AVIFAUNAL IMPACT ASSESSMENT: SCOPING

Camden 1 Wind Energy Facility, Mpumalanga Province

October 2021

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EXECUTIVE SUMMARY

Enertrag South Africa is proposing to develop the Camden Renewable Energy Complex in Mpumalanga, South Africa. The Complex is being developed 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) or similar programmes under the IRP. In addition, private off-take agreements are considered where possible.

The Cluster comprises eight (8) distinct projects, namely:

i. Camden I Wind Energy Facility (up to 210MW).
ii. Camden I Wind Grid Connection (up to 132kV).
iii. Camden up to 400kV Gid Connection and Collector substation.
iv. Camden I Solar (up to 100MW).
v. Camden I Solar up to 132kV Gid Connection.
vi. Camden Green Hydrogen and Ammonia Facility, including grid connection infrastructure.
vii. Camden II Wind Energy Facility (up to 210MW).
viii. Camden II Wind Energy Facility up to 132kV Gid Connection.

This report deals with the Camden 1 Wind Energy Facility (WEF).

IMPACT RATING

The table below is a summarised scoping level assessment of the anticipated impacts

Table: Summarised scoping level assessment of the anticipated impacts

Impact	Nature of Impact	Extent of Impact	Significance (pre-mitigation)	No-Go Areas	Mitigation measures
During construction: Displacement due to disturbance associated with the construction of the wind turbines and associated infrastructure.	It is inevitable that a measure of displacement will take place for all priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species in the remaining high-quality grassland, wetlands and wetland fringes the most, as this could temporarily disrupt their reproductive cycle. Some species might be able to recolonise the area after the completion of the construction phase, but for some species, this might only be partially the case, resulting in lower densities than before once the WEF is operational, due to the disturbance factor of the operational turbines, and the habitat fragmentation. In summary, the following species could be impacted by disturbance during the construction phase: Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Grey Crowned Crane, Spotted Eagle-Owl, Grey-winged Francolin, Northern Black Korhaan, Blue Korhaan, Marsh Owl and African Grass Owl.	Local	High	• 100m buffer around wetlands – all infrastructure • 1km buffer around pans – turbines only	• 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. • Measures to control noise and dust should be applied according to current best practice in the industry. • 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.
During operation: Displacement of priority species due to habitat transformation as a result of the operation of the wind turbines and associated infrastructure.	The network of roads is likely to result in significant habitat fragmentation. This, together with the disturbance factor of the operating turbines, could have an effect on the density of several species, particularly larger terrestrial species which is breeding in the remaining high-quality grassland, wetlands, and wetland fringes. Given the conceptual turbine layout and associated road infra-structure, it is not expected that any priority species will be permanently displaced from the development	Local	Medium	• 100m buffer around wetlands – all infrastructure • 1km buffer around pans – turbines only	• Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. • Development in the remaining high sensitivity grassland must be limited as far as possible. Where possible, infrastructure must be located near margins,

	site, but densities may be reduced. In summary, the following species are likely to be affected by habitat transformation: Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Northern Black Korhaan, Blue Korhaan, Marsh Owl, African Grass Owl, Black-winged Lapwing and Secretarybird.				with shortest routes taken from the existing roads.
During operation: Mortality of priority species due to collisions with wind turbines.	The proposed WEF will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species and occasional long-distance fliers i.e., bustards, cranes, flamingos, storks, Southern Bald Ibis and Secretarybird, although bustards and cranes generally seem to be not as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species, i.e., species such as Cape Vulture and a variety of raptors, including several species of eagles, are highly vulnerable to the risk of collisions. In summary, the following priority species could be at risk of collisions with the turbines: Common Buzzard, Jackal Buzzard, Blue Crane, Brown Snake Eagle, Black-chested Snake Eagle, Long-crested Eagle, Martial Eagle, Peregrine Falcon, Lanner Falcon, Greater Flamingo, Lesser Flamingo, Montagu's Harrier, African Marsh Harrier, Black Harrier, African Harrier-Hawk, Cape Vulture, Secretarybird, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Wattled Crane, Grey Crowned Crane, African Fish Eagle, Spotted Eagle-Owl, Amur Falcon, Grey-winged Francolin, Southern Bald Ibis, Black-winged Kite, Northern Black Korhaan, Blue Korhaan, Black-winged Lapwing, Western Osprey, Marsh Owl, African Grass Owl, Black Sparrowhawk and White Stork.	Regional	High	• 100m buffer around wetlands – all infrastructure • 1km buffer around pans – turbines only	It is recommended that suitable pro-active mitigation be implemented at all turbines, which could include shut down on demand or other proven mitigation measures. This is recommended for the following reasons: • The site is wedged between three IBAs. 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 at risk of collisions they leave to forage or breed beyond the borders of the IBA at the project site. • Cape Vultures have been recorded at the site. The species could occur sporadically, and they are highly vulnerable to turbine collisions. • The habitat at the site is used by a variety of Red List priority species. This includes not only natural grassland, but also agriculture e.g., Southern Bald Ibis forage

					extensively in agricultural fields.
During operation: Mortality of priority species due to electrocution on the medium voltage internal reticulation network	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 electricity could potentially pose an electrocution risk to several priority species that could on occasion perch on these poles. In summary, the following priority species are potentially vulnerable to electrocution in this manner: Grey Crowned Crane, Marsh Owl, African Grass Owl, Spotted Eagle-Owl, Common Buzzard, Peregrine Falcon, Black Harrier, Jackal Buzzard, Brown Snake Eagle, Black-chested Snake Eagle, Long-crested Eagle, Martial Eagle, Lanner Falcon, Montagu's Harrier, African Marsh Harrier, African Harrier-Hawk, Cape Vulture, African Fish Eagle, Southern Bald Ibis, Black-winged Kite, Western Osprey and Black Sparrowhawk.	Regional	High	• 100m buffer around wetlands – all infrastructure	A raptor-friendly pole design must be used, and the pole design must be approved by the avifaunal specialist.
During operation: Mortality of priority species due to collisions with the medium voltage internal reticulation network	While the intention is to place the majority of the medium voltage reticulation network underground at the wind farm, there are areas where the lines will run above ground. Priority species which most at risk of collisions with the medium voltage powerlines are the following: Grey Crowned Crane, Marsh Owl, African Grass Owl, Spotted Eagle-Owl, Cape Vulture, Southern Bald Ibis, Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Northern Black Korhaan, Blue Korhaan, Secretarybird, Greater Flamingo, Lesser Flamingo and White Stork.	Regional	High	• 100m buffer around wetlands – all infrastructure	All internal medium voltage lines must be marked with Eskom approved Bird Flight Diverters according to the Eskom standard.

ENVIRONMENTAL SENSITIVITIES

The following specific environmental sensitivities were identified from an avifaunal perspective:

- **100m all infrastructure exclusion zone around drainage lines and associated wetlands.** 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).
- **1km turbine exclusion zone around large pans**. The most significant landscape features from a collision risk perspective are the large pans. Pans attract many birds, including Red List species such as Greater Flamingo (SA status Near-threatened), Lesser Flamingo (SA status near-threatened), Martial Eagle (SA Status Endangered), Cape Vulture (SA Status Endangered) and Secretarybird (SA status Vulnerable).
- **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).

See Figure 6 for the avifaunal sensitivities identified from a wind energy perspective.

