Cumulative	Low (4)

## 8. Legislative and Permit Requirements

### 8.1 Legislative Framework

There is no legislation pertaining specifically to the impact of solar facilities and associated electrical infrastructure on avifauna. There are best practice guidelines available which were compiled under the auspices of BirdLife South Africa (BLSA) i.e. Jenkins, A.R., Ralston-Patton, Smit- Robinson, A.H. 2017. Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa.

#### 8.1.1 Agreements and conventions

**Table 4: International 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 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; and 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 UNEP, 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 name	Description	Geographic scope
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

### 8.1.2 National legislation

#### 8.1.2.1 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.

#### 8.1.2.2 The National Environmental Management Act 107 of 1998

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 (via the promulgation of the EIA Regulations (2014, as amended), which may significantly affect the environment, may be performed only after an EIA has been done and authorisation 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.

### *8.1.2.3 The National Environmental Management: Biodiversity Act 10 of 2004 and the Threatened or Protected Species Regulations, February 2007*

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) 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 (as noted in Table 4 above). The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

### *8.1.2.4 Provincial legislation*

The Northern Cape Nature Conservation Act No 9 of 2009 was enacted to provide for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations, and to provide for matters connected therewith.

There are no specific sections dealing with the protection of avifauna, except to classify birds in general as specially protected species which require a permit to be hunted, imported, exported, transported, kept, possessed, bred or traded in. The act therefore does not apply in situations where birds are unintentionally killed as a by-product of an industrial activity. It also does not place restrictions on the removal of bird nests, should that become necessary because they are impacting on sensitive equipment.

## **9. Environmental Management Programme Inputs**

Refer to Appendix 4 for the EMPr inputs. It is important to note that a comprehensive EMPr is included in the BA Report, which includes input from all specialists in this regard.

## **10. Summary of Findings and Recommendations**

It is estimated that a total of 203 bird species could potentially occur in the broader area – Appendix 2 provides a comprehensive list of all the species, including those recorded during the pre-construction monitoring. Of the priority species potentially occurring in the broader area, 26 could potentially occur in the study area. Eight of these are South African Red List species, and three are globally Red listed.

The proposed project will have the following potential impacts on avifauna:

- Displacement due to disturbance associated with the construction of the substations/switching stations, grid connection and associated infrastructure.
- Electrocutions in the on-site substation/switching stations
- Collisions with the 132kV grid connection
- Displacement due to disturbance associated with the decommissioning of the substations/switching stations, grid connection and associated infrastructure.



## **10.1 Displacement due to disturbance associated with the construction of the substations/switching stations, grid connection and associated infrastructure.**

Construction could impact on birds through temporary displacement due to disturbance, particularly for larger species. This could lead to breeding failure if the disturbance happens during a critical stage of the breeding cycle. The reporting rates for Red List species in the broader area are generally low, which is an indication that they are not regularly utilising the area for breeding. However, there is a possibility of disturbing of a breeding pair of ground nesting priority species during the construction of the substations/switching stations.

Species potentially at risk of displacement due to disturbance are the following:

- Karoo Korhaan
- Kori Bustard
- Secretarybird
- Northern Black Korhaan
- Namaqua Sandgrouse
- Spotted Eagle-owl
- Helmeted Guineafowl
- Ludwig's Bustard

**The impact is assessed to be Low before mitigation, and Very Low after mitigation.** The proposed mitigation measures are (1) construction activity should be restricted to the immediate footprint of the infrastructure (2) access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifauna (3) measures to control noise should be applied according to current best practice in the industry (4) maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum and (5) a walk-through must be conducted by the avifaunal specialist when the final pole positions have been determined, to assess whether there are any Red List species breeding in the vicinity of the final alignment, which could be displaced by the construction activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of construction activities.

## **10.2 Electrocutation of priority species**

Electrocutation 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). There could be an electrocution risk to certain species, mostly raptors, but also some waterbirds, in the substation yard of the onsite substations/switching stations, and on some of the pole designs.

Species potentially at risk of electrocution in the substation yard and inverter station are the following:

- Barn Owl
- Black-headed Heron
- Booted Eagle
- Egyptian Goose
- Greater Kestrel
- Lanner Falcon
- Martial Eagle
- Southern Pale Chanting Goshawk
- Spotted Eagle-Owl
- Spur-winged Goose
- Steppe Buzzard

- Tawny Eagle
- Pied Crow
- Helmeted Guineafowl

**The impact is assessed to be Low before mitigation, and Very Low after mitigation.** With regards to the infrastructure within the yard, the hardware is too complex to recommend any mitigation for electrocution at this stage. It is instead recommended that if any impacts are recorded once operational, site specific mitigation should be applied reactively. It is recommended that the 7611/7622/T2002 intermediate pole is avoided.

### 10.3 Mortality of priority species due to collisions with the grid connection

Collisions with the earthwire are probably the biggest single threat posed by the proposed grid connection to priority species in the study area. Most heavily impacted upon heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004; Anderson 2001; Shaw 2013).

