AVIFAUNAL IMPACT ASSESSMENT

Camden up to 400kV powerline and Collector Substation
Mpumalanga Province

June 2022

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EXECUTIVE SUMMARY

1 BACKGROUND

The proposed Camden Renewable Energy Complex (the 'Complex') is being developed by ENERTRAG South Africa (Pty) Ltd ("ENERTRAG" or "Developer") in the context of the Department of Mineral Resources and Energy's (DMRE) Integrated Resource Plan, and the Renewable Energy Independent Power Producer Procurement Programme (REIPPP).

The Complex can be divided into eight (8) Projects, namely:

- Camden I Wind Energy Facility (up to 200MW).
- Camden I Wind Grid Connection (up to 132kV).
- Camden up to 400kV Gid Connection and Collector substation (including the Camden Power Station substation extension).
- Camden I Solar up to 100MW.
- Camden I Solar up to 132kV Gid Connection.
- Camden Green Hydrogen and Ammonia Facility, including grid connection infrastructure.
- Camden II Wind Energy Facility (up to 200MW).
- Camden II Wind Energy Facility up to 132kV Gid Connection.

This impact report deals with the Camden I up to 400kV Gid Connection, Collector substation and Camden Power Station substation extension.

2 AVIFAUNA

The SABAP2 data indicates that a total of 234 bird species could potentially occur within the broader area – Appendix 1 provides a comprehensive list of all the species. Of these, 78 are classified as powerline sensitive species. Of the 78 powerline sensitive species, 15 are South African Red List species. 55 powerline sensitive species are likely to occur regularly in the project area.

3 SUMMARY AND CONCLUSION

3.1 Up to 400kV HV powerline and collector substation

The proposed Camden up to 400kV HV powerline, collector substation and extension of the Camden PS substation could have several potential impacts on priority avifauna. These impacts are the following:

- Displacement due to disturbance associated with the construction of the proposed powerline, on-site collector substation and the extension of the Camden PS substation.
- Displacement due to habitat transformation associated with the construction of the proposed powerline, on-site collector substation and the extension of the Camden PS substation.
- Mortality due to electrocution on the electrical infrastructure within the proposed on-site collector substation.
- Mortality due to collisions with the proposed powerline.
- Displacement due to disturbance associated with the dismantling of the proposed powerline and on-site collector substation.

3.1.1 Displacement of powerline sensitive species due to disturbance in the construction phase

Construction activities impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities

to avoid disturbance during a critical phase of the breeding cycle, although this is often impractical to implement due to tight construction schedules. Powerline sensitive species which are potentially vulnerable to displacement due to habitat transformation are mostly ground nesting species. Species that could be impacted are African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and will be reduced to a **low** level post-mitigation.

3.1.2 Displacement of powerline sensitive species due to habitat transformation in the construction phase

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed powerline and collector substation through the transformation of habitat. Relevant to this development, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the on-site substation is unavoidable. In the case of the powerline, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed powerline. The loss of habitat in the substation footprint (7 ha) will be a relatively insignificant percentage of the habitat that regularly supports powerline sensitive species, and the resultant impact is likely to be fairly minimal. Powerline sensitive species which are potentially most vulnerable to displacement due to habitat transformation are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and, White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

3.1.3 Collisions of powerline sensitive species with the up to 400kV HV powerline in the operational phase

Collisions could be the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins *et al.* 2010; Martin *et al.* 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (e.g. Bernardino *et al.* 2018; Sporer *et al.* 2013, Barrientos *et al.* 2011; Jenkins *et al.* 2010; Alonso & Alonso 1999; Koops & De Jong 1982).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 up to 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. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck. The impact is rated as **moderate** pre-mitigation but should be reduced to a **low** level post-mitigation.

3.1.4 Mortality due to electrocution on the electrical infrastructure within the proposed on-site collector substation

Electrocutions within the proposed substation yard are possible but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls, and certain species of waterbirds. The powerline sensitive species which are potentially vulnerable to electrocution impact are Common Buzzard, Jackal Buzzard, Cape Crow, Pied Crow, African Fish Eagle, Black-chested Snake Eagle, Brown Snake Eagle, Long-crested Eagle, Martial Eagle, Spotted Eagle-Owl, Amur Falcon, Lanner Falcon, Peregrine Falcon, Helmeted Guineafowl, Black-headed Heron, Hadada Ibis, Southern Bald Ibis, Black-winged Kite, Yellow-billed Kite, Western Osprey, African Grass Owl, Marsh Owl, Western Barn Owl, Black Sparrowhawk and Cape Vulture. The impact is rated as **low** pre- and post-mitigation.

3.1.5 Displacement of powerline sensitive species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed up to 400kV powerline and collector substation. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

3.2 Cumulative impacts

3.2.1 Up to 400kV HV powerline

According to the official database of DFFE and other documents in the public domain, there are currently three planned renewable energy facility within a 30km radius around the proposed development, namely the Camden I and II Wind Energy Facilities and the Camden Solar Energy Facility (SEF) (see Figure 11). These developments will include grid connections with a maximum combined length of 31.2km. The up to 400kV HV powerline connection to the Camden Power Station Substation will have a maximum length of 8.9km. The maximum combined length of the grid connections for the Camden I and II renewable wind energy projects listed above, the up to 400kV HV powerline to Camden Power Station Substation, and the Camden I SEF (maximum 13.7km) will therefore be approximately 40.1km. The existing high voltage lines in the 30km radius around the proposed Camden I SEF run into hundreds of kilometres (see Figure 11). The Camden up to 400kV contribution (maximum 8.9km) to the total length of high voltage lines within a 30km radius is **Low**. However, the density of all planned and existing high voltage lines within a 30km radius, and by implication the cumulative impact on avifauna, is considered to be **Moderate**.

3.2.2 The collector substation and Camden Power Station SS extension

The collector substation and Camden PS substation extension will transform an area of approximately 7 ha. Given the available habitat of 4 258km² within a 30km radius around the project site, the cumulative impact of displacement and habitat transformation caused by these developments is **Low** due to the small footprint.

4 CONCLUSION AND IMPACT STATEMENT

4.1 The up to 400kV HV powerline, collector substation and Camden PS substation extension

The proposed up to 400kV HH powerline, collector substation and Camden PS substation extension will have a mostly **low to moderate** impact on priority avifauna which, in all instances, could be reduced to a low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The proposed developments are therefore supported, provided the mitigation measures listed in this report are strictly implemented.

CONTENTS

DETAILS OF THE SPECIALIST

Chris van Rooyen (Bird Specialist)

Chris has 25 years' experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (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 worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in numerous power line and wind generation projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in Southern Africa, which is currently (2016) accepted as the industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Albert Froneman (Bird and GIS Specialist)

Albert has an M. Sc. in Conservation Biology from the University of Cape Town and started his career in the natural sciences as a Geographic Information Systems (GIS) specialist at Council for Scientific and Industrial Research (CSIR). In 1998, he joined the Endangered Wildlife Trust where he headed up the Airports Company South Africa – EWT Strategic Partnership, a position he held until he resigned in 2008 to work as a private ornithological consultant. Albert's specialist field is the management of wildlife, especially bird related hazards at airports. His expertise is recognized internationally; in 2005 he was elected as Vice Chairman of the International Bird Strike Committee. Since 2010, Albert has worked closely with Chris van Rooyen in developing a protocol for pre-construction monitoring at wind energy facilities, and he is currently jointly coordinating pre-construction monitoring programmes at several solar facility facilities. Albert also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

1 INTRODUCTION

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This impact report deals with the Camden I up to 400kV Gid Connection, Collector substation and Camden Power Station substation extension.

1.1 Camden up to 400kV high voltage (HV) powerline and Collector Substation

It is proposed that the broader Camden developments will connect to the nearby Camden Power Station substation (Camden substation and Uitkoms substation) through an up to 400kV powerline (either single or double circuit) either directly (alternate option), or via a Loop-In-Loop-Out (LILO) option into the existing Eskom Camden I – Incandu 400kV line traversing the Camden I project site (preferred option). Where direct connection is envisaged, the powerline will be approximately 8km in length. Depending on location, the LILO into the Camden I – Incandu 400kV line will require a 400kV line of approximately 2km in length.

The onsite Collector Substation (MTS)(two alternatives being provided for the purposes of assessment) will consist of a high voltage substation yard to allow for multiple (up to) 400kV feeder bays and transformers, control building, telecommunication infrastructure, access roads, etc. This substation will comprise the high-voltage components of the export solution for the broader Camden Cluster development and will comprise 132kV Collector substation components, which collect all the incoming 132kV power lines from the respective facilities, as well as the 400kV step-up infrastructure required for connection to the Camden Power Station. In addition, the expansion of the Camden Power Station substation as required forms part of this application.

The area for the onsite Collector Substation (MTS) will be up to 7ha and up to 1ha for the Camden Power Station substation expansion (if and as required). The up to 400kV powerline and substation will have a 250m assessment corridor to allow for micro-siting.

Two alternative new powerline routes are being investigated for direct connection into the Camden Power Station. In addition, two alternate routes are envisaged from the respective on-site Collector Substation for the Loop-In-Loop-Out option connection. Each of these will have a 250m assessment corridor to allow for micro-siting.

See Figure 1 for a map of the development area.

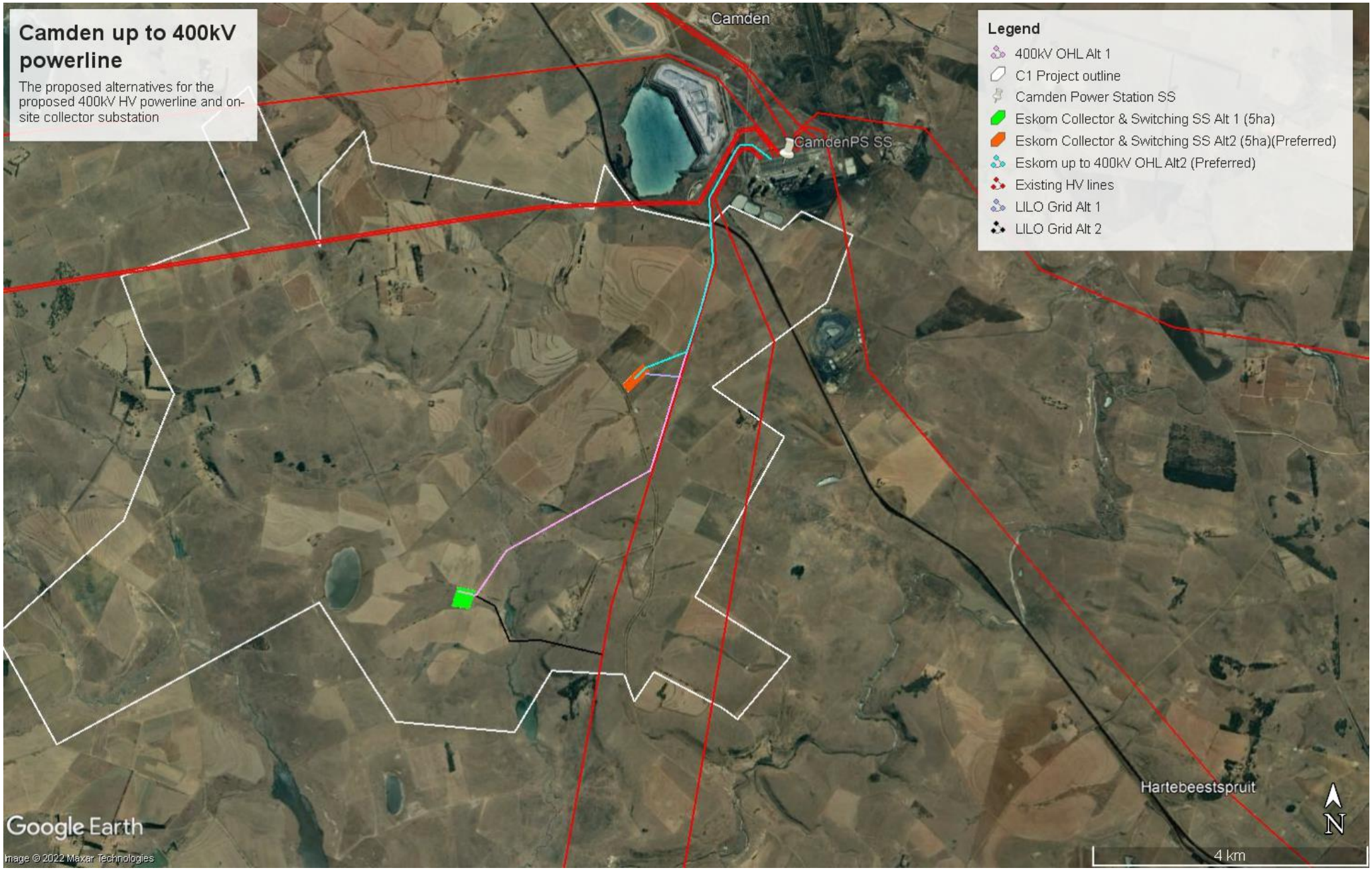

Figure 1: Proposed layout of the proposed Camden 400kV HV powerline and collector substation.

2 TERMS OF REFERENCE & PROTOCOLS

2.1 Up to 400V grid connection protocol

The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020).

The purpose of the specialist report is to determine the main issues and potential impacts of the 400kV HV powerline, based by the on existing information and field assessments, according to the said protocol. In summary, the protocol require the following:

- Describe the affected environment from an avifaunal perspective.
- Discuss gaps in baseline data and other limitations and describe the expected impacts associated up to 400kV HV powerline and collector substation.
- Identify potential sensitive environments and receptors that may be impacted on by the proposed up to 400kV HV powerline and collector substation and the types of impacts (i.e. direct, indirect and cumulative) that are most likely to occur.
- Determine the nature and extent of potential impacts during the construction, operational and decommissioning phases of the up to 400kV HV powerline and collector substation.
- Identify avifaunal sensitivities, including 'No-Go' areas, where applicable.
- Recommend mitigation measures to reduce the impact of the expected impacts.
- Provide an impact statement on whether the projects should be approved or not.