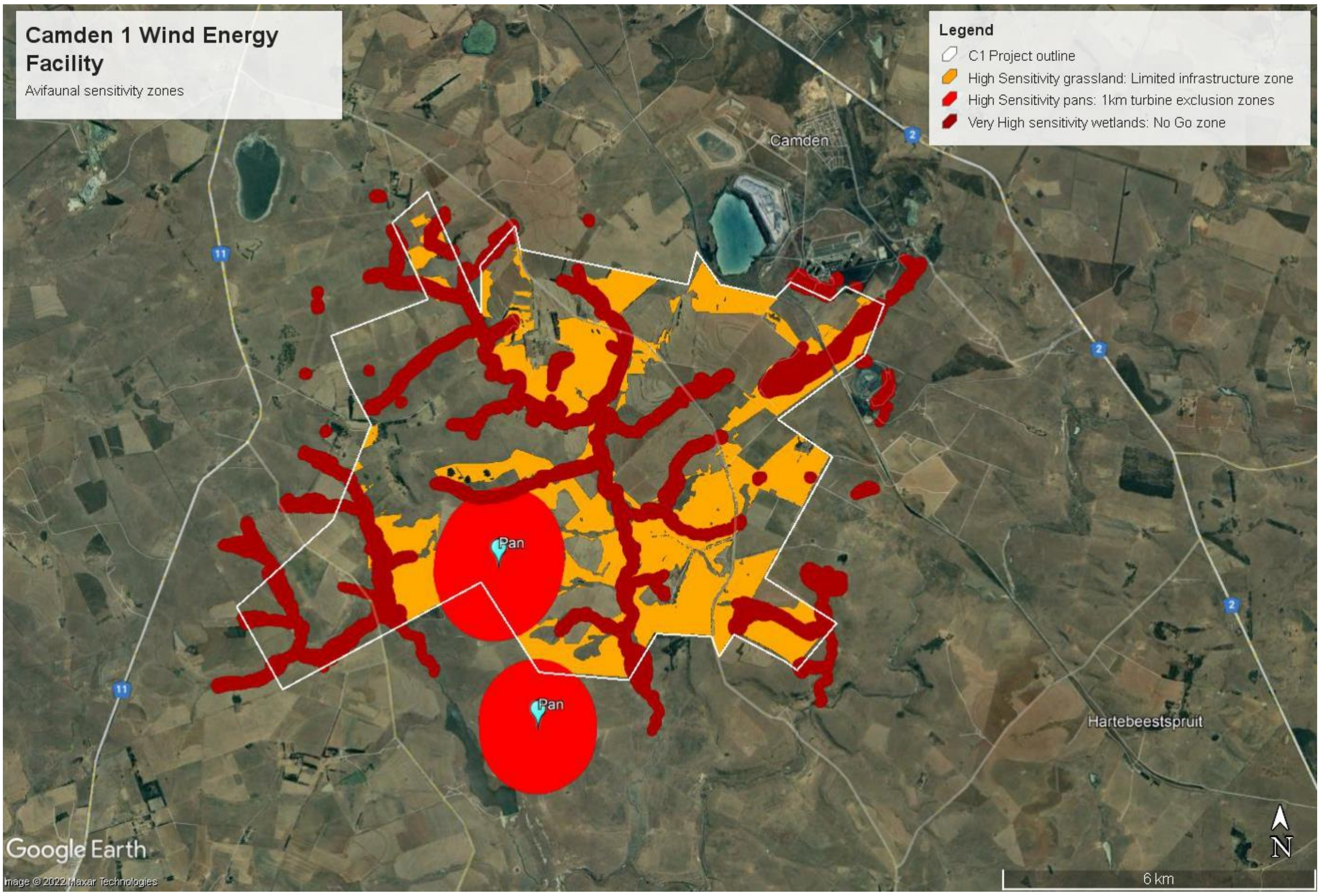

Figure 1: Avifaunal sensitivities

EIA PHASE

Plan of study

The following are proposed for the EIA Phase:

- The implementation of four avifaunal surveys, utilising transects, vantage point watches, focal points and incidental counts, to inform the assessment of the potential impacts of the planned infrastructure within the development footprint (see Appendix 3)[1]. The monitoring protocol is guided by the following:
    - Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020)
    - Protocol for the specialist assessment and minimum report content requirements for environmental impacts om avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).
    - Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa. Hereafter referred to as the wind guidelines.
- The avifaunal specialists report will be structured around the following terms of reference:
    - Description of the affected environment from an avifaunal perspective.
    - Discussion of gaps in baseline data and other limitations.
    - Description of the methodology that was used for the field surveys.
    - Comparison of the site sensitivity recorded in the field with the sensitivity classification in the DFFE National Screening Tool and adjustment if necessary.
    - Provision of an overview of all applicable legislation.
    - Provision of an overview of assessment methodology.
    - Identification and assessment of the potential impacts of the proposed development on avifauna including cumulative impacts.
    - Provision of sufficient mitigation measures to include in the Environmental Management Programme (EMPr).
    - Conclusion with an impact statement whether the facility is fatally flawed or may be authorised.

Environmental Management Programme

For each anticipated impact, management recommendations for the design, construction, and operational phase (where appropriate) will be drafted for inclusion in the project EMPRs.

PRELIMINARY CONCLUSIONS

According to the DFFE national screening tool, the habitat within the project site is classified as **Low** sensitivity for birds from a wind energy perspective. This classification is not accurate as far as the impact of the proposed Camden 1 Wind Energy Facility is concerned, based on actual conditions recorded on the ground during the 12-months of pre-construction monitoring. The classification should be **High** based on the recorded presence of Red List priority species in the development area, namely Secretarybird (Globally Endangered, Locally Vulnerable) White-bellied Bustard (Locally Vulnerable), Blue Crane (Globally Vulnerable, Locally Near-threatened), Grey Crowned Crane (Globally and Locally Endangered), Martial Eagle (Globally and Locally Endangered), Lanner Falcon (Locally Vulnerable), Greater Flamingo (Locally Near-threatened), Lesser Flamingo (Globally and Locally Near-threatened), Black Harrier (Locally and Globally Endangered), Southern Bald Ibis (Locally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), African Grass Owl (Locally Vulnerable) and Cape Vulture (Globally and Locally Endangered).

The proposed Camden 1 Wind Energy Facility will have an anticipated medium to high pre-mitigation negative impact on priority avifauna, which is expected to be reduced to medium and low with appropriate mitigation.

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[1] This has been completed.

CONTENTS

DETAILS OF THE SPECIALIST

Chris van Rooyen (Bird Specialist)

Chris has 25 years' experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in numerous power line and wind generation projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in Southern Africa, which is currently (2016) accepted as the industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Albert Froneman (Bird and GIS Specialist)

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

Enertrag South Africa is proposing to develop the Camden Renewable Energy Complex in Mpumalanga, South Africa. The Complex is being developed 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), or similar programmes under the IRP. In addition, private off-take agreements are considered where possible.

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This report deals with the Camden 1 Wind Energy Facility (WEF).

Table 1 below summarises the main features of the proposed WEF.

Table 1: Camden 1 Wind Energy Facility summary

Facility Name	Camden 1 Wind Energy Facility
Applicant	Camden 1 Wind Energy Facility (RF) Propriety Limited
Municipalities	Msukaligwa Local Municipality of the Gert Sibande District Municipality
Affected Farms[2]	o Portion 0 of Klipfontein Farm No. 442 o Portion 1 of Welgelegen Farm No. 322 o Portion 1 of Klipfontein Farm No. 442 o Portion 2 of Uitkomst Farm No. 292 o Portion 2 of Welgelegen Farm No. 322 o Portion 3 of Langverwatch Farm No. 293 o Portion 3 of Klipbank Farm No. 295 o Portion 3 of Klipfontein Farm No. 442 o Portion 10 of Uitkomst Farm No. 292 o Portion 14 of Mooiplaats Farm No. 290
Extent	6000 ha
Buildable area	Approximately 200 ha

[2] Based on the current conceptual layout.