Species potentially at risk of collisions with the earthwire of the grid connection are the following:

- Black-headed Heron
- Booted Eagle
- Egyptian Goose
- Martial Eagle
- Spur-winged Goose
- Tawny Eagle
- Abdim's Stork
- Cattle Egret
- Karoo Korhaan
- Kori Bustard
- Ludwig's Bustard
- Secretarybird
- South African Shelduck
- White-faced Duck
- Yellow-billed Duck
- Northern Black Korhaan
- Namaqua Sandgrouse

**The impact is assessed to be Moderate before mitigation, and Low after mitigation.** The preferred alternative from an avifaunal impact perspective is Alternative 2, because it follows the existing McTaggerts/Oasis 132kV powerline. This will reduce the impact significantly because it restricts the length of line which will constitute a new impact from 35km to 19km. It is therefore recommended that this alternative is used. However, should it not be possible to utilise this option due to technical reasons, Updated Alternative 1 could also be acceptable. Updated Alternative 1 will run next to the proposed Aries 400kV, (should it eventually be built) for a substantial length, and then mostly along the busy N14 provincial road. It is thought that by placing two lines together, the birds will benefit from the combined increased profile of the two lines, making the obstacle more visible to the birds (APLIC 2012). It is furthermore likely that powerline sensitive species will avoid the vicinity of the N14, thereby reducing the risk of collisions with the powerline.

It is furthermore recommended that Eskom approved bird flight diverters be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour

devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.

#### 10.4 Displacement due to disturbance associated with the de-commissioning of the substations/switching stations, grid connection and associated infrastructure.

De-commissioning could impact on birds through temporary displacement due to disturbance, particularly for larger species. This could lead to breeding failure if the disturbance happens during a critical stage of the breeding cycle. The reporting rates for Red List species in the broader area are generally low, which is an indication that they are not regularly utilising the area for breeding. However, there is a possibility of disturbing of a breeding pair of ground nesting priority species during the de-commissioning of the substations/switching stations.

Species potentially at risk of displacement due to disturbance are the following:

- Karoo Korhaan
- Kori Bustard
- Secretarybird
- Northern Black Korhaan
- Namaqua Sandgrouse
- Spotted Eagle-owl
- Helmeted Guineafowl
- Ludwig's Bustard

**The impact is assessed to be Low before mitigation, and Very Low after mitigation.** The proposed mitigation measures are (1) de-commissioning activity should be restricted to the immediate vicinity of the infrastructure (2) access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifauna (3) measures to control noise should be applied according to current best practice in the industry (4) maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum and (5) a walk-through must be conducted by the avifaunal specialist to assess whether there are any breeding Red List species which could be displaced by the de-commissioning activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of activities.

#### 10.5 Cumulative impacts

The grid connection will add either approximately 19km (Alternative 2) or 35km (Updated Alternative 1) high voltage line to the existing high voltage network within the 30km radius, depending which alternative is used. This, together with the planned grid connections of the other planned or constructed projects within the 30km radius, will result in a significant increase in the total length of the high voltage network in this area.

The cumulative impact of the increase in the total length of high voltage lines, particularly mortality due to collisions, is rated as **Moderate, and Low after mitigation.**

**Table 5: Overall impact significance rating**

Impact	Rating pre-mitigation	Rating post-mitigation
Displacement due to disturbance associated with the construction of the substations/switching stations, grid connection and associated infrastructure.	Low (4)	Very Low (5)

Electrocutions in the onsite substation/switching station yard or grid connection poles.	Low (4)	Very Low (5)
Mortality of priority species due to collisions with the 132kV grid connection.	Moderate (3)	Low (4)
Displacement due to disturbance associated with the de-commissioning of the substations/switching stations, grid connection and associated infrastructure.	Low (4)	Very Low (5)
Cumulative impacts	Moderate (3)	Low (4)
<b>Average:</b>	<b>Moderate (3.6)</b>	<b>Low – Very Low (4.6)</b>

## 11. Final Specialist Statement and Authorisation Recommendation

In terms of an average, the pre-mitigation significance of all potential impacts identified in this specialist study is assessed as halfway between **Low** and **Moderate**, and the post-mitigation significance is assessed as Low to Very Low, leaning more towards **Very Low** (i.e. average of 4.6, as shown in Table 5 above). It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the EMPr (Appendix 4) are strictly implemented.

### 11.1. EA Condition Recommendations

The proposed mitigation measures are detailed in the EMPr (Appendix 4)