3 OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following methods were employed to conduct this study:

- The study area was defined as a 2km zone around the proposed on-site substation and up to up to 400kV overhead power line, inclusive of the Eskom Camden substation upgrades as needed.
- Powerline sensitive species were defined as species which could potentially be impacted by powerline collisions or electrocutions, based on their morphology. Larger birds, particularly raptors and vultures, are more vulnerable to electrocution as they are more likely to bridge the clearances between electrical components than smaller birds. Large terrestrial species and certain waterbirds with high wing loading are less manoeuvrable than smaller species and are therefore more likely to collide with overhead lines.
- 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 development is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5' × 5'). Each pentad is approximately 8 × 7.6 km. To get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 16 pentads some of which intersect and others that are near the development area, henceforth referred to as "the broader area" (see Figure 2Figure 2). The decision to include multiple pentads around the development area was to get a more representative picture of the bird abundance and variety in the region. The additional pentads and their data augment the bird distribution data. A total of 165 full protocol lists (i.e. bird listing surveys lasting a minimum of two hours each) and 227 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed to date for the 16 pentads where the development area is located. The SABAP2 data was therefore regarded as a reliable reflection of the avifauna which occurs in the area, but the data was also supplemented by data collected during the site surveys and general knowledge of the area.
- A classification of the vegetation types in the development 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 powerline sensitive species was determined with the use of the most recent edition of the Red List 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 powerline sensitive species was determined by consulting the latest (2021.3) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015; http://www.birdlife.org.za/conservation/important-bird-areas) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth © 2022) was used in order to view the broader area on a landscape level and to help identify bird habitat on the ground.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the development areas relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the development area.
- The South African National Biodiversity Institute (SANBI) guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa (2020) were consulted to assist with the interpretation of the Terrestrial Animal Species protocol.
- The main source of information on the avifaunal diversity and abundance at the project area is an integrated pre-construction monitoring programme which was implemented at the project area, covering all seven proposed sub projects of the Camden Renewable Energy Complex, including the Camden 400kV HV powerline and collector substation, according to the applicable best practice guidelines (See Appendix 3).

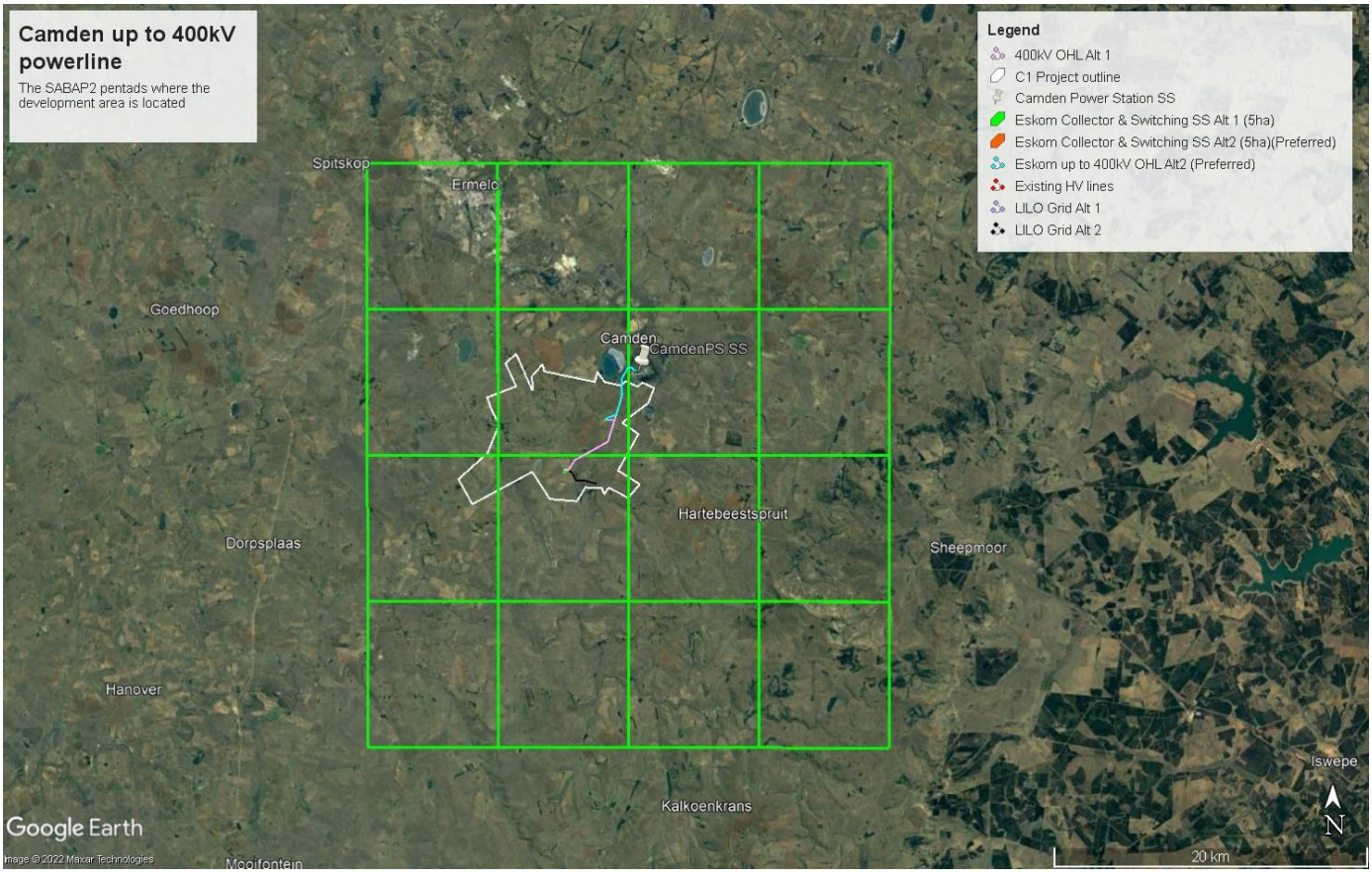

Figure 2: Area covered by the sixteen SABAP2 pentad grid cells (green squares).

4 ASSUMPTIONS AND LIMITATIONS

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

- The SABAP2 dataset is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, and the results of the pre-construction monitoring which was conducted over 12 months.
- Conclusions in this report are based on experience of these and similar species at solar facility developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.

5 LEGISLATIVE CONTEXT

5.1 Agreements and conventions

Table 2 below lists agreements and conventions which South Africa is party to, and which are relevant to the conservation of avifauna[1].

Table 1: Agreements and conventions which South Africa is party to and which are relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
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

[1] (BirdLife International (2021) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa. Checked: 2021-09-20).

5.2 National legislation

5.2.1 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.

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

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

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. In the case of wind energy developments, the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species where the output is 20MW or more (Government Gazette No 43110, 20 March 2020) is applicable to the solar facility development. The Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species was published on 30 October 2020. This protocol applies also for the assessment of impacts caused by powerlines on avifauna.

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

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

5.3 Provincial Legislation

The current legislation applicable to the conservation of fauna and flora in Mpumalanga is the Mpumalanga Nature Conservation Act 10 of 1998. It consolidated and amended the laws relating to nature conservation within the province and provides for matters connected therewith. All birds are classified as Protected Game (Section 4 (1) (b)), except those listed in Schedule 3, which are classified as Ordinary Game (Section 4 (1)(c)).

6 BASELINE ASSESSMENT

6.1 Important Bird Areas

The project site is not located in an Important Bird Area (IBA), but it is located between three IBAs. The closest IBA to the project site is the Grasslands IBA SA020, which is located 6-7km to the east of the site. The Chrissies Pans IBA SA019 is located 16-17km to the north-east of the site, and the Amersfoort-Bethal-Carolina IBA SA018 is located about 7-8km to the west. Due to the close proximity of the site to the IBAs, it is possible that some highly mobile powerline sensitive species which are also IBA trigger species, and which occur either permanently or sporadically in the IBAs, might be impacted by the project when they leave to forage or breed beyond the borders of the IBA. Species that were recorded in the broader area and fall within this category are the following:

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

6.2 DFFE National Screening Tool

In the case of the Animal Species theme, relevant to the proposed up to 400kV HV powerline and collector substation, the project area is classified as **Medium to High** sensitivity, based on the potential presence of Southern Bald Ibis (Globally and Regionally Vulnerable) and African Grass Owl (Locally Vulnerable) (Figure 4). This classification was confirmed during the surveys at the site and immediate environment, based on the presence of recorded species of conservation concern (SCC), namely Secretarybird (Globally Endangered, Regionally Vulnerable) White-bellied Bustard (Regionally Vulnerable), Blue Crane (Globally Vulnerable, Regionally Near-threatened), Grey Crowned Crane (Globally and Regionally Endangered), Martial Eagle (Globally and Regionally Endangered), Lanner Falcon (Regionally Vulnerable), Greater Flamingo (Regionally Near-threatened), Lesser Flamingo (Globally and Regionally Near-threatened), Black Harrier (Regionally and Globally Endangered), Southern Bald Ibis (Regionally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), African Grass Owl (Regionally Vulnerable) and Cape Vulture (Globally Vulnerable and Regionally Endangered).

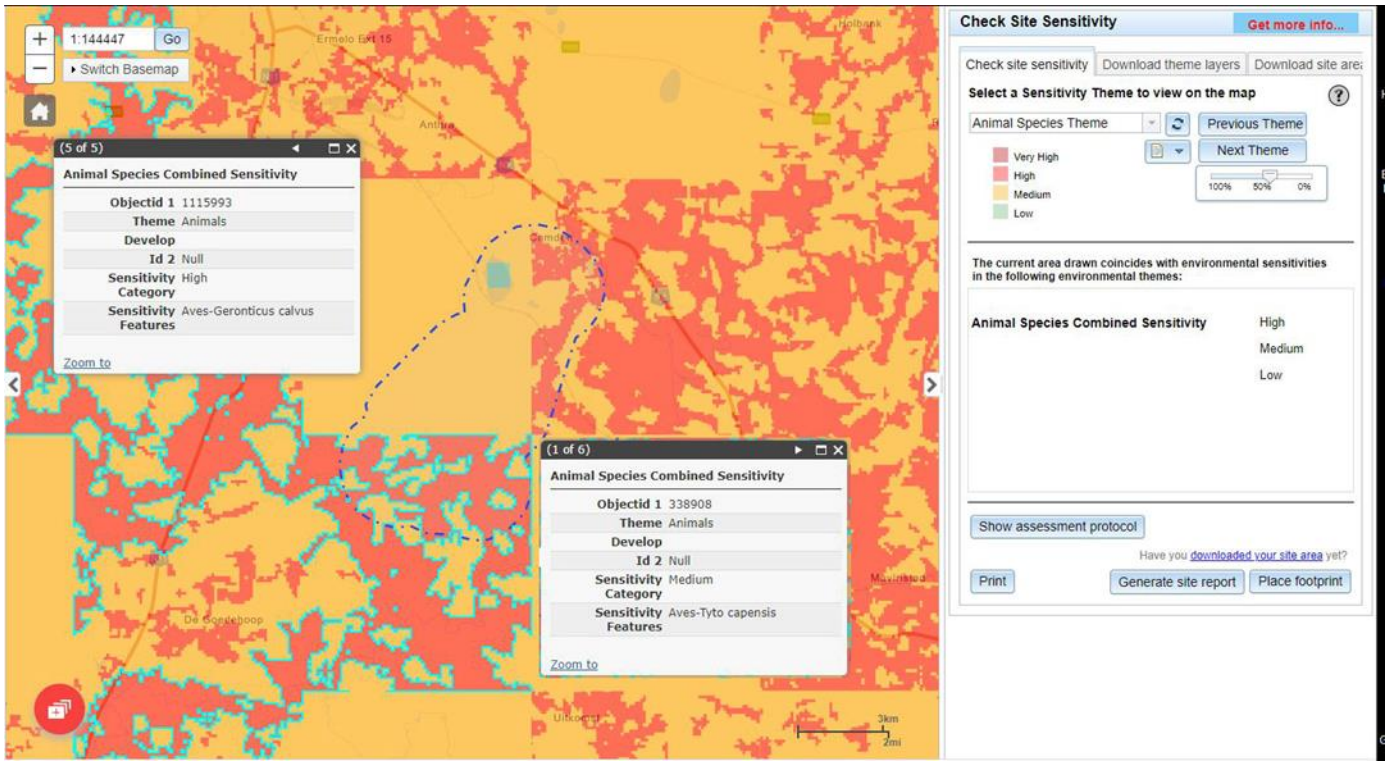

Figure 3: The National Web-Based Environmental Screening Tool map of the Camden I up to 400kV Gid Connection, Collector substation and Camden Power Station substation extension, indicating sensitivities for the Animal Species theme. The classification of High sensitivity based on the presence of Red List species at the site namely African Grass Owl (Local Status Vulnerable) and Southern Bald Ibis (Locally and Globally Vulnerable).

6.3 Protected Areas

According to the South African Protected Areas database (SAPAD), part of the project area overlaps with the Langcarel Private Nature Reserve. From an avifaunal perspective the state of the habitat and land use at the project area is more important than the legal status, which has been surveyed and assessed for this assessment. The results provided are therefore applicable regardless of the legal status of the land parcels considered.

6.4 Biomes and vegetation types

The project area is situated in the Grassland Biome, in the Mesic Highveld Grassland Bioregion (Muchina & Rutherford 2006). Vegetation on site consists predominantly Amersfoort Highveld Clay Grassland and Eastern Highveld Grassland, which is comprised of undulating grassland plains, with small, scattered patches of dolerite outcrops in areas, low hills, and pan depressions. The vegetation is comprised of a short, closed grassland cover, largely

dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn (Mucina & Rutherford 2006).

Ermelo has a temperate climate. January is the warmest month with a maximum temperature of 24.4 C°. June and July are the coldest months, with a minimum temperature of 0.2 C°. The driest month is June with an average of 3 mm of precipitation. Most of the precipitation falls in December, averaging 151 mm. The average annual precipitation is around 756 mm (Climate – data.org 2021).

The topography in the project area is characterised by gentle undulating plains. The predominant land use for this area is livestock grazing with some crop farming, mostly maize, soya beans and pastures. The livestock in the project area is a combination of mostly sheep and cattle, with a few horses.

6.5 Bird habitat

Whilst much of the distribution and abundance of the bird species in the project area can be explained by the dominant biomes and vegetation types, it is also important to examine the modifications which have changed the natural landscape, and which may have an effect on the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types and are determined by a host of factors such as topography, land use and man-made infrastructure.

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

6.5.1 Grassland

The majority of the habitat in the project area comprises grassland. The grassland varies from dense stands of relatively high grass to areas of heavily grazed short grass.

6.5.1.1 Powerline sensitive species

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

- Secretarybird
- White-bellied Bustard
- Lanner Falcon
- Southern Bald Ibis
- African Grass Owl
- Blue Crane
- Blue Korhaan
- Grey Crowned Crane
- Common Buzzard
- Jackal Buzzard
- Cape Crow
- Pied Crow
- Black-chested Snake Eagle
- Long-crested Eagle
- Spotted Eagle-Owl
- Western Cattle Egret
- Amur Falcon

- Helmeted Guineafowl
- African Harrier-Hawk
- Black-headed Heron
- Hadada Ibis
- Black-winged Kite
- Marsh Owl
- Western Barn Owl
- White Stork

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

- Denham's Bustard
- Martial Eagle
- Black Harrier
- Cape Vulture
- Black-bellied Bustard
- Brown Snake Eagle
- Peregrine Falcon
- Montagu's Harrier
- Yellow-billed Kite
- Northern Black Korhaan

6.5.2 Drainage lines and wetlands

6.5.2.1 Powerline sensitive species

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

- African Grass Owl
- Blue Crane
- Grey Crowned Crane
- Hamerkop
- African Black Duck
- Great Egret
- Intermediate Egret
- Little Egret
- Glossy Ibis
- Hadada Ibis
- Marsh Owl

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

- African Marsh Harrier
- Wattled Crane

6.5.3 Agricultural lands

The project site contains a patchwork of agricultural fields, where maize, soya beans and pastures are cultivated. Some fields are lying fallow or are in the process of being re-vegetated by grass.