Capacity	Up to 210MW
Number of turbines	Up to 47
Turbine hub height:	Up to 200m
Rotor Diameter:	Up to 200m
Foundation	Approximately 25m² diameter x 3m deep – 500 – 650m³ concrete. Excavation approximately 1000m², in sandy soils due to access requirements and safe slope stability requirements.
Operations and Maintenance (O&M) building footprint:	Located in close proximity to the substation. Septic tanks with portable toilets Typical areas include: - Operations building – 20m x 10m = 200m² - Workshop – 15m x 10m = 150m² Stores - 15m x 10m = 150m²
Construction camp laydown	Typical area 100m x 50m = 5000m². Sewage: Septic tanks and portable toilets
Temporary laydown or staging area:	Typical area 220m x 100m = 22000m². Laydown area could increase to 30000m² for concrete towers, should they be required.
Cement batching plant (temporary):	Gravel and sand will be stored in separate heaps whilst the cement will be contained in a silo. The footprint will be around 0.5ha. Maximum height of the silo will be 20m.
Internal Roads:	Width of internal road – Between 5m and 6m, this can be increased to 8m on bends. Length of internal road – Approximately 60km.
Cables:	The medium voltage collector system will comprise of cables up to and include 33kV that run underground, except where a technical assessment suggest that overhead lines are required, in the facility connecting the turbines to the onsite substation.
Independent Power Producer (IPP) site substation and battery energy storage system (BESS):	Total footprint will be up to 10ha in extent. The substation will consist of a high voltage substation yard to allow for multiple (up to) 400kV feeder bays and transformers, control building, telecommunication infrastructure, access roads, etc. The associated BESS storage capacity will be up to 200MW/800MWh 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.

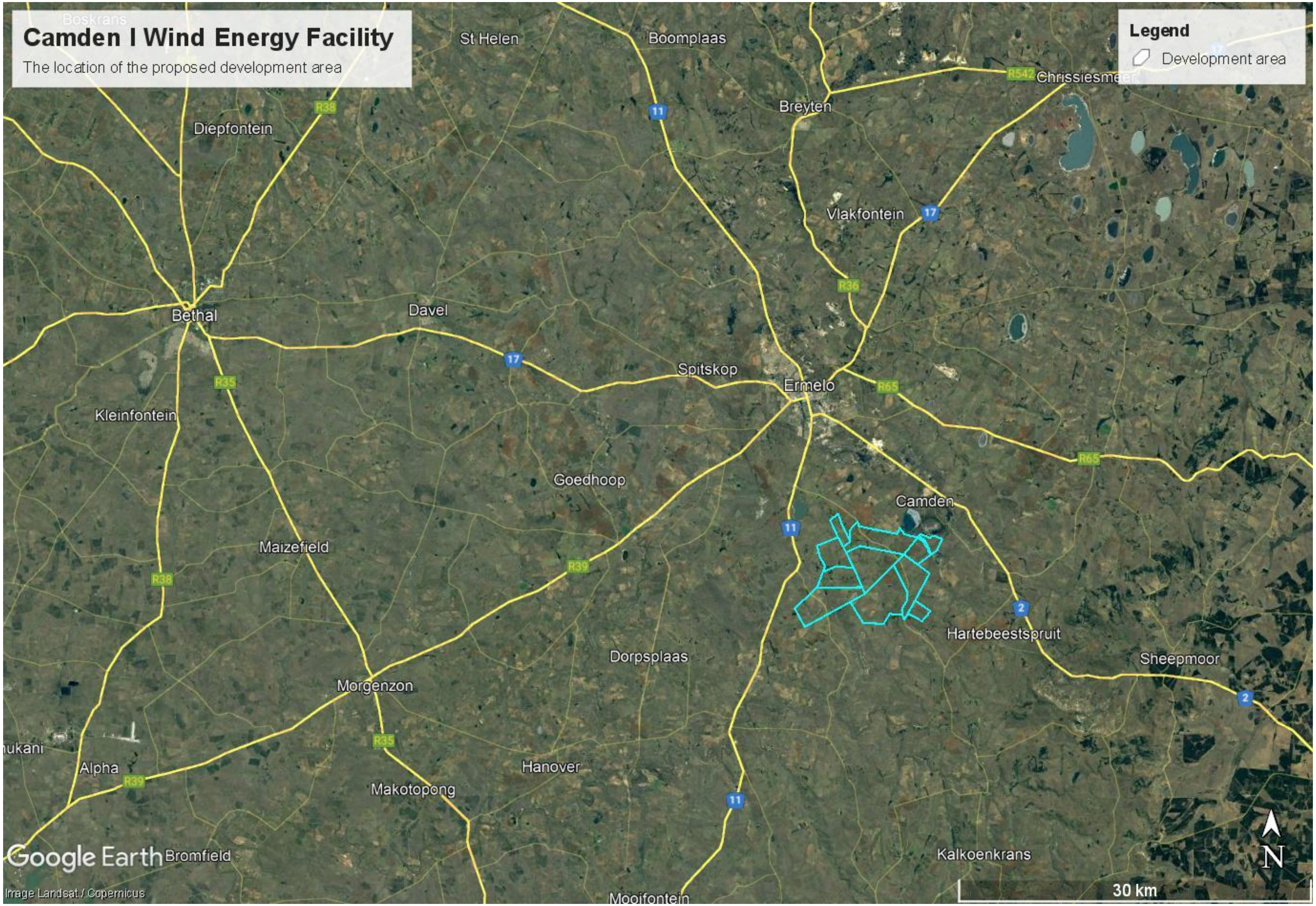

Figure 2: Locality map of the development area of the proposed Camden 1 Wind Energy Facility