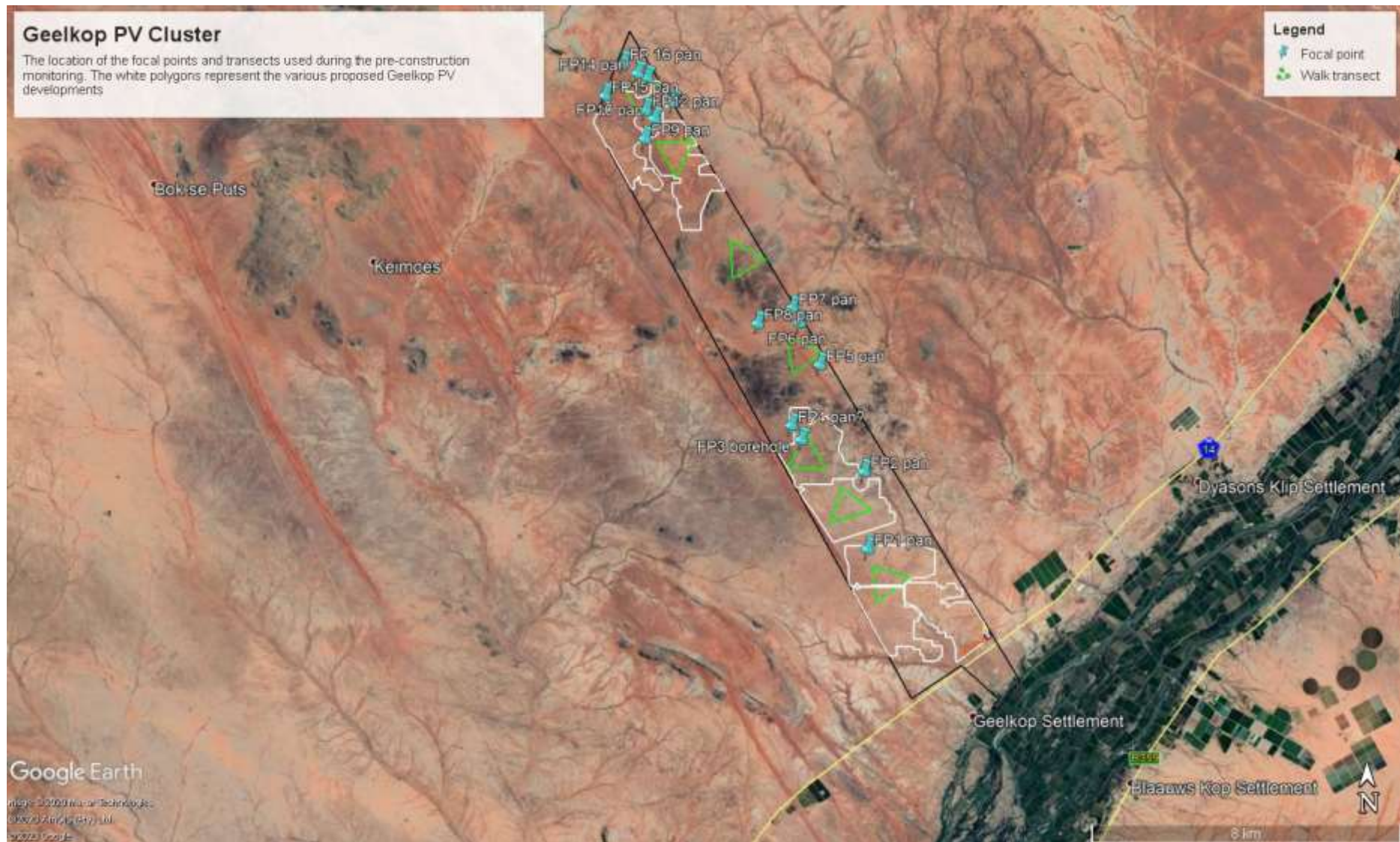
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## APPENDIX 1: PRE-CONSTRUCTION MONITORING



## APPENDIX 2: SPECIES OCCURRING IN THE BROADER AREA

Family	Species	Taxonomic name	SABAP2 full protocol reporting rate	Recorded during surveys
Barbet	Acacia Pied Barbet	<i>Tricholaema leucomelas</i>	59.66	x
Barbet	Black-collared Barbet	<i>Lybius torquatus</i>	1.14	
Barbet	Crested Barbet	<i>Trachyphonus vaillantii</i>	48.86	
Batis	Pirit Batis	<i>Batis pirit</i>	35.80	x
Bee-eater	European Bee-eater	<i>Merops apiaster</i>	21.02	x
Bee-eater	Swallow-tailed Bee-eater	<i>Merops hirundineus</i>	30.68	
Bee-eater	White-fronted Bee-eater	<i>Merops bullockoides</i>	22.16	
Bishop	Southern Red Bishop	<i>Euplectes orix</i>	64.20	x
Bittern	Little Bittern	<i>Ixobrychus minutus</i>	13.64	
Bokmakierie	Bokmakierie Bokmakierie	<i>Telophorus zeylonus</i>	50.00	x
Brubru	Brubru Brubru	<i>Nilaus afer</i>	25.00	
Bulbul	African Red-eyed Bulbul	<i>Pycnonotus nigricans</i>	73.86	
Bunting	Cinnamon-breasted Bunting	<i>Emberiza tahapisi</i>	1.14	
Bunting	Lark-like Bunting	<i>Emberiza impetuani</i>	41.48	x
Bustard	Kori Bustard	<i>Ardeotis kori</i>	5.11	x
Bustard	Ludwig's Bustard	<i>Neotis ludwigii</i>	3.41	x
Buzzard	Jackal Buzzard	<i>Buteo rufofuscus</i>	0.57	
Buzzard	Steppe Buzzard	<i>Buteo vulpinus</i>	2.27	
Canary	Black-throated Canary	<i>Crithagra atrogularis</i>	39.77	
Canary	White-throated Canary	<i>Crithagra alboqularis</i>	3.98	
Canary	Yellow Canary	<i>Crithagra flaviventris</i>	43.18	x
Chat	Anteating Chat	<i>Myrmecocichla formicivora</i>	21.59	x
Chat	Familiar Chat	<i>Cercomela familiaris</i>	28.41	
Chat	Karoo Chat	<i>Cercomela schlegelii</i>	0.57	x
Chat	Tractrac Chat	<i>Cercomela tractrac</i>	1.14	
Cisticola	Desert Cisticola	<i>Cisticola aridulus</i>	13.64	x
Cisticola	Grey-backed Cisticola	<i>Cisticola subruficapilla</i>	3.41	
Cisticola	Levaillant's Cisticola	<i>Cisticola tinniens</i>	40.34	
Cisticola	Zitting Cisticola	<i>Cisticola juncidis</i>	38.07	
Cliff-swallow	South African Cliff-swallow	<i>Hirundo spilodera</i>	13.64	
Coot	Red-knobbed Coot	<i>Fulica cristata</i>	3.98	
Cormorant	Reed Cormorant	<i>Phalacrocorax africanus</i>	41.48	
Cormorant	White-breasted Cormorant	<i>Phalacrocorax carbo</i>	39.77	
Coucal	Burchell's Coucal	<i>Centropus burchellii</i>	33.52	
Courser	Double-banded Courser	<i>Rhinoptilus africanus</i>	3.98	
Crake	Black Crake	<i>Amaurornis flavirostris</i>	11.36	
Crombec	Long-billed Crombec	<i>Sylvietta rufescens</i>	14.20	
Crow	Pied Crow	<i>Corvus albus</i>	33.52	x
Cuckoo	Diderick Cuckoo	<i>Chrysococcyx caprius</i>	24.43	
Cuckoo	Jacobin Cuckoo	<i>Clamator jacobinus</i>	1.70	
Darter	African Darter	<i>Anhinga rufa</i>	45.45	
Dove	Laughing Dove	<i>Streptopelia senegalensis</i>	75.57	
Dove	Namaqua Dove	<i>Oena capensis</i>	47.73	x
Dove	Red-eyed Dove	<i>Streptopelia semitorquata</i>	62.50	
Dove	Rock Dove	<i>Columba livia</i>	3.41	
Duck	African Black Duck	<i>Anas sparsa</i>	14.20	
Duck	Maccoa Duck	<i>Oxyura maccoa</i>	0.57	
Duck	White-faced Duck	<i>Dendrocygna viduata</i>	13.64	
Duck	Yellow-billed Duck	<i>Anas undulata</i>	9.66	



