AVIFAUNAL IMPACT ASSESSMENT

Camden I Solar Energy Facility, Grid Connection and Battery Storage Facility

Mpumalanga Province

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AFRIMAGE Photography (Pty) Ltd t/a:
Chris van Rooyen Consulting
VAT#: 4580238113
email: vanrooyen.chris@gmail.com
Tel: +27 (0)82 4549570 cell

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.
- Camden I Solar up to 100MW.
- Camden I Solar up to 132kV Gid Connection.
- Camden Green Hydrogen and Ammonia Facility, including grid connection infrastructure and water pipeline.
- Camden II Wind Energy Facility (up to 200MW).
- Camden II Wind Energy Facility up to 132kV Grid Connection.

This impact report deals with the Camden I Solar Energy Facility (SEF), Battery Energy Storage System (BESS) and 132kV grid connection.

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, 107 species are classified as solar priority species and 78 as powerline sensitive species. Of the 107 solar priority species, 17 are South African Red List species, and of the 78 powerline sensitive species, 15 are South African Red List species. Of the solar priority species, 35 are likely to occur regularly in the development area, and 55 powerline sensitive species are likely to occur regularly in the project area.

3 SUMMARY AND CONCLUSION

3.1 Solar Energy Facility

The proposed Camden 1 SEF will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure
- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences

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

As far as disturbance is concerned, it is likely that all the avifauna, including all the priority species, will be temporarily displaced in the footprint area, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities e.g. increased vehicle traffic, and short-term construction-related noise (from equipment) and visual disturbance. At the PV facility, the priority species which would be most severely affected by disturbance would be ground dwelling species which are the following: White-bellied Bustard, Cloud Cisticola, Blue Crane, Western Cattle Egret, Grey-winged Francolin, Cape Grassbird, Blue Korhaan, African Grass Owl, Marsh Owl, Drakensberg Prinia, and Pied Starling. Secretarybirds breeding or roosting at or near to the project site might also be affected. The impact is rated as **moderate** pre-mitigation and will be reduced but remain at a **moderate** level post-mitigation.

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

Ground-disturbing activities affect a variety of processes, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011). Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns. As far as displacement, either completely or partially (reduced densities) due to habitat loss is concerned, it is highly likely that the same pattern of reduced avifaunal densities will manifest itself at the proposed PV facility. In addition, ground dwelling species and some raptors are also likely to be impacted by the habitat transformation, as it will result in reduced prey availability and accessibility. Priority species that could be negatively affected by displacement due to habitat loss are the following: Common Buzzard, Jackal Buzzard, Cloud Cisticola, Blue Crane, Black-chested Snake Eagle, Long-crested Eagle, Western Cattle Egret, Amur Falcon, Lanner Falcon, Grey-winged Francolin, Cape Grassbird, Black-headed Heron, Southern Bald Ibis, Rock Kestrel, Black-winged Kite, Blue Korhaan, African Grass Owl, Marsh Owl, Pied Starling, White Stork, and South African Cliff Swallow. The impact is rated as **moderate** pre-mitigation and will be reduced but remain at a **moderate** level post-mitigation.

3.1.3 Collision mortality of priority species caused by the solar panels in the operational phase

The proposed Camden 1 Solar Energy Facility could potentially pose a collision risk to several priority species which could occur regularly at the site. However, the results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. The lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely preliminary and based on professional opinion. Based on the lack of evidence to the contrary, it is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small to medium-sized, ground-dwelling birds which forage between the solar panels, and possibly raptors which prey on them, or forage for insects between the PV panels, e.g. Amur Falcons (i.e. if they are not completely displaced due to the habitat transformation). Due to the absence of large permanent waterbodies at or close to the development area, it is unlikely that waterbirds will be attracted in large numbers to the solar arrays due to the “lake effect”. Priority species which occur regularly and could potentially be impacted due to collisions with the solar panels are the following: Western Cattle Egret, Amur Falcon, Lanner Falcon, Fiscal Flycatcher, Grey-winged Francolin, Egyptian Goose, Spur-winged Goose, Cape Grassbird, Black-headed Heron, Southern Bald Ibis, African Sacred Ibis, Blue Korhaan, Blacksmith Lapwing, African Grass Owl, Marsh Owl, Three-banded Plover, Drakensberg Prinia, South African Shelduck, African Snipe, Black Sparrowhawk, Pied Starling, South African Cliff Swallow and Cape Weaver. The impact is rated as **low**. No mitigation measures are recommended.

3.1.4 Electrocution of priority species on the medium voltage overhead lines (if any) in the operational phase

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the electrical infrastructure could potentially pose an electrocution risk to several power line sensitive species that could on occasion perch on these poles. In summary, the following priority species are potentially vulnerable to electrocution in this manner: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite. The impact is rated as **moderate** pre-mitigation but should be reduced to a **low** level post-mitigation.

3.1.5 Collisions of priority species with the medium voltage overhead lines (if any) in the operational phase

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. These spans could pose a collision risk to virtually all powerline sensitive avifauna, depending on where those spans are located. 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.

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

The impact is likely to be similar in nature and extent to the construction phase of the proposed SEF. The impact is rated as **medium** pre-mitigation and it will decrease to **low** post-mitigation.

3.2 Battery Energy Storage Facility (BESS)

The impact that is associated with the construction of the BESS is the potential displacement of priority avifauna due to disturbance associated with the construction and dismantling of the facility and habitat transformation in the footprint of the facility.

3.2.1 Displacement due to disturbance associated with the construction of the facility

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 in practice that can admittedly be challenging to implement. The priority species which are potentially most vulnerable to the impact of displacement due to disturbance linked to the BESS are terrestrial species and owls. Priority species that could be most affected are the following: African Grass Owl, Black-bellied Bustard, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned

Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Secretarybird and White-bellied Bustard. The impact is rated as **low** pre-mitigation and it will decrease to **very low** post-mitigation.

3.2.2 Displacement due to habitat transformation associated with the construction of the facility

These construction activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 5 ha proposed facility is likely to be relatively insignificant due to the relatively small size of the footprint (only 0.07% of the total project area, and 2.5% of the buildable area). The impact is rated as **low** pre- and post-mitigation.

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

The impact is likely to be similar in nature and extent to the construction phase of the proposed BESS. The impact is rated as **low** pre-mitigation and it will decrease to **very low** post-mitigation.

3.3 The up to 132kV OHL

The following potential impacts on powerline sensitive avifauna are associated with the construction and operation of the up to 132kV grid connection related to the Solar Energy Facility:

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

3.3.1 Displacement due to disturbance associated with the construction of the proposed OHL and on-site substation.

Construction activities could 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 most vulnerable to displacement due to disturbance are mostly ground dwelling 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.

3.3.2 Displacement due to habitat transformation associated with the construction of the proposed OHL and on-site substation.

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. 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 OHL, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed OHL. The loss of habitat in the substation footprint (2 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 dwelling 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.

3.3.3 Mortality of powerline sensitive avifauna due to electrocutions on the OHL

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 voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The only priority species capable of bridging the clearance distances of an OHL constructed using this specification is the Cape Vulture, due to their size and gregarious nature. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

3.3.4 Mortality of powerline sensitive avifauna due to electrocutions in the onsite substation

Electrocutions within the proposed on-site substation are possible, however the likelihood of this impact on the more sensitive SCC is remote, as these species are unlikely to regularly utilise the infrastructure within the onsite substation station for perching or roosting. Powerline sensitive species that are more vulnerable to electrocutions are medium-sized raptors, corvids, owls and certain species of waterbirds.. As far as the substation is concerned, the following species are potentially at risk of electrocution: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite. The impact is rated as **low** pre- and post-mitigation.

3.3.5 Mortality of powerline sensitive avifauna due to collisions with the OHL

The up to 132kV OHL could pose a collision risk to virtually all powerline sensitive avifauna, depending on where the spans are located. Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions, powerline configuration and visual capacity. 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 and it will decrease to **low** post-mitigation.

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

The impact is likely to be similar in nature and extent to the construction phase of the proposed OHL and onsite substation. The impact is rated as **medium** pre-mitigation and it will decrease to **low** post-mitigation.

3.4 Cumulative impacts

3.4.1 Solar Energy Facility

The total area of similar habitat (excluding opencast mining and urban areas) available to birds in the 30km radius around the project area (including the project area) is approximately 4 258 km². The land parcels affected by the planned renewable energy facilities, including the Camden I SEF, in this radius takes up a total of ~124km², which is 2.9% of the available habitat. The impact on avifauna of the currently planned renewable energy projects within this area, including the Camden I SEF, is therefore considered to be **Low**, and the impact could be reduced if the recommended mitigation at the two Camden wind projects and the Camden I SEF is diligently implemented.

3.4.2 Up to 132kV OHL

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**.

3.4.3 Battery Energy Storage Facility

The BESS will transform an area of approximately 5 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 the BESS is **Low** due to the small footprint.

4 CONCLUSION AND IMPACT STATEMENT

4.1 Solar Energy Facility

The proposed solar energy facility will have a moderate impact on priority avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation, although some instances moderate residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed SEF development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

4.2 Battery Energy Storage Facility (BESS)

The proposed BESS will have a low impact on priority avifauna which, could be reduced to a very low level in most instances through appropriate mitigation, although some instances low residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed BESS development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

4.3 The up to 132kV OHL

The proposed up to 132kV OHL will have a mostly 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 development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

4 ENVIRONMENTAL SENSITIVITIES

The following specific environmental sensitivities were identified from an avifaunal perspective (see Figure a):

- **100m all infrastructure exclusion zone around drainage lines, associated wetlands and pans excluding essential road and grid crossings.** Wetlands are important breeding, roosting and foraging habitat for a variety of Red List priority species, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African Marsh Harrier (SA status Endangered).

- **High sensitivity grassland - Limited infrastructure zone**. Development in the remaining high sensitivity grassland must be limited as far as possible. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads. The grassland is vital breeding, roosting and foraging habitat for a variety of Red List priority species. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham's Bustard (SA Status Vulnerable).

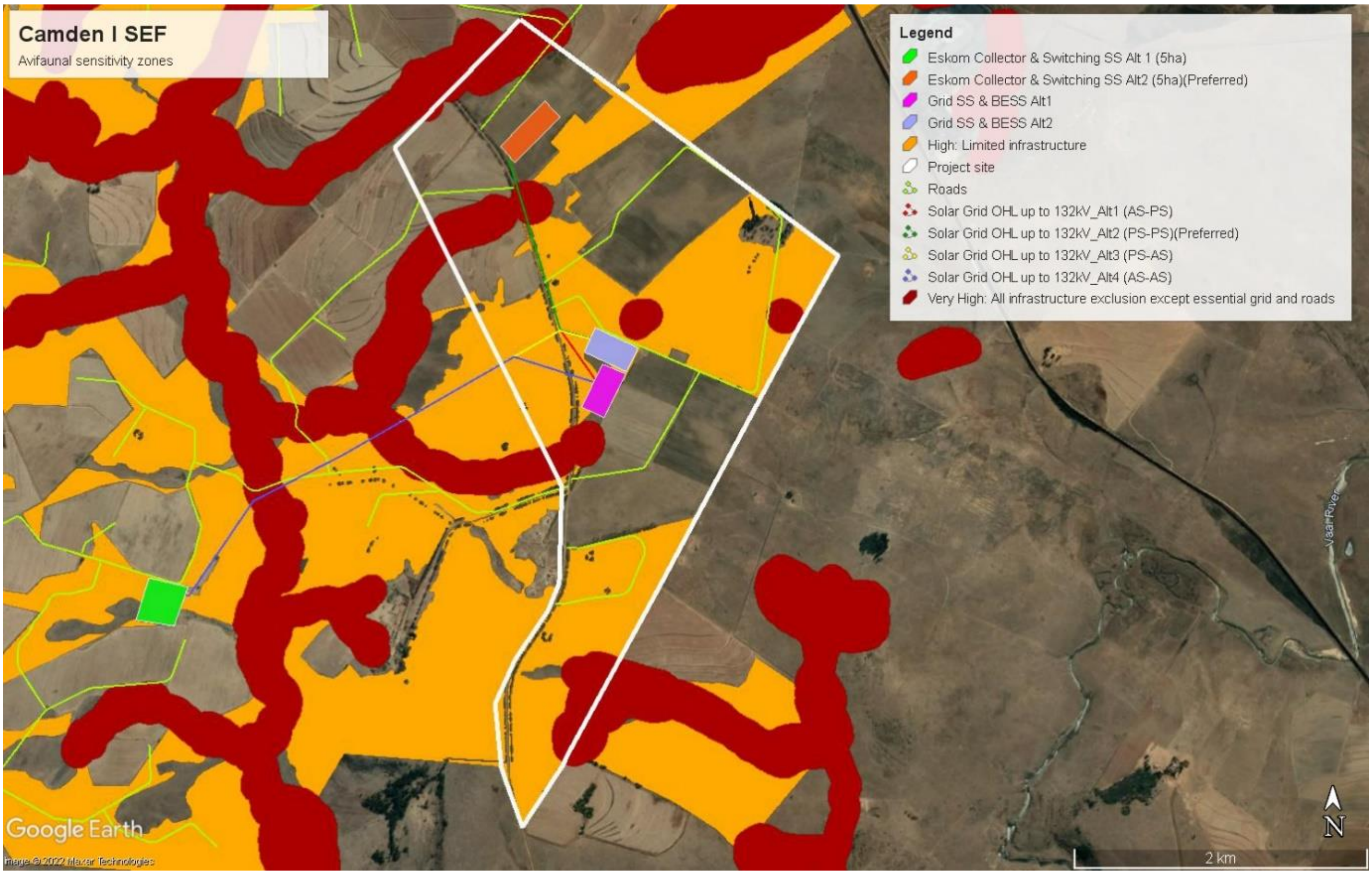

Figure a: Avifaunal sensitivity zones at the Camden 1 Solar Energy Facility.

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

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This impact report deals with the Camden I Solar Energy Facility (SEF), Battery Energy Storage System (BESS) and 132kV grid connection.

1.1 Solar Energy Facility and Battery Energy Storage Facility

Table 1 summarises the main features of the proposed SEF, relevant to potential avifaunal impacts.

Table 1: Camden I Solar Energy Facility summary

Facility Name	Camden I Solar Energy Facility
Applicant	Camden I Solar Energy Facility (RF) Propriety Limited
Municipalities	Msukaligwa Local Municipality of the Gert Sibande District Municipality
Affected Farms[1]	Portion 1 of Welgelegen Farm No. 322
Extent	~ 695 ha
Buildable area	Approximately 310 ha, subject to finalization based on technical and environmental requirements
Capacity	Up to 100MW
Power system technology	PV panels will have a maximum height of 5 m, and could be mounted on fixed tilt, single axis tracking or dual axis tracking mounting structures or Bifacial Solar Modules with a maximum combined height of up to 10m. Where desirable and feasible, Agri-Voltaic principles could be considered in the final design.
Operations and Maintenance (O&M) building footprint:	Located near the substation. Septic tanks with portable toilets Typical areas include: - Operations building – 20m x 10m = 200m^2 - Workshop – 15m x 10m = 150m^2 Stores - 15m x 10m = 150m^2
Construction camp and laydown area	Typical construction camp area 100m x 50m = 5,000m^2. Typical laydown area 100m x 200m = 20,000m^2. Sewage: Septic tanks and portable toilets
Cement batching plant (temporary):	Gravel and sand will be stored in separate heaps whilst the cement will be contained in a silo.
Internal Roads:	Width of internal road – Between 4m and 5m. Where required for turning circle/bypass areas, access or internal roads may be up to 20m to allow for larger component transport. Length of internal road –

[1] Based on the current conceptual layout.

	Approximately 8km.
Cables:	Communication, AC and DC cables.
Independent Power Producer (IPP) site substation and battery energy storage system (BESS):	Total footprint will be up to 6.5ha in extent (5ha for the BESS and 1.5ha for the IPP portion of the substation). The substation will consist of a high voltage substation yard to allow for multiple (up to) 132kV feeder bays and transformers, control building, telecommunication infrastructure, access roads, etc. The associated BESS storage capacity will be up to 100MW/400MWh with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers.