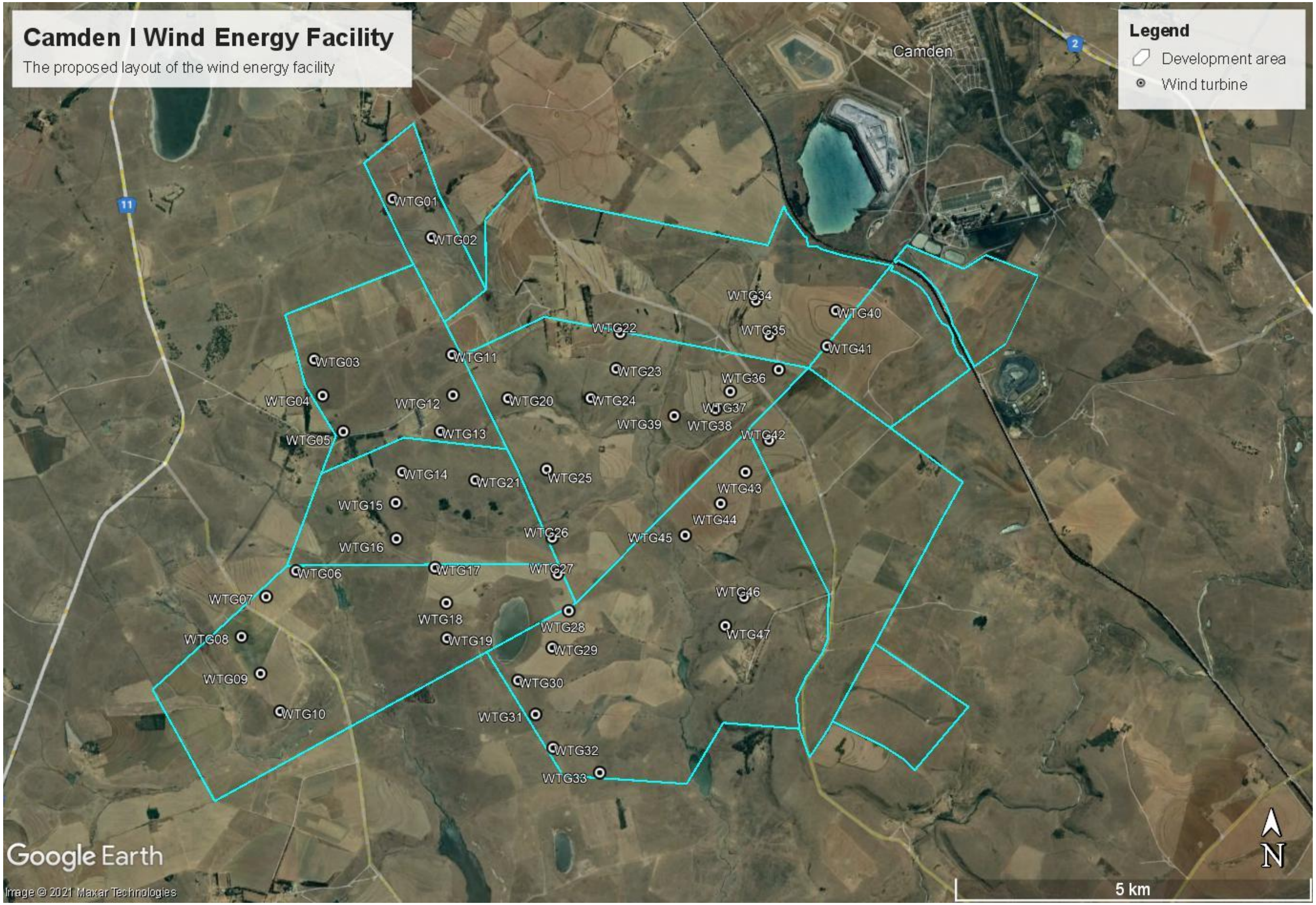

Figure 3: Conceptual lay-out of the proposed Camden 1 Wind Energy Facility development area.

2. TERMS OF REFERENCE

The purpose of the scoping phase report is to determine the main issues and potential impacts of the proposed project/s based on existing information and field assessments. The terms of reference are as follows:

- Describe the affected environment from an avifaunal perspective.
- Discuss gaps in baseline data and other limitations and describe the expected impacts associated with the wind farm and associated infrastructure.
- Identify potential sensitive environments and receptors that may be impacted on by the proposed wind farm 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 and operational phases.
- Identify 'No-Go' areas, where applicable.
- Summarise the potential impacts that will be considered further in the EIA Phase through specialist assessments.
- Recommend mitigation measures to reduce the impact of the expected impacts.

3. OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following information sources were consulted to conduct this study:

- 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 4). 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 (2021.2) 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).
- An intensive internet search was conducted to source information on the impacts of wind energy facilities on avifauna.
- Satellite imagery (Google Earth © 2021) 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 area relative to National Protected Areas.

- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the development area.
- The following sources were consulted to determine the investigation protocol that is required for the site:
    - Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020)
    - Protocol for the specialist assessment and minimum report content requirements for environmental impacts om avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).
- The main source of information on the avifaunal diversity and abundance at the project site and development area is an integrated pre-construction monitoring programme which was implemented at the project site, covering all seven proposed sub projects of the Camden Renewable Energy Complex (See Appendix 3).

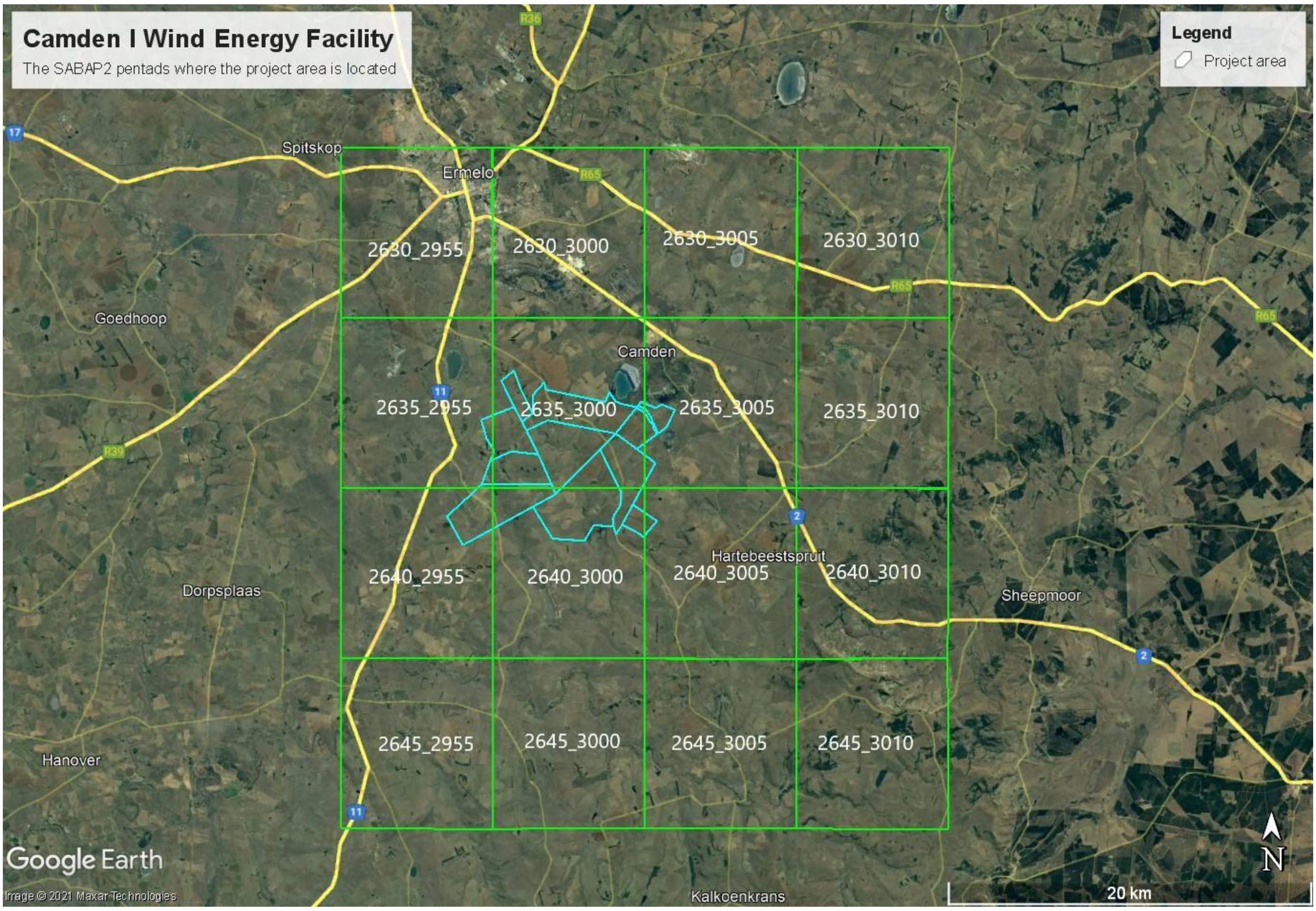

Figure 4: Area covered by the sixteen SABAP2 pentads.

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 scoping report are based on experience of these and similar species at wind farm developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.

- To date, only one peer-reviewed scientific paper has been published on the impacts wind farms have on birds in South Africa (Perold *et al*. 2020). The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: "in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation."
- 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.
- The broader area refers to the area covered by the sixteen SABAP2 pentads (see Figure 4).
- Priority species for wind development were identified from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al*. 2012).

5. LEGISLATIVE CONTEXT

5.1 Agreements and conventions

Table 1 below lists agreements and conventions which South Africa is party to, and which are relevant to the conservation of avifauna[3].

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	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

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

Flora and Fauna, (CITES), Washington DC, 1973		
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.

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

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

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. In the case of wind energy developments, the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species where the output is 20MW or more (Government Gazette No 43110, 20 March 2020) is applicable.

5.4 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.