Common_group	Species	Taxonomic name	SABAP2 full protocol reporting rate	Recorded during surveys
Eagle	Booted Eagle	<i>Aquila pennatus</i>	6.25	
Eagle	Martial Eagle	<i>Polemaetus bellicosus</i>	2.27	
Eagle	Tawny Eagle	<i>Aquila rapax</i>	0.00	x
Eagle-owl	Spotted Eagle-owl	<i>Bubo africanus</i>	2.27	
Egret	Cattle Egret	<i>Bubulcus ibis</i>	61.36	
Egret	Little Egret	<i>Egretta garzetta</i>	14.20	
Eremomela	Yellow-bellied Eremomela	<i>Eremomela icteropygialis</i>	14.77	
Falcon	Lanner Falcon	<i>Falco biarmicus</i>	10.80	
Falcon	Peregrine Falcon	<i>Falco peregrinus</i>	1.70	
Falcon	Pygmy Falcon	<i>Polihierax semitorquatus</i>	7.39	
Finch	Red-headed Finch	<i>Amadina erythrocephala</i>	4.55	
Finch	Scaly-feathered Finch	<i>Sporopipes squamifrons</i>	26.70	x
Firefinch	Red-billed Firefinch	<i>Lagonosticta senegala</i>	17.61	
Fiscal	Common (Southern) Fiscal	<i>Lanius collaris</i>	77.27	
Fish-eagle	African Fish-eagle	<i>Haliaeetus vocifer</i>	32.39	
Flamingo	Greater Flamingo	<i>Phoenicopterus ruber</i>	0.57	
Flycatcher	Chat Flycatcher	<i>Bradornis infuscatus</i>	20.45	x
Flycatcher	Fairy Flycatcher	<i>Stenostira scita</i>	1.14	
Flycatcher	Fiscal Flycatcher	<i>Sigelus silens</i>	15.34	
Flycatcher	Spotted Flycatcher	<i>Muscicapa striata</i>	2.27	
Goose	Egyptian Goose	<i>Alopochen aegyptiacus</i>	59.66	x
Goose	Spur-winged Goose	<i>Plectropterus gambensis</i>	18.18	
Goshawk	Southern Pale Chanting Goshawk	<i>Melierax canorus</i>	15.34	x
Grebe	Little Grebe	<i>Tachybaptus ruficollis</i>	15.34	
Greenshank	Common Greenshank	<i>Tringa nebularia</i>	3.98	
Guineafowl	Helmeted Guineafowl	<i>Numida meleagris</i>	46.59	
Hamerkop	Hamerkop Hamerkop	<i>Scopus umbretta</i>	31.25	
Harrier	Montagu's Harrier	<i>Circus pygargus</i>	1.70	
Harrier	Pallid Harrier	<i>Circus macrourus</i>	0.57	
Harrier-Hawk	African Harrier-Hawk	<i>Polyboroides typus</i>	0.00	
Heron	Black Heron	<i>Egretta ardesiaca</i>	0.57	
Heron	Black-headed Heron	<i>Ardea melanocephala</i>	29.55	
Heron	Goliath Heron	<i>Ardea goliath</i>	19.32	
Heron	Green-backed Heron	<i>Butorides striata</i>	1.70	
Heron	Grey Heron	<i>Ardea cinerea</i>	39.77	
Heron	Purple Heron	<i>Ardea purpurea</i>	7.95	
Heron	Squacco Heron	<i>Ardeola ralloides</i>	5.68	
Honeyguide	Lesser Honeyguide	<i>Indicator minor</i>	13.64	
Hoopoe	African Hoopoe	<i>Upupa africana</i>	43.18	
Hornbill	African Grey Hornbill	<i>Tockus nasutus</i>	0.57	
Ibis	African Sacred Ibis	<i>Threskiornis aethiopicus</i>	51.14	
Ibis	Glossy Ibis	<i>Plegadis falcinellus</i>	1.14	
Ibis	Hadedda Ibis	<i>Bostrychia hagedash</i>	73.30	
Jacana	African Jacana	<i>Actophilornis africanus</i>	0.57	
Kestrel	Greater Kestrel	<i>Falco rupicoloides</i>	3.98	
Kestrel	Lesser Kestrel	<i>Falco naumanni</i>	0.57	
Kestrel	Rock Kestrel	<i>Falco rupicolus</i>	6.82	
Kingfisher	Brown-hooded Kingfisher	<i>Halcyon albiventris</i>	4.55	
Kingfisher	Giant Kingfisher	<i>Megaceryle maximus</i>	33.52	
Kingfisher	Malachite Kingfisher	<i>Alcedo cristata</i>	13.07	
Kingfisher	Pied Kingfisher	<i>Ceryle rudis</i>	27.84	