1.2 Up to 132kV Grid Connection

It is proposed that Camden I Solar will connect to the nearby Camden Collector substation (which in turn will connect to the Camden Power Station), through an up to 132kV powerline (either single or double circuit) between the grid connection substation portion (immediately adjacent the Camden I Solar PV on-site IPP substation portion) and that of the Camden Collector substation. The powerline will be approximately 14km in length, depending on the authorized location of the collector substation. The onsite grid connection substation will consist of high voltage substation yard to allow for multiple (up to) 132kV feeder bays and transformers, control building, telecommunication infrastructure, access roads, etc. The area for the onsite substation will be up to 1.5ha. The up to 132kV powerline and substation will have a 250m corridor. This application includes the necessary up to 132kV voltage electrical components required for connection at the Collector Substation (i.e. the termination works).

See Figure 1 for a map of the development area.

Figure 1: Proposed layout of the project area of the proposed Camden I SEF, BESS and grid alternatives.

2 TERMS OF REFERENCE & PROTOCOLS

2.1 Solar Energy Facility 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).

2.2 Up to 132kV 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 solar facility, BESS and grid connection, based by the on existing information and field assessments, according to the said protocols. In summary, the protocols 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 with the solar facility, BESS and the up to 132kV grid connection.
- Identify potential sensitive environments and receptors that may be impacted on by the proposed solar facility, BESS and 132kV grid connection 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 SEF, BESS and up to 132kV grid connection.
- 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:

- Priority species were defined as follows:
    - South African Red Data species: High conservation significance
    - South African endemics and near-endemics: High conservation significance
    - Raptors: High conservation significance. Raptors are at the top of the food chain and play a key role in their ecosystems. When populations of birds of prey go down, then the numbers of their prey species go up, creating an imbalance in the ecosystem.
    - Waterbirds: Evidence indicate that waterbirds may be particular susceptible to collisions with solar arrays due to the so-called lake effect, caused by the reflection of the sun of the smooth surface of solar panels.
- 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 priority 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 priority 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 areas.
- 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 I SEF, according to the applicable best practice guidelines (See Appendix 3).

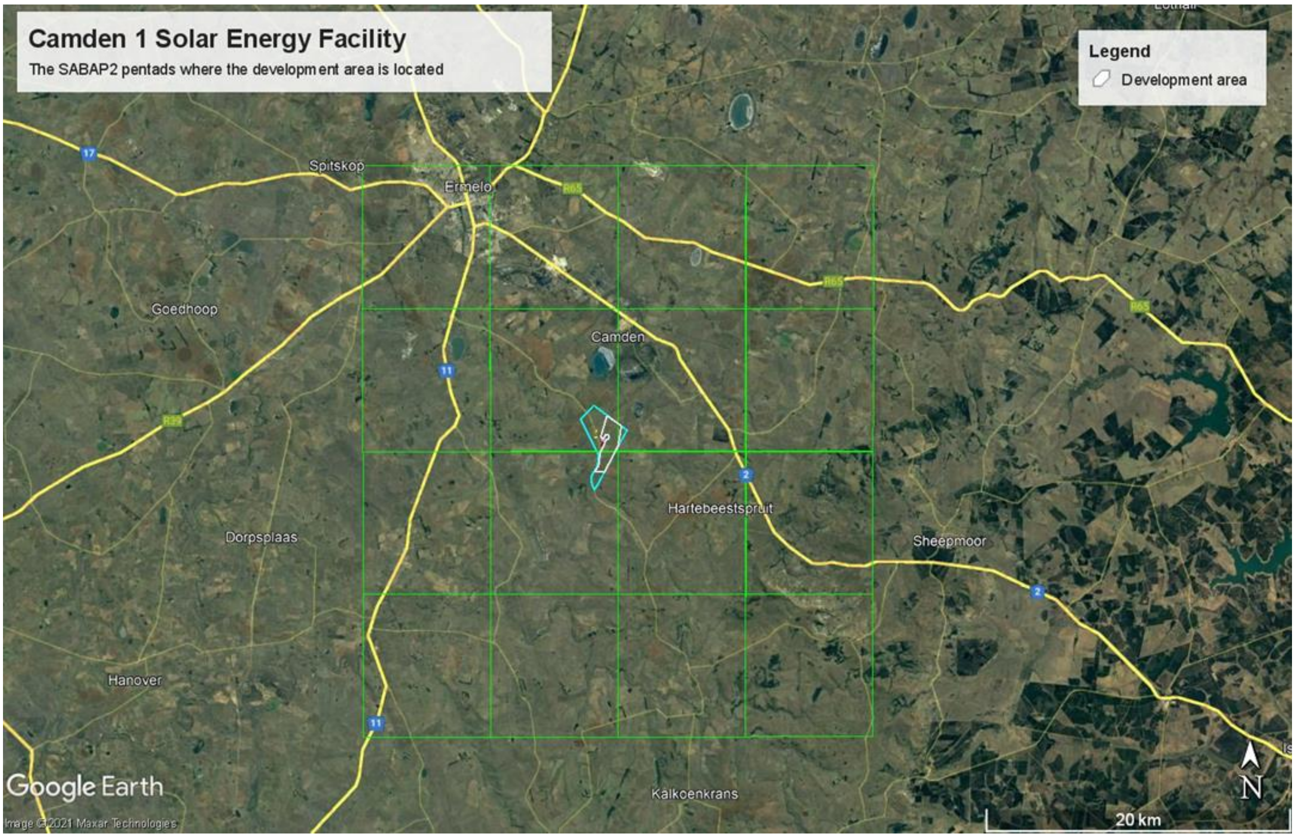

Figure 2: Area covered by the sixteen SABAP2 pentad grid cells (green squares).

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.
- The impact of solar installations on avifauna is a new field of study, with only one published scientific study on the impact of PV facilities on avifauna in South Africa (Visser *et al.* 2019). Strong reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the USA where monitoring has been ongoing since 2013. The pre-cautionary principle was applied throughout as the full extent of impacts on avifauna at solar facilities is not presently known.
- According to the specifications received from the proponent, the 33kV medium-voltage lines will be buried where practically feasible. It was therefore assumed that there could be 33kV overhead lines which could pose an electrocution risk to priority species.
- It is assumed that the up to 132kV overhead line will be built on poles/towers designed to 132kV specifications.

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[2].

Table 2: 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

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.

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

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. 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 solar facilities, power lines and BESS 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 priority 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 solar facility, grid connection and BESS, 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).

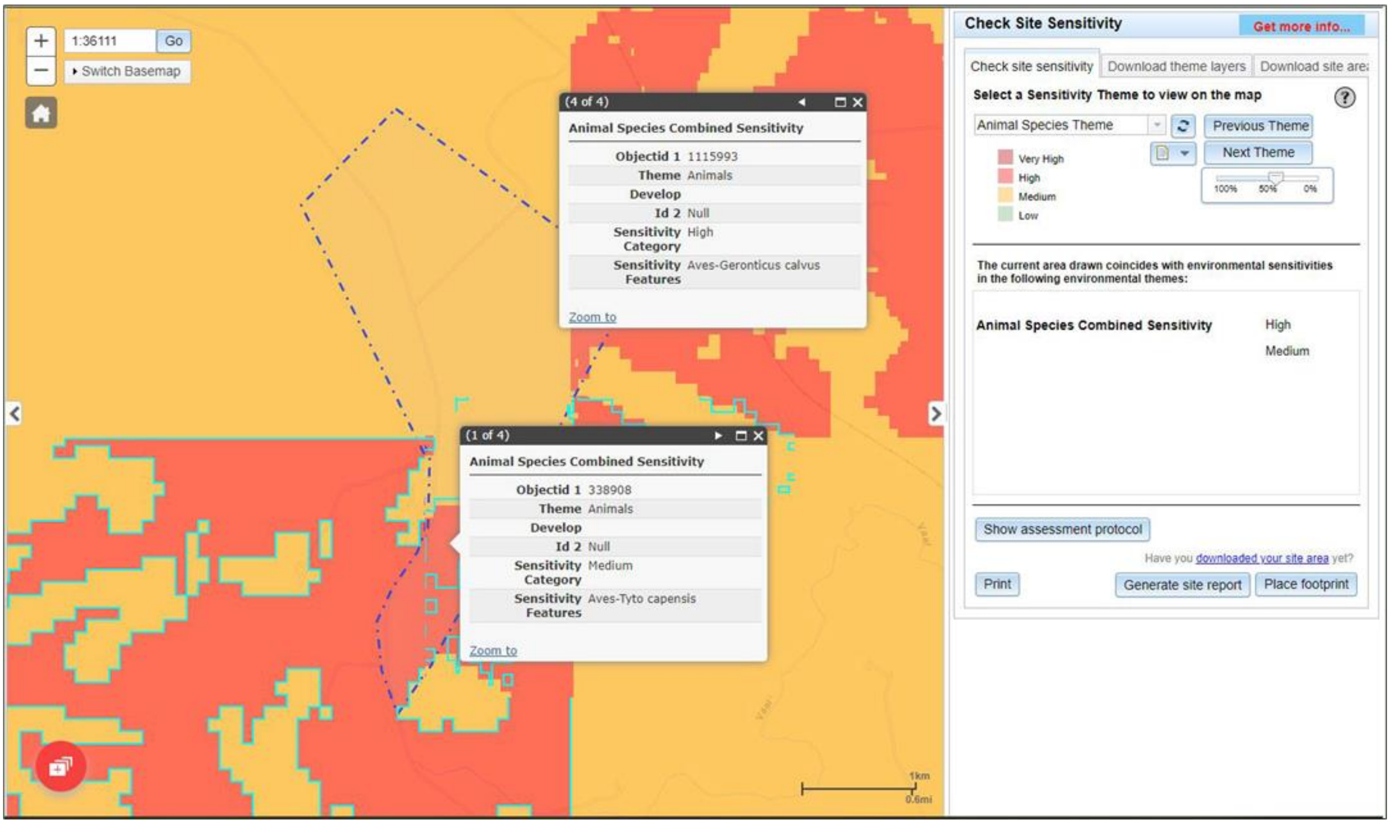

Figure 3: The National Web-Based Environmental Screening Tool map of the Camden I solar development area, grid connection and BESS, indicating sensitivities for the Animal Species theme. The classification of High sensitivity based on the presence of Red List species at the site namely African Grass 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 Solar priority species

The **solar** priority species which could potentially use the grassland in the project area on a regular basis are the following:

- African Grass Owl
- African Harrier-Hawk
- Amur Falcon
- Black-chested Snake Eagle
- Black-headed Heron
- Black-winged Kite
- Blue Crane
- Blue Korhaan
- Cape Grassbird
- Cloud Cisticola
- Common Buzzard
- Grey-winged Francolin
- Jackal Buzzard
- Lanner Falcon
- Long-crested Eagle
- Marsh Owl
- Pied Starling
- Rock Kestrel
- Secretarybird
- South African Cliff Swallow
- Southern Bald Ibis
- Western Cattle Egret
- White Stork
- White-bellied Bustard

The solar priority species which could occasionally use the grassland in the project area are the following:

- Black Harrier

- Brown Snake Eagle
- Cape Vulture
- Denham's Bustard
- Eastern Long-billed Lark
- Grey Crowned Crane
- Martial Eagle
- Montagu's Harrier
- Peregrine Falcon
- Red-chested Flufftail
- Spotted Eagle-Owl
- Western Barn Owl
- Yellow-billed Kite

6.5.1.2 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

There are several wetlands in the project area, most of which are associated with drainage lines. Wetlands are characterised by static or slow flowing water and are extensively covered by tall emergent wetland vegetation.

6.5.2.1 Solar priority species

The priority species which could potentially use the wetlands in the project area on a <u>regular</u> basis are the following:

- African Grass Owl
- African Snipe
- Black-headed Heron
- Blacksmith Lapwing
- Blue Crane
- Egyptian Goose
- Marsh Owl

The priority species which could <u>occasionally</u> use the wetlands in the project area are the following:

- African Black Duck
- African Marsh Harrier
- African Rail
- African Swamphen
- Glossy Ibis
- Grey Crowned Crane
- Hamerkop
- Ruff
- Wattled Crane

6.5.2.2 Powerline sensitive species

The powerline sensitive species which could potentially use the wetlands in the project area on a <u>regular</u> 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 Solar priority species

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

- Common Buzzard
- Blue Crane
- Amur Falcon
- Lanner Falcon
- Egyptian Goose
- Spur-winged Goose
- Southern Bald Ibis
- Black-winged Kite

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

- Grey Crowned Crane

6.5.3.2 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), Quercus (Oak), 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 Solar priority species

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

- Secretarybird
- Common Buzzard
- Jackal Buzzard
- Black-chested Snake Eagle
- Long-crested Eagle
- Western Cattle Egret
- Amur Falcon
- Lanner Falcon
- Fiscal Flycatcher
- African Harrier-Hawk
- Black-headed Heron
- African Sacred Ibis
- Southern Bald Ibis
- Rock Kestrel
- Black-winged Kite
- Black Sparrowhawk
- Pied Starling
- White Stork
- Cape Weaver

The priority species which could occasionally use the alien trees in the project area are the following:

- Reed Cormorant
- White-breasted Cormorant
- Grey Crowned Crane
- African Darter
- African Fish Eagle
- Brown Snake Eagle
- Martial Eagle
- Spotted Eagle-Owl

- Peregrine Falcon
- Black-crowned Night Heron
- Grey Heron
- Giant Kingfisher
- Yellow-billed Kite
- Western Osprey
- Western Barn Owl
- African Spoonbill
- Karoo Thrush
- Cape Vulture
- Cape White-eye

6.5.5 Dams

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

6.5.5.1 Solar priority species

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

- Egyptian Goose
- Spur-winged Goose
- African Sacred Ibis
- Blacksmith Lapwing
- Three-banded Plover
- South African Shelduck
- Cape Weaver

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

- Hamerkop
- Pied Avocet
- Red-knobbed Coot
- Reed Cormorant
- White-breasted Cormorant
- Black Crake
- African Darter
- Fulvous Whistling Duck
- White-backed Duck
- White-faced Whistling Duck
- Yellow-billed Duck
- African Fish Eagle
- Martial Eagle
- Great Egret
- Intermediate Egret
- Little Egret
- Black-necked Grebe
- Little Grebe
- Common Greenshank

- Grey-headed Gull
- Black Heron
- Black-crowned Night Heron
- Goliath Heron
- Grey Heron
- Purple Heron
- Squacco Heron
- African Jacana
- Giant Kingfisher
- Malachite Kingfisher
- Pied Kingfisher
- Common Moorhen
- Lesser Moorhen
- Western Osprey
- Kittlitz's Plover
- Southern Pochard
- African Rail
- Common Sandpiper
- Wood Sandpiper
- Cape Shoveler
- African Spoonbill
- Black-winged Stilt
- Little Stint
- African Swamphen
- Blue-billed Teal
- Cape Teal
- Red-billed Teal
- Whiskered Tern

6.5.5.2 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 priority species which could <u>occasionally</u> 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

The project site contains two small pans. These pans are a potential drawcard for many species. Lesser and Greater Flamingos could use these pans for foraging and roosting. Large raptors and vultures could use the pans for bathing and drinking, and Blue Cranes could roost there on occasion.

6.5.6.1 Solar priority species

The solar priority species which could potentially use the pans in the project site on a <u>regular</u> basis are the following:

- Blue Crane
- Egyptian Goose
- Spur-winged Goose
- African Sacred Ibis
- Blacksmith Lapwing
- Three-banded Plover
- African Snipe

The priority species which could <u>occasionally</u> use the pans in the project site are the following:

- Red-knobbed Coot
- Black Crake
- White-faced Whistling Duck
- African Fish Eagle
- Martial Eagle
- Great Egret
- Intermediate Egret
- Little Egret
- Greater Flamingo
- Lesser Flamingo
- Little Grebe
- Common Greenshank

- Grey-headed Gull
- Black Heron
- African Jacana
- Kittlitz's Plover
- African Rail
- Common Sandpiper
- Wood Sandpiper
- African Spoonbill
- Black-winged Stilt
- Little Stint
- Blue-billed Teal
- Red-billed Teal
- Whiskered Tern

6.5.6.2 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 priority species

The solar priority 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 priority 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, 107 species are classified as solar priority species and 78 as powerline sensitive species. Of the 107 solar priority species, 17 are South African Red List species, and of the 78 powerline sensitive species, 15 are South African Red List species. Of solar priority species, 35 are likely to occur regularly in the development area, and 55 powerline sensitive species are likely to occur regularly in the project area.

Table 3 and Table 4 list all the solar priority species and powerline sensitive species respectively that are likely to occur regularly and the possible impact on the respective species by the proposed solar facility (including the BESS) and 132kV grid connection. The following abbreviations and acronyms are used:

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

Table 3: Solar priority species potentially occurring at the project area.