5.5 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 Amersfoort-Bethal-Carolina IBA SA018, which is located within 1.5km from the site to the west. The Grasslands IBA SA020 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. 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 areas 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

According to the DFFE national screening tool, the habitat within the development site is classified as **Low** sensitivity for birds according to the Avian Wind theme (see Figure 4). This classification is not accurate as far as the impact of the proposed WEF is concerned, based on actual conditions recorded on the ground during the 12 months of pre-construction monitoring. The classification should be **High** based on the recorded presence of Red List priority species in the development area, namely Secretarybird (Globally Endangered, Locally Vulnerable) White-bellied Bustard (Locally Vulnerable), Blue Crane (Globally Vulnerable, Locally Near-threatened), Grey Crowned Crane (Globally and Locally Endangered), Martial Eagle (Globally and Locally Endangered), Lanner Falcon (Locally Vulnerable), Greater Flamingo (Locally Near-threatened), Lesser Flamingo (Globally and Locally Near-threatened), Black Harrier (Locally and Globally Endangered), Southern Bald Ibis (Locally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), African Grass Owl (Locally Vulnerable) and Cape Vulture (Globally and Locally Endangered).

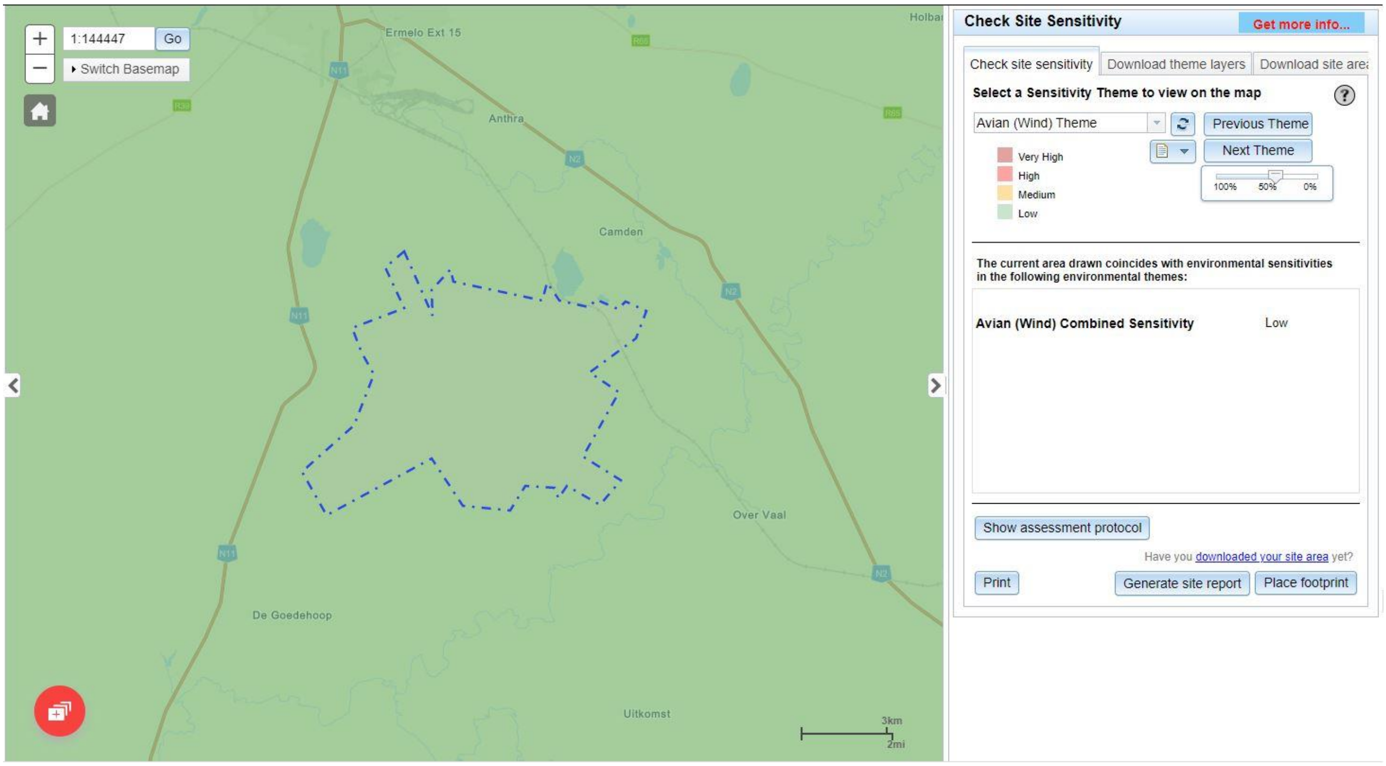

Figure 5: The National Web-Based Environmental Screening Tool map of the project site, indicating sensitivities for the Avian Wind theme. The classification should be changed to High sensitivity based on the presence of several Red List species at the site.

6.3 Protected Areas

According to the South African Protected Areas database (SAPAD), part of the site overlaps with the Langcarel Private Nature Reserve. No further information could be obtained about the nature reserve. However, from an avifaunal perspective the state of the habitat and land use at the project site 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 application site 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 application site 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 site 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 site 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 site (see Appendix 2 for examples of the habitat classes):

6.5.1 Grassland

The majority of the habitat in the project site comprises grassland. The grassland varies from dense stands of relatively high grass to areas of heavily grazed short grass. The priority species which could potentially use the grassland in the project site on a regular basis are the following:

- Secretarybird
- White-bellied Bustard
- Common Buzzard
- Jackal Buzzard
- Buff-streaked Chat
- Blue Crane
- Grey Crowned Crane
- Black-chested Snake Eagle
- Long-crested Eagle
- Spotted Eagle-Owl
- Amur Falcon
- Lanner Falcon
- Grey-winged Francolin
- African Harrier-Hawk
- Southern Bald Ibis
- Black-winged Kite
- Blue Korhaan
- Black-winged Lapwing
- African Grass Owl
- Marsh Owl
- Black Sparrowhawk
- White Stork

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

- Black-bellied Bustard
- Denham's Bustard
- Brown Snake Eagle
- Martial Eagle
- Peregrine Falcon
- African Marsh Harrier
- Black Harrier
- Montagu's Harrier
- Northern Black Korhaan
- Cape Vulture

6.5.2 Drainage lines and wetlands

There are several wetlands in the project site, most of which are associated with drainage lines. The priority species which could potentially use the wetlands in the project site on a regular basis are the following:

- Blue Crane
- Grey Crowned Crane
- African Grass Owl
- Marsh Owl

The priority species which could occasionally use the wetlands in the project site are the following:

- African Marsh Harrier
- Montagu's 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. The priority species which could potentially use the agricultural fields in the project site on a regular basis are the following:

- Blue Crane
- Grey Crowned Crane
- Common Buzzard
- Spotted Eagle-Owl
- Amur Falcon
- Lanner Falcon
- Southern Bald Ibis
- Black-winged Kite

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

- Peregrine Falcon
- African Marsh Harrier
- Montagu's Harrier
- Wattled Crane
- Black Harrier
- Black-bellied Bustard

- Denham's Bustard
- Brown Snake Eagle
- Martial Eagle
- Northern Black Korhaan
- Cape Vulture

6.5.4 Alien trees

The project site contains few trees. Most trees are alien species, particularly Eucalyptus, Australian Acacia (Wattle), and Salix (Willow) species. Trees are often planted as wind breaks next to agricultural lands and around homesteads. Some of the drainage lines also have trees growing in them. The priority species which could potentially use the alien trees in the project site on a regular basis are the following:

- Grey Crowned Crane
- Common Buzzard
- Spotted Eagle-Owl
- Amur Falcon
- Lanner Falcon
- Southern Bald Ibis
- Black-winged Kite
- Jackal Buzzard
- Black-chested Snake Eagle
- Long-crested Eagle
- African Harrier-Hawk
- Black Sparrowhawk
- African Fish Eagle

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

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

6.5.5 Dams

There are numerous ground dams at the project site, located in drainage lines. The priority species which could potentially use the dams in the project site on a regular basis are the following:

- African Fish Eagle

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

- Western Osprey

6.5.6 Pans

The project site contains one large pan, and another large pan is located approximately one kilometre south of the site. These pans are a potential drawcard for many priority 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. The priority species which could potentially use the pans in the project site on a regular basis are the following:

- Common Buzzard
- Jackal Buzzard
- Blue Crane
- Black-chested Snake Eagle
- Long-crested Eagle
- Lanner Falcon
- Greater Flamingo
- Lesser Flamingo
- African Harrier-Hawk

The priority species which could occasionally use the pans in the project site are the following:

- Brown Snake Eagle
- Martial Eagle
- Peregrine Falcon
- African Marsh Harrier
- Montagu's Harrier
- Black Harrier
- Cape Vulture
- Black-bellied Bustard
- Denham's Bustard
- Wattled Crane
- Northern Black Korhaan
- Western Osprey

See Appendix 2 for photographic record of habitat features in the project site 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, 37 species are classified as priority species (see definition of priority species in section 4) and 16 of these are South African Red List species. Of the priority species, 25 are likely to occur regularly in the development area (see Table 2 below).