Common_group	Species	Taxonomic name	SABAP2 full protocol reporting rate	Recorded during surveys
Kingfisher	Striped Kingfisher	<i>Halcyon chelicuti</i>	0.57	
Kite	Black-shouldered Kite	<i>Elanus caeruleus</i>	28.41	
Korhaan	Karoo Korhaan	<i>Eupodotis vigorsii</i>	35.23	x
Korhaan	Northern Black Korhaan	<i>Afrotis afraoides</i>	34.09	x
Korhaan	Red-crested Korhaan	<i>Lophotis ruficrista</i>	0.57	
Lapwing	Blacksmith Lapwing	<i>Vanellus armatus</i>	55.68	
Lapwing	Crowned Lapwing	<i>Vanellus coronatus</i>	21.59	x
Lark	Eastern Clapper Lark	<i>Mirafraga fasciolata</i>	19.32	x
Lark	Fawn-coloured Lark	<i>Calendulauda africanoides</i>	38.07	x
Lark	Karoo Long-billed Lark	<i>Certhilauda subcoronata</i>	6.25	
Lark	Pink-billed Lark	<i>Spizocorys conirostris</i>	2.84	
Lark	Red-capped Lark	<i>Calandrella cinerea</i>	0.57	
Lark	Sabota Lark	<i>Calendulauda sabota</i>	36.36	x
Lark	Spike-heeled Lark	<i>Chersomanes albofasciata</i>	29.55	x
Lark	Stark's Lark	<i>Spizocorys starki</i>	9.09	x
Lovebird	Rosy-faced Lovebird	<i>Agapornis roseicollis</i>	0.57	
Martin	Brown-throated Martin	<i>Riparia paludicola</i>	50.57	
Martin	Rock Martin	<i>Hirundo fuligula</i>	34.66	
Masked-weaver	Southern Masked-weaver	<i>Ploceus velatus</i>	75.00	x
Moorhen	Common Moorhen	<i>Gallinula chloropus</i>	11.93	
Mousebird	Red-faced Mousebird	<i>Urocolius indicus</i>	50.00	
Mousebird	White-backed Mousebird	<i>Colius colius</i>	69.32	x
Night-Heron	Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	5.11	
Nightjar	Rufous-cheeked Nightjar	<i>Caprimulgus rufigena</i>	7.95	
Ostrich	Common Ostrich	<i>Struthio camelus</i>	1.70	
Owl	Barn Owl	<i>Tyto alba</i>	19.89	
Owlet	Pearl-spotted Owlet	<i>Glaucidium perlatum</i>	2.27	
Palm-swift	African Palm-swift	<i>Cypsiurus parvus</i>	52.27	
Penduline-tit	Cape Penduline-tit	<i>Anthoscopus minutus</i>	1.70	
Pigeon	Speckled Pigeon	<i>Columba guinea</i>	59.09	
Pipit	African Pipit	<i>Anthus cinnamomeus</i>	28.98	x
Plover	Kittlitz's Plover	<i>Charadrius pecuarius</i>	0.57	
Plover	Three-banded Plover	<i>Charadrius tricollaris</i>	38.07	
Prinia	Black-chested Prinia	<i>Prinia flavicans</i>	84.66	x
Pytilia	Green-winged Pytilia	<i>Pytilia melba</i>	0.57	
Quail	Common Quail	<i>Coturnix coturnix</i>	1.14	x
Quelea	Red-billed Quelea	<i>Quelea quelea</i>	52.84	
Reed-warbler	African Reed-warbler	<i>Acrocephalus baeticatus</i>	26.14	
Reed-warbler	Great Reed-warbler	<i>Acrocephalus arundinaceus</i>	0.57	
Robin-chat	Cape Robin-chat	<i>Cossypha caffra</i>	55.11	
Rock-thrush	Short-toed Rock-thrush	<i>Monticola brevipes</i>	0.57	
Ruff	Ruff Ruff	<i>Philomachus pugnax</i>	1.70	
Sandgrouse	Burchell's Sandgrouse	<i>Pterocles burchelli</i>	0.57	
Sandgrouse	Namaqua Sandgrouse	<i>Pterocles namaqua</i>	47.16	x
Sandpiper	Common Sandpiper	<i>Actitis hypoleucos</i>	2.27	
Sandpiper	Wood Sandpiper	<i>Tringa glareola</i>	7.95	
Scimitarbill	Common Scimitarbill	<i>Rhinopomastus cyanomelas</i>	7.95	
Scrub-robin	Kalahari Scrub-robin	<i>Cercotrichas paena</i>	10.23	x
Scrub-robin	Karoo Scrub-robin	<i>Cercotrichas coryphoeus</i>	41.48	
Secretarybird	Secretarybird Secretarybird	<i>Sagittarius serpentarius</i>	1.14	
Shelduck	South African Shelduck	<i>Tadorna cana</i>	22.73	