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of regular occurrence	Habitat							Impacts					
		Full protocol	Ad hoc protocol	Global status	Regional status	IBA trigger species			Grassland	Drainage line & wetlands	Agriculture	Dams	Pans	Alien trees	HV lines	Solar - Collisions with solar panels	Solar - Displacement: Disturbance	Solar - Displacement: Habitat transformation	Solar - Entanglement in fences	Powerline - Electrocution MV	Powerline - Collision
African Black Duck	*Anas sparsa*	10.9	0.0	-	-		x	L		x						x					x
African Darter	*Anhinga rufa*	16.4	2.2	-	-		x	L				x		x		x					x
African Fish Eagle	*Haliaeetus vocifer*	12.1	0.9	-	-		x	L				x	x	x	x		x	x		x	
African Grass Owl	*Tyto capensis*	2.4	0.0	-	VU	x	x	M	x	x						x	x	x	x	x	x
African Harrier-Hawk	*Polyboroides typus*	11.5	1.8	-	-		x	M	x					x						x	
African Jacana	*Actophilornis africanus*	1.8	1.3	-	-			L				x	x			x					
African Marsh Harrier	*Circus ranivorus*	0.6	0.0	-	EN	x		L		x							x	x		x	
African Rail	*Rallus caerulescens*	5.5	0.0	-	-		x	L		x		x	x			x					
African Sacred Ibis	*Threskiornis aethiopicus*	47.9	6.2	-	-		x	M				x	x	x	x	x				x	x
African Snipe	*Gallinago nigripennis*	20.0	0.9	-	-		x	M		x			x			x					
African Spoonbill	*Platalea alba*	16.4	2.2	-	-		x	L				x	x	x		x					x
African Swamphen	*Porphyrio madagascariensis*	6.1	2.2	-	-		x	L		x		x				x					
Amur Falcon	*Falco amurensis*	29.1	6.6	-	-		x	H	x		x			x	x	x		x			
Black Crake	*Zapornia flavirostra*	9.1	0.0	-	-		x	L				x	x			x					
Black Harrier	*Circus maurus*	0.0	0.9	EN	EN	x		L	x									x		x	
Black Heron	*Egretta ardesiaca*	0.6	0.0	-	-			L				x	x			x					x
Black Sparrowhawk	*Accipiter melanoleucus*	12.1	0.9	-	-		x	M						x		x				x	
Black-chested Snake Eagle	*Circaetus pectoralis*	3.0	0.4	-	-		x	M	x					x	x			x		x	
Black-crowned Night Heron	*Nycticorax nycticorax*	0.6	0.0	-	-			L				x		x		x					x
Black-headed Heron	*Ardea melanocephala*	52.1	4.0	-	-		x	H	x	x				x	x	x		x		x	x
Black-necked Grebe	*Podiceps nigricollis*	0.6	0.4	-	-	x		L				x				x					x
Blacksmith Lapwing	*Vanellus armatus*	67.9	7.0	-	-		x	H		x		x	x			x					

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of regular occurrence	Habitat							Impacts					
		Full protocol	Ad hoc protocol	Global status	Regional status	IBA trigger species			Grassland	Drainage line & wetlands	Agriculture	Dams	Pans	Alien trees	HV lines	Solar - Collisions with solar panels	Solar - Displacement: Disturbance	Solar - Displacement: Habitat transformation	Solar - Entanglement in fences	Powerline - Electrocution MV	Powerline - Collision
Black-winged Kite	*Elanus caeruleus*	60.6	12.8	-	-		x	H	x		x			x	x			x			
Black-winged Stilt	*Himantopus himantopus*	9.1	0.0	-	-		x	L				x	x			x					
Blue Crane	*Grus paradisea*	11.5	0.4	VU	NT	x	x	H	x	x	x		x				x	x	x		x
Blue Korhaan	*Eupodotis caerulescens*	6.1	0.0	NT	LC		x	M	x							x	x	x	x		x
Blue-billed Teal	*Spatula hottentota*	1.2	0.0	-	-			L				x	x			x					x
Brown Snake Eagle	*Circaetus cinereus*	1.8	0.0	-	-			L	x					x	x		x	x		x	
Buff-streaked Chat	*Campicoloides bifasciatus*	5.5	0.4	-	-			L								x	x				
Cape Grassbird	*Sphenoeacus afer*	24.8	0.9	-	-		x	H	x							x	x	x			
Cape Shoveler	*Spatula smithii*	18.8	0.0	-	-	x	x	L				x				x					x
Cape Teal	*Anas capensis*	3.0	0.0	-	-		x	L				x				x					x
Cape Vulture	*Gyps coprotheres*	0.00	0.00	EN	EN		x	L	x					x	x		x			x	x
Cape Weaver	*Ploceus capensis*	33.9	2.2	-	-		x	H				x		x		x					
Cape White-eye	*Zosterops virens*	35.2	1.3	-	-		x	L						x		x	x	x			
Chorister Robin-Chat	*Cossypha dichroa*	1.2	0.0	-	-			L								x		x			
Cloud Cisticola	*Cisticola textrix*	7.9	0.9	-	-		x	M	x							x	x	x			
Common Buzzard	*Buteo buteo*	27.9	9.3	-	-		x	H	x		x			x	x			x		x	
Common Greenshank	*Tringa nebularia*	5.5	0.0	-	-		x	L				x	x			x					
Common Moorhen	*Gallinula chloropus*	32.7	1.8	-	-		x	L				x				x					
Common Sandpiper	*Actitis hypoleucos*	1.2	0.0	-	-			L				x	x			x					
Denham's Bustard	*Neotis denhami*	1.8	0.0	NT	VU	x		L	x								x	x	x		x
Drakensberg Prinia	*Prinia hypoxantha*	18.8	0.0	-	-		x	M								x	x				
Eastern Long-billed Lark	*Certhilauda semitorquata*	4.8	0.0	-	-		x	L	x							x	x				
Egyptian Goose	*Alopochen aegyptiaca*	78.2	6.2	-	-		x	H		x	x	x	x		x	x				x	x
Fiscal Flycatcher	*Melaenornis silens*	17.0	0.9	-	-		x	M						x		x					
Fulvous Whistling Duck	*Dendrocygna bicolor*	0.0	0.4	-	-			L				x				x					x

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of regular occurrence	Habitat							Impacts					
		Full protocol	Ad hoc protocol	Global status	Regional status	IBA trigger species			Grassland	Drainage line & wetlands	Agriculture	Dams	Pans	Alien trees	HV lines	Solar - Collisions with solar panels	Solar - Displacement: Disturbance	Solar - Displacement: Habitat transformation	Solar - Entanglement in fences	Powerline - Electrocution MV	Powerline - Collision
Giant Kingfisher	*Megaceryle maxima*	4.8	0.0	-	-			L				x		x							
Glossy Ibis	*Plegadis falcinellus*	4.2	1.8	-	-			L		x						x					x
Goliath Heron	*Ardea goliath*	2.4	0.0	-	-			L				x				x					x
Great Egret	*Ardea alba*	7.9	1.3	-	-			L				x	x			x					x
Greater Flamingo	*Phoenicopterus roseus*	3.6	4.4	-	NT	x	x	L					x			x					x
Grey Crowned Crane	*Balearica regulorum*	5.5	0.0	EN	EN	x	x	L	x	x	x			x	x		x	x	x	x	x
Grey Heron	*Ardea cinerea*	24.8	3.5	-	-		x	L				x		x	x	x					x
Grey-headed Gull	*Chroicocephalus cirrocephalus*	3.6	0.4	-	-			L				x	x								
Grey-winged Francolin	*Scleroptila afra*	27.3	2.2	-	-		x	H	x							x	x	x	x		
Hamerkop	*Scopus umbretta*	11.5	0.0	-	-		x	L		x		x	x			x				x	x
Intermediate Egret	*Ardea intermedia*	13.9	1.8	-	-		x	L				x	x			x					x
Jackal Buzzard	*Buteo rufofuscus*	19.4	2.2	-	-		x	H	x					x	x			x		x	
Karoo Thrush	*Turdus smithi*	5.5	0.0	-	-			L						x		x	x	x			
Kittlitz's Plover	*Charadrius pecuarius*	7.3	0.4	-	-		x	L				x	x			x					
Lanner Falcon	*Falco biarmicus*	7.3	0.0	-	VU	x	x	M	x		x			x	x	x		x		x	
Lesser Flamingo	*Phoeniconaias minor*	3.6	1.3	NT	NT	x	x	L					x			x					x
Lesser Moorhen	*Paragallinula angulata*	0.6	0.4	-	-		x	L				x				x					
Little Egret	*Egretta garzetta*	4.2	1.3	-	-			L				x	x			x					x
Little Grebe	*Tachybaptus ruficollis*	38.8	3.1	-	-	x	x	L				x	x			x					x
Little Stint	*Calidris minuta*	1.8	0.0	-	-			L				x	x			x					
Long-crested Eagle	*Lophaetus occipitalis*	6.7	9.3	-	-		x	M	x					x	x			x		x	
Malachite Kingfisher	*Corythornis cristatus*	7.3	0.0	-	-		x	L				x									
Marsh Owl	*Asio capensis*	5.5	0.4	-	-		x	H	x	x						x	x	x	x	x	x
Martial Eagle	*Polemaetus bellicosus*	2.4	0.0	EN	EN	x	x	L	x			x	x	x	x		x	x		x	
Montagu's Harrier	*Circus pygargus*	1.2	0.0	-	-			L	x									x		x	

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of regular occurrence	Habitat							Impacts					
		Full protocol	Ad hoc protocol	Global status	Regional status	IBA trigger species			Grassland	Drainage line & wetlands	Agriculture	Dams	Pans	Alien trees	HV lines	Solar - Collisions with solar panels	Solar - Displacement: Disturbance	Solar - Displacement: Habitat transformation	Solar - Entanglement in fences	Powerline - Electrocution MV	Powerline - Collision
Peregrine Falcon	*Falco peregrinus*	1.2	0.0	-	-		x	L	x					x	x			x		x	
Pied Avocet	*Recurvirostra avosetta*	4.8	0.0	-	-	x	x	L				x	x			x					
Pied Kingfisher	*Ceryle rudis*	12.7	0.4	-	-		x	L				x									
Pied Starling	*Lamprotornis bicolor*	55.2	11.5	-	-		x	H	x					x		x	x	x			
Purple Heron	*Ardea purpurea*	4.2	0.0	-	-			L				x				x					x
Red-billed Teal	*Anas erythrorhyncha*	17.0	1.3	-	-		x	L				x	x			x					x
Red-chested Flufftail	*Sarothrura rufa*	0.6	0.0	-	-		x	L	x							x	x				
Red-knobbed Coot	*Fulica cristata*	58.2	4.8	-	-		x	L				x	x			x					x
Reed Cormorant	*Microcarbo africanus*	63.6	4.8	-	-		x	L				x		x		x					x
Rock Kestrel	*Falco rupicolus*	5.5	0.9	-	-		x	M	x					x	x			x			
Ruff	*Calidris pugnax*	1.8	0.4	-	-			L		x						x					
Secretarybird	*Sagittarius serpentarius*	13.3	0.0	EN	VU	x	x	H	x					x			x	x	x		x
Sentinel Rock Thrush	*Monticola explorator*	2.4	0.0	NT	LC		x	L								x					
South African Cliff Swallow	*Petrochelidon spilodera*	38.2	3.5	-	-		x	H	x							x		x			
South African Shelduck	*Tadorna cana*	30.3	3.5	-	-		x	M				x				x					x
Southern Bald Ibis	*Geronticus calvus*	23.0	3.1	VU	VU	x	x	H	x		x			x	x	x		x		x	x
Southern Pochard	*Netta erythrophthalma*	9.1	0.0	-	-	x	x	L				x				x					x
Spotted Eagle-Owl	*Bubo africanus*	9.1	0.9	-	-		x	L	x					x	x	x	x		x	x	x
Spur-winged Goose	*Plectropterus gambensis*	44.2	1.8	-	-		x	M			x	x	x		x	x				x	x
Squacco Heron	*Ardeola ralloides*	1.2	0.0	-	-			L				x				x					x
Three-banded Plover	*Charadrius tricollaris*	35.2	0.9	-	-		x	M				x	x			x					
Wattled Crane	*Grus carunculata*	0.6	0.0	VU	CR	x		L		x						x	x	x	x		x
Western Barn Owl	*Tyto alba*	3.0	0.4	-	-			L	x					x						x	x
Western Cattle Egret	*Bubulcus ibis*	44.8	12.3	-	-		x	H	x					x		x	x	x			x
Western Osprey	*Pandion haliaetus*	0.6	0.0	-	-			L				x		x	x					x	
Whiskered Tern	*Chlidonias hybrida*	12.1	5.3	-	-			L				x	x								

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during monitoring	Likelihood of regular occurrence	Habitat							Impacts					
		Full protocol	Ad hoc protocol	Global status	Regional status	IBA trigger species			Grassland	Drainage line & wetlands	Agriculture	Dams	Pans	Alien trees	HV lines	Solar - Collisions with solar panels	Solar - Displacement: Disturbance	Solar - Displacement: Habitat transformation	Solar - Entanglement in fences	Powerline - Electrocution MV	Powerline - Collision
White Stork	*Ciconia ciconia*	7.3	1.3	-	-		x	M	x					x	x			x			x
White-backed Duck	*Thalassornis leuconotus*	6.7	0.0	-	-	x	x	L				x				x					x
White-bellied Bustard	*Eupodotis senegalensis*	7.9	0.0	-	VU		x	M	x							x	x	x	x		x
White-breasted Cormorant	*Phalacrocorax lucidus*	11.5	0.9	-	-		x	L				x		x		x					x
White-faced Whistling Duck	*Dendrocygna viduata*	0.6	0.0	-	-			L				x	x			x					x
White-winged Tern	*Chlidonias leucopterus*	3.6	0.9	-	-	x	x	L													
Wood Sandpiper	*Tringa glareola*	6.1	0.0	-	-			L				x	x			x					
Yellow-billed Duck	*Anas undulata*	61.8	4.4	-	-	x	x	L				x				x					x
Yellow-billed Kite	*Milvus aegyptius*	2.4	0.0	-	-		x	L	x					x	x					x	

Table 4: Powerline sensitive species potentially occurring at the project area.

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during surveys	Likelihood of regular occurrence	Habitat							Impacts			
		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 and MV 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			
Cape Teal	*Anas capensis*	3	0	-	-		x	L			x	x				x			

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during surveys	Likelihood of regular occurrence	Habitat							Impacts			
		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 and MV lines
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
Pied Crow	*Corvus albus*	12	3.5	-	-		x	H	x				x	x					x
Purple Heron	*Ardea purpurea*	4.2	0	-	-			M			x					x			

Species name	Scientific name	SABAP2 reporting rate		Status			Recorded during surveys	Likelihood of regular occurrence	Habitat							Impacts			
		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 and MV lines
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

Table 55, and Figure 4 5 and 6 below present the results of the pre-construction monitoring conducted at the Camden I PV project area. Monitoring was conducted by means of drive and walk transect counts (see Appendix 3 for more detail on the methodology) as per the requirements of the latest avifaunal guideline at the time of writing. Monitoring was implemented in the following time slots:

1. Survey 1: 10 – 11, 20 – 26 February 2021
2. Survey 2: 20 – 21 March,12 and 14 April, 5 and 12 May 2021

6.6.2.1 Transects

The results of the transect counts are tabled in Table 5 below:

Table 5: The results of the transect counts

PV site	Number of records
Species composition	
All Species	74
Solar Priority Species (30%)	22
Non-Priority Species	52
Total count	
Drive transects	1103
Walk transects	217
Total	1320

An Index of Kilometric Abundance (IKA = birds/km) was calculated for each solar priority species recorded during transects counts (see Figures 5 and 6 below).