Table 3 below lists all the priority species that are likely to occur regularly and the possible impact on the respective species by the proposed wind farm. The following abbreviations and acronyms are used:

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

Table 3: Priority species potentially occurring at the development area (Red List species are shaded).

Species	Taxonomic name	SABAP2 reporting rate		Conservation status					Habitat feature						Potential impact				
		Full protocol reporting rate	ad hoc protocol reporting rate	Global status	Regional status	IBA trigger species	Recorded during surveys	Likelihood of regular occurrence	Grassland	Drainage lines and wetlands	Alien trees	Pans	Agriculture	Dams	Collisions with turbines	Displacement: Habitat transformation	Displacement: Disturbance	Electrocution: MV lines	Collisions: MV OHL
African Fish Eagle	*Haliaeetus vocifer*	12.12	0.88	-	-		x	H			x			x	x			x	
African Grass Owl	*Tyto capensis*	2.42	0.00	-	VU	x	x	M	x	x					x	x	x	x	
African Harrier-Hawk	*Polyboroides typus*	11.52	1.76	-	-		x	M	x		x	x			x			x	
African Marsh Harrier	*Circus ranivorus*	0.61	0.00	-	EN	x		L	x	x		x			x			x	
Amur Falcon	*Falco amurensis*	29.09	6.61	-	-		x	H	x		x		x		x				
Black Harrier	*Circus maurus*	0.00	0.88	EN	EN	x		L	x			x			x			x	
Black Sparrowhawk	*Accipiter melanoleucus*	12.12	0.88	-	-		x	M	x		x				x			x	
Black-bellied Bustard	*Lissotis melanogaster*	0.61	0.00	-	-			L	x						x	x	x		
Black-chested Snake Eagle	*Circaetus pectoralis*	3.03	0.44	-	-		x	M	x		x	x			x			x	
Black-winged Kite	*Elanus caeruleus*	60.61	12.78	-	-		x	H	x		x		x		x			x	
Black-winged Lapwing	*Vanellus melanopterus*	14.55	0.00	-	-		x	H	x						x	x			
Blue Crane	*Grus paradisea*	11.52	0.44	VU	NT	x	x	H	x	x		x	x		x	x	x		
Blue Korhaan	*Eupodotis caerulescens*	6.06	0.00	NT	LC	x	x	M	x						x	x	x		
Brown Snake Eagle	*Circaetus cinereus*	1.82	0.00	-	-			L	x		x	x			x			x	
Buff-streaked Chat	*Campicoloides bifasciatus*	5.45	0.44	-	-	x		M	x							x	x		
Cape Vulture	*Gyps coprotheres*	0.00	0.00	EN	EN		x	L	x		x	x			x			x	x
Common Buzzard	*Buteo buteo*	27.88	9.25	-	-		x	H	x		x	x	x		x			x	
Denham's Bustard	*Neotis denhami*	1.82	0.00	NT	VU	x		L	x						x	x	x		
Greater Flamingo	*Phoenicopterus roseus*	3.64	4.41	-	NT	x	x	M				x			x				
Long-crested Eagle	*Lophaetus occipitalis*	6.67	9.25	-	-		x	M	x		x	x			x			x	
Marsh Owl	*Asio capensis*	5.45	0.44	-	-		x	H	x	x					x	x	x	x	
Martial Eagle	*Polemaetus bellicosus*	2.42	0.00	EN	EN	x	x	L	x		x	x			x			x	
Montagu's Harrier	*Circus pygargus*	1.21	0.00	-	-			L	x	x		x			x			x	

Species	Taxonomic name	SABAP2 reporting rate		Conservation status		IBA trigger species	Recorded during surveys	Likelihood of regular occurrence	Habitat feature						Potential impact				
		Full protocol reporting rate	ad hoc protocol reporting rate	Global status	Regional status				Grassland	Drainage lines and wetlands	Alien trees	Pans	Agriculture	Dams	Collisions with turbines	Displacement: Habitat transformation	Displacement: Disturbance	Electrocution: MV lines	Collisions: MV OHL
Northern Black Korhaan	*Afrotis afraoides*	0.61	0.00	-	-			L	x						x	x	x		
Peregrine Falcon	*Falco peregrinus*	1.21	0.00	-	-		x	L	x		x	x	x		x			x	
Secretarybird	*Sagittarius serpentarius*	13.33	0.00	EN	VU	x	x	H	x						x	x			
Southern Bald Ibis	*Geronticus calvus*	23.03	3.08	VU	VU	x	x	H	x		x		x		x			x	
Spotted Eagle-Owl	*Bubo africanus*	9.09	0.88	-	-		x	H	x		x		x		x		x	x	
Wattled Crane	*Grus carunculata*	0.61	0.00	VU	CR	x		L		x					x				
Western Osprey	*Pandion haliaetus*	0.61	0.00	-	-			L						x	x			x	
White Stork	*Ciconia ciconia*	7.27	1.32	-	-		x	M	x						x				
White-bellied Bustard	*Eupodotis senegalensis*	7.88	0.00	-	VU	x	x	M	x						x	x	x		

7. IMPACT ASSESSMENT

The effects of a wind farm on birds are highly variable and depend on a wide range of factors, including the specification of the development, the topography of the surrounding land, the habitats affected and the number and species of birds present. With so many variables involved, the impacts of each wind farm must be assessed individually. The principal areas of concern with regard to effects on birds are listed below. Each of these potential effects can interact with each other, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss or displacement causes a reduction in birds using an area which might then reduce the risk of collision):

- Mortality due to collisions with the wind turbines
- Displacement due to disturbance during construction and operation of the wind farm
- Displacement due to habitat change and loss at the wind farm
- Mortality due to electrocution on the medium voltage overhead lines
- Mortality due to collisions with the medium voltage overhead lines

It should be noted that the assessment is made on the status quo as it is currently on site. The possible change in land use in the broader development site is not considered because the extent and nature of future developments (not only wind energy development) are unknown at this stage. It is however highly unlikely that the land use will change in the foreseeable future due to climatic limitations.