Common_group	Species	Taxonomic name	SABAP2 full protocol reporting rate	Recorded during surveys
Shoveler	Cape Shoveler	<i>Anas smithii</i>	1.70	
Shrike	Lesser Grey Shrike	<i>Lanius minor</i>	2.27	
Shrike	Red-backed Shrike	<i>Lanius collurio</i>	0.57	
Sparrow	Cape Sparrow	<i>Passer melanurus</i>	77.27	x
Sparrow	House Sparrow	<i>Passer domesticus</i>	59.66	
Sparrow	Southern Grey-headed Sparrow	<i>Passer diffusus</i>	18.75	
Sparrowlark	Black-eared Sparrowlark	<i>Eremopterix australis</i>	5.68	x
Sparrowlark	Grey-backed Sparrowlark	<i>Eremopterix verticalis</i>	19.32	x
Sparrow-weaver	White-browed Sparrow-weaver	<i>Plocepasser mahali</i>	34.09	
Spoonbill	African Spoonbill	<i>Platalea alba</i>	0.57	
Spurfowl	Cape Spurfowl	<i>Pternistis capensis</i>	1.14	
Starling	Cape Glossy Starling	<i>Lamprotornis nitens</i>	53.98	
Starling	Pale-winged Starling	<i>Onychognathus nabouroup</i>	2.27	
Starling	Wattled Starling	<i>Creatophora cinerea</i>	26.14	x
Stilt	Black-winged Stilt	<i>Himantopus himantopus</i>	18.18	
Stork	Abdim's Stork	<i>Ciconia abdimii</i>	9.66	
Stork	White Stork	<i>Ciconia ciconia</i>	0.57	
Stork	Yellow-billed Stork	<i>Mycteria ibis</i>	2.27	
Sunbird	Dusky Sunbird	<i>Cinnyris fuscus</i>	58.52	x
Sunbird	Marico Sunbird	<i>Cinnyris mariquensis</i>	3.41	
Swallow	Barn Swallow	<i>Hirundo rustica</i>	35.23	x
Swallow	Greater Striped Swallow	<i>Hirundo cucullata</i>	42.05	
Swallow	White-throated Swallow	<i>Hirundo albigularis</i>	44.89	
Swamp-warbler	Lesser Swamp-warbler	<i>Acrocephalus gracilirostris</i>	42.61	
Swift	Alpine Swift	<i>Tachymarptis melba</i>	1.70	
Swift	Common Swift	<i>Apus apus</i>	10.80	x
Swift	Little Swift	<i>Apus affinis</i>	64.20	x
Swift	White-rumped Swift	<i>Apus caffer</i>	26.70	
Teal	Cape Teal	<i>Anas capensis</i>	5.68	
Teal	Red-billed Teal	<i>Anas erythrorhyncha</i>	18.75	
Thick-knee	Spotted Thick-knee	<i>Burhinus capensis</i>	21.59	
Thrush	Karoo Thrush	<i>Turdus smithi</i>	52.27	
Tit	Ashy Tit	<i>Parus cinerascens</i>	9.09	
Tit-babbler	Chestnut-vented Tit-babbler	<i>Parisoma subcaeruleum</i>	28.41	
Tit-babbler	Layard's Tit-babbler	<i>Parisoma layardi</i>	1.14	
Turtle-dove	Cape Turtle-dove	<i>Streptopelia capicola</i>	66.48	
Wagtail	African Pied Wagtail	<i>Motacilla aguimp</i>	22.16	
Wagtail	Cape Wagtail	<i>Motacilla capensis</i>	64.77	
Warbler	Icterine Warbler	<i>Hippolais icterina</i>	1.14	
Warbler	Namaqua Warbler	<i>Phragmacia substriata</i>	35.80	
Warbler	Rufous-eared Warbler	<i>Malcorus pectoralis</i>	39.77	x
Warbler	Willow Warbler	<i>Phylloscopus trochilus</i>	2.27	
Waxbill	Black-faced Waxbill	<i>Estrilda erythronotos</i>	1.70	
Waxbill	Common Waxbill	<i>Estrilda astrild</i>	27.27	
Weaver	Sociable Weaver	<i>Philetairus socius</i>	43.18	x
Wheatear	Capped Wheatear	<i>Oenanthe pileata</i>	15.34	x
Wheatear	Mountain Wheatear	<i>Oenanthe monticola</i>	1.14	x
White-eye	Orange River White-eye	<i>Zosterops pallidus</i>	61.36	
Whydah	Pin-tailed Whydah	<i>Vidua macroura</i>	17.05	
Wood-hoopoe	Green Wood-hoopoe	<i>Phoeniculus purpureus</i>	0.57	
Woodpecker	Cardinal Woodpecker	<i>Dendropicos fuscescens</i>	11.93	
Woodpecker	Golden-tailed Woodpecker	<i>Campethera abingoni</i>	23.30	