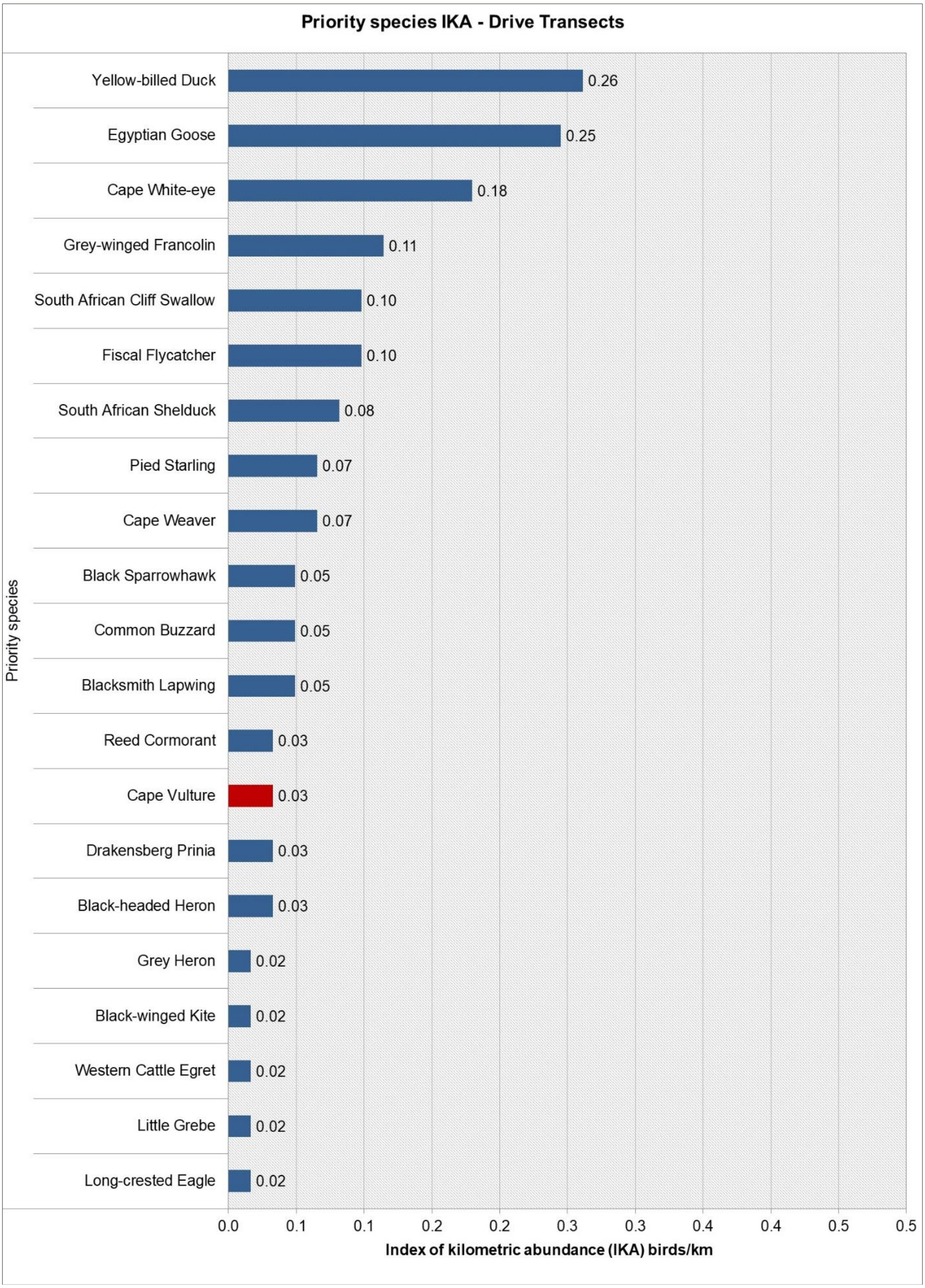

Figure 4: Index of kilometric abundance of solar priority species recorded at the project site. Species of conservation concern (SCC) are indicated in red.

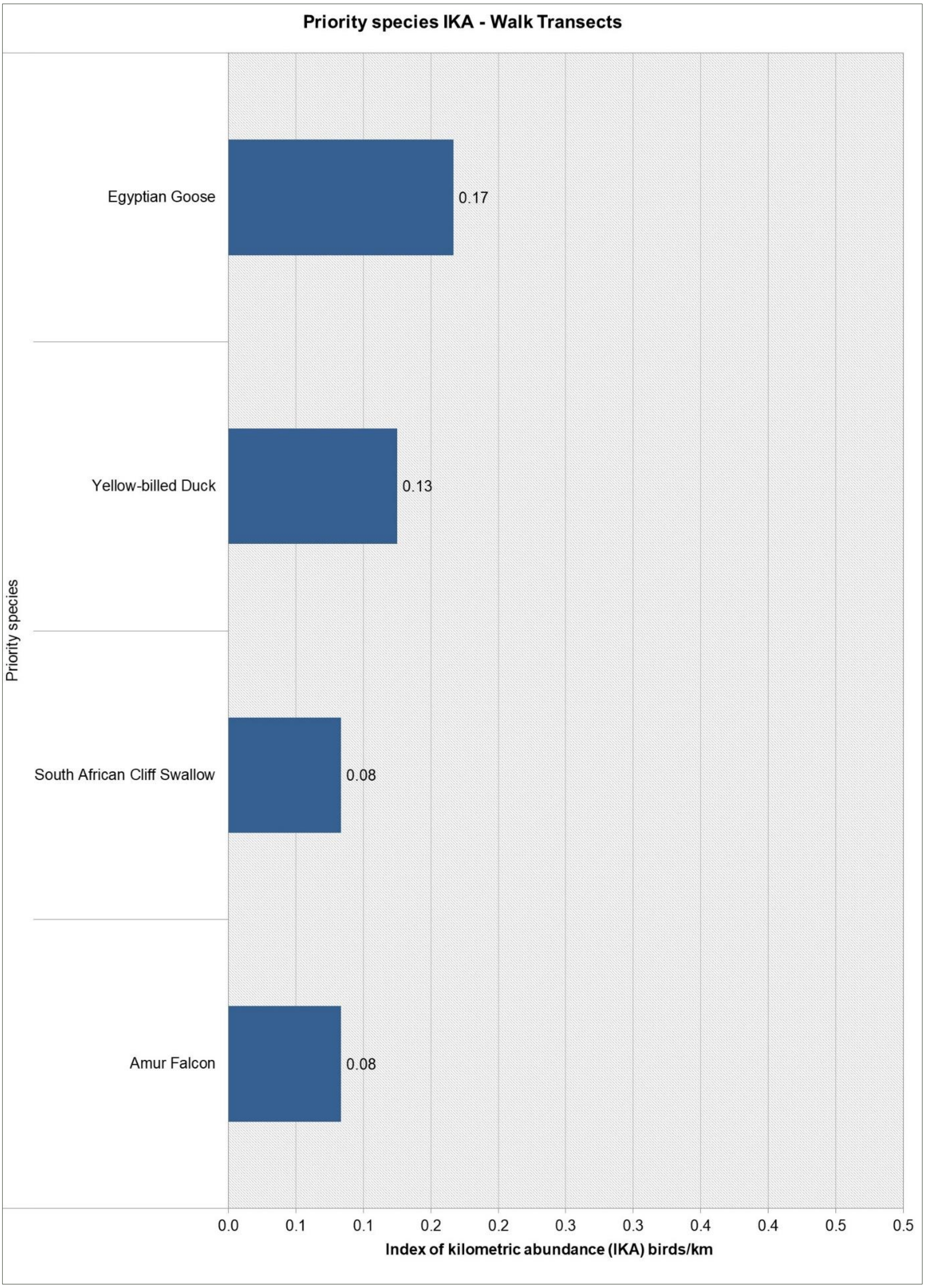

Figure 5: Index of kilometric abundance of solar priority species recorded at the SEF through walk transect surveys.

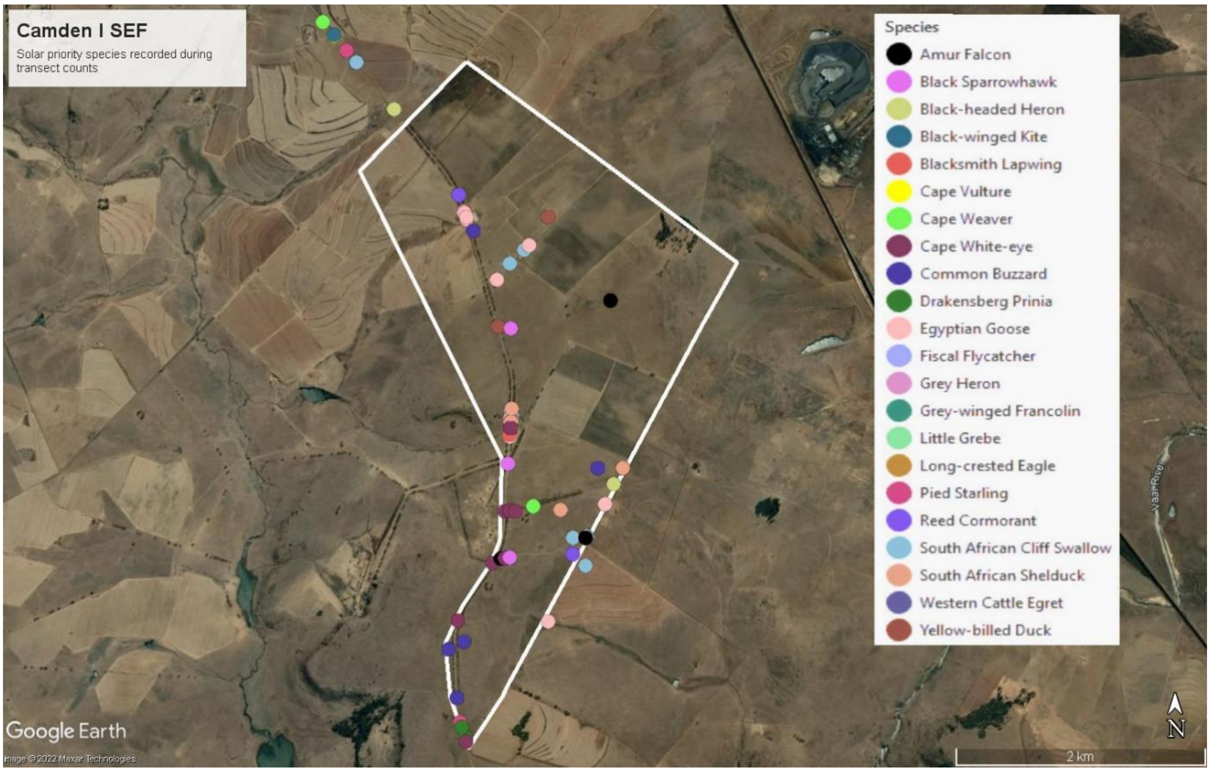

Figure 6**7** below shows the spatial distribution of the solar priority species recorded during transect counts.

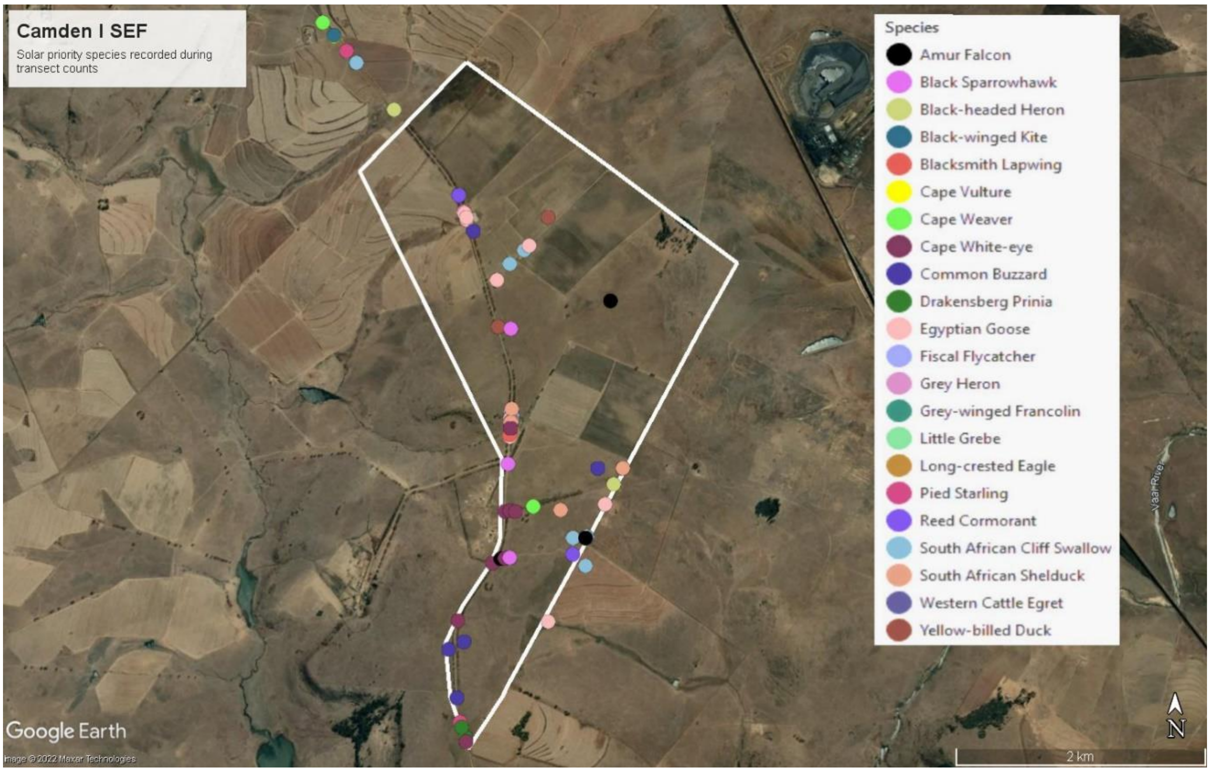

Figure 6: The location of solar priority species recorded at the proposed SEF through transect counts.

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

7 IMPACT ASSESSMENT

7.1 Solar Energy Facility

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants is a relatively recent phenomenon. The main source of information for these types of impacts are from compliance reports and a few government-sponsored studies relating to recently constructed solar plants in the south-west United States. In South Africa, one published scientific study has been completed on the impacts of PV plants in a South African context (Visser *et al.* 2019).

In summary, the main impacts of PV plants on avifauna which have emerged so far include the following:

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure
- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences

Increasingly, human-induced climate change is recognized as a fundamental driver of biological processes and patterns. Historic climate change is known to have caused shifts in the geographic ranges of many plants and animals, and future climate change is expected to result in even greater redistributions of species (National Audubon Society 2015). In 2006 WWF Australia produced a report on the envisaged impact of climate change on birds worldwide (Wormworth, J. & Mallon, K. 2006). The report found that:

- Climate change now affects bird species' behaviour, ranges and population dynamics;
- Some bird species are already experiencing strong negative impacts from climate change;
- In future, subject to greenhouse gas emissions levels and climatic response, climate change will put large numbers bird species at risk of extinction, with estimates of extinction rates varying from 2 to 72%, depending on the region, climate scenario and potential for birds to shift to new habitat.

Using statistical models based on the North American Breeding Bird Survey and Audubon Christmas Bird Count datasets, the National Audubon Society assessed geographic range shifts through the end of the century for 588 North American bird species during both the summer and winter seasons under a range of future climate change scenarios (National Audubon Society 2015). Their analysis showed the following:

- 314 of 588 species modelled (53%) lose more than half of their current geographic range in all three modelled scenarios.
- For 126 species, loss occurs without accompanying range expansion.
- For 188 species, loss is coupled with the potential to colonize new areas.

Climate sensitivity is an important piece of information to incorporate into conservation planning and adaptive management strategies. The persistence of many birds will depend on their ability to colonize climatically suitable areas outside of current ranges and management actions that target climate change adaptation.

South Africa is among the world's top 10 developing countries required to significantly reduce their carbon emissions (Seymore *et al.* 2014), and the introduction of low-carbon technologies into the country's compliment of power generation will greatly assist with achieving this important objective (Walwyn & Brent 2015). Given that South Africa receives among the highest levels of solar radiation on earth (Fluri 2009; Munzhedi *et al.* 2009), it is clear that solar power generation should feature prominently in future efforts to convert to a more sustainable energy mix in order to combat climate change, also from an avifaunal impact perspective. However, while the expansion of solar power generation is undoubtedly a positive development for avifauna in the longer term in that it will help reduce the effect of climate change and thus habitat transformation, it must also be acknowledged that renewable energy facilities, including solar PV facilities, in themselves have some potential for negative impacts on avifauna.