6.5.3.1 Powerline sensitive species

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

- Amur Falcon
- Blue Crane
- Egyptian Goose
- Grey Crowned Crane
- Helmeted Guineafowl
- Lanner Falcon
- Southern Bald Ibis
- Spur-winged Goose

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

- Black-bellied Bustard
- Brown Snake Eagle
- Cape Vulture
- Denham's Bustard
- Martial Eagle
- Montagu's Harrier
- Northern Black Korhaan
- Peregrine Falcon
- Wattled Crane
- Yellow-billed Kite

6.5.4 Alien trees

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

6.5.4.1 Powerline sensitive species

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

- Secretarybird
- Common Buzzard
- Jackal Buzzard
- Reed Cormorant
- White-breasted Cormorant
- Cape Crow
- Pied Crow
- African Darter
- African Fish Eagle
- Black-chested Snake Eagle
- Long-crested Eagle
- Spotted Eagle-Owl

- Western Cattle Egret
- Amur Falcon
- Lanner Falcon
- Helmeted Guineafowl
- African Harrier-Hawk
- African Sacred Ibis
- Hadada Ibis
- Southern Bald Ibis
- Rock Kestrel
- Black-winged Kite
- Western Barn Owl
- Black Sparrowhawk

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

- Peregrine Falcon
- Brown Snake Eagle
- Martial Eagle
- Cape Vulture
- Grey Crowned Crane
- Western Osprey
- Cape Vulture

6.5.5 Dams

There are three small ground dams at the project site, located in drainage lines.

6.5.5.1 Powerline sensitive species

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

- African Darter
- African Sacred Ibis
- African Swamphen
- Common Moorhen
- Egyptian Goose
- Great Egret
- Grey Heron
- Hamerkop
- Intermediate Egret
- Little Egret
- Little Grebe
- Purple Heron
- Red-billed Teal
- Red-knobbed Coot
- Reed Cormorant
- South African Shelduck
- Southern Pochard

- Spur-winged Goose
- White Stork
- White-breasted Cormorant

The powerline sensitive species which could occasionally use the dams in the project area are the following:

- Black Heron
- Black-crowned Night Heron
- Black-necked Grebe
- Blue-billed Teal
- Cape Teal
- Goliath Heron
- Mallard
- Squacco Heron
- Western Osprey

6.5.6 Pans

6.5.6.1 Powerline sensitive species

The powerline sensitive species which could potentially use the pans in the project area on a regular basis are the following:

- Black-chested Snake Eagle
- Blue Crane
- Egyptian Goose
- Greater Flamingo
- Grey Crowned Crane
- Hamerkop
- Lanner Falcon
- Lesser Flamingo
- Red-knobbed Coot
- Secretarybird
- South African Shelduck

The powerline sensitive species which could occasionally use the pans in the project area are the following:

- Brown Snake Eagle
- Cape Teal
- Cape Vulture
- Mallard
- Martial Eagle
- Peregrine Falcon
- Yellow-billed Kite

6.5.7 High voltage lines

The project area is transected by two high voltage lines which originating at the nearby Camden power station and substation. High voltage lines are used by a variety of avifauna for perching, roosting and in some cases, breeding These include raptors, vultures, ibis and also cranes.

6.5.7.1 Solar powerline sensitive species

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

- African Fish Eagle
- Amur Falcon
- Black-chested Snake Eagle
- Black-winged Kite
- Common Buzzard
- Grey Crowned Crane
- Lanner Falcon
- Long-crested Eagle
- Southern Bald Ibis

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

- Brown Snake Eagle
- Cape Vulture
- Martial Eagle
- Peregrine Falcon

6.5.7.2 Powerline sensitive species

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

- Amur Falcon
- Black-chested Snake Eagle
- Black-winged Kite
- Cape Crow
- Common Buzzard
- Jackal Buzzard
- Lanner Falcon
- Long-crested Eagle
- Pied Crow
- Rock Kestrel
- Southern Bald Ibis

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

- Brown Snake Eagle
- Cape Vulture
- Martial Eagle
- Peregrine Falcon
- Western Osprey

See Appendix 2 for photographic record of habitat features in the development area and immediate surroundings.

6.6 AVIFAUNA

6.6.1 South African Bird Atlas Project 2

The SABAP2 data indicates that a total of 234 bird species could potentially occur within the broader area – Appendix 1 provides a comprehensive list of all the species. Of these, 78 are classified as powerline sensitive species. Of the 78 powerline sensitive species, 15 are South African Red List species. 55 powerline sensitive species are likely to occur regularly in the project area.

Table 2 lists all the powerline sensitive species that are likely to occur regularly and the possible impact on the respective species by the 400kV HV powerline and collector substation. The following abbreviations and acronyms are used:

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

Table 2: Powerline sensitive species potentially occurring at the project area.

Species	Taxonomic name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of occurrence	Habitat							Habitat			
		SABAp2 full protocol reporting rate	SABAp2 Ad hoc protocol reporting rate	Global status	Regional status	IBA trigger species			Grassland	Drainage lines and wetlands	Dams	Pans	Alien trees	HV lines	Agriculture	Collisions: Powerline	Displacement: Disturbance	Displacement: Habitat transformation	Electrocutions: Substation lines
African Black Duck	*Anas sparsa*	11	0	-	-		x	H		x						x			
African Darter	*Anhinga rufa*	16	2.2	-	-		x	H			x		x			x			
African Fish Eagle	*Haliaeetus vocifer*	12	0.9	-	-		x	H					x						x
African Grass Owl	*Tyto capensis*	2.4	0	-	VU		x	M	x	x						x	x	x	x
African Harrier-Hawk	*Polyboroides typus*	12	1.8	-	-		x	M	x				x						
African Marsh Harrier	*Circus ranivorus*	0.6	0	-	EN			L		x									
African Sacred Ibis	*Threskiornis aethiopicus*	48	6.2	-	-		x	H			x		x			x			
African Spoonbill	*Platalea alba*	16	2.2	-	-		x	H								x			
African Swamphen	*Porphyrio madagascariensis*	6.1	2.2	-	-		x	M			x								
Amur Falcon	*Falco amurensis*	29	6.6	-	-		x	H	x				x	x	x				x
Black Harrier	*Circus maurus*	0	0.9	EN	EN			L	x										
Black Heron	*Egretta ardesiaca*	0.6	0	-	-			L			x					x			
Black Sparrowhawk	*Accipiter melanoleucus*	12	0.9	-	-		x	H					x						x
Black-bellied Bustard	*Lissotis melanogaster*	0.6	0	-	-			L	x						x	x	x	x	
Black-chested Snake Eagle	*Circaetus pectoralis*	3	0.4	-	-		x	M	x			x	x	x					x
Black-crowned Night Heron	*Nycticorax nycticorax*	0.6	0	-	-			L			x					x			
Black-headed Heron	*Ardea melanocephala*	52	4	-	-		x	H	x							x			x
Black-necked Grebe	*Podiceps nigricollis*	0.6	0.4	-	-			L			x					x			
Black-winged Kite	*Elanus caeruleus*	61	13	-	-		x	H	x				x	x					x
Blue Crane	*Grus paradisea*	12	0.4	VU	NT		x	H	x	x		x			x	x	x	x	
Blue Korhaan	*Eupodotis caerulescens*	6.1	0	NT			x	H	x							x	x	x	
Blue-billed Teal	*Spatula hottentota*	1.2	0	-	-			L			x					x			
Brown Snake Eagle	*Circaetus cinereus*	1.8	0	-	-			L	x			x	x	x	x				x
Cape Crow	*Corvus capensis*	18	0.4	-	-		x	H	x				x	x					x
Cape Shoveler	*Spatula smithii*	19	0	-	-		x	H								x			

Species	Taxonomic name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of occurrence	Habitat							Habitat			
		SABAp2 full protocol reporting rate	SABAp2 Ad hoc protocol reporting rate	Global status	Regional status	IBA trigger species			Grassland	Drainage lines and wetlands	Dams	Pans	Alien trees	HV lines	Agriculture	Collisions: Powerline	Displacement: Disturbance	Displacement: Habitat transformation	Electrocutions: Substation lines
Cape Teal	*Anas capensis*	3	0	-	-		x	L			x	x				x			
Cape Vulture	*Gyps coprotheres*	0	0	EN	EN		x	L	x			x	x	x	x	x			x
Common Buzzard	*Buteo buteo*	28	9.3	-	-		x	H	x				x	x					x
Common Moorhen	*Gallinula chloropus*	33	1.8	-	-		x	H			x								
Denham's Bustard	*Neotis denhami*	1.8	0	NT	VU			L	x						x	x	x	x	
Egyptian Goose	*Alopochen aegyptiaca*	78	6.2	-	-		x	H			x	x			x	x			
Fulvous Whistling Duck	*Dendrocygna bicolor*	0	0.4	-	-			L								x			
Glossy Ibis	*Plegadis falcinellus*	4.2	1.8	-	-			M		x						x			
Goliath Heron	*Ardea goliath*	2.4	0	-	-			L			x					x			
Great Egret	*Ardea alba*	7.9	1.3	-	-			M		x	x					x			
Greater Flamingo	*Phoenicopterus roseus*	3.6	4.4	-	NT		x	M				x				x			
Grey Crowned Crane	*Balearica regulorum*	5.5	0	EN	EN		x	M	x	x		x	x		x	x	x	x	
Grey Heron	*Ardea cinerea*	25	3.5	-	-		x	H			x					x			
Hadada Ibis	*Bostrychia hagedash*	90	14	-	-		x	H	x	x			x			x			x
Hamerkop	*Scopus umbretta*	12	0	-	-		x	H		x	x	x				x			
Helmeted Guineafowl	*Numida meleagris*	49	3.1	-	-		x	H	x				x		x		x	x	x
Intermediate Egret	*Ardea intermedia*	14	1.8	-	-		x	H		x	x					x			
Jackal Buzzard	*Buteo rufofuscus*	19	2.2	-	-		x	H	x				x	x					x
Lanner Falcon	*Falco biarmicus*	7.3	0	-	VU		x	M	x			x	x	x	x				x
Lesser Flamingo	*Phoeniconaias minor*	3.6	1.3	NT	NT		x	M				x				x			
Little Egret	*Egretta garzetta*	4.2	1.3	-	-			H		x	x					x			
Little Grebe	*Tachybaptus ruficollis*	39	3.1	-	-		x	H			x					x			
Long-crested Eagle	*Lophaetus occipitalis*	6.7	9.3	-	-		x	M	x				x	x					x
Mallard	*Anas platyrhynchos*	0.6	0.4	-	-			L			x	x				x			
Marsh Owl	*Asio capensis*	5.5	0.4	-	-		x	M	x	x						x	x	x	x
Martial Eagle	*Polemaetus bellicosus*	2.4	0	EN	EN		x	L	x			x	x	x	x				x
Montagu's Harrier	*Circus pygargus*	1.2	0	-	-			L	x						x				
Northern Black Korhaan	*Afrotis afraoides*	0.6	0	-	-			L	x						x	x	x	x	
Peregrine Falcon	*Falco peregrinus*	1.2	0	-	-		x	L	x			x	x	x	x				x

Species	Taxonomic name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of occurrence	Habitat							Habitat			
		SABAp2 full protocol reporting rate	SABAp2 Ad hoc protocol reporting rate	Global status	Regional status	IBA trigger species			Grassland	Drainage lines and wetlands	Dams	Pans	Alien trees	HV lines	Agriculture	Collisions: Powerline	Displacement: Disturbance	Displacement: Habitat transformation	Electrocutions: Substation lines
Pied Crow	*Corvus albus*	12	3.5	-	-		x	H	x				x	x					x
Purple Heron	*Ardea purpurea*	4.2	0	-	-			M			x					x			
Red-billed Teal	*Anas erythrorhyncha*	17	1.3	-	-		x	H			x					x			
Red-knobbed Coot	*Fulica cristata*	58	4.8	-	-		x	H			x	x				x			
Reed Cormorant	*Microcarbo africanus*	64	4.8	-	-		x	H			x		x			x			
Rock Kestrel	*Falco rupicolus*	5.5	0.9	-	-		x	M					x	x					
Secretarybird	*Sagittarius serpentarius*	13	0	EN	VU		x	H	x			x	x			x	x	x	
South African Shelduck	*Tadorna cana*	30	3.5	-	-		x	H			x	x				x			
Southern Bald Ibis	*Geronticus calvus*	23	3.1	VU	VU		x	H	x				x	x	x	x			x
Southern Pochard	*Netta erythrophthalma*	9.1	0	-	-		x	M			x					x			
Spotted Eagle-Owl	*Bubo africanus*	9.1	0.9	-	-		x	M	x				x			x	x	x	x
Spur-winged Goose	*Plectropterus gambensis*	44	1.8	-	-		x	H			x				x	x			
Squacco Heron	*Ardeola ralloides*	1.2	0	-	-			L			x					x			
Wattled Crane	*Grus carunculata*	0.6	0	VU	CR			L		x					x	x			
Western Barn Owl	*Tyto alba*	3	0.4	-	-			M	x				x			x			x
Western Cattle Egret	*Bubulcus ibis*	45	12	-	-		x	H	x				x			x			
Western Osprey	*Pandion haliaetus*	0.6	0	-	-			L			x		x	x					x
White Stork	*Ciconia ciconia*	7.3	1.3	-	-		x	M	x		x					x			
White-backed Duck	*Thalassornis leuconotus*	6.7	0	-	-		x	M								x			
White-bellied Bustard	*Eupodotis senegalensis*	7.9	0	-	VU		x	M	x							x	x	x	
White-breasted Cormorant	*Phalacrocorax lucidus*	12	0.9	-	-		x	H			x		x			x			
White-faced Whistling Duck	*Dendrocygna viduata*	0.6	0	-	-			L								x			
Yellow-billed Duck	*Anas undulata*	62	4.4	-	-		x	H								x			
Yellow-billed Kite	*Milvus aegyptius*	2.4	0	-	-		x	L	x			x	x		x				x

6.6.2 Pre-construction monitoring

Figures 4 and 5 indicates the powerline sensitive species that were recorded during transect counts during the pre-construction monitoring conducted in the study area and immediate surrounding area. Monitoring was conducted by means of drive and walk transect counts (see Appendix 3 for more detail on the methodology). Monitoring was implemented in the following time slots:

1. 26 July - 07 August 2020
2. 16 - 30 September 2020
3. 02 - 08 October 2020
4. 20 - 21 March, 12 - 15 April and 3 - 13 May 2021

An Index of Kilometric Abundance (IKA = birds/km) was calculated for all species recorded during transects counts (see Figures 4 and 5 below).