### APPENDIX 3: RENEWABLE ENERGY PROJECTS WITHIN A 30KM RADIUS AROUND THE STUDY AREA

PROJECT TITLE	FOOTPRINT	TECHNOLOGY	MW	EA STATUS
Bloemsmond 1	280	PV	75	Authorised
Bloemsmond 2	275	PV	75	Authorised
Bloemsmond 3	310	PV	100	Authorised
Bloemsmond 4	360	PV	100	Authorised
Bloemsmond 5	390	PV	100	Authorised
Dyasonsklip 1 Solar	209	PV	86	Constructed
Dyasonsklip 2 Solar	210	PV	75	Constructed
RE Capital 3 C Solar	166	PV	75	Authorised
Dyasonsklip 5	280	PV	100	In process
Sirius Solar 1	244	PV	75	Constructed
Sirius Solar 2	254	PV	75	Authorised
Sirius Solar 3	280	PV	100	In process
Sirius Solar 4	280	PV	100	In process
Khi Solar 1 CSP	600	CSP	110	Constructed
McTaggarts Camp PV 1	190	PV	75	Authorised
McTaggarts Camp PV 2	173	PV	75	Authorised
McTaggarts Camp PV 3	210	PV	75	Authorised
Klip Punt PV 1	200	PV	75	Authorised
Bushmanland PV	260	PV	100	In process
Duneveld PV	240	PV	100	In process
Gordonia Solar PV	250	PV	100	In process
Hari PV	240	PV	100	In process
Karroid PV	240	PV	100	In process
Shrubland PV	245	PV	100	In process
GK Solar PV	260	PV	100	In process
Ofir-Zx Photovoltaic	400	PV	200	Authorised
Eenduin PV	210	PV	75	In process
Upington Solar Park	5 000	CSP/PV	1000	In process
Solis 1 CSP	400	CSP	125	Authorised

## APPENDIX 4: ENVIRONMENTAL MANAGEMENT PROGRAMME

### Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
Avifauna: Mortality due to electrocution					
Electrocution of priority avifauna on grid connection poles	Prevention of electrocution of avifauna.	It is recommended that the 7611/7622/T2002 intermediate pole is avoided.	Use other approved pole designs	Once-off during the planning phase.	Project Developer

### Management Plan for the Construction Phase

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

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			<p>demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.</p> <p>6. A walk-through must be conducted by the avifaunal specialist to assess whether there are any breeding Red List species breeding, which could be displaced by the de-commissioning activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of activities.</p>		
Avifauna: Mortality due to collisions with the earthwire of the grid connection					
Mortality of priority avifauna due to collisions with the earthwire of the grid connection.	Prevention of collision related mortality.	Eskom approved bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.	Installation of Eskom approved Bird Flight Diverters according to the Eskom specifications.	Once-off during the construction phase.	<ol style="list-style-type: none"> <li>1. Project Developer</li> <li>2. Contractor</li> </ol>

### Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
Avifauna: Mortality due to electrocution					
Electrocution of priority avifauna in the onsite substation/switching station.	Prevention of ongoing electrocution of avifauna through reactive mitigation if necessary, depending on the gravity of the problem.	Implementation of mitigation measures such as insulation of live parts to prevent further electrocutions.	<ol style="list-style-type: none"> <li>1. Site investigation to determine causes of the mortality.</li> <li>2. Implementation of appropriate measures e.g. insulation of live parts with appropriate products.</li> </ol>	As and when required	<ol style="list-style-type: none"> <li>1. Facility Environmental Manager</li> <li>2. Facility operational manager</li> </ol>

### Management Plan for the Decommissioning Phase

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

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		<p>pertaining to the limitation of the footprint.</p>	<p>report non-compliance.</p> <p>5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.</p> <p>6. A walk-through must be conducted by the avifaunal specialist to assess whether there are any breeding Red List species breeding, which could be displaced by the de-commissioning activities. Should this be the case, appropriate measures must be put in place if possible, to prevent the displacement of the breeding birds, through the timing of activities.</p>		



## APPENDIX 5: ASSESSMENT CRITERIA

The identification of potential impacts includes impacts that may occur during the construction, operational and decommissioning phases of the proposed development. The assessment of impacts includes direct, indirect as well as cumulative impacts.

In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed activity is well understood so that the impacts associated with the activity can be understood. The process of identification and assessment of impacts will include:

- Determine the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Determine future changes to the environment that will occur if the activity does not proceed;
- An understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken.

The impact assessment methodology has been aligned with the requirements for BA Reports as stipulated in Appendix 1 (3) (j) of the 2014 EIA Regulations (as amended), which states the following:

“A BA Report must contain the information that is necessary for the Competent Authority to consider and come to a decision on the application, and must include an assessment of each identified potentially significant impact and risk, including –

- (i) cumulative impacts;
- (ii) the nature, significance and consequences of the impact and risk;
- (iii) the extent and duration of the impact and risk;
- (iv) the probability of the impact and risk occurring;
- (v) the degree to which the impact and risk can be reversed;
- (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and
- (vii) the degree to which the impact and risk can be mitigated”.