A literature review reveals a scarcity of published, scientifically examined information regarding large-scale PV plants and birds. The reason for this is mainly that large-scale PV plants are a relatively recent phenomenon. The main source of information for these types of impacts are from compliance reports and a few government-sponsored studies relating to recently constructed solar plants in the south-west United States. In South Africa, only one published scientific study has been completed on the impacts of PV plants in a South African context (Visser *et al.* 2019).

7.2 Impacts associated with PV facility

7.2.1 Impact trauma (collisions)

This impact refers to collision-related fatality i.e. fatality resulting from the direct contact of the bird with a project structure(s). This type of fatality has been occasionally documented at solar projects of all technology types (McCrary *et al.* 1986; Hernandez *et al.* 2014; Kagan *et al.* 2014). In some instances, the bird is not killed outright by the collision impact, but succumbs to predation later, as it cannot avoid predators due to its injured state.

Sheet glass used in commercial and residential buildings has been well established as a hazard for birds. When the sky is reflected in the sheet glass, birds fail to see the building as an obstacle and attempt to fly through the glass, mistaking it for empty space (Loss *et al.* 2014). Although very few cases have been reported it is possible that the reflective surfaces of solar panels could constitute a similar risk to avifauna.

An extremely rare but potentially related problem is the so-called "lake effect" i.e. it seems possible that reflections from solar facilities' infrastructure, particularly large sheets of dark blue photovoltaic panels, may attract birds in flight across the open desert, who mistake the broad reflective surfaces for water (Kagan *et al.* 2014)[3]. The unusually high percentage of waterbird mortalities at the Desert Sunlight PV facility (44%) may support the "lake effect" hypothesis (West 2014). Although in the case of Desert Sunlight, the proximity of evaporation ponds may act as an additional risk increasing factor, in that birds are both attracted to the water feature and habituated to the presence of an accessible aquatic environment in the area. This may translate into the misinterpretation of diffusely reflected sky or horizontal polarised light source as a body of water. However, due to limited data it would be

[3] This could either result in birds colliding directly with the solar panels or getting stranded and unable to take off again because many aquatic bird species find it very difficult and sometimes impossible to take off from dry land e.g. grebes and cormorants. This exposes them to predation, even if they do not get injured through direct collisions with the panels.

premature to make any general conclusions about the influence of the lake effect or other factors that contribute to fatality of water-dependent birds. The activity and abundance of water-dependent species near solar facilities may depend on other site-specific or regional factors, such as the surrounding landscape (Walston *et al.* 2015). However, until such time that enough scientific evidence has been collected to discount the "lake effect" hypothesis, it must be considered as a potential source of impacts.

Weekly mortality searches at 20% coverage were conducted at the 250MW, 1300ha California Valley Solar Ranch PV site (Harvey & Associates 2014a and 2014b). According to the information that could be sourced from the internet (two quarterly reports), 152 avian mortalities were reported for the period 16 November 2013 – 15 February 2014, and 54 for the period 16 February 2014 – 15 May 2014, of which approximately 90% were based on feather spots which precluded a finding on the cause of death. These figures give an estimated unadjusted 1 030 mortalities per year, which is obviously an underestimate as it does not include adjustments for carcasses removed by scavengers and missed by searchers. The authors stated clearly that these quarterly reports do not include the results of searcher efficiency trials, carcass removal trials, or data analyses, nor does it include detailed discussions.

In a report by the National Fish and Wildlife Forensic Laboratory (Kagan *et al.* 2014), the cause of avian mortalities was estimated based on opportunistic avian carcass collections at several solar facilities, including the 550MW, 1 600ha Desert Sunlight PV plant. Impact trauma emerged as the highest identifiable cause of avian mortality, but most mortality could not be traced to an identifiable cause.

Walston *et al.* (2015) conducted a comprehensive review of avian fatality data from large scale solar facilities (all technology types) in the USA. Collision as cause of death (19 birds) ranked second at Desert Sunlight PV plant and California Valley Solar Ranch (CVSR) PV plant, after unknown causes. Cause of death could not be determined for over 50% of the fatality observations and many carcasses included in these analyses consisted only of feather spots (feathers concentrated together in a small area) or partial carcasses, thus making determination of cause of death difficult. It is anticipated that some unknown fatalities were caused by predation or some other factor unrelated to the solar project. However, they found that the lack of systematic data collection and standardization was a major impediment in establishing the actual extent and causes of fatalities across all projects.

Koskiuch *et al.* (2020) synthesized results from fatality monitoring studies at 10 photovoltaic solar facilities across 13 site years in California and Nevada in the USA. They concluded that there are consistent patterns in several aspects of their analysis that could provide insight into potential patterns of bird mortality at PV facilities. Four patterns that could provide broader inference to other regions are: 1) the most widely occurring species among site-years have populations in the millions in the areas where studies occurred, and 3 of the top 4 species detected are ground-dwelling birds; 2) most detections occurred in autumn (seasonal variation); 3) there was no evidence of a comparatively large-scale fatality events of nocturnal migrating passerines or migrating water associates or water obligates[4]; 4) most detections were of unknown cause feather spots.

[4] They define water-associated birds based on life history traits and include any species that relies primarily upon aquatic habitats for the purposes of foraging, reproduction, and/or roosting and could be present in the study areas based upon their known range. Water associates can walk on and take off from land. They distinguished water-obligate birds, which rely on water for landing or take off, from water associates because of the importance of water obligates to the foundation of the lake-effect hypothesis.

The only scientific investigation of potential avifaunal impacts that has been performed at a South African PV facility was completed in 2016 at the 96MW Jasper PV solar facility (28°17′53″S, 23°21′56″E) which is located on the Humansrus Farm, approximately 4 km south-east of Groenwater and 30km east of Postmasburg in the Northern Cape Province (Visser *et al.* 2019). The Jasper PV facility contains 325 360 solar panels over a footprint of 180 hectares with the capacity to deliver 180 000 MWh of renewable electricity annually. The solar panels face north at a fixed 20° angle, reaching a height of approximately 1.86 m relative to ground level with a distance of 3.11 m between successive rows of panels. Mortality surveys were conducted from the 14th of September 2015 until the 6th of December 2015, with a total of seven mortalities recorded among the solar panels which gives an average rate of 0.003 birds per hectare surveyed per month. All fatalities were inferred from feather spots. Extrapolated bird mortality within the solar field at the Jasper PV facility was 435 birds/yr (95% CI 133 - 805). The broad confidence intervals result from the small number of birds detected. The mortality estimate is likely conservative because detection probabilities were based on intact birds, and probably decrease for older carcasses and feather spots. The study concluded inter alia that the short study period, and lack of comparable results from other sources made it difficult to provide a meaningful assessment of avian mortality at PV facilities. It further stated that despite these limitations, the few bird fatalities that were recorded might suggest that there is no significant collision-related mortality at the study site. The conclusion was that to fully understand the risk of solar energy development on birds, further collation and analysis of data from solar energy facilities across spatial and temporal scales, based on scientifically rigorous research designs, is required (Visser et al. 2019).

The results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. However, it is clear from this limited literature survey that the lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely speculative and based on professional opinion.

Based on the lack of evidence to the contrary, it is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small to medium-sized, ground-dwelling birds which forage between the solar panels, and possibly raptors which prey on them, or forage for insects between the PV panels, e.g. Amur Falcons (i.e. if they are not completely displaced due to the habitat transformation). Due to the absence of large permanent waterbodies at or close to the development area, it is unlikely that waterbirds will be attracted in large numbers to the solar arrays due to the "lake effect".

Priority species which occur regularly and could potentially be impacted due to collisions with the solar panels are the following: Western Cattle Egret, Amur Falcon, Lanner Falcon, Fiscal Flycatcher, Grey-winged Francolin, Egyptian Goose, Spur-winged Goose, Cape Grassbird, Black-headed Heron, Southern Bald Ibis, African Sacred Ibis, Blue Korhaan, Blacksmith Lapwing, African Grass Owl, Marsh Owl, Three-banded Plover, Drakensberg Prinia, South African Shelduck, African Snipe, Black Sparrowhawk, Pied Starling, South African Cliff Swallow and Cape Weaver.

7.2.2 Entrapment in perimeter fences

Visser *et al.* (2018) recorded a fence-line fatality (Orange River Francolin *Scleroptila gutturalis*) resulting from the bird being trapped between the inner and outer perimeter fence of the facility. This was further supported by observations of large-bodied birds unable to escape from between the two fences (e.g. Red-crested Korhaan *Lophotis ruficrista*) (Visser *et al.* 2019). Considering that one would expect the birds to be able to take off in the lengthwise direction (parallel to the fences), it seems possible that the birds panicked when they were approached by observers and thus flew into the fence.

It is not foreseen that entrapment of priority species in perimeter fences will be a significant impact at the PV facility. The priority species which could potentially be affected by this impact are most likely medium to large terrestrial species.

Priority species which could potentially be impacted due entrapment are the following: Secretarybird, White-bellied Bustard, Blue Crane, Blue Korhaan, African Grass Owl, Grey-winged Francolin and Marsh Owl.

7.2.3 Displacement due to habitat transformation associated with the construction of the solar PV **facility**

Ground-disturbing activities affect a variety of processes, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011).

Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns (Lovich & Ennen 2011).

The activities listed below are typically associated with the construction and operation of solar facilities and could have direct impacts on avifauna through the transformation of habitat (County of Merced 2014):

- Preparation of solar panel areas for installation, including vegetation clearing, grading, cut and fill;
- Excavation/trenching for water pipelines, cables, fibre-optic lines, and the septic system;
- Construction of piers and building foundations;
- Construction of new dirt or gravel roads and improvement of existing roads;

- Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes;
- Soil compaction, dust, and water runoff from construction sites;
- Degradation of water quality in drainages and other water bodies resulting from project runoff;
- Maintenance of fire breaks and roads; and
- Weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.

These activities could have an impact on birds breeding, foraging, and roosting in or in close proximity through transformation of habitat, which could result in temporary or permanent displacement.

In a study comparing the avifaunal habitat use in PV arrays with adjoining managed grassland at airports in the USA, DeVault *et al.* (2014) found that species diversity in PV arrays was reduced compared to the grasslands (37 vs 46), supporting the view that solar development is generally detrimental to wildlife on a local scale.

In order to identify functional and structural changes in bird communities in and around the development footprint, Visser *et al.* (2018) gathered bird transect data at the 180 hectares, 96MW Jasper PV solar facility in the Northern Cape, representing the solar development, boundary, and untransformed landscape. The study found both bird density and diversity per unit area was higher in the boundary and untransformed landscape, however, the extent therefore was not considered to be statistically significant. This indicates that the PV facility matrix is permeable to most species. However, key environmental features, including available habitat and vegetation quality are most likely the overriding factors influencing species' occurrence and their relative density within the development footprint. Her most significant finding was that the distribution of birds in the landscape changed, from a shrubland to open country and grassland bird community, in response to changes in the distribution and abundance of habitat resources such as food, water and nesting sites. These changes in resource availability patterns were detrimental to some bird species and beneficial to others. Shrubland specialists appeared to be negatively affected by the presence of the PV facility. In contrast, open country/grassland and generalist species, were favoured by its development (Visser *et al.* 2019).

As far as displacement, either completely or partially (reduced densities) due to habitat loss is concerned, it is highly likely that the same pattern of reduced avifaunal densities will manifest itself at the proposed PV facility. In addition, ground dwelling species and some raptors are also likely to be impacted by the habitat transformation, as it will result in reduced prey availability and accessibility.

Priority species that could be negatively affected by displacement due to habitat loss are the following: Common Buzzard, Jackal Buzzard, Cloud Cisticola, Blue Crane, Black-chested Snake Eagle, Long-crested Eagle, Western Cattle Egret, Amur Falcon, Lanner Falcon, Grey-winged Francolin, Cape Grassbird, Black-headed Heron, Southern Bald Ibis, Rock Kestrel, Black-winged Kite, Blue Korhaan, African Grass Owl, Marsh Owl, Pied Starling, White Stork, and South African Cliff Swallow

7.2.4 Displacement due to disturbance associated with the construction of the solar PV facility

As far as disturbance is concerned, it is likely that all the avifauna, including all the priority species, will be temporarily displaced in the footprint area, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities e.g. increased vehicle traffic, and short-term construction-related noise (from equipment) and visual disturbance.

At the PV facility, the priority species which would be most severely affected by disturbance would be ground dwelling species which are the following: White-bellied Bustard, Cloud Cisticola, Blue Crane, Western Cattle Egret, Grey-winged Francolin, Cape Grassbird, Blue Korhaan, African Grass Owl, Marsh Owl, Drakensberg Prinia, and Pied Starling. Secretarybirds breeding or roosting at or near to the project site might also be affected.

7.3 Impacts associated with the medium voltage network

7.3.1 Electrocution of priority species on the internal medium voltage reticulation network

Medium voltage electricity poles could potentially pose an electrocution risk to raptors. 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 2000). The electrocution risk is largely determined by the design of the electrical hardware.

While the intention is to place the majority of the medium voltage reticulation network underground at the PV facility, there are areas where the lines will run above ground. Priority species which could be at risk of electrocution on the medium voltage powerlines are the following: Common Buzzard, Jackal Buzzard, Black-chested Snake Eagle, Long-crested Eagle, Lanner Falcon, Egyptian Goose, Spur-winged Goose, African Harrier-Hawk, Black-headed Heron, Southern Bald Ibis, African Sacred Ibis, African Grass Owl, Marsh Owl and Black Sparrowhawk.

7.3.2 Collisions with the internal medium voltage overhead lines

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).

From 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 (see Figure 5 below).

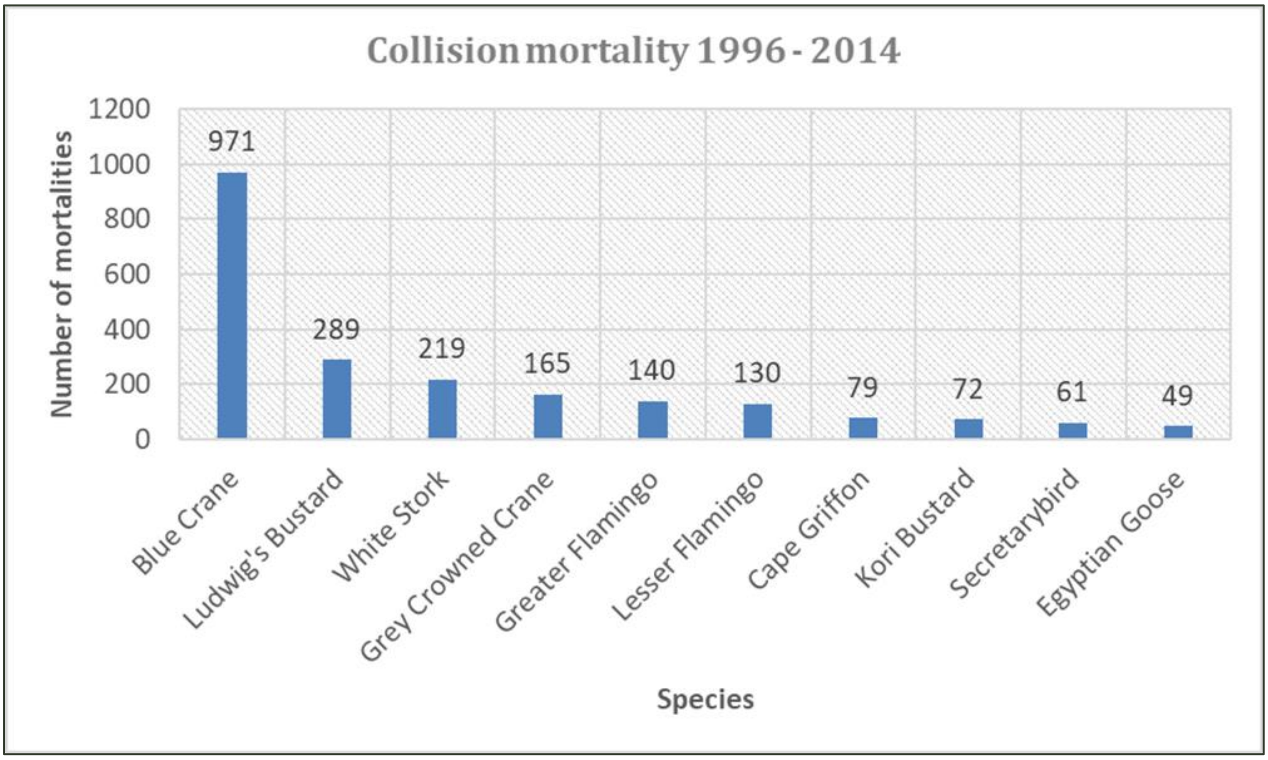

Figure 7: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

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 one 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 *Ardeotis kori* 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).