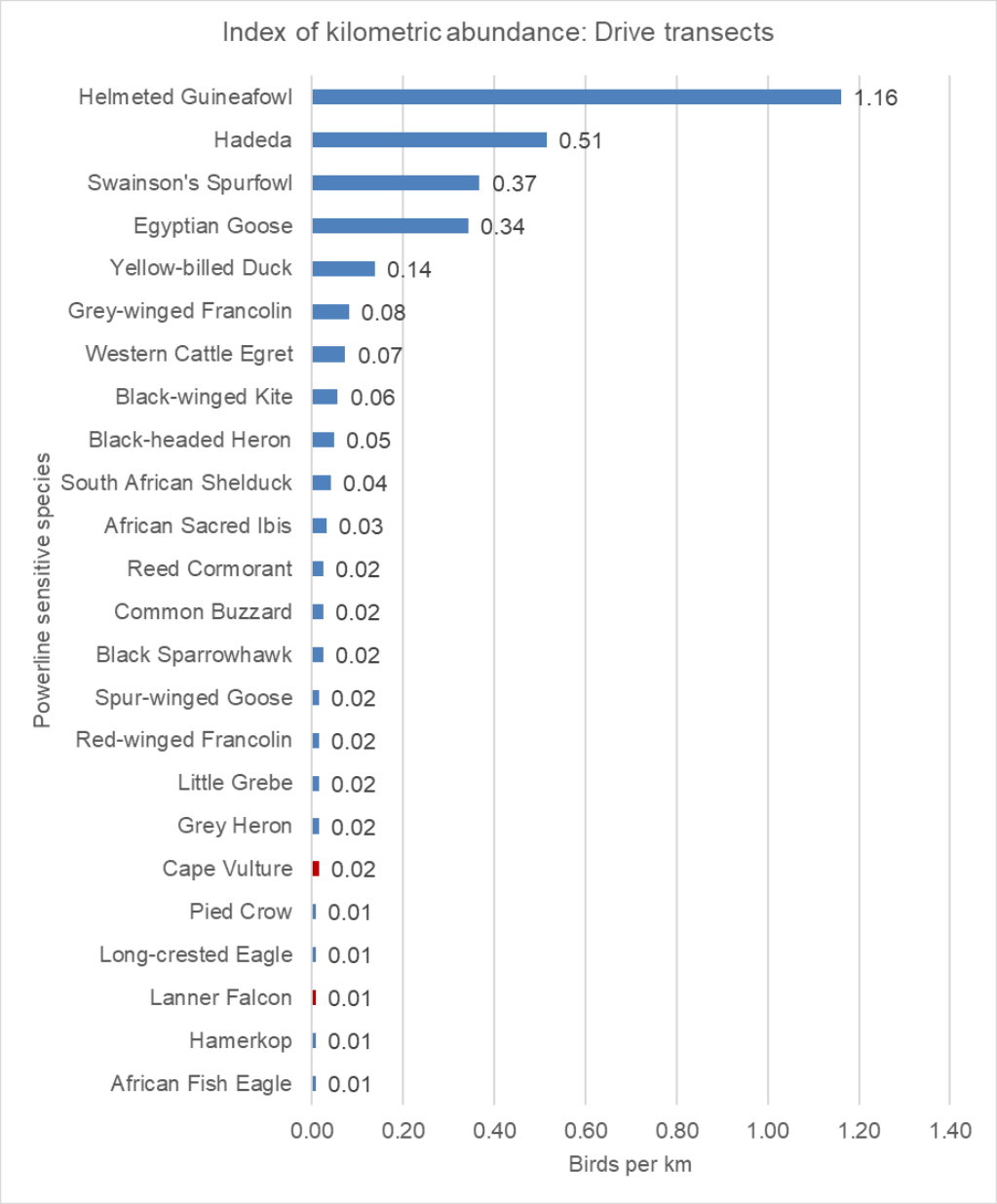

Figure 4: Index of kilometric abundance of powerline sensitive species recorded at the project site through drive transects. Species of conservation concern (SCC) are indicated in red.

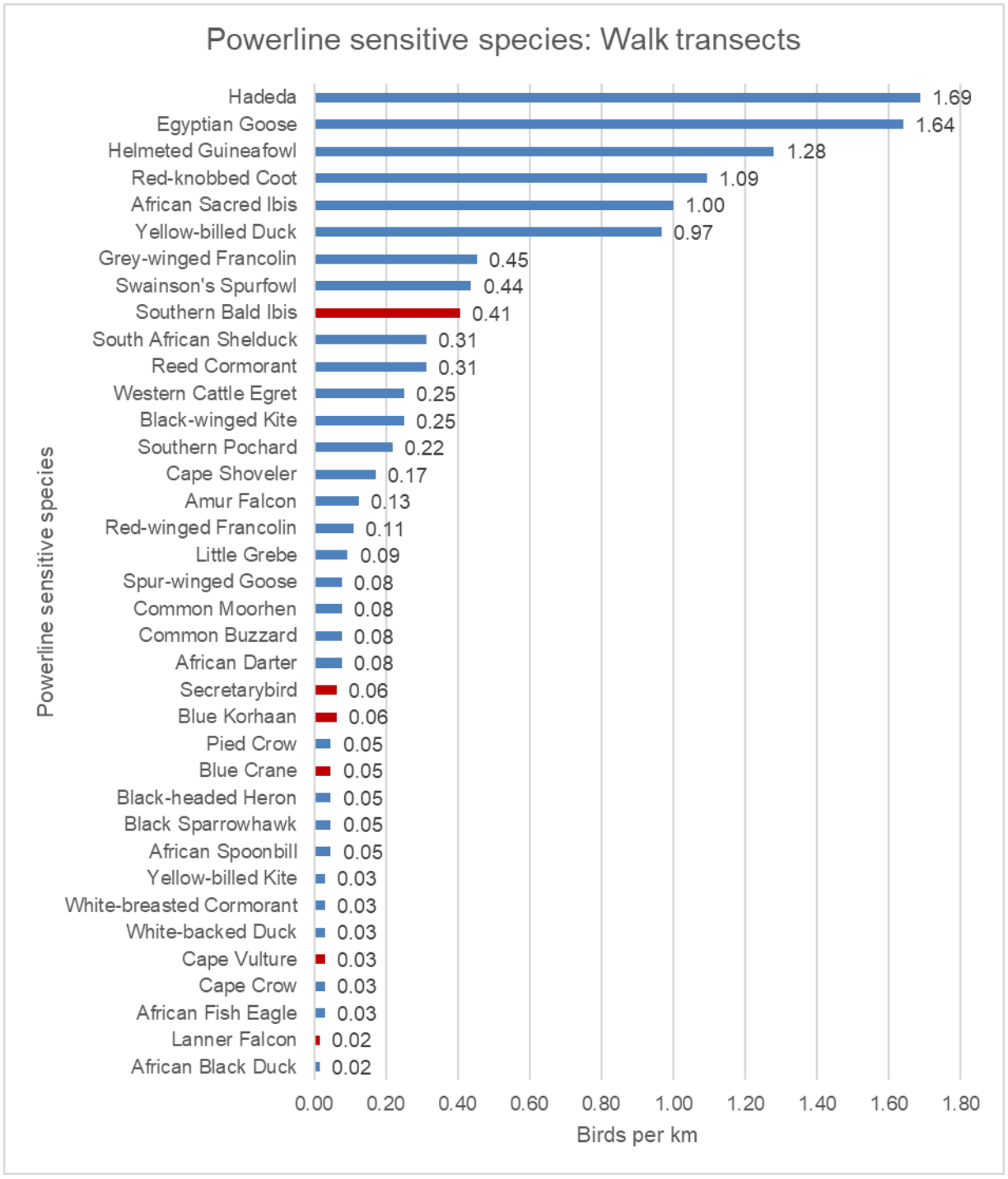

Figure 5: Index of kilometric abundance of powerline sensitive species recorded at the project site through walk transect surveys. Species of conservation concern (SCC) are indicated in red.

See Appendix 1 for a list of all species recorded during the pre-construction monitoring.

7 IMPACT ASSESSMENT

7.1 Up to 400kV HV powerline and collector substation

The following potential impacts on powerline sensitive avifauna are associated with the construction and operation of the up to 400kV HV powerline and collector substation:

- Mortality due to electrocution on the electrical infrastructure within the proposed on-site collector substation.
- Mortality due to collisions with the proposed powerline.
- Displacement due to disturbance associated with the construction of the proposed powerline and on-site collector substation.
- Displacement due to habitat transformation associated with the construction of the proposed powerline and on-site collector substation.

7.1.1 Mortality of powerline sensitive avifauna due to electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the pole/tower design. In the case of the proposed up to 400kV grid connection, the electrocution risk is envisaged to be negligible because the proposed design of the up to 400kV line because of the clearance distances between the live and earthed components. The up to 400kV grid connection power line should not pose an electrocution threat to the priority species which are likely to occur in the study area and immediate surrounding environment.

Electrocutions within the proposed substation yards are possible but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls, and certain species of waterbirds.

The powerline sensitive species which are potentially vulnerable to electrocution impact are listed in Table 3, and below:

- Common Buzzard
- Jackal Buzzard
- Cape Crow
- Pied Crow
- African Fish Eagle
- Black-chested Snake Eagle
- Brown Snake Eagle
- Long-crested Eagle
- Martial Eagle
- Spotted Eagle-Owl
- Amur Falcon
- Lanner Falcon
- Peregrine Falcon

- Helmeted Guineafowl
- Black-headed Heron
- Hadada Ibis
- Southern Bald Ibis
- Black-winged Kite
- Yellow-billed Kite
- Western Osprey
- African Grass Owl
- Marsh Owl
- Western Barn Owl
- Black Sparrowhawk
- Cape Vulture

7.1.2 Mortality of powerline sensitive avifauna due to collisions

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

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

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

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

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

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

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

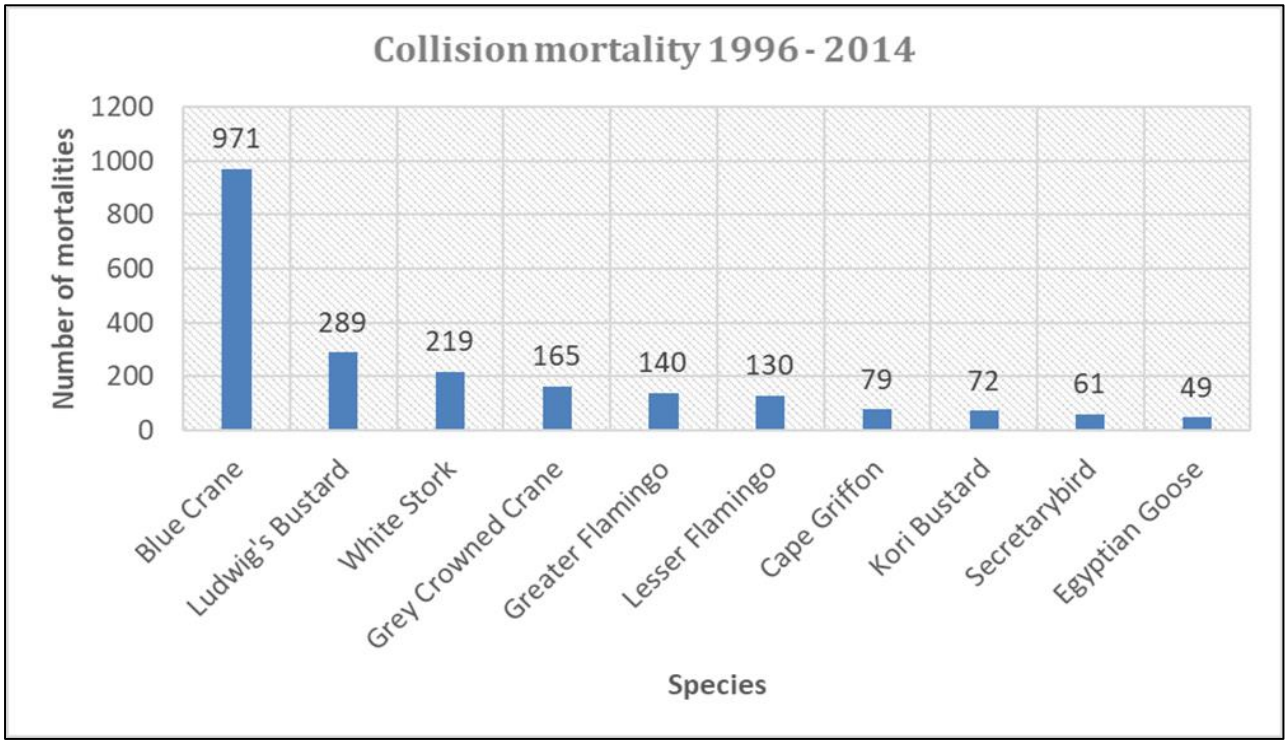

Figure 6: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data).

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

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

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (EWT) and Eskom tested the effectiveness of two types of line markers in reducing power line collision mortalities of large birds on three up to 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, with a 92% reduction in mortality, and large

birds in general with a 56% reduction in mortality, but not for bustards, including the endangered Ludwig's Bustard. The two different marking devices were approximately equally effective, namely spirals and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw *et al*. 2017).

The powerline sensitive species which are potentially vulnerable to this impact are listed in Table 2, and below:

- Hamerkop
- Mallard
- Secretarybird
- Black-bellied Bustard
- Denham's Bustard
- White-bellied Bustard
- Red-knobbed Coot
- Reed Cormorant
- White-breasted Cormorant
- Blue Crane
- Grey Crowned Crane
- Wattled Crane
- African Darter
- African Black Duck
- Fulvous Whistling Duck
- White-backed Duck
- White-faced Whistling Duck
- Yellow-billed Duck
- Spotted Eagle-Owl
- Great Egret
- Intermediate Egret
- Little Egret
- Western Cattle Egret
- Greater Flamingo
- Lesser Flamingo
- Egyptian Goose
- Spur-winged Goose
- Black-necked Grebe
- Little Grebe
- Black Heron
- Black-crowned Night Heron
- Black-headed Heron
- Goliath Heron
- Grey Heron
- Purple Heron
- Squacco Heron
- African Sacred Ibis
- Glossy Ibis

- Hadada Ibis
- Southern Bald Ibis
- Blue Korhaan
- Northern Black Korhaan
- African Grass Owl
- Marsh Owl
- Western Barn Owl
- Southern Pochard
- South African Shelduck
- Cape Shoveler
- African Spoonbill
- White Stork
- Blue-billed Teal
- Cape Teal
- Red-billed Teal
- Cape Vulture

7.1.3 Displacement due to habitat transformation

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed OHL grid connection through the transformation of habitat. The construction activities will constitute the following:

- Site clearance and preparation;
- Excavations for infrastructure;
- Construction of the substation and grid connection infrastructure; and
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site.