7.1 Collision mortality on wind turbines[4]

- Wind energy generation has experienced rapid worldwide development over recent decades as its environmental impacts are considered to be relatively lower than those caused by traditional energy sources, with reduced environmental pollution and water consumption (Saidur *et al.*, 2011). However, bird fatalities due to collisions with wind turbines have been consistently identified as a main ecological drawback to wind energy (Drewitt and Langston, 2006).
- Collisions with wind turbines appear to kill fewer birds than collisions with other man-made infrastructure, such as power lines, buildings or even traffic (Calvert *et al.* 2013; Erickson *et al.* 2005). Nevertheless, estimates of bird deaths from collisions with wind turbines worldwide range from 0 to almost 40 deaths per turbine per year (Sovacool, 2009). The number of birds killed varies greatly between sites, with some sites posing a higher collision risk than others, and with some species being more vulnerable (e.g. Hull *et al.* 2013; May *et al.* 2012a). These numbers may not reflect the true magnitude of the problem, as some studies do not account for detectability biases such as those caused by scavenging, searching efficiency and search radius (Bernardino *et al.* 2013; Erickson *et al.* 2005; Huso and Dalthorp 2014). Additionally, even for low fatality rates, collisions with wind turbines may have a disproportionate effect on some species. For long-lived species with low productivity and slow maturation rates (e.g. raptors), even low mortality rates can have a significant impact at the population level (e.g. Carrete *et al.* 2009; De Lucas *et*

4 This section is based largely on a (2014) review paper by Ana Teresa Marques, Helena Batalha, Sandra Rodrigues, Hugo Costa, Maria João Ramos Pereira,Carlos Fonseca, Miguel Mascarenhas, Joana Bernardino. *Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies*. Biological Conservation 179 (2014) 40– 52.

al. 2012a; Drewitt and Langston, 2006). The situation is even more critical for species of conservation concern, which sometimes are most at risk (e.g. Osborn *et al.* 1998).

- High bird fatality rates at several wind farms have raised concerns among the industry and scientific community. High profile examples include the Altamont Pass Wind Resource Area (APWRA) in California because of high fatality of Golden eagles (*Aquila chrysaetos*), Tarifa in Southern Spain for Griffon vultures (*Gyps fulvus*), Smøla in Norway for White-tailed eagles (*Haliaatus albicilla*), and the port of Zeebrugge in Belgium for gulls (*Larus* sp.) and terns (*Sterna* sp.) (Barrios and Rodríguez, 2004; Drewitt and Langston, 2006; Everaert and Stienen, 2008; May *et al.* 2012a; Thelander *et al.* 2003). Due to their specific features and location, and characteristics of their bird communities, these wind farms have been responsible for a large number of fatalities that culminated in the deployment of additional measures to minimize or compensate for bird collisions. However, currently, no simple formula can be applied to all sites; in fact, mitigation measures must inevitably be defined according to the characteristics of each wind farm and the diversity of species occurring there (Hull *et al.* 2013; May *et al.* 2012b). An understanding of the factors that explain bird collision risk and how they interact with one another is therefore crucial to proposing and implementing valid mitigation measures.

Species-specific factors

- Morphological features

- Certain morphological traits of birds, especially those related to size, are known to influence collision risk with structures such as power lines and wind turbines. Janss (2000) identified weight, wing length, tail length and total bird length as being collision risk determinant. Wing loading (ratio of body weight to wing area) and aspect ratio (ratio of wingspan squared to wing area) are particularly relevant, as they influence flight type and thus collision risk (Bevanger, 1994; De Lucas *et al.* 2008; Herrera-Alsina *et al.* 2013; Janss, 2000). Birds with high wing loading, such as the Griffon Vulture (*Gyps fulvus*), seem to collide more frequently with wind turbines at the same sites than birds with lower wing loadings, such as Common Buzzards (*Buteo buteo*) and Short-toed Eagles (*Circaetus gallicus*), and this pattern is not related with their local abundance (Barrios and Rodríguez, 2004; De Lucas *et al.* 2008). High wing-loading is associated with low flight manoeuvrability (De Lucas *et al.* 2008), which determines whether a bird can escape an encountered object fast enough to avoid collision.

Information on the wing loading of the priority species potentially occurring regularly at the proposed Camden 1 Wind Energy Facility was not available at the time of writing. However, based on general observations, and research on related species, it can be confidently assumed that priority species that could potentially be vulnerable to wind turbine collisions due to morphological features (high wing loading) are bustards, cranes, flamingos and vultures, making them less manoeuvrable (Keskin et al. 2019).

- Sensorial perception

- Birds are assumed to have excellent visual acuity, but this assumption is contradicted by the large numbers of birds killed by collisions with man-made structures (Drewitt and Langston, 2008; Erickson *et al.* 2005). A common explanation is that birds collide more often with these structures in conditions of low visibility, but recent studies have shown that this is not always the case (Krijgsveld *et al.* 2009). The visual acuity of birds seems to be slightly superior to that of other vertebrates (Martin, 2011; McIsaac, 2001). Unlike humans, who have a broad horizontal binocular field of 120°, some birds have two high acuity areas that overlap in a very narrow horizontal binocular field (Martin, 2011). Relatively small frontal binocular fields have been described for several species that are particularly vulnerable to power line collisions, such as vultures (Gyps sp.) cranes and bustards (Martin and Katzir, 1999; Martin et.al, 2010; Martin, 2012, 2011; O'Rourke *et al.* 2010). Furthermore, for some species, their high-resolution vision areas are often found in the lateral fields of view, rather than frontally (e.g. Martin et.al, 2010; Martin, 2012, 2011; O'Rourke *et al.* 2010). Finally, some birds tend to look downwards when in flight, searching for conspecifics or food, which puts the direction of flight completely inside the blind zone of some species (Martin et.al, 2010; Martin, 2011).

Some of the regularly occurring priority species at the proposed Camden 1 Wind Energy Facility have high resolution vision areas found in the lateral fields of view, rather than frontally, e.g., the vultures, bustards and cranes. The exceptions to this are the priority raptors which all have wider binocular fields, although as pointed out by Martin (2011, 2012), this does not necessarily result in these species being able to avoid obstacles better.

- Phenology

- Recent studies have shown that, within a wind farm, raptor collision risk and fatalities are higher for resident than for migrating birds of the same species. An explanation for this may be that resident birds generally use the wind farm area several times while a migrant bird crosses it just once (Krijgsveld *et al.* 2009). However, other factors like bird behaviour are certainly relevant. Katzner *et al.* (2012) showed that Golden Eagles performing local movements fly at lower altitudes, putting them at a greater risk of collision than migratory eagles. Resident eagles flew more frequently over cliffs and steep slopes, using low altitude slope updrafts, while migratory eagles flew more frequently over flat areas and gentle slopes where thermals are generated, enabling the birds to use them to gain lift and fly at higher altitudes.

South Africa is at the end of the migration path for summer migrants; therefore, the phenomenon of migratory flyways where birds are concentrated in large numbers for a limited period of time, e.g. the African Rift Valley or Mediterranean Red Sea flyways, is not a feature of the national landscape. The migratory priority species which could occur at the proposed Camden 1 Wind Energy Facility with some regularity, e.g., White Stork, Amur Falcon and Common Buzzard will behave much the same as the resident birds once they arrive in the area. The same is valid for local migrants such as the Denham's Bustard, Lesser Flamingo and Greater Flamingo. It is expected that, for the period when they are present, these species will be exposed to the same risks as resident species.

- Bird behaviour

- Flight type seems to play an important role in collision risk, especially when associated with hunting and foraging strategies. Kiting flight (hanging in the wind with almost motionless wings), which is used in strong winds and occurs in rotor swept zones, has been highlighted as a factor explaining the high collision rate of Red-tailed Hawks *Buteo jamaicensis* at APWRA (Hoover and Morrison, 2005), and could also be a factor in contributing to the high collision rate for Jackal Buzzards in South Africa (Ralston-Paton & Camagu 2019). The hovering behaviour exhibited by Common Kestrels *Falco tinnunculus* when hunting may also explain the fatality levels of this species at wind farms in the Strait of Gibraltar (Barrios and Rodríguez, 2004). This may also explain the high mortality rate of Rock Kestrels *Falco rupicolus* at wind farms in South Africa (Ralston-Paton & Camagu 2019). Kiting and hovering are associated with strong winds, which often produce unpredictable gusts that may suddenly change a bird's position (Hoover and Morrison, 2005). Additionally, while birds are hunting and focused on prey, they might lose track of wind turbine positions (Krijgsveld *et al.* 2009; Smallwood *et al.* 2009). In the case of raptors, aggressive interactions may play an important role in turbine fatalities, in that birds involved in these interactions are momentarily distracted, putting them at risk. At least one eye-witness account of a Martial Eagle getting killed by a turbine in South Africa in this fashion is on record (Simmons & Martins 2016)

- Social behaviour may also result in a greater collision risk with wind turbines due to a decreased awareness of the surroundings. Several authors have reported that flocking behaviour increases collision risk with power lines as opposed to solitary flights (e.g. Janss, 2000). However, caution must be exercised when comparing the particularities of wind farms with power lines, as some species appear to be vulnerable to collisions with power lines but not with wind turbines, e.g. indications are that bustards, which are highly vulnerable to power line collisions, are not prone to wind turbine collisions – a Spanish database of over 7000 recorded turbine collisions contains no Great Bustards *Otis tarda* (A. Camiña 2012a). Similarly, in South Africa, very few bustard collisions with wind turbines have been reported to date, all Ludwig's Bustards (Ralston-Paton & Camagu 2019). No Denham's Bustards *Neotis denhami* turbine fatalities have been reported to date, despite the species occurring at several wind farm sites.