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

While the intention is to place the majority of the medium voltage reticulation network underground at the PV facility, there are areas where the lines could run above ground. Priority species which are most at risk of collisions with the medium voltage powerlines are the following: Secretarybird, White-bellied Bustard, Blue Crane, Western Cattle Egret, Egyptian Goose, Spur-winged Goose, Black-

headed Heron, Southern Bald Ibis, African Sacred Ibis, Blue Korhaan, African Grass Owl, Marsh Owl, South African Shelduck and White Stork.

7.4 Battery Energy Storage Facility (BESS)

The impact that is associated with the construction of the BESS is the potential displacement of priority avifauna due to disturbance associated with the construction of the facility and habitat transformation in the footprint of the facility.

7.4.1 Displacement due to habitat destruction and disturbance

During the construction of the BESS, habitat destruction/transformation will inevitably take place. The construction activities will constitute the following:

- Site clearance and preparation.
- Construction of the infrastructure related to the BESS.
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site.
- Removal of vegetation for the proposed infrastructure line, stockpiling of topsoil and cleared vegetation.
- Excavations for infrastructure.

These activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 5 ha proposed facility is likely to be relatively insignificant due to the relatively small size of the footprint (only 0.07% of the total project area, and 2.5% of the buildable area).

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 in practice that can admittedly be challenging to implement.

The priority species which are potentially most vulnerable to the impact of displacement due to disturbance and habitat transformation linked to the BESS are terrestrial species and owls. Priority species that could be affected are the following: African Grass Owl, Black-bellied Bustard, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Secretarybird and White-bellied Bustard

7.5 Up to 132kV overhead line (OHL)

The following potential impacts on powerline sensitive avifauna are associated with the construction and operation of the up to 132kV grid connection:

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

7.5.1 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 voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The only priority species capable of bridging the clearance distances of an OHL constructed using this specification is the Cape Vulture, due to their size and gregarious nature.

Ordinarily, the construction of a single circuit powerline using the approved vulture friendly pole/tower design D-DT-7649 accordance with the Distribution Technical Bulletin titled *Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration* - *Reference Number 240-170000467* will eliminate the electrocution risk. The configuration of the insulators and the clearance distances between the live and earthed components on this structure can comfortably accommodate a perching vulture. However if the OHL will be built on lattice structures, it is imperative that there is a minimum clearance of 1.8m between the jumper cables and/or insulators and the horizontal earthed component on the lattice structure (pers.comm. Lourens Leeuwner - Eskom-EWT Strategic Partnership Manager). Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended (if suitable insulation material is readily available), alternatively all jumper cables must be suspended below the crossarms.

Electrocutions within the proposed on-site substation are possible, however the likelihood of this impact on the more sensitive SCC is remote, as these species are unlikely to regularly utilise the infrastructure within the onsite substation station for perching or roosting. Species that are more vulnerable to this impact are medium-sized raptors, corvids, owls and certain species of waterbirds.

It is assumed that the OHL will be built on 132kV pole/tower designs therefore the powerline sensitive species which is potentially vulnerable to electrocution on the actual towers/poles is Cape Vulture. As far as the substation is concerned, the following species are potentially at risk of electrocution: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite.

7.5.2 Mortality of powerline sensitive avifauna due to collisions

See also the discussion under 7.1.5.

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

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

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

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

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

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and powerline configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as powerlines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is key to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with powerlines i.e. Kori Bustard *Ardeotis kori*, Blue Crane and White Stork. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35°, respectively, are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and powerlines. These findings have applicability to species outside of these families especially raptors (A*ccipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes, and are also known to be vulnerable to powerline collisions.

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

The up to 132kV OHL could pose a collision risk to virtually all powerline sensitive avifauna, depending on where those spans are located. 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 and, Yellow-billed Duck.

7.5.3 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 OHL, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed OHL. The loss of habitat in the substation footprint (2 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 dwelling 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

7.5.4 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 disturbance are mostly ground dwelling 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*

8 IMPACT RATINGS

The impacts on avifauna of the proposed Camden 1 SEF, BESS and 132V OHL 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[5], indirect[6], secondary[7] as well as cumulative[8] 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[9] presented in Table 8.

Table 6: 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

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

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

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

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

[9] 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.

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**

8.2 Impact Assessments

8.2.1 Impact assessment tables

The impacts are summarised in table form are 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

8.3.1 Solar Energy Facility

According to the official database of DFFE and other documents in the public domain, there are currently two additional planned renewable energy facilities within a 30km radius around the proposed development, namely the Camden I and II Wind Energy Facilities (see Figure 11).

The total area of similar habitat (excluding opencast mining and urban areas) available to birds in the 30km radius around the project area (including the project area) is approximately 4 258 km². The land parcels affected by the planned renewable energy facilities, including the Camden I SEF, in this radius takes up a total of ~124km², which is 2.9% of the available habitat. The impact on avifauna of the currently planned renewable energy projects within this area, including the Camden I SEF, is therefore considered to be **Low**, and the impact could be reduced if the recommended mitigation at the two Camden wind projects and the Camden I SEF is diligently implemented.

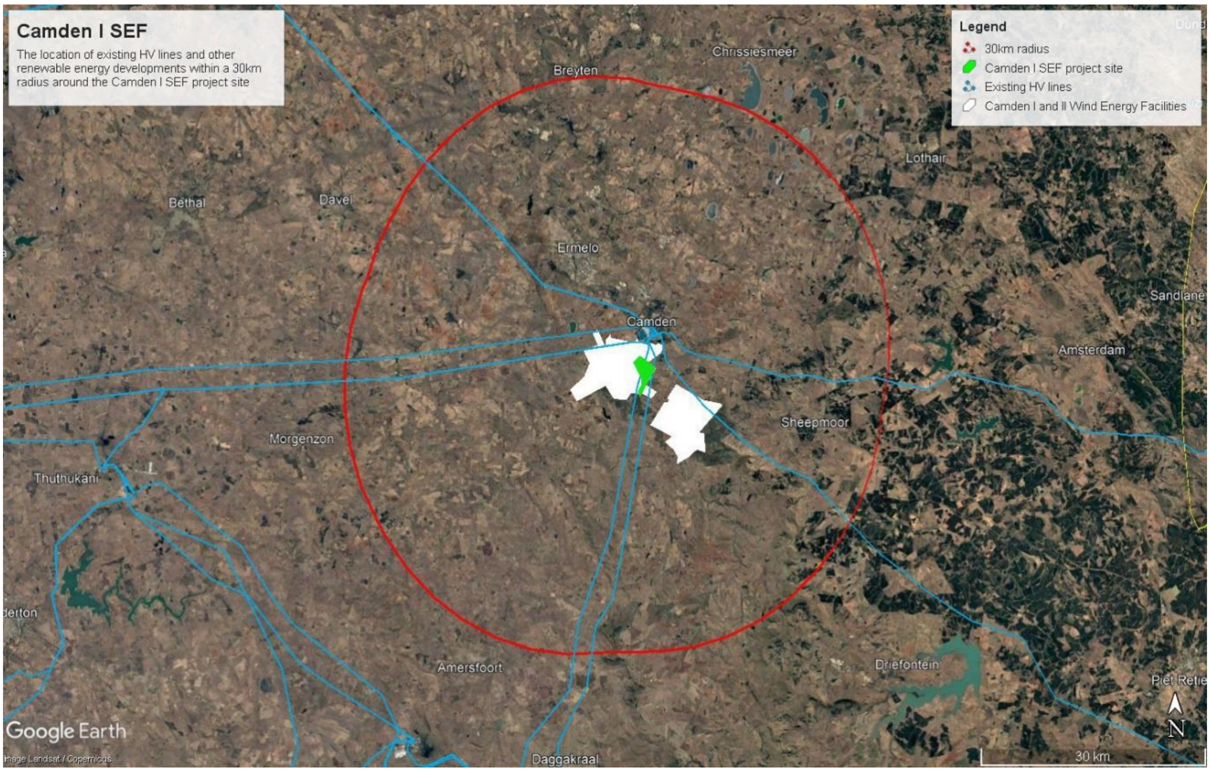

Figure 8: Proposed renewable energy projects and existing HV lines within 30km of the proposed Camden I SEF (Source: DFFE database 2022 & WSP Environmental).

8.3.2 Up to 132kV OHL

According to the official database of DFFE and other documents in the public domain, there are currently two additional planned renewable energy facility within a 30km radius around the proposed development, namely the Camden I and II Wind Energy Facilities (see Figure 11) which will have grid connections with a maximum combined length of 17.5km. In addition, there will be a 400kV connection to the Camden Power Station Substation of maximum 8.9km.

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**.

8.3.3 Battery Energy Storage System

The BESS will transform an area of approximately 5 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 the BESS 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 13.

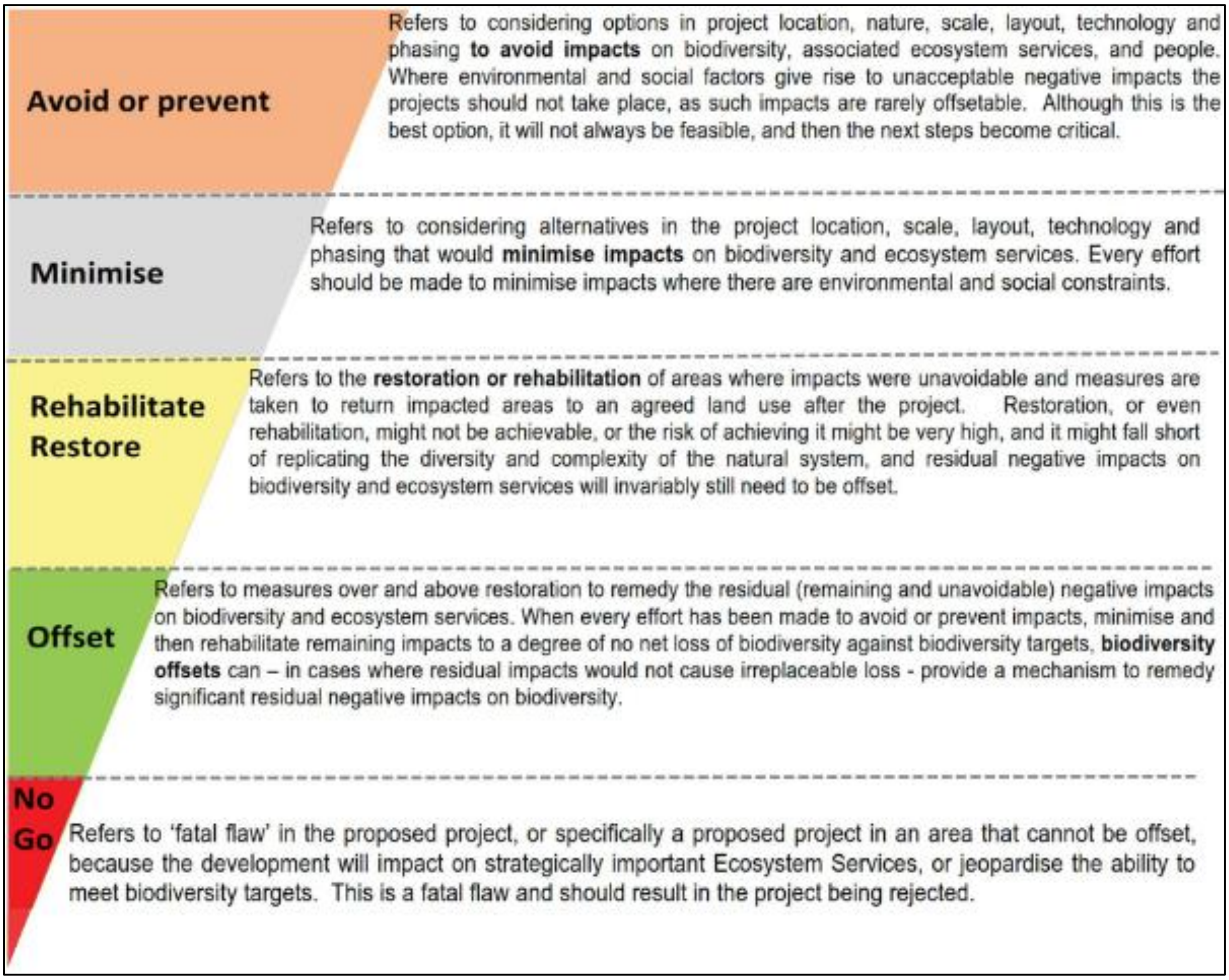

Figure 9: **Mitigation Sequence/Hierarchy**

9.1 Solar Energy Facility

The mitigation measures that are proposed for the solar energy facility are listed below.

9.1.1 Design Phase

- The medium voltage cable should be buried as far as possible. Overhead lines should only be considered if technical constraints to trenching are present.
- A bird-friendly pole design must be employed for all medium voltage overhead lines. The avifaunal specialist must approve the final design prior to construction commencing.
- Bird flight diverters should be installed on all overhead medium voltage power lines according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines).
- A 100m **all infrastructure exclusion zone** must be implemented around drainage lines, associated wetlands, and pans **(except essential road and gridline crossings).** Wetlands are important breeding, roosting and foraging habitat for a variety of SCC, most notably for African Grass Owl (SA status Vulnerable), Grey Crowned Crane (SA status Endangered) and African

Marsh Harrier (SA status Endangered). Where unavoidable, road and grid line crossings across these features should be restricted to the immediate footprint of the infrastructure only.

- Development in the remaining **high sensitivity grassland must be limited as far as possible (limited infrastructure zone)**. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads. The grassland is vital breeding, roosting and foraging habitat for a variety of SCC. These include Blue Crane (SA status near-threatened), Blue Korhaan (Global status near -threatened), White-bellied Bustard (SA Status Vulnerable), Denham's Bustard (SA Status Vulnerable).
- It is recommended that a single perimeter fence is used to reduce the risk of entrapment of large-bodied birds.

9.1.2 Construction phase

- Conduct an inspection to identify SCC that may be breeding within the project footprint to ensure that the impacts on breeding species (if any) are adequately managed.
- Construction 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 priority species. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum
- Measures to control noise and dust should be applied according to current best practice in the industry.

9.1.3 Operational phase

- The mitigation measures proposed by the vegetation specialist must be strictly enforced, including rehabilitation of disturbed areas.

9.1.4 De-commissioning phase

- 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 priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.
- The mitigation measures proposed by the vegetation specialist must be strictly enforced, including rehabilitation of disturbed areas.

Figure 13 indicates the avifauna sensitivity zones identified in the course of the study, relevant to the solar energy facility.

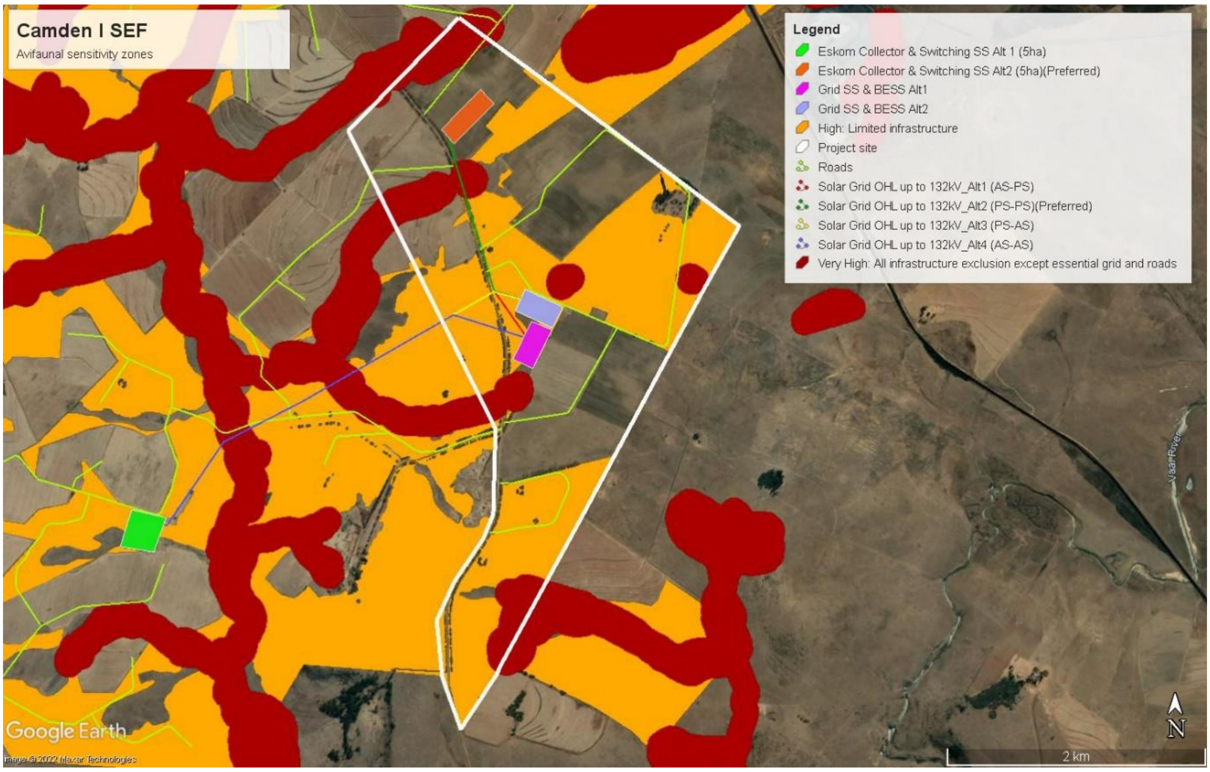

Figure 10: Avifaunal sensitivity zones

9.2 Battery Energy Storage Facility (BESS)

The mitigation measures that are proposed for the BESS are listed below.