Relevant to this development, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the on-site substation is unavoidable. In the case of the powerline, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed powerline. The loss of habitat in the substation footprint (7 ha) will be a relatively insignificant percentage of the habitat that regularly supports powerline sensitive species and the resultant impact is likely to be fairly minimal.

Powerline sensitive species which are potentially vulnerable to displacement due to habitat transformation are mostly ground nesting species:

- African Grass Owl
- Black-bellied Bustard
- Blue Crane
- Blue Korhaan
- Denham's Bustard
- Grey Crowned Crane
- Helmeted Guineafowl
- Marsh Owl

- Northern Black Korhaan
- Secretarybird
- Spotted Eagle-Owl
- White-bellied Bustard

7.1.4 Displacement due to disturbance

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although this is often impractical to implement due to tight construction schedules.

Powerline sensitive species which are potentially vulnerable to displacement due to habitat transformation are mostly ground nesting species:

- African Grass Owl
- Black-bellied Bustard
- Blue Crane
- Blue Korhaan
- Denham's Bustard
- Grey Crowned Crane
- Helmeted Guineafowl
- Marsh Owl
- Northern Black Korhaan
- Secretarybird
- Spotted Eagle-Owl
- White-bellied Bustard

8 IMPACT RATINGS

The impacts on avifauna of the proposed up to 400kV powerline and collector substation are rated according to the criteria set out below.

8.1 Determination of Significance of Impacts

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

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur

following mitigation. The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects are reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[2], indirect[3], secondary[4] as well as cumulative[5] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[6] presented in Table 8.

Table 3: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

[2] Impacts that arise directly from activities that form an integral part of the Project.

[3] Impacts that arise indirectly from activities not explicitly forming part of the Project.

[4] Secondary or induced impacts caused by a change in the Project environment.

[5] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

[6] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

8.2 Impact Assessments

8.2.1 Impact assessment tables

The impacts are summarised in table form in Appendix 4.

8.3 Cumulative impacts

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

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section addresses whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment
- Unacceptable increase in impact

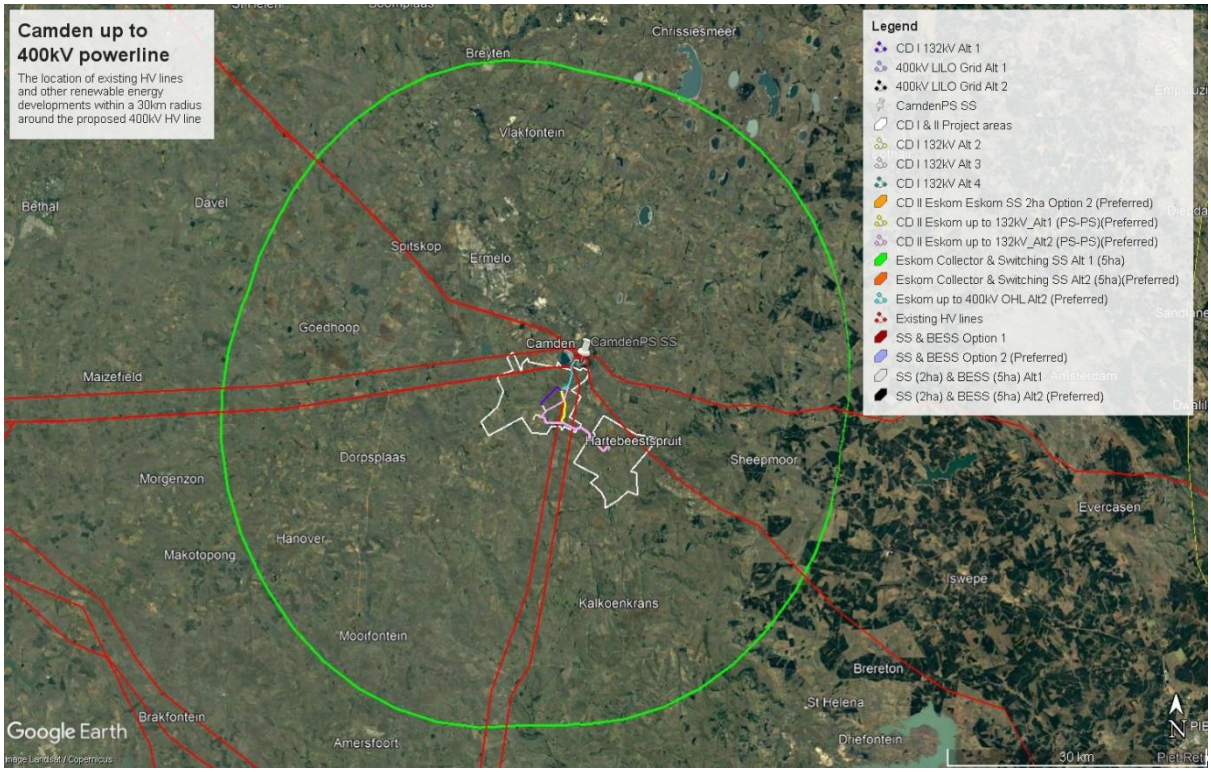

Figure 7: Proposed renewable energy projects and existing HV lines within 30km of the proposed 400kV HV powerline and collector substation (Source: DFFE database 2022 & WSP Environmental). The green circle represents the 30km radius.

8.3.1 Up to 400kV HV powerline

According to the official database of DFFE and other documents in the public domain, there are currently three planned renewable energy facility within a 30km radius around the proposed development, namely the Camden I and II Wind Energy Facilities and the Camden Solar Energy Facility (SEF) (see Figure 11). These developments will require grid connections with a maximum combined length of 31.2km. The up to 400kV HV powerline connection to the Camden Power Station Substation will have a maximum length of 8.9km. The maximum combined length of the grid connections for the Camden I and II renewable wind energy projects listed above, the up to 400kV HV powerline to Camden Power Station Substation, and the Camden I SEF (maximum 13.7km) will therefore be approximately 40.1km. The existing high voltage lines in the 30km radius around the proposed Camden I SEF run into hundreds of kilometres (see Figure 11). The Camden up to 400kV contribution (maximum 8.9km) to the total length of high voltage lines within a 30km radius is **Low.** However, the density of all planned and existing high voltage lines within a 30km radius, and by implication the cumulative impact on avifauna, is considered to be **Moderate**.

8.3.2 The collector substation and extension of the Camden PS substation

The collector substation and Camden PS substation extension will transform an area of approximately 7 ha. Given the available habitat of 4 258km² within a 30km radius around the project site, the cumulative impact of displacement and habitat transformation caused by these developments is Low due to the small footprint.

9 MITIGATION MEASURES

The impact significance without mitigation measures is assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the proposed Project. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in Figure 12.

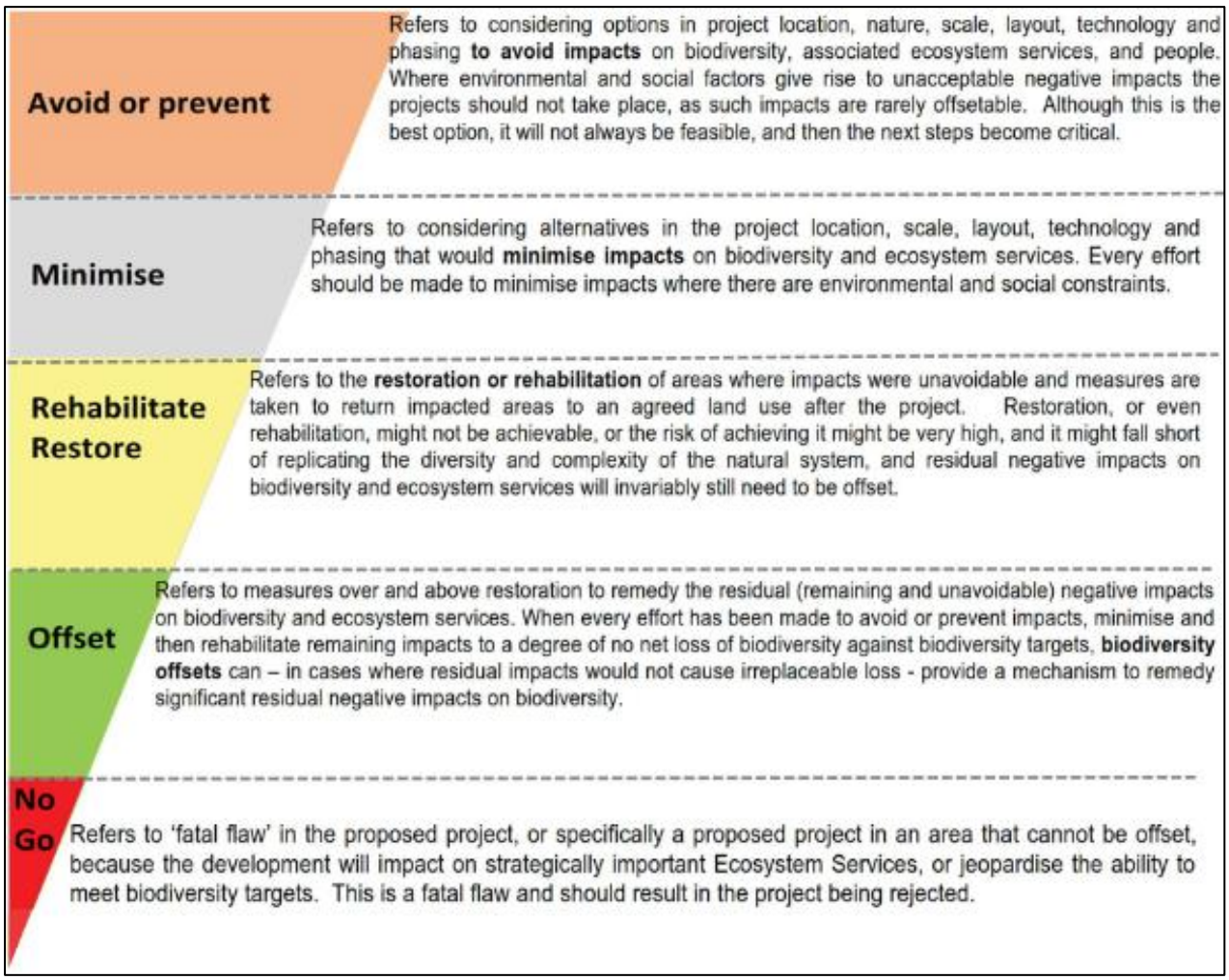

Figure 8: Mitigation Sequence/Hierarchy

9.1 Up to 400kV HV powerline and collector substation

The mitigation measures that are proposed for the up to 400kV HV powerline, collector substation and Camden Power Station substation extension (where applicable) are listed below.

9.1.1 Planning & Design phase

- None

9.1.2 Construction phase

- Conduct an inspection (avifaunal walk-through) to identify SCC that may be breeding within the infrastructure footprints. If a nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding birds during the construction period. This could include measures such as delaying some of the activities until after the breeding season, or other measures deemed suitable and practical at the time.
- Bird Flight Diverters must be fitted to the entire powerline according to the applicable Eskom Engineering Instruction (*Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines*). These devices must be installed as soon as the conductors and earthwires are strung.

- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of powerline sensitive species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- Vegetation clearance should be limited to what is absolutely necessary.
- The mitigation measures proposed by the biodiversity specialist must be strictly enforced.

9.1.3 Operational phase

- The hardware within the proposed switching station is too complex to warrant any mitigation for electrocution at this stage. It is recommended that regular inspections are performed of the onsite substation yard to monitor the electrocution mortality. If on-going impacts are recorded once operational, site specific mitigation (insulation) be applied reactively. This is an acceptable approach because SCC are unlikely to frequent the switching station infrastructure.

9.1.4 De-commissioning phase

- Conduct an avifaunal inspection of the powerline prior to its decommissioning to identify nests on the poles/towers.
- Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of powerline sensitive species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

10 PREFERRED ALTERNATIVE

10.1 Up to 400kV HV line

The LILO Alternatives 1 and 2 are the preferred alternatives due to them being the shortest alternatives. As far as the direct line alternatives are concerned, Alternative 1 is the least preferred alternative due to it being the longest and running through high sensitivity grassland for more than half the way, and crossing two drainage lines. However, all the alternatives can be mitigated to acceptable levels and therefore are considered suitable from an avifaunal perspective.

10.2 Collector substation

Option 2 of the switching station is preferred, as it is allows for the shortest powerline routes and therefore reduces impact on high quality grassland. Option 1 of the switching station is not preferred as it is partially located in high quality grassland and requires a longer grid connection. However both options are considered acceptable due to the small size of the footprint.

11 CONDITIONS FOR INCLUSION IN THE EMPr

Please see Appendix 5 for the monitoring requirements to be included in the EMPr for thisproject.

12 'NO-GO' ALTERNATIVE

The 'no-go' alternative is the option of not constructing the Camden up to 400kV HV powerline and collector substation, where the *status quo* of the current status and/or activities on the project areas would prevail. This alternative would result in no additional impact on the receiving environment.

Should the 'no-go' alternative be considered, there would be no impact on the existing environmental baseline and no benefits to the local economy and affected communities. The alternative also bears the opportunity cost of missed socio-economic benefits to the local community that would otherwise realise from establishing the farms which form part of the project areas. The option of not developing also entails that the bid to provide renewable/clean energy to the national grid and contribute to meeting the country's energy demands will be forfeited.

However, from a strictly avifaunal perspective, the 'no-go' alternative will result in the current *status quo* being maintained. The 'no-go' option would eliminate any additional impact on the ecological integrity of the proposed project, as far as avifauna is concerned, bearing in mind that there have already been extensive impacts in the project area in the form of agriculture.

13 SUMMARY AND CONCLUSION

13.1 Up to 400kV HV powerline and collector substation

The proposed Camden up to 400kV HV powerline, collector substation and extension of the Camden PS substation will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement due to disturbance associated with the construction of the proposed powerline, on-site collector substation and the extension of the Camden PS substation.
- Displacement due to habitat transformation associated with the construction of the proposed powerline, on-site collector substation and the extension of the Camden PS substation.
- Mortality due to electrocution on the electrical infrastructure within the proposed on-site collector substation.
- Mortality due to collisions with the proposed powerline.
- Displacement due to disturbance associated with the dismantling of the proposed powerline and on-site collector substation.

13.1.1 Displacement of powerline sensitive species due to disturbance in the construction phase

Construction activities impact on birds through disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although this is often impractical to implement due to tight construction schedules.

Powerline sensitive species which are potentially vulnerable to displacement due to habitat transformation are mostly ground nesting species. Species that could be impacted are African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and White-bellied Bustard. The impact is rated as **moderate** pre-mitigation and will be reduced to a low level post-mitigation.

13.1.2 Displacement of powerline sensitive species due to habitat transformation in the construction phase

During the construction of powerlines, service roads (jeep tracks), substations and other associated infrastructure, habitat destruction/transformation inevitably takes place. These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed powerline and collector substation through the transformation of habitat. Relevant to this development, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the on-site substation is unavoidable. In the case of the powerline, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed powerline. The loss of habitat in the substation footprint (7 ha) will be a relatively insignificant percentage of the habitat that regularly supports powerline sensitive species, and the resultant impact is likely to be fairly minimal. Powerline sensitive species which are potentially most vulnerable to displacement due to habitat transformation are mostly ground nesting species: African Grass Owl, Black-bellied Bustard, Blue Crane, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Helmeted Guineafowl, Marsh Owl, Northern Black Korhaan, Secretarybird, Spotted Eagle-Owl and, White-bellied Bustard. The impact is rated as moderate pre-mitigation and it will decrease to low post-mitigation.

13.1.3 Collisions of powerline sensitive species with the up to 400kVHV powerline in the operational phase

Collisions could be the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins *et al.* 2010; Martin *et al.* 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (e.g. Bernardino *et al.* 2018; Sporer *et al.* 2013, Barrientos *et al.* 2011; Jenkins *et al.* 2010; Alonso & Alonso 1999; Koops & De Jong 1982).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 up to 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. Species potentially at risk are African Black Duck, African Darter, African Grass Owl, African Sacred Ibis, African Spoonbill, Black Heron, Black-bellied Bustard, Black-crowned Night Heron, Black-headed Heron, Black-necked Grebe, Blue Crane, Blue Korhaan, Blue-billed Teal, Cape Shoveler, Cape Teal, Cape Vulture, Denham's Bustard, Egyptian Goose, Fulvous Whistling Duck, Glossy Ibis, Goliath Heron, Great Egret, Greater Flamingo, Grey Crowned Crane, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Lesser Flamingo, Little Egret, Little Grebe, Mallard, Marsh Owl, Northern Black Korhaan, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant,

Secretarybird, South African Shelduck, Southern Bald Ibis, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Wattled Crane, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-bellied Bustard, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck. The impact is rated as moderate pre-mitigation but should be reduced to a low level post-mitigation.

13.1.4 Mortality due to electrocution on the electrical infrastructure within the proposed on-site collector substation

Electrocutions within the proposed substation yard are possible but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls, and certain species of waterbirds. The powerline sensitive species which are potentially vulnerable to electrocution impact are Common Buzzard, Jackal Buzzard, Cape Crow, Pied Crow, African Fish Eagle, Black-chested Snake Eagle, Brown Snake Eagle, Long-crested Eagle, Martial Eagle, Spotted Eagle-Owl, Amur Falcon, Lanner Falcon, Peregrine Falcon, Helmeted Guineafowl, Black-headed Heron, Hadada Ibis, Southern Bald Ibis, Black-winged Kite, Yellow-billed Kite, Western Osprey, African Grass Owl, Marsh Owl, Western Barn Owl, Black Sparrowhawk and Cape Vulture. The impact is rated as **low** pre- and post-mitigation.

13.1.5 Displacement of powerline sensitive species due to disturbance linked to dismantling activities in the decommissioning phase

The impact is likely to be similar in nature and extent to the construction phase of the proposed up to 400kV powerline and collector substation. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

13.2 Cumulative impacts

13.2.1 Up to 400kV HV powerline

The maximum combined length of the grid connections for the Camden I and II renewable energy projects listed above, the 400kV OHL to Camden Power Station Substation, and the Camden I SEF (maximum 13.7km) is approximately 40.1km. The existing high voltage lines in the 30km radius around the proposed Camden I SEF run into hundreds of kilometres (see Figure 11). The Camden I SEF OHL contribution (maximum 13.7km) to the total length of high voltage lines within a 30km radius is **Low.** However, the density of all planned and existing high voltage lines within a 30km radius, and by implication the cumulative impact on avifauna, is considered to be **Moderate**.

13.2.2 The collector substation and Camden Power Station SS extension

The collector substation and Camden PS substation extension will transform an area of approximately 7 ha. Given the available habitat of 4 258km² within a 30km radius around the project site, the cumulative impact of displacement and habitat transformation caused by these developments is **Low** due to the small footprint.

14 CONCLUSION AND IMPACT STATEMENT

14.1 The up to 400kV HV powerline, collector substation and Camden PS substation extension

The proposed up to 400kV HH powerline, collector substation and Camden PS substation extension will have a mostly **low to moderate** impact on priority avifauna which, in all instances, could be reduced to a low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The proposed developments are therefore supported, provided the mitigation measures listed in this report are strictly implemented.

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APPENDIX 1: SPECIES LISTS

Species list for the broader area **Powerline sensitive species are shaded** **Species name**	**Taxonomic name**	**SABAP2 full protocol reporting rate**	**SABAP2 Ad hoc protocol reporting rate**	**Global status**	**Regional status**
African Black Duck	*Anas sparsa*	10.9	0.0	-	-
African Black Swift	*Apus barbatus*	3.0	0.4	-	-
African Darter	*Anhinga rufa*	16.4	2.2	-	-
African Fish Eagle	*Haliaeetus vocifer*	12.1	0.9	-	-
African Grass Owl	*Tyto capensis*	2.4	0.0	-	VU
African Harrier-Hawk	*Polyboroides typus*	11.5	1.8	-	-
African Hoopoe	*Upupa africana*	12.7	0.9	-	-
African Jacana	*Actophilornis africanus*	1.8	1.3	-	-
African Marsh Harrier	*Circus ranivorus*	0.6	0.0	-	EN
African Palm Swift	*Cypsiurus parvus*	1.2	1.3	-	-
African Paradise Flycatcher	*Terpsiphone viridis*	4.8	0.0	-	-
African Pipit	*Anthus cinnamomeus*	74.5	8.4	-	-
African Rail	*Rallus caerulescens*	5.5	0.0	-	-
African Reed Warbler	*Acrocephalus baeticatus*	3.0	0.4	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	47.9	6.2	-	-
African Snipe	*Gallinago nigripennis*	20.0	0.9	-	-
African Spoonbill	*Platalea alba*	16.4	2.2	-	-
African Stonechat	*Saxicola torquatus*	87.9	10.6	-	-
African Swamphen	*Porphyrio madagascariensis*	6.1	2.2	-	-
African Wattled Lapwing	*Vanellus senegallus*	23.0	0.4	-	-
African Yellow Warbler	*Iduna natalensis*	3.0	0.0	-	-
Amethyst Sunbird	*Chalcomitra amethystina*	11.5	0.4	-	-
Amur Falcon	*Falco amurensis*	29.1	6.6	-	-
Ant-eating Chat	*Myrmecocichla formicivora*	89.7	12.3	-	-
Banded Martin	*Riparia cincta*	42.4	3.1	-	-
Barn Swallow	*Hirundo rustica*	41.8	7.9	-	-
Bar-throated Apalis	*Apalis thoracica*	5.5	0.0	-	-
Black Crake	*Zapornia flavirostra*	9.1	0.0	-	-
Black Harrier	*Circus maurus*	0.0	0.9	EN	EN
Black Heron	*Egretta ardesiaca*	0.6	0.0	-	-
Black Sparrowhawk	*Accipiter melanoleucus*	12.1	0.9	-	-
Black-bellied Bustard	*Lissotis melanogaster*	0.6	0.0	-	-
Black-chested Prinia	*Prinia flavicans*	16.4	0.0	-	-
Black-chested Snake Eagle	*Circaetus pectoralis*	3.0	0.4	-	-
Black-collared Barbet	*Lybius torquatus*	28.5	0.9	-	-
Black-crowned Night Heron	*Nycticorax nycticorax*	0.6	0.0	-	-
Black-headed Heron	*Ardea melanocephala*	52.1	4.0	-	-
Black-headed Oriole	*Oriolus larvatus*	13.9	1.8	-	-
Black-necked Grebe	*Podiceps nigricollis*	0.6	0.4	-	-
Blacksmith Lapwing	*Vanellus armatus*	67.9	7.0	-	-
Black-throated Canary	*Crithagra atrogularis*	67.9	2.2	-	-
Black-winged Kite	*Elanus caeruleus*	60.6	12.8	-	-
Black-winged Lapwing	*Vanellus melanopterus*	14.5	0.0	-	-
Black-winged Stilt	*Himantopus himantopus*	9.1	0.0	-	-
Blue Crane	*Grus paradisea*	11.5	0.4	VU	NT
Blue Korhaan	*Eupodotis caerulescens*	6.1	0.0	NT	

Species list for the broader area **Powerline sensitive species are shaded** **Species name**	**Taxonomic name**	**SABAP2 full protocol reporting rate**	**SABAP2 Ad hoc protocol reporting rate**	**Global status**	**Regional status**
Blue-billed Teal	*Spatula hottentota*	1.2	0.0	-	-
Bokmakierie	*Telophorus zeylonus*	64.8	4.4	-	-
Brown Snake Eagle	*Circaetus cinereus*	1.8	0.0	-	-
Brown-throated Martin	*Riparia paludicola*	46.7	4.0	-	-
Buff-streaked Chat	*Campicoloides bifasciatus*	5.5	0.4	-	-
Cape Batis	*Batis capensis*	0.6	0.0	-	-
Cape Bunting	*Emberiza capensis*	13.9	0.4	-	-
Cape Canary	*Serinus canicollis*	75.2	7.0	-	-
Cape Crow	*Corvus capensis*	17.6	0.4	-	-
Cape Grassbird	*Sphenoeacus afer*	24.8	0.9	-	-
Cape Longclaw	*Macronyx capensis*	86.7	10.1	-	-
Cape Robin-Chat	*Cossypha caffra*	60.0	3.5	-	-
Cape Shoveler	*Spatula smithii*	18.8	0.0	-	-
Cape Sparrow	*Passer melanurus*	81.8	6.6	-	-
Cape Starling	*Lamprotornis nitens*	6.1	0.0	-	-
Cape Teal	*Anas capensis*	3.0	0.0	-	-
Cape Turtle Dove	*Streptopelia capicola*	92.1	23.8	-	-
Cape Vulture	*Gyps coprotheres*	0.0	0.0	EN	EN
Cape Wagtail	*Motacilla capensis*	78.2	3.5	-	-
Cape Weaver	*Ploceus capensis*	33.9	2.2	-	-
Cape White-eye	*Zosterops virens*	35.2	1.3	-	-
Capped Wheatear	*Oenanthe pileata*	10.3	0.0	-	-
Cardinal Woodpecker	*Dendropicos fuscescens*	9.1	1.3	-	-
Chorister Robin-Chat Robin-Chat	*Cossypha dichroa*	1.2	0.0	-	-
Cinnamon-breasted Bunting	*Emberiza tahapisi*	1.8	0.0	-	-
Cloud Cisticola	*Cisticola textrix*	7.9	0.9	-	-
Common Buttonquail	*Turnix sylvaticus*	0.6	0.0	-	-
Common Buzzard	*Buteo buteo*	27.9	9.3	-	-
Common Greenshank	*Tringa nebularia*	5.5	0.0	-	-
Common House Martin	*Delichon urbicum*	6.1	0.0	-	-
Common Moorhen	*Gallinula chloropus*	32.7	1.8	-	-
Common Myna	*Acridotheres tristis*	21.2	10.1	-	-
Common Ostrich	*Struthio camelus*	21.8	1.3	-	-
Common Quail	*Coturnix coturnix*	29.1	0.4	-	-
Common Sandpiper	*Actitis hypoleucos*	1.2	0.0	-	-
Common Waxbill	*Estrilda astrild*	52.7	3.5	-	-
Crested Barbet	*Trachyphonus vaillantii*	3.0	0.0	-	-
Crowned Lapwing	*Vanellus coronatus*	61.2	3.1	-	-
Cuckoo Finch	*Anomalospiza imberbis*	1.2	0.0	-	-
Dark-capped Bulbul	*Pycnonotus tricolor*	50.3	4.0	-	-
Denham's Bustard	*Neotis denhami*	1.8	0.0	NT	VU
Diederik Cuckoo	*Chrysococcyx caprius*	24.2	0.9	-	-
Domestic Duck	*Anas platyrhynchos domestica*	0.6	0.0	-	-
Drakensberg Prinia	*Prinia hypoxantha*	18.8	0.0	-	-
Eastern Clapper Lark	*Mirafra fasciolata*	6.7	0.0	-	-
Eastern Long-billed Lark	*Certhilauda semitorquata*	4.8	0.0	-	-
Egyptian Goose	*Alopochen aegyptiaca*	78.2	6.2	-	-

Species list for the broader area **Powerline sensitive species are shaded** **Species name**	**Taxonomic name**	**SABAP2 full protocol reporting rate**	**SABAP2 Ad hoc protocol reporting rate**	**Global status**	**Regional status**
European Bee-eater	*Merops apiaster*	0.6	0.0	-	-
Familiar Chat	*Oenanthe familiaris*	0.6	0.0	-	-
Fan-tailed Widowbird	*Euplectes axillaris*	39.4	3.1	-	-
Fiscal Flycatcher	*Melaenornis silens*	17.0	0.9	-	-
Fork-tailed Drongo	*Dicrurus adsimilis*	10.3	0.4	-	-
Fulvous Whistling Duck	*Dendrocygna bicolor*	0.0	0.4	-	-
Giant Kingfisher	*Megaceryle maxima*	4.8	0.0	-	-
Glossy Ibis	*Plegadis falcinellus*	4.2	1.8	-	-
Golden-breasted Bunting	*Emberiza flaviventris*	5.5	0.4	-	-
Goliath Heron	*Ardea goliath*	2.4	0.0	-	-
Great Egret	*Ardea alba*	7.9	1.3	-	-
Greater Flamingo	*Phoenicopterus roseus*	3.6	4.4	-	NT
Greater Striped Swallow	*Cecropis cucullata*	55.8	7.9	-	-
Green Wood Hoopoe	*Phoeniculus purpureus*	7.9	0.4	-	-
Grey Crowned Crane	*Balearica regulorum*	5.5	0.0	EN	EN
Grey Heron	*Ardea cinerea*	24.8	3.5	-	-
Grey-headed Gull	*Chroicocephalus cirrocephalus*	3.6	0.4	-	-
Grey-winged Francolin	*Scleroptila afra*	27.3	2.2	-	-
Groundscraper Thrush	*Turdus litsitsirupa*	0.6	0.0	-	-
Hadada Ibis	*Bostrychia hagedash*	89.7	13.7	-	-
Hamerkop	*Scopus umbretta*	11.5	0.0	-	-
Helmeted Guineafowl	*Numida meleagris*	49.1	3.1	-	-
Horus Swift	*Apus horus*	1.2	0.0	-	-
House Sparrow	*Passer domesticus*	20.0	9.3	-	-
Intermediate Egret	*Ardea intermedia*	13.9	1.8	-	-
Jackal Buzzard	*Buteo rufofuscus*	19.4	2.2	-	-
Karoo Thrush	*Turdus smithi*	5.5	0.0	-	-
Kittlitz's Plover	*Charadrius pecuarius*	7.3	0.4	-	-
Kurrichane Thrush	*Turdus libonyana*	8.5	0.4	-	-
Lanner Falcon	*Falco biarmicus*	7.3	0.0	-	VU
Laughing Dove	*Spilopelia senegalensis*	45.5	7.5	-	-
Lazy Cisticola	*Cisticola aberrans*	4.8	0.0	-	-
Lesser Flamingo	*Phoeniconaias minor*	3.6	1.3	NT	NT
Lesser Grey Shrike	*Lanius minor*	0.6	0.0	-	-
Lesser Honeyguide	*Indicator minor*	0.6	0.0	-	-
Lesser Moorhen	*Paragallinula angulata*	0.6	0.4	-	-
Lesser Striped Swallow	*Cecropis abyssinica*	0.6	1.3	-	-
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	12.7	0.4	-	-
Levaillant's Cisticola	*Cisticola tinniens*	73.9	5.7	-	-
Little Egret	*Egretta garzetta*	4.2	1.3	-	-
Little Grebe	*Tachybaptus ruficollis*	38.8	3.1	-	-
Little Rush Warbler	*Bradypterus baboecala*	6.7	0.9	-	-
Little Stint	*Calidris minuta*	1.8	0.0	-	-
Little Swift	*Apus affinis*	16.4	4.8	-	-
Long-crested Eagle	*Lophaetus occipitalis*	6.7	9.3	-	-
Long-tailed Widowbird	*Euplectes progne*	84.8	15.4	-	-
Malachite Kingfisher	*Corythornis cristatus*	7.3	0.0	-	-
Malachite Sunbird	*Nectarinia famosa*	11.5	0.4	-	-

Species list for the broader area **Powerline sensitive species are shaded** **Species name**	**Taxonomic name**	**SABAP2 full protocol reporting rate**	**SABAP2 Ad hoc protocol reporting rate**	**Global status**	**Regional status**
Mallard	*Anas platyrhynchos*	0.6	0.4	-	-
Marsh Owl	*Asio capensis*	5.5	0.4	-	-
Martial Eagle	*Polemaetus bellicosus*	2.4	0.0	EN	EN
Montagu's Harrier	*Circus pygargus*	1.2	0.0	-	-
Mountain Wheatear	*Myrmecocichla monticola*	4.8	0.9	-	-
Namaqua Dove	*Oena capensis*	1.8	0.0	-	-
Neddicky	*Cisticola fulvicapilla*	7.9	0.0	-	-
Nicholson's Pipit	*Anthus nicholsoni*	1.8	0.4	-	-
Northern Black Korhaan	*Afrotis afraoides*	0.6	0.0	-	-
Olive Thrush	*Turdus olivaceus*	6.1	0.4	-	-
Olive Woodpecker	*Dendropicos griseocephalus*	3.0	0.0	-	-
Orange-breasted Waxbill	*Amandava subflava*	9.7	0.0	-	-
Pale-crowned Cisticola	*Cisticola cinnamomeus*	21.2	0.0	-	-
Peregrine Falcon	*Falco peregrinus*	1.2	0.0	-	-
Pied Avocet	*Recurvirostra avosetta*	4.8	0.0	-	-
Pied Crow	*Corvus albus*	11.5	3.5	-	-
Pied Kingfisher	*Ceryle rudis*	12.7	0.4	-	-
Pied Starling	*Lamprotornis bicolor*	55.2	11.5	-	-
Pin-tailed Whydah	*Vidua macroura*	44.8	2.6	-	-
Plain-backed Pipit	*Anthus leucophrys*	1.2	0.0	-	-
Purple Heron	*Ardea purpurea*	4.2	0.0	-	-
Quailfinch	*Ortygospiza atricollis*	47.9	1.8	-	-
Red-backed Shrike	*Lanius collurio*	0.6	0.0	-	-
Red-billed Quelea	*Quelea quelea*	38.8	1.8	-	-
Red-billed Teal	*Anas erythrorhyncha*	17.0	1.3	-	-
Red-capped Lark	*Calandrella cinerea*	56.4	2.2	-	-
Red-chested Cuckoo	*Cuculus solitarius*	4.8	0.4	-	-
Red-chested Flufftail	*Sarothrura rufa*	0.6	0.0	-	-
Red-collared Widowbird	*Euplectes ardens*	12.1	1.3	-	-
Red-eyed Dove	*Streptopelia semitorquata*	64.2	12.3	-	-
Red-faced Mousebird	*Urocolius indicus*	4.2	0.4	-	-
Red-headed Finch	*Amadina erythrocephala*	1.8	0.0	-	-
Red-knobbed Coot	*Fulica cristata*	58.2	4.8	-	-
Red-throated Wryneck	*Jynx ruficollis*	29.7	2.2	-	-
Red-winged Francolin	*Scleroptila levaillantii*	24.8	1.3	-	-
Red-winged Starling	*Onychognathus morio*	8.5	3.1	-	-
Reed Cormorant	*Microcarbo africanus*	63.6	4.8	-	-
Rock Dove	*Columba livia*	6.1	4.4	-	-
Rock Kestrel	*Falco rupicolus*	5.5	0.9	-	-
Rock Martin	*Ptyonoprogne fuligula*	13.9	1.8	-	-
Ruff	*Calidris pugnax*	1.8	0.4	-	-
Rufous-naped Lark	*Mirafra africana*	1.2	0.9	-	-
Sand Martin	*Riparia riparia*	1.2	0.4	-	-
Secretarybird	*Sagittarius serpentarius*	13.3	0.0	EN	VU
Sedge Warbler	*Acrocephalus schoenobaenus*	0.6	0.0	-	-
Sentinel Rock Thrush	*Monticola explorator*	2.4	0.0	NT	
South African Cliff Swallow	*Petrochelidon spilodera*	38.2	3.5	-	-
South African Shelduck	*Tadorna cana*	30.3	3.5	-	-

Species list for the broader area **Powerline sensitive species are shaded** **Species name**	**Taxonomic name**	**SABAP2 full protocol reporting rate**	**SABAP2 Ad hoc protocol reporting rate**	**Global status**	**Regional status**
Southern Bald Ibis	*Geronticus calvus*	23.0	3.1	VU	VU
Southern Boubou	*Laniarius ferrugineus*	15.2	0.9	-	-
Southern Fiscal	*Lanius collaris*	92.1	15.4	-	-
Southern Grey-headed Sparrow	*Passer diffusus*	57.6	4.4	-	-
Southern Masked Weaver	*Ploceus velatus*	90.9	9.7	-	-
Southern Pochard	*Netta erythrophthalma*	9.1	0.0	-	-
Southern Red Bishop	*Euplectes orix*	84.2	12.3	-	-
Speckled Mousebird	*Colius striatus*	25.5	0.9	-	-
Speckled Pigeon	*Columba guinea*	67.3	13.2	-	-
Spike-heeled Lark	*Chersomanes albofasciata*	48.5	1.3	-	-
Spotted Eagle-Owl	*Bubo africanus*	9.1	0.9	-	-
Spotted Flycatcher	*Muscicapa striata*	4.2	0.4	-	-
Spotted Thick-knee	*Burhinus capensis*	9.1	0.0	-	-
Spur-winged Goose	*Plectropterus gambensis*	44.2	1.8	-	-
Squacco Heron	*Ardeola ralloides*	1.2	0.0	-	-
Streaky-headed Seedeater	*Crithagra gularis*	9.1	0.4	-	-
Swainson's Spurfowl	*Pternistis swainsonii*	61.2	2.6	-	-
Tawny-flanked Prinia	*Prinia subflava*	0.6	0.4	-	-
Temminck's Courser	*Cursorius temminckii*	1.8	0.0	-	-
Three-banded Plover	*Charadrius tricollaris*	35.2	0.9	-	-
Village Weaver	*Ploceus cucullatus*	4.2	0.0	-	-
Wailing Cisticola	*Cisticola lais*	9.1	0.0	-	-
Wattled Crane	*Grus carunculata*	0.6	0.0	VU	CR
Wattled Starling	*Creatophora cinerea*	0.6	0.0	-	-
Western Barn Owl	*Tyto alba*	3.0	0.4	-	-
Western Cattle Egret	*Bubulcus ibis*	44.8	12.3	-	-
Western Osprey	*Pandion haliaetus*	0.6	0.0	-	-
Whiskered Tern	*Chlidonias hybrida*	12.1	5.3	-	-
White Stork	*Ciconia ciconia*	7.3	1.3	-	-
White-backed Duck	*Thalassornis leuconotus*	6.7	0.0	-	-
White-bellied Bustard	*Eupodotis senegalensis*	7.9	0.0	-	VU
White-breasted Cormorant	*Phalacrocorax lucidus*	11.5	0.9	-	-
White-faced Whistling Duck	*Dendrocygna viduata*	0.6	0.0	-	-
White-rumped Swift	*Apus caffer*	30.3	4.0	-	-
White-throated Swallow	*Hirundo albigularis*	37.6	1.8	-	-
White-winged Tern	*Chlidonias leucopterus*	3.6	0.9	-	-
Willow Warbler	*Phylloscopus trochilus*	4.2	0.0	-	-
Wing-snapping Cisticola	*Cisticola ayresii*	45.5	6.2	-	-
Wood Sandpiper	*Tringa glareola*	6.1	0.0	-	-
Yellow Canary	*Crithagra flaviventris*	15.8	0.4	-	-
Yellow-billed Duck	*Anas undulata*	61.8	4.4	-	-
Yellow-billed Kite	*Milvus aegyptius*	2.4	0.0	-	-
Yellow-crowned Bishop	*Euplectes afer*	34.5	4.0	-	-
Yellow-fronted Canary	*Crithagra mozambica*	9.1	0.9	-	-
Zitting Cisticola	*Cisticola juncidis*	41.2	2.6	-	-

Species recorded during transect and incidental counts **Powerline sensitive species are shaded**			
Species	**Taxonomic name**	**Transect counts**	**Incidental counts**
African Black Duck	*Anas sparsa*	*	
African Darter	*Anhinga rufa*	*	
African Fish Eagle	*Haliaeetus vocifer*	*	*
African Grass Owl	*Tyto capensis*		*
African Harrier-Hawk	*Polyboroides typus*		*
African Hoopoe	*Upupa africana*		
African Pipit	*Anthus cinnamomeus*	*	
African Quail-Finch	*Ortygospiza atricollis*	*	
African Rail	*Rallus caerulescens*		
African Reed Warbler	*Acrocephalus baeticatus*	*	
African Sacred Ibis	*Threskiornis aethiopicus*	*	
African Snipe	*Gallinago nigripennis*	*	
African Spoonbill	*Platalea alba*	*	
African Stonechat	*Saxicola torquatus*	*	
African Swamphen	*Porphyrio madagascariensis*		
African Wattled Lapwing	*Vanellus senegallus*	*	
Amur Falcon	*Falco amurensis*	*	*
Ant-eating Chat	*Myrmecocichla formicivora*	*	
Banded Martin	*Riparia cincta*	*	
Barn Swallow	*Hirundo rustica*	*	
Black Crake	*Amaurornis flavirostra*		
Black Sparrowhawk	*Accipiter melanoleucus*	*	*
Black-chested Prinia	*Prinia flavicans*	*	
Black-chested Snake Eagle	*Circaetus pectoralis*		*
Black-collared Barbet	*Lybius torquatus*	*	
Black-headed Heron	*Ardea melanocephala*	*	
Black-headed Oriole	*Oriolus larvatus*		
Black-rumped Buttonquail	*Turnix nanus*		*
Blacksmith Lapwing	*Vanellus armatus*	*	
Black-throated Canary	*Crithagra atrogularis*	*	
Black-winged Kite	*Elanus caeruleus*	*	*
Black-winged Lapwing	*Vanellus melanopterus*	*	*
Black-winged Stilt	*Himantopus himantopus*		
Blue Crane	*Grus paradisea*	*	*
Blue Korhaan	*Eupodotis caerulescens*	*	*
Bokmakierie	*Telophorus zeylonus*	*	
Brown Snake Eagle	*Circaetus cinereus*		*
Brown-throated Martin	*Riparia paludicola*	*	
Buff-streaked Chat	*Campicoloides bifasciatus*		*

Species recorded during transect and incidental counts **Powerline sensitive species are shaded**			
Species	**Taxonomic name**	**Transect counts**	**Incidental counts**
Cape Bunting	*Emberiza capensis*		
Cape Canary	*Serinus canicollis*	*	
Cape Crow	*Corvus capensis*	*	
Cape Glossy Starling	*Lamprotornis nitens*	*	
Cape Grassbird	*Sphenoeacus afer*		
Cape Longclaw	*Macronyx capensis*	*	
Cape Robin-Chat	*Cossypha caffra*	*	
Cape Shoveler	*Lamprotornis nitens*	*	
Cape Sparrow	*Passer melanurus*	*	
Cape Teal	*Anas capensis*		
Cape Turtle Dove	*Streptopelia capicola*	*	
Cape Vulture	*Gyps coprotheres*	*	*
Cape Wagtail	*Motacilla capensis*	*	
Cape Weaver	*Ploceus capensis*	*	
Cape White-eye	*Zosterops virens*	*	
Capped Wheatear	*Oenanthe pileata*	*	
Cardinal Woodpecker	*Dendropicos fuscescens*		
Chinspot Batis	*Batis molitor*		
Cloud Cisticola	*Cisticola textrix*	*	
Common Buzzard	*Buteo buteo*	*	*
Common Greenshank	*Tringa nebularia*		
Common Moorhen	*Gallinula chloropus*	*	
Common Myna	*Acridotheres tristis*	*	
Common Ostrich	*Struthio camelus*	*	
Common Quail	*Coturnix coturnix*	*	
Common Waxbill	*Estrilda astrild*	*	
Crowned Lapwing	*Vanellus coronatus*	*	
Dark-capped Bulbul	*Pycnonotus tricolor*	*	
Diederik Cuckoo	*Chrysococcyx caprius*	*	
Drakensberg Prinia	*Prinia hypoxantha*	*	
Eastern Clapper Lark	*Mirafra fasciolata*	*	
Eastern Long-billed Lark	*Certhilauda semitorquata*	*	
Egyptian Goose	*Alopochen aegyptiaca*	*	
Fan-tailed Widowbird	*Euplectes axillaris*	*	
Fiscal Flycatcher	*Melaenornis silens*	*	
Fork-tailed Drongo	*Dicrurus adsimilis*		
Giant Kingfisher	*Bostrychia hagedash*		
Greater Flamingo	*Phoenicopterus roseus*		*
Greater Striped Swallow	*Cecropis cucullata*	*	