The priority species which could occur with some regularity at the proposed Camden 1 Wind Energy Facility can be classified as either terrestrial species, soaring species or occasional long-distance fliers. Terrestrial species spend most of the time foraging on the ground. They do not fly often and when they do, they generally fly for short distances at low to medium altitude. At the application site bustards and korhaans are included in this category. Occasional long-distance fliers generally behave as terrestrial species but can and do undertake long distance flights on occasion. Species in this category are White Stork, Denham's Bustard, Blue Crane, Grey Crowned Crane, Southern Bald Ibis, Secretarybird and Greater and Lesser Flamingo. Soaring species spend a significant time on the wing in a variety of flight modes including soaring, kiting, hovering, and gliding at medium to high altitudes. At the project site, these include all the raptors and vultures.

- Avoidance behaviours

- Two types of avoidance have been described (Furness *et al.*, 2013): 'macro-avoidance' whereby birds alter their flight path to keep clear of the entire wind farm (e.g. Desholm and Kahlert, 2005; Plonczkier and Simms, 2012; Villegas-Patraca *et al.* 2014), and 'micro-avoidance' whereby birds enter the wind farm but take evasive actions to avoid individual wind turbines (Band *et al.* 2007). This may differ between species and may have a significant impact on the size of the risk associated with a specific species. It is generally assumed that 95-98% of birds will successfully avoid the turbines (SNH 2010).

It is anticipated that most birds at the proposed Camden 1 Wind Energy Facility will avoid the wind turbines, as is generally the case at all wind farms (SNH 2010). Exceptions already mentioned are raptors that engage in hunting which might serve to distract them and place them at risk of collision, birds engaged in display behaviour or inter- and intraspecific aggressive interaction. Complete macro-avoidance of the wind farm is unlikely for any of the priority species likely to occur at the proposed WEF.

- Bird abundance

- Some authors suggest that fatality rates are related to bird abundance, density or utilization rates (Carrete *et al.* 2012; Kitano and Shiraki, 2013; Smallwood and Karas, 2009), whereas others point out that, as birds use their territories in a non-random way, fatality rates do not depend on bird abundance alone (e.g.

Ferrer *et al.* 2012; Hull *et al.* 2013). Instead, fatality rates depend on other factors such as differential use of specific areas within a wind farm (De Lucas *et al.* 2008). For example, at Smøla, White-tailed Eagle flight activity is correlated with collision fatalities (Dahl *et al.* 2013). In the APWRA, Golden Eagles, Red-tailed Hawks and American Kestrels (*Falco spaverius*) have higher collision fatality rates than Turkey Vultures (*Cathartes aura*) and Common Raven (*Corvus corax*), even though the latter are more abundant in the area (Smallwood *et al.* 2009), indicating that fatalities are more influenced by each species' flight behaviour and turbine perception. Also, in southern Spain, bird fatality was higher in the winter, even though bird abundance was higher during the pre-breeding season (De Lucas *et al.* 2008).

The abundance of priority species at the proposed Camden 1 Wind Energy Facility will fluctuate depending on the season of the year. Greater numbers are expected during the rainy season, when foraging conditions are better and certain migratory species are present.

Site-specific factors

- Landscape features

- Susceptibility to collision can also heavily depend on landscape features at a wind farm site, particularly for soaring birds that predominantly rely on wind updrafts to fly. Some landforms such as ridges, steep slopes and valleys may be more frequently used by some birds, for example for hunting or during migration (Barrios and Rodríguez, 2004; Drewitt and Langston, 2008; Katzner *et al.* 2012; Thelander *et al.* 2003). In APWRA, Red-tailed Hawk fatalities occur more frequently than expected by chance at wind turbines located on ridge tops and swales, whereas Golden Eagle fatalities are higher at wind turbines located on slopes (Thelander *et al.* 2003). Other birds may follow other landscape features, such as peninsulas and shorelines, during dispersal and migration periods. Kitano and Shiraki (2013) found that the collision rate of White-tailed Eagles along a coastal cliff was extremely high, suggesting an effect of these landscape features on fatality rates.

The project site does not contain many landscape features as it is situated on a slightly undulating plain. The most significant landscape features from a collision risk perspective are the large pans. Pans attract many birds, including Red List species such as Greater Flamingo, Lesser Flamingo, Martial Eagle, Cape Vulture and Secretarybird.

- Flight paths

- For territorial raptors like Golden Eagles (and Verreaux's Eagles – see Ralston-Patton 2017)), foraging areas are preferably located near to the nest, when compared to the rest of their home range. For example, in Scotland 98% of Golden Eagle movements were registered at ranges less than 6 km from the nest, and the core areas were located within a 2 - 3 km radius (McGrady *et al.* 2002). These results, combined with the terrain features selected by Golden Eagles to forage such as areas close to ridges, can be used to predict the areas used by the species to forage (McLeod *et al.* 2002), and therefore provide a sensitivity map and guidance to the development of new wind farms (Bright *et al.* 2006).

The pans are likely to act as a focal point for flight activity as birds converge on the pan, e.g. Blue Crane to roost and flamingos to forage. Several raptor species and Cape Vultures may also use the pans intermittently for bathing and drinking.

- Food availability

- Factors that increase the use of a certain area or that attract birds, like food availability; also play a role in collision risk. For example, the high density of raptors at the APWRA and the high collision fatality due to collision with turbines is thought to result, at least in part, from high prey availability in certain areas (Hoover and Morrison, 2005; Smallwood *et al.* 2001). This may be particularly relevant for birds that are less aware of obstructions such as wind turbines while foraging (Krijgsveld *et al.* 2009; Smallwood *et al.* 2009). It is assumed that the mortality of three Verreaux's Eagles in 2015 at a wind farm site in South Africa may have been linked to the availability of food (Smallie 2015).

The occurrence of Cape Vultures at the project site could be linked to the availability of food, while the agricultural activity is an attractant for Southern Bald Ibis.

- The proposed Camden 1 Wind Energy Facility will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species and occasional long distance fliers i.e., bustards, cranes, flamingos, storks, Southern Bald Ibis and Secretarybird, although bustards and cranes generally seem to be not as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species, i.e., species such as Cape Vulture and a variety of raptors, including several species of eagles, are highly vulnerable to the risk of collisions. In summary, the following priority species could be at risk of collisions with the turbines: Common Buzzard, Jackal Buzzard, Blue Crane, Brown Snake Eagle, Black-chested Snake Eagle, Long-crested Eagle, Martial Eagle, Peregrine Falcon, Lanner Falcon, Greater Flamingo, Lesser Flamingo, Montagu's Harrier, African Marsh Harrier, Black Harrier, African Harrier-Hawk, Cape Vulture, Secretarybird, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Wattled Crane, Grey Crowned Crane, African Fish Eagle, Spotted Eagle-Owl, Amur Falcon, Grey-winged Francolin, Southern