9.2.1 Design Phase

None.

9.2.2 Construction phase

- Conduct an inspection to identify SCC that may be breeding within the project footprint to ensure that the impacts on breeding species (if any) are adequately managed.
- Construction 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 priority species. Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum
- Measures to control noise and dust should be applied according to current best practice in the industry.

9.2.3 Operational phase

- None.

9.2.4 De-commissioning phase

- 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 priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- The mitigation measures proposed by the vegetation/biodiversity specialist must be strictly enforced, including rehabilitation of disturbed areas.

9.3 Up to 132kV OHL

The mitigation measures that are proposed for the up to 132kV OHL are listed below.

9.3.1 Planning & Design phase

- If a steel monopole pole design is used, the approved vulture friendly pole/tower design D-DT-7649 in accordance with the Eskom Distribution Technical Bulletin titled *Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration - Reference Number 240-170000467* relating to bird friendly structures, must be used.
- If lattice type structures are used, it is imperative that a minimum vertical clearance of 1.8m is maintained between the jumper cables and/or insulator live ends, and the horizontal earthed components. Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended (if suitable insulation material is readily available).

9.3.2 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 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.
- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

- Vegetation clearance should be limited to what is absolutely necessary.
- The mitigation measures proposed by the vegetation specialist must be strictly enforced.

9.3.3 Operational phase

- No management actions are required for the operational phase

9.3.4 De-commissioning phase

- Conduct an avifaunal inspection of the OHL 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 priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

10 PREFERRED ALTERNATIVE

10.1 Solar energy facility

Only one proposed solar lay-out was provided for assessment. This layout has been refined to consider the specialist sensitivities as far as possible and adheres to the no-go zones requested in this report.

10.2 Battery Energy Storage System

Alternative 1 and Alternative 2 two are both located in the same habitat type, namely partially in low and in high sensitivity grassland. Both alternatives will therefore have the same potential displacement impact on priority avifauna, therefore no preferred alternative can be selected. However, both options are acceptable, due to the low impact of the small footprint.

10.3 Up to 132kV OHL

Alternatives 1 and 2 are the preferred alternatives due to them being the shortest alternatives. Alternatives 3 and 4 are the least preferred alternatives due to them being the longest and running mostly through high sensitivity grassland, and they cross two drainage lines. However, all the alternatives can be mitigated to acceptable levels and therefore are considered suitable from an avifaunal perspective.

11 CONDITIONS FOR INCLUSION IN THE EMPr

Please see Appendix 6 for the monitoring requirements to be included in the EMPr for the SEF project.

12 'NO-GO' ALTERNATIVE

The 'no-go' alternative is the option of not constructing the Camden 1 SEF, BESS and up to 132kV OHL, 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 SEF development site, 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 Solar Energy Facility

The proposed Camden 1 SEF will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement due to disturbance associated with the construction of the solar PV plant and associated infrastructure
- Displacement due to habitat transformation associated with the construction of the solar PV plant and associated infrastructure
- Collisions with the solar panels
- Entrapment in perimeter fences

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

As far as disturbance is concerned, it is likely that all the avifauna, including all the priority species, will be temporarily displaced in the footprint area, either completely or more likely partially (reduced densities) during the construction phase, due to the disturbance associated with the construction activities e.g. increased vehicle traffic, and short-term construction-related noise (from equipment) and visual disturbance. At the PV facility, the priority species which would be most severely affected by disturbance would be ground dwelling species which are the following: White-bellied Bustard, Cloud Cisticola, Blue Crane, Western Cattle Egret, Grey-winged Francolin, Cape Grassbird, Blue Korhaan, African Grass Owl, Marsh Owl, Drakensberg Prinia, and Pied Starling. Secretarybirds breeding or roosting at or near to the project site might also be affected. The impact is rated as **moderate** pre-mitigation and will be reduced but remain at a **moderate** level post-mitigation.

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

Ground-disturbing activities affect a variety of processes, including soil density, water infiltration rate, vulnerability to erosion, secondary plant succession, invasion by exotic plant species, and stability of cryptobiotic soil crusts. These processes have the ability – individually and together – to alter habitat quality, often to the detriment of wildlife, including avifauna. Any disturbance and alteration to the landscape, including the construction and decommissioning of utility-scale solar energy facilities, has the potential to increase soil erosion. Erosion can physically and physiologically affect plant species and can thus adversely influence primary production and food availability for wildlife (Lovich & Ennen 2011). Solar energy facilities require substantial site preparation (including the removal of vegetation) that alters topography and, thus, drainage patterns to divert the surface flow associated with rainfall away from facility infrastructure. Channelling runoff away from plant communities can have dramatic negative effects on water availability and habitat quality. Areas deprived of runoff from sheet flow support less biomass of perennial and annual plants relative to adjacent areas with uninterrupted water-flow patterns. As far as displacement, either completely or partially (reduced densities) due to habitat loss is concerned, it is highly likely that the same pattern of reduced avifaunal densities will manifest itself at the proposed PV facility. In addition, ground dwelling species and some raptors are also likely to be impacted by the habitat transformation, as it will result in reduced prey availability and accessibility. Priority species that could be negatively affected by displacement due to habitat loss are the following: Common Buzzard, Jackal Buzzard, Cloud Cisticola, Blue Crane, Black-chested Snake Eagle, Long-crested Eagle, Western Cattle Egret, Amur Falcon, Lanner Falcon, Grey-winged Francolin, Cape Grassbird, Black-headed Heron, Southern Bald Ibis, Rock Kestrel, Black-winged Kite, Blue Korhaan, African Grass Owl, Marsh Owl, Pied Starling, White Stork, and South African Cliff Swallow. The impact is rated as **moderate** pre-mitigation and will be reduced but remain at a **moderate** level post-mitigation.

13.1.3 Collision mortality of priority species caused by the solar panels in the operational phase

The proposed Camden 1 Wind Energy Facility could potentially pose a collision risk to several priority species which could occur regularly at the site. However, the results of the available literature lack compelling evidence of collisions as a cause of large-scale mortality among birds at PV facilities. The lack of systematic and standardised data collection is a major problem in the assessment of the causes and extent of avian mortality at all types of solar facilities, regardless of the technology employed. Until statistically tested results emerge from existing compliance programmes and more dedicated scientific research, conclusions will inevitably be largely preliminary and based on professional opinion. Based on the lack of evidence to the contrary, it is not foreseen that collisions with the solar panels at the PV facility will be a significant impact. The priority species which would most likely be potentially affected by this impact are mostly small to medium-sized, ground-dwelling birds which forage between the solar panels, and possibly raptors which prey on them, or forage for insects between the PV panels, e.g. Amur Falcons (i.e. if they are not completely displaced due to the habitat transformation). Due to the absence of large permanent waterbodies at or close to the development area, it is unlikely that waterbirds will be attracted in large numbers to the solar arrays due to the “lake effect”. Priority species which occur regularly and could potentially be impacted due to collisions with the solar panels are the following: Western Cattle Egret, Amur Falcon, Lanner Falcon, Fiscal Flycatcher, Grey-winged Francolin, Egyptian Goose, Spur-winged Goose, Cape Grassbird, Black-headed Heron, Southern Bald Ibis, African Sacred Ibis, Blue Korhaan, Blacksmith Lapwing, African Grass Owl, Marsh Owl, Three-banded Plover, Drakensberg Prinia, South African

Shelduck, African Snipe, Black Sparrowhawk, Pied Starling, South African Cliff Swallow and Cape Weaver. The impact is rated as **low**. No mitigation measures are recommended.

13.1.4 Electrocution of priority species on the medium voltage overhead lines (if any) in the operational phase

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the electrical infrastructure could potentially pose an electrocution risk to several power line sensitive species that could on occasion perch on these poles. In summary, the following priority species are potentially vulnerable to electrocution in this manner: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite. The impact is rated as **moderate** pre-mitigation but should be reduced to a **low** level post-mitigation.

13.1.5 Collisions of priority species with the medium voltage overhead lines (if any) in the operational phase

While the intention is to place the medium voltage reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. These spans could pose a collision risk to virtually all powerline sensitive avifauna, depending on where those spans are located. 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.

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

The impact is likely to be similar in nature and extent to the construction phase of the proposed SEF. The impact is rated as **medium** pre-mitigation and it will decrease to **low** post-mitigation.

13.2 Battery Energy Storage Facility (BESS)

The impact that is associated with the construction of the BESS is the potential displacement of priority avifauna due to disturbance associated with the construction and dismantling of the facility and habitat transformation in the footprint of the facility.

13.2.1 Displacement due to disturbance associated with the construction of the facility

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 in practice that can admittedly be challenging to implement. The priority species which are potentially most vulnerable to the impact of displacement due to disturbance linked to the BESS are terrestrial species and owls. Priority species that could be most affected are the following: African Grass Owl, Black-bellied Bustard, Black-winged Lapwing, Blue Crane, Blue Korhaan, Buff-streaked Chat, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Marsh Owl, Northern Black Korhaan, Secretarybird and White-bellied Bustard. The impact is rated as **low** pre-mitigation and it will decrease to **very low** post-mitigation.

13.2.2 Displacement due to habitat transformation associated with the construction of the facility

These construction activities will impact on birds breeding, foraging and roosting in or in close proximity of the proposed facility through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the facility is unavoidable. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the 5 ha proposed facility is likely to be relatively insignificant due to the relatively small size of the footprint (only 0.07% of the total project area, and 2.5% of the buildable area). The impact is rated as **low** pre- and post-mitigation.

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

The impact is likely to be similar in nature and extent to the construction phase of the proposed BESS. The impact is rated as **low** pre-mitigation and it will decrease to **very low** post-mitigation.

13.3 The up to 132kV OHL

The following potential impacts on powerline sensitive avifauna are associated with the construction and operation of the up to 132kV grid connection related to the Solar Energy Facility:

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

13.3.1 Displacement due to disturbance associated with the construction of the proposed OHL and on-site substation.

Construction activities could 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 most vulnerable to displacement due to disturbance are mostly ground dwelling 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.

13.3.2 Displacement due to habitat transformation associated with the construction of the proposed OHL and on-site substation.

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. 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 OHL, the direct habitat transformation is limited to the on-site substation and pole/tower footprints and the narrow access road/track under the proposed OHL. The loss of habitat in the substation footprint (2 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 dwelling 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.

13.3.3 Mortality of powerline sensitive avifauna due to electrocutions on the OHL

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 voltage size of the proposed powerline and the pole/tower design. Should the proposed OHL be constructed using a 132kV tower specification, the electrocution impact for the majority of priority species will be negligible. The only priority species capable of bridging the clearance distances of an OHL constructed using this specification is the Cape Vulture, due to their size and gregarious nature. The impact is rated as **moderate** pre-mitigation and it will decrease to **low** post-mitigation.

13.3.4 Mortality of powerline sensitive avifauna due to electrocutions in the onsite substation

Electrocutions within the proposed on-site substation are possible, however the likelihood of this impact on the more sensitive SCC is remote, as these species are unlikely to regularly utilise the infrastructure within the onsite substation station for perching or roosting. Powerline sensitive species that are more vulnerable to electrocutions are medium-sized raptors, corvids, owls and certain species of waterbirds.. As far as the substation is concerned, the following species are potentially at risk of electrocution: African Fish Eagle, African Grass Owl, Amur Falcon, Black Sparrowhawk, Black-chested Snake Eagle, Black-headed Heron, Black-winged Kite, Brown Snake Eagle, Cape Crow, Cape Vulture, Common Buzzard, Hadada Ibis, Helmeted Guineafowl, Jackal Buzzard, Lanner Falcon, Long-crested Eagle, Marsh Owl, Martial Eagle, Peregrine Falcon, Pied Crow, Southern Bald Ibis, Spotted Eagle-Owl, Western Barn Owl, Western Osprey and Yellow-billed Kite. The impact is rated as **low** pre- and post-mitigation.

13.3.5 Mortality of powerline sensitive avifauna due to collisions with the OHL

The up to 132kV OHL could pose a collision risk to virtually all powerline sensitive avifauna, depending on where the spans are located. Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions, powerline configuration and visual capacity. 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 and it will decrease to **low** post-mitigation.

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

The impact is likely to be similar in nature and extent to the construction phase of the proposed OHL and onsite substation. The impact is rated as **medium** pre-mitigation and it will decrease to **low** post-mitigation.

13.4 Cumulative impacts

13.4.1 Solar Energy Facility

The total area of similar habitat (excluding opencast mining and urban areas) available to birds in the 30km radius around the project area (including the project area) is approximately 4 258 km². The land parcels affected by the planned renewable energy facilities, including the Camden I SEF, in this radius takes up a total of ~124km², which is 2.9% of the available habitat. The impact on avifauna of the currently planned renewable energy projects within this area, including the Camden I SEF, is therefore considered to be **Low**, and the impact could be reduced if the recommended mitigation at the two Camden wind projects and the Camden I SEF is diligently implemented.

13.4.2 Up to 132kV OHL

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**.

13.4.3 Battery Energy Storage Facility

The BESS will transform an area of approximately 5 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 the BESS is **Low** due to the small footprint.