Species recorded during transect and incidental counts **Powerline sensitive species are shaded**			
Species	**Taxonomic name**	**Transect counts**	**Incidental counts**
Grey Crowned Crane	*Balearica regulorum*		*
Grey Heron	*Ardea cinerea*	*	
Grey-winged Francolin	*Scleroptila afra*	*	*
Hadeda	*Bostrychia hagedash*	*	
Hamerkop	*Scopus umbretta*	*	
Helmeted Guineafowl	*Numida meleagris*	*	
Horus Swift	*Apus horus*		
House Sparrow	*Passer domesticus*	*	
Intermediate Egret	*Ardea intermedia*		
Jackal Buzzard	*Buteo rufofuscus*		*
Kittlitz's Plover	*Charadrius pecuarius*	*	
Kurrichane Thrush	*Turdus libonyana*		
Lanner Falcon	*Falco biarmicus*	*	*
Laughing Dove	*Spilopelia senegalensis*	*	
Lazy Cisticola	*Cisticola aberrans*	*	
Lesser Flamingo	*Phoeniconaias minor*		*
Lesser Moorhen	*Paragallinula angulata*		
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	*	
Levaillant's Cisticola	*Cisticola tinniens*	*	
Little Grebe	*Tachybaptus ruficollis*	*	
Little Rush Warbler	*Bradypterus baboecala*		
Little Swift	*Apus affinis*	*	
Long-crested Eagle	*Lophaetus occipitalis*	*	*
Long-tailed Widowbird	*Euplectes progne*	*	
Malachite Kingfisher	*Corythornis cristatus*	*	
Marsh Owl	*Asio capensis*		*
Martial Eagle	*Polemaetus bellicosus*		*
Mountain Wheatear	*Myrmecocichla monticola*	*	
Namaqua Dove	*Oena capensis*		
Olive Woodpecker	*Dendropicos griseocephalus*	*	
Orange-breasted Waxbill	*Ortygospiza atricollis*	*	
Pale-crowned Cisticola	*Cisticola cinnamomeus*	*	
Peregrine Falcon	*Falco peregrinus*		*
Pied Avocet	*Recurvirostra avosetta*		
Pied Crow	*Corvus albus*	*	
Pied Kingfisher	*Ceryle rudis*	*	
Pied Starling	*Lamprotornis bicolor*	*	
Pin-tailed Whydah	*Vidua macroura*	*	
Red-billed Quelea	*Quelea quelea*	*	

Species recorded during transect and incidental counts **Powerline sensitive species are shaded**			
Species	**Taxonomic name**	**Transect counts**	**Incidental counts**
Red-billed Teal	*Anas erythrorhyncha*		
Red-capped Lark	*Calandrella cinerea*	*	
Red-chested Cuckoo	*Cuculus solitarius*	*	
Red-chested Flufftail	*Sarothrura rufa*	*	
Red-collared Widowbird	*Euplectes ardens*	*	
Red-eyed Dove	*Streptopelia capicola*	*	
Red-faced Mousebird	*Urocolius indicus*	*	
Red-knobbed Coot	*Fulica cristata*	*	
Red-throated Wryneck	*Jynx ruficollis*	*	
Red-winged Francolin	*Scleroptila levaillantii*	*	
Reed Cormorant	*Microcarbo africanus*	*	
Ring-necked Dove	*Streptopelia capicola*		
Rock kestrel	*Falco rupicolus*		*
Rock Martin	*Ptyonoprogne fuligula*	*	
Secretarybird	*Sagittarius serpentarius*	*	*
Sentinel Rock Thrush	*Monticola explorator*	*	
South African Cliff Swallow	*Petrochelidon spilodera*	*	
South African Shelduck	*Tadorna cana*	*	
Southern Bald Ibis	*Geronticus calvus*	*	*
Southern Boubou	*Laniarius ferrugineus*		
Southern Fiscal	*Lanius collaris*	*	
Southern Grey-headed Sparrow	*Passer diffusus*	*	
Southern Masked Weaver	*Ploceus velatus*	*	
Southern Pochard	*Netta erythrophthalma*	*	
Southern Red Bishop	*Euplectes orix*	*	
Speckled Mousebird	*Colius striatus*	*	
Speckled Pigeon	*Columba guinea*	*	
Spike-heeled Lark	*Chersomanes albofasciata*	*	
Spotted Eagle-Owl	*Bubo africanus*		*
Spotted Flycatcher	*Muscicapa striata*	*	
Spotted Thick-knee	*Burhinus capensis*		
Spur-winged Goose	*Plectropterus gambensis*	*	
Streaky-headed Seedeater	*Crithagra gularis*	*	
Swainson's Spurfowl	*Pternistis swainsonii*	*	
Temminck's Courser	*Cursorius temminckii*	*	
Three-banded Plover	*Charadrius tricollaris*	*	
Wailing Cisticola	*Cisticola lais*	*	
Wattled Starling	*Creatophora cinerea*	*	
Western Cattle Egret	*Bubulcus ibis*	*	

Species recorded during transect and incidental counts **Powerline sensitive species are shaded**			
Species	**Taxonomic name**	**Transect counts**	**Incidental counts**
Whiskered Tern	*Chlidonias hybrida*	*	
White Stork	*Ciconia ciconia*		*
White-backed Duck	*Thalassornis leuconotus*	*	
White-bellied Bustard	*Eupodotis senegalensis*		*
White-breasted Cormorant	*Phalacrocorax lucidus*	*	
White-rumped Swift	*Apus caffer*	*	
White-throated Swallow	*Hirundo albigularis*	*	
White-winged Tern	*Chlidonias leucopterus*	*	
Willow Warbler	*Phylloscopus trochilus*		
Wing-snapping Cisticola	*Cisticola ayresii*	*	
Yellow Canary	*Crithagra flaviventris*	*	
Yellow-billed Duck	*Anas undulata*	*	
Yellow-billed Kite	*Milvus aegyptius*	*	
Yellow-crowned Bishop	*Euplectes afer*	*	
Yellow-fronted Canary	*Crithagra mozambica*	*	
Zitting Cisticola	*Cisticola juncidis*	*	

APPENDIX 2: HABITAT FEATURES AT THE PROJECT AREA

Figure 1: High sensitivity natural grassland in the study area.

Figure 3: An example of an earth dam in the broader area.

Figure 4: Agriculture in the study area.

Figure 5: Drainage line and associated wetland in the broader area.

Figure 6: Alien trees in the study area.

APPENDIX 3: PRE-CONSTRUCTION MONITORING

1. Objectives

The objective of the pre-construction monitoring at the proposed Camden I Wind Energy Facility (WEF) was to gather baseline data over a period of four seasons on the variety and abundance of avifauna at the project area. Data gathering for the WEF monitoring included the study area for the up to 400kV HV powerline and collector substation, and therefore informed the current assessment, despite no guideline requirement towards multi-season monitoring for the electrical grid infrastructure contemplated in this report. Given the extensive data gathering, the information was utilised towards informing this impact assessment.

2. Methods

Monitoring surveys for the Camden I WEF were conducted during the following periods:

- 26 - 31 July 2020 (winter)
- 2 - 7 August 2020 (winter)
- 16 - 19, 30 September 2020 (spring)
- 2 - 3, 7 - 8 October 2020 (spring)
- 4 – 5 November 2020 (spring)
- 10 – 13, 20 - 27 February 2021 (summer)
- 21 – 22 March 2021 (summer)
- 12 – 15 April 2021 (autumn)
- 3 – 6, 12 – 13 May 2021 (autumn)

Monitoring relevant to the up to 400kV HV powerline and collector substation was conducted in the following manner:

- One drive transect was identified totalling 10.2km on the Camden I Wind Energy development site.
- One monitor travelling slowly (± 10km/h) in a vehicle recorded all birds on both sides of the transect. The observer stopped at regular intervals (every 500m) to scan the environment with binoculars. Drive transects were counted three times per sampling session.
- In addition, 4 walk transects of 1km each were identified at the development site and counted 4 times per sampling season. All birds were recorded during walk transects.
- The following variables were recorded:
    - Species
    - Number of birds
    - Date
    - Start time and end time
    - Estimated distance from transect
    - Wind direction
    - Wind strength (estimated Beaufort scale)
    - Weather (sunny; cloudy; partly cloudy; rain; mist)
    - Temperature (cold; mild; warm; hot)
    - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground) and

- Co-ordinates (priority species only)

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

See Figure 1 for the location of the transects at the project site.

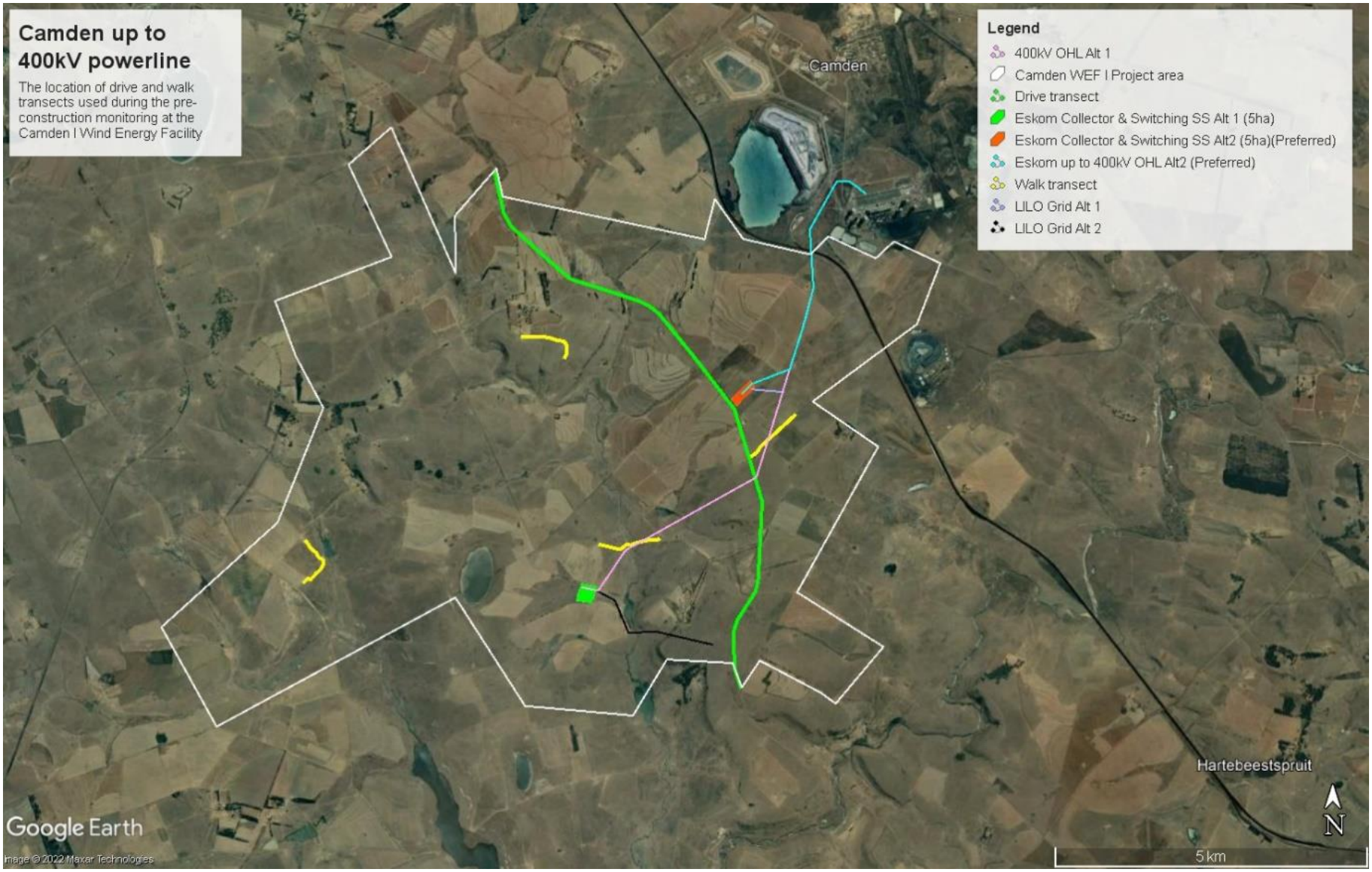

Figure 1: Transects used during the pre-construction monitoring at the proposed Camden I Wind Energy Facility. These results were used to inform this assessment.

APPENDIX 4: IMPACT TABLES

Project Name: Camden up to 400kV HV powerline and collector substation

CONSTRUCTION

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with construction of the on-site substation, extension of the Camden PS substation and up to 400kV overhead power line	Construction	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	3	2	3	**30**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with construction of the on-site substation, the Camden PS extension and up to 400kV overhead power line	Construction	Negative	Moderate	2	2	3	2	4	**36**	**N3**	2	2	3	2	3	**27**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

OPERATIONAL

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Mortality: Collision	Mortality of priority species due to collisions with the up to 400kV overhead power line	Operational	Negative	Moderate	5	3	3	4	4	**60**	**N3**	3	3	3	4	2	**26**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Mortality: Electrocution	Electrocution of priority species on the on-site substation infrastructure	Operational	Negative	High	5	3	3	4	2	**30**	**N2**	1	2	3	4	2	**20**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						

DECOMISSIONING

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with decommissioning of the on-site substation and up to 400kV overhead power line	Decommissioning	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	3	2	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

CUMULATIVE

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Mortality: Collision	Powerline collision mortality of priority avifauna due to the construction of the overhead power line.	Cumulative	Negative	Moderate	2	2	2	4	3	**30**	**N2**	2	3	3	4	2	**24**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
Impact 2:	Displacement	Displacement of priority avifauna due to disturbance and habitat transformation	Cumulative	Negative	Moderate	3	2	3	2	3	**30**	**N2**	3	2	3	2	2	**20**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
Impact 3:	Mortality: Electrocution	Mortality (electrocution) of priority avifauna due to the construction of the on-site substation	Cumulative	Negative	High	3	3	3	4	2	**26**	**N2**	1	2	3	4	2	**20**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						

APPENDIX 5: ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

Environmental Management Programme (EMPr): Up to 400kV overhead line and collector substation

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	Conduct an inspection (avifaunal walk-through) of the final powerline alignment to identify powerline sensitive species that may be breeding within the final footprint. If a SSC nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding birds during the construction period. 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: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property;	1. Walk-through by avifaunal specialist 2. 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. 3. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 4. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 5. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 6. Ensure that the construction area is demarcated clearly and that construction	1. Once-off 2. Monthly 3. Monthly 4. Monthly 5. Monthly	1. Avifaunal Specialist 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO 6. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		5. Strict application of all recommendations in the biodiversity specialist report pertaining to the limitation of the footprint.	personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		
Avifauna: Mortality due to collision with the overhead powerline					
Mortality of avifauna due to collisions with the overhead powerline.	Reduction of avian collision mortality	Bird Flight Diverters must be fitted to the entire OHL according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines). These devices must be installed as soon as the conductors and earthwires are strung.	1. Fit Eskom approved Bird Flight Diverters on the entire length of line	1. Once-off	1. Contractor and ECO

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Mortality of avifauna due to electrocution on the collector substation infrastructure					
Mortality of avifauna due to electrocutions within the collector substation	Reduction of avian electrocution mortality	1. Monitor the electrocution mortality within the collector substation 2. Apply mitigation if electrocution happens regularly.	1. Regular inspections of the onsite substation yard.	1. Monthly	1. The holder of the EA

Management Plan for the Decommissioning Phase

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