As per DEA *Guideline 5: Assessment of Alternatives and Impacts* the following methodology is to be applied to the prediction and assessment of impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

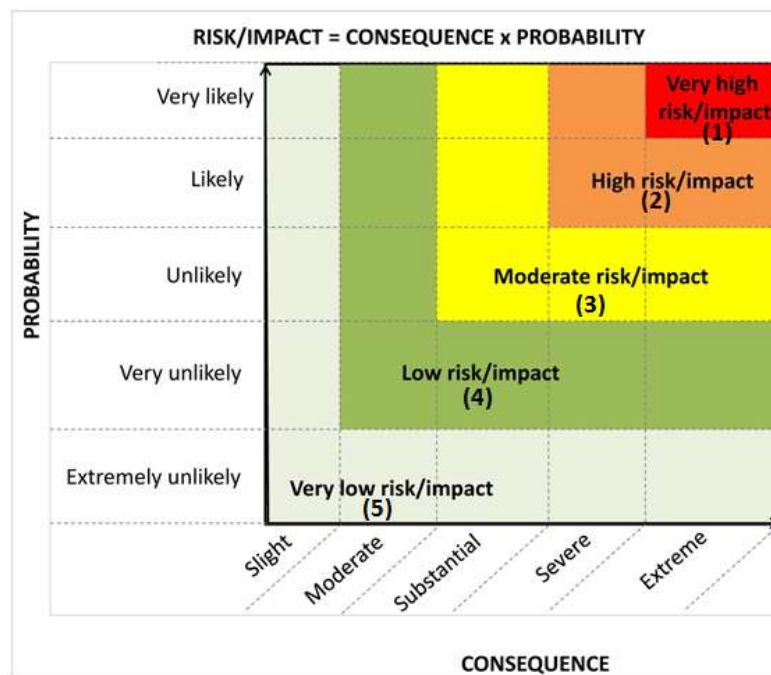
- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.
- **Nature of impact** - this reviews the type of effect that a proposed activity will have on the environment and should include “what will be affected and how?”
- **Spatial extent** – The size of the area that will be affected by the risk/impact:
  - Site specific;

- Local (<10 km from site);
  - Regional (<100 km of site);
  - National; or
  - International (e.g. Greenhouse Gas emissions or migrant birds).
- **Duration** – The timeframe during which the risk/impact will be experienced:
    - Very short term (instantaneous);
    - Short term (less than 1 year);
    - Medium term (1 to 10 years);
    - Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or
    - Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).
  - **Reversibility of impacts** - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase) will be:
    - High reversibility of impacts (impact is highly reversible at end of project life, i.e. this is the most favourable assessment for the environment. For example, the nuisance factor caused by noise impacts associated with the operational phase of an exporting terminal can be considered to be highly reversible at the end of the project life);
    - Moderate reversibility of impacts;
    - Low reversibility of impacts; or
    - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment. The impact is permanent. For example, the loss of a palaeontological resource on the site caused by building foundations could be non-reversible).
  - **Irreplaceability of resource loss caused by impacts** – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase) will be:
    - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment. For example, if the project will destroy unique wetland systems, these may be irreplaceable);
    - Moderate irreplaceability of resources;
    - Low irreplaceability of resources; or
    - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

***Using the criteria above, the impacts will further be assessed in terms of the following:***

- **Probability** – The probability of the impact occurring:
  - Extremely unlikely (little to no chance of occurring);
  - Very unlikely (<30% chance of occurring);
  - Unlikely (30-50% chance of occurring)
  - Likely (51 – 90% chance of occurring); or
  - Very Likely (>90% chance of occurring regardless of prevention measures).
- **Consequence** – The anticipated severity of the impact:
  - Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
  - Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);

- Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or
  - Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).
- **Significance** – To determine the significance of an identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure 6 below). The approach incorporates internationally recognised methods from the Intergovernmental Panel on Climate Change (IPCC) (2014) assessment of the effects of climate change and is based on an interpretation of existing information in relation to the proposed activity, to generate an integrated picture of the risks related to a specified activity in a given location, with and without mitigation. Risk is assessed for each significant stressor (e.g. physical disturbance), on each different type of receiving entity (e.g. the municipal capacity, a sensitive wetland), qualitatively (very low, low, moderate, high, very high) against a predefined set of criteria (as shown in Figure 1 below). The significance is rated qualitatively as follows against a predefined set of criteria (i.e. probability and consequence) as indicated in Figure 1:



**Figure 1: Guide to assessing risk/impact significance as a result of consequence and probability.**

- **Significance** – Will the impact cause a notable alteration of the environment?
- Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
  - Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
  - Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);

- High (the risk/impacts will result in a major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); or
- Very high (the risk/impacts will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).

The above assessment must be described in the text (with clear explanation provided on the rationale for the allocation of significance ratings) and summarised in an impact assessment Table in a similar manner as shown in the example below (Table 1).

With the implementation of mitigation measures, the residual impacts/risks must be ranked as follows in terms of significance:

- Very low = 5;
  - Low = 4;
  - Moderate = 3;
  - High = 2; and
  - Very high = 1.
- **Status** - Whether the impact on the overall environment (social, biophysical and economic) will be:
    - Positive - environment overall will benefit from the impact;
    - Negative - environment overall will be adversely affected by the impact; or
    - Neutral - environment overall will not be affected.
  - **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge:
    - Low;
    - Medium; or
    - High.

Impacts will then be collated into an EMPr and these will include the following:

- Management actions and monitoring of the impacts;
- Identifying negative impacts and prescribing mitigation measures to avoid or reduce negative impacts; and
- Positive impacts will be identified and enhanced where possible.

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