14 CONCLUSION AND IMPACT STATEMENT

14.1 Solar Energy Facility

The proposed solar energy facility will have a moderate impact on priority avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation, although some instances moderate residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed SEF development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

14.2 Battery Energy Storage Facility (BESS)

The proposed BESS will have a low impact on priority avifauna which, could be reduced to a very low level in most instances through appropriate mitigation, although some instances low residual impacts will still be present after mitigation. No fatal flaws were discovered during the onsite investigations. The proposed BESS development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

14.3 The up to 132kV OHL

The proposed up to 132kV OHL will have a mostly 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 development is 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 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 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 **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 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 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	-	-

Priority Species	Taxonomic name	Solar site
Amur Falcon	*Falco amurensis*	*
Black Sparrowhawk	*Accipiter melanoleucus*	*
Black-headed Heron	*Ardea melanocephala*	*
Blacksmith Lapwing	*Vanellus armatus*	*
Black-winged Kite	*Elanus caeruleus*	*
Cape Vulture	*Gyps coprotheres*	*
Cape Weaver	*Ploceus capensis*	*
Cape White-eye	*Zosterops virens*	*
Common Buzzard	*Buteo buteo*	*
Drakensberg Prinia	*Prinia hypoxantha*	*
Egyptian Goose	*Alopochen aegyptiaca*	*
Fiscal Flycatcher	*Melaenornis silens*	*
Grey Heron	*Ardea cinerea*	*
Grey-winged Francolin	*Scleroptila afra*	*
Little Grebe	*Tachybaptus ruficollis*	*
Long-crested Eagle	*Lophaetus occipitalis*	*
Pied Starling	*Lamprotornis bicolor*	*
Reed Cormorant	*Microcarbo africanus*	*
South African Cliff Swallow	*Petrochelidon spilodera*	*
South African Shelduck	*Tadorna cana*	*
Western Cattle Egret	*Bubulcus ibis*	*
Yellow-billed Duck	*Anas undulata*	*
22		**22**
Non-Priority Species	**Taxonomic name**	**Solar site**
African Pipit	*Anthus cinnamomeus*	*
African Quail-Finch	*Ortygospiza atricollis*	*
African Reed Warbler	*Acrocephalus baeticatus*	*
African Stonechat	*Saxicola torquatus*	*
Ant-eating Chat	*Myrmecocichla formicivora*	*
Banded Martin	*Riparia cincta*	*
Barn Swallow	*Hirundo rustica*	*
Black-chested Prinia	*Prinia flavicans*	*
Black-throated Canary	*Crithagra atrogularis*	*
Bokmakierie	*Telophorus zeylonus*	*
Brown-throated Martin	*Riparia paludicola*	*
Cape Canary	*Serinus canicollis*	*
Cape Longclaw	*Macronyx capensis*	*
Cape Robin-Chat	*Cossypha caffra*	*
Cape Sparrow	*Passer melanurus*	*
Cape Turtle Dove	*Streptopelia capicola*	*
Cape Wagtail	*Motacilla capensis*	*
Common Ostrich	*Struthio camelus*	*
Common Quail	*Coturnix coturnix*	*
Common Waxbill	*Estrilda astrild*	*

Non-Priority Species cont.	Taxonomic name	Solar site
Crowned Lapwing	*Vanellus coronatus*	*
Dark-capped Bulbul	*Pycnonotus tricolor*	*
Fan-tailed Widowbird	*Euplectes axillaris*	*
Greater Striped Swallow	*Cecropis cucullata*	*
Hadeda	*Bostrychia hagedash*	*
Helmeted Guineafowl	*Numida meleagris*	*
House Sparrow	*Passer domesticus*	*
Laughing Dove	*Spilopelia senegalensis*	*
Levaillant's Cisticola	*Cisticola tinniens*	*
Long-tailed Widowbird	*Euplectes progne*	*
Olive Woodpecker	*Dendropicos griseocephalus*	*
Orange-breasted Waxbill	*Amandava subflava*	*
Pale-crowned Cisticola	*Cisticola cinnamomeus*	*
Pin-tailed Whydah	*Lamprotornis nitens*	*
Red-billed Quelea	*Quelea quelea*	*
Red-capped Lark	*Calandrella cinerea*	*
Red-collared Widowbird	*Euplectes ardens*	*
Red-eyed Dove	*Streptopelia semitorquata*	*
Red-winged Francolin	*Scleroptila levaillantii*	*
Southern Fiscal	*Lanius collaris*	*
Southern Grey-headed Sparrow	*Passer diffusus*	*
Southern Masked Weaver	*Ploceus velatus*	*
Southern Red Bishop	*Euplectes orix*	*
Speckled Pigeon	*Columba guinea*	*
Spike-heeled Lark	*Chersomanes albofasciata*	*
Spotted Flycatcher	*Muscicapa striata*	*
Swainson's Spurfowl	*Pternistis swainsonii*	*
White-throated Swallow	*Hirundo albigularis*	*
Wing-snapping Cisticola	*Cisticola ayresii*	*
Yellow Canary	*Crithagra flaviventris*	*
Yellow-crowned Bishop	*Euplectes afer*	*
Zitting Cisticola	*Cisticola juncidis*	*
52	Subtotal	52
	Grand total	**74**

APPENDIX 2: HABITAT FEATURES AT THE PROJECT AREA

Figure 1: High sensitivity natural grassland in the project site.

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 project site.

APPENDIX 3: PRE-CONSTRUCTION MONITORING

1. Objectives

The objective of the pre-construction monitoring at the proposed Camden I Solar Energy Facility (SEF) was to gather baseline data over a period of six months, including the high season, on the variety and abundance of avifauna at the project area.

2. Methods

The following sources were consulted to compile the monitoring protocol:

- The BirdLife South Africa (BLSA) Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. BirdLife South Africa by Jenkins, A.R., Ralston-Patton, Smit- Robinson, A.H. 2017
- Guidelines for the Implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for EIAs in South Africa produced by the South African National Biodiversity Institute on behalf of the Department of Environment, Forestry and Fisheries (2020).

Monitoring surveys were conducted during the following periods:

- Survey 1: 10 – 11, 20 – 26 February 2021
- Survey 2: 20 – 21 March,12 and 14 April, 5 and 12 May 2021

Monitoring was conducted in the following manner:

- One drive transect was identified totalling 10.2km that traversed the 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, two walk transects of 1km and 2km respectively were identified at the development site and counted 4 times per sampling survey. 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.

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

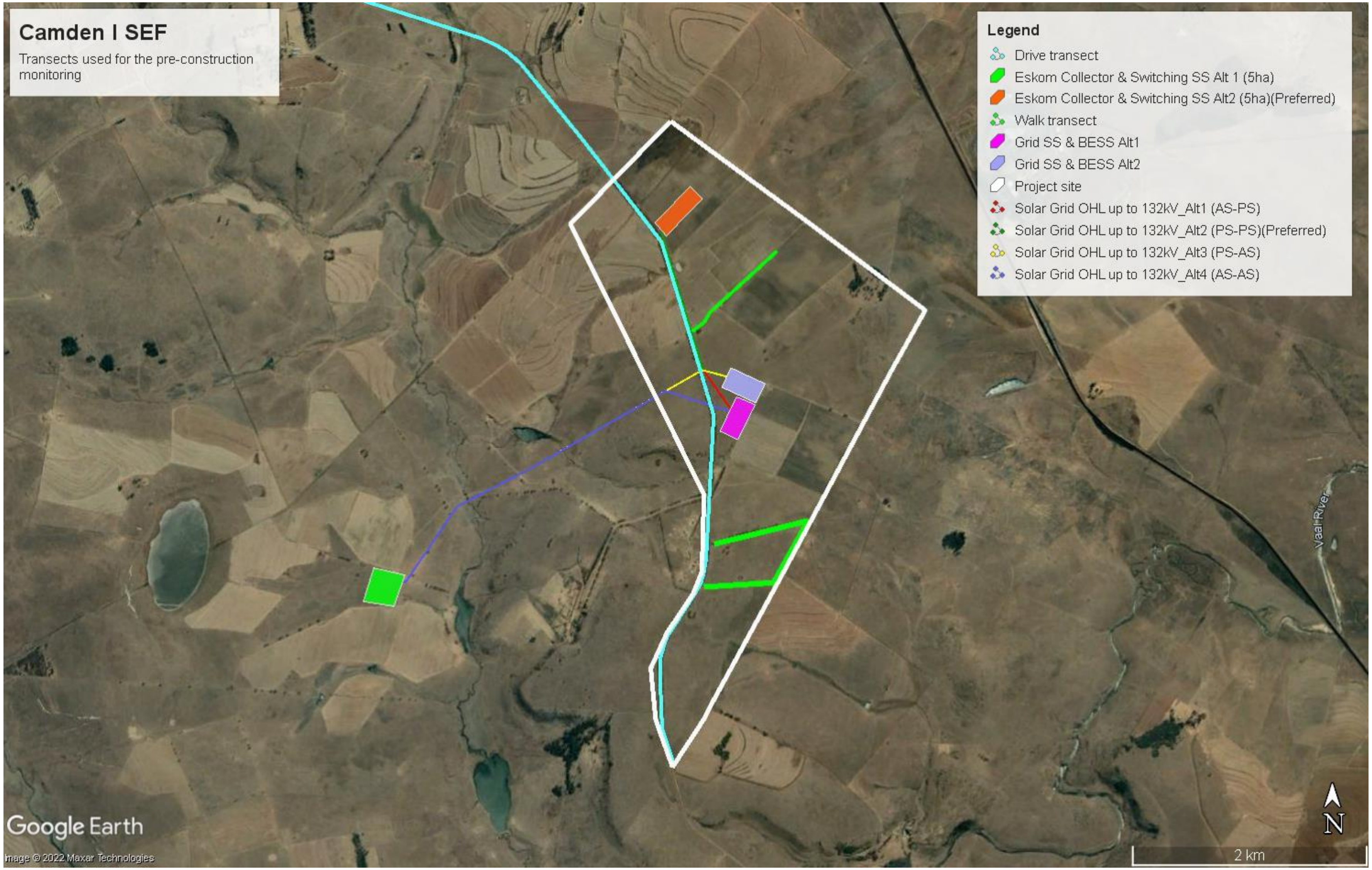

Figure 1: Area where monitoring was performed, with position of drive transects and walk transects.

APPENDIX 4: IMPACT TABLES

Project Name: Camden I SEF

Impact Assessment

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 the construction of the solar panels and associated infrastructure.	Construction	Negative	Moderate	4	2	4	2	5	**60**	**N3**	3	2	3	2	4	**40**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with the construction of the solar panels and associated infrastructure.	Construction	Negative	Moderate	3	2	4	4	4	**52**	**N3**	3	2	3	4	3	**36**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						

Project Name: Camden I SEF

Impact Assessment

OPERATIONAL

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:	Mortality: Collision	Mortality of priority species due to collisions with the solar panels	Operational	Negative	Low	2	1	1	4	2	**16**	**N2**	2	1	1	4	2	**16**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
Impact 2:	Mortality: Entrapment in perimeter fence	Entrapment of large-bodied birds in the double perimeter fence	Operational	Negative	High	3	2	1	4	3	**30**	**N2**	3	2	1	4	1	**10**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 3:	Mortality: Collision	Mortality of priority species due to collisions with the medium voltage overhead power lines	Operational	Negative	Moderate	4	3	4	4	3	**45**	**N3**	3	3	3	4	2	**26**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 4:	Mortality: Electrocution	Electrocution of priority species on the medium voltage infrastructure	Operational	Negative	High	4	3	4	4	4	**60**	**N3**	1	3	2	4	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

Project Name: Camden I SEF

Impact Assessment

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 the dismantling of the solar panels and associated infrastructure.	Construction	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	2	2	3	**27**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

Project Name: Camden I SEF

Impact Assessment

CUMULATIVE

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 the construction of the solar panels and associated infrastructure.	Construction	Negative	Moderate	4	3	3	3	4	**52**	**N3**	3	3	3	2	3	**33**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with the construction of the solar panels and associated infrastructure.	Construction	Negative	Moderate	3	3	4	4	4	**56**	**N3**	3	3	3	4	3	**39**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						
Impact 3:	Mortality: Collision	Mortality of priority species due to collisions with the solar panels	Operational	Negative	Low	2	1	1	4	2	**16**	**N2**	2	1	1	4	2	**16**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
Impact 4:	Mortality: Collision	Mortality of priority species due to collisions with the medium voltage overhead power lines	Operational	Negative	Moderate	4	3	4	4	4	**60**	**N3**	3	3	3	4	4	**52**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						

Impact 5:	Mortality: Electrocution	Electrocution of priority species on the medium voltage infrastructure	Operational	Negative	High	5	3	4	4	4	**64**	**N4**	2	3	2	4	3	**33**	**N3**
					Significance	**N4 - High**							**N3 - Moderate**						

Project Name: Camden I SEF BESS

Impact Assessment

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 the construction of the BESS	Construction	Negative	Moderate	2	1	1	2	3	**18**	**N2**	2	1	1	2	2	**12**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with the construction of the BESS	Construction	Negative	Moderate	2	1	5	4	2	**24**	**N2**	2	1	5	4	2	**24**	**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 the dismantling of the BESS	Construction	Negative	Moderate	2	1	1	2	3	**18**	**N2**	2	1	1	2	2	**12**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						

Project Name: Camden I SEF BESS

Impact Assessment

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:	Displacement	Displacement of priority species due to disturbance associated with the construction of the BESS	Construction	Negative	Moderate	2	1	1	2	4	**24**	**N2**	2	1	1	2	3	**18**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with the construction of the BESS	Construction	Negative	Moderate	3	1	5	4	2	**26**	**N2**	3	1	5	4	2	**26**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						

Project Name: Camden I SEF Up to 132kV OHL

Impact Assessment

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 and up to 132kV 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 and up to 132kV 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**						

Project Name: Camden I SEF Up to 132kV OHL
Impact Assessment

OPERATION

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 132kV 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**						
Impact 3:	Mortality: Electrocution	Electrocution of priority species on the up to 132kV OHL	Operational	Negative	High	5	3	3	4	3	**45**	**N3**	1	2	3	4	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

Project Name: Camden I SEF Up to 132kV OHL

Impact Assessment

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 132kV 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**						

Project Name: Camden I SEF Up to 132kV OHL

Impact Assessment

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): SEF

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Entrapment					
Entrapment of birds in the perimeter fences, leading to mortality.	Prevent mortality of avifauna	1. Increase the spacing between at least the top two wires (to a minimum of 30cm) and ensure they are correctly tensioned. 2. Use a single perimeter fence if possible.	1 Design the facility with a bird-friendly perimeter fence. 2 Use a single perimeter fence if possible.	Once-off during the planning phase.	Project Developer
Avifauna: Displacement due to habitat transformation					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plants and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that sensitive habitat is protected.	1. Maintain 100m solar panel buffer zones around drainage lines, wetlands and pans. 2. Limit construction of infrastructure in high sensitivity grassland as much as possible.	1. Design facility with a 100m buffer around drainage lines, wetlands, and pans – all infrastructure except essential roads and grid crossings. 2. Development in the remaining high sensitivity grassland must be limited as far as possible. Where possible, infrastructure must be located near margins, with shortest routes taken from the existing roads.	Once-off during the planning phase.	Project Developer
Avifauna: Electrocution on the 33kV medium voltage reticulation lines					
Electrocution of priority species on the 33kV medium voltage reticulation lines	Prevent the mortality of priority species	1 Bury cables as far as possible. 2 In instances where the medium voltage cables cannot be buried due to technical constraints, a bird-friendly pole design must be used for the overhead lines. The avifaunal specialist must approve the pole design.	Ensure that a bird friendly design is used for the 33kV medium voltage lines. Final design to be approved by the avifaunal specialist.	Once-off during the planning phase.	Project Developer

EMPr for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area.	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	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. 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. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 2. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 3. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 4. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. Monthly 2. Monthly 3. Monthly 4. Monthly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO
Avifauna: Displacement due to habitat transformation					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the solar PV plants and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented by an appropriately qualified rehabilitation specialist, according to the recommendations of the biodiversity specialist study.	1. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.	All biodiversity recommendations regarding rehabilitation must be followed	1. Frequency as stated by the biodiversity specialist	1. Project Developer 2. Facility Environmental Manager 3. Project Developer and Facility Operational Manager

EMPr for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Electrocution pf Red Data species in the onsite substations					
Electrocution of Red Data species in the onsite substations	Prevent the mortality of Red Data species	Inspections of the substation yard to look for carcasses of electrocuted birds.	Implement appropriate mitigation by insulating the hardware, if need be.	Monthly	Facility Operational Manager

EMPr for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance associated with the dismantling activities					
The noise and movement associated with the de-commissioning activities at the SEF 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 EMPr.	A site-specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and must apply good environmental practice during construction. The EMPr must specifically include the following: 1. No off-road driving. 2. Maximum use of existing roads. 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 EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction 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 footprint area is demarcated and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. Monthly 2. Monthly 3. Monthly 4. Monthly 5. monthly	1. O&M Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Mortality of avifauna, specifically Cape Vulture, due to electrocutions on the overhead powerline poles/towers	Reduction of avian electrocution mortality	If a steel monopole pole design is used, the approved vulture friendly pole/tower design D-DT-7649 in accordance with the Eskom Distribution Technical Bulletin titled Refurbishment of 66/88kV line kite type frames with D-DT-7649 type top configuration - Reference Number 240-170000467 relating to bird friendly structures, must be used. If lattice type structures are used, it is imperative that a minimum vertical clearance of 1.8m is maintained between the jumper cables and/or insulator live ends, and the horizontal earthed components. Additional mitigation in the form of insulating sleeves on jumper cables present on strain poles and terminal poles is also recommended (if suitable insulation material is readily available), alternatively all jumper cables must be suspended below the crossarms.	1. Construct the powerline using a minimum vertical clearance of 1.8m between the jumper cables and/or insulators and the horizontal earthed component on the lattice structure.	Once-off	Contractor and ECO

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 priority species that may be breeding within the final footprint. If a SSC nest is occupied, the avifaunal specialist must consult with the contractor to find ways of 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; 5. Strict application of all recommendations in the biodiversity specialist report pertaining to the limitation of the footprint.	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	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*
			and that construction 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 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	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	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

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		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.	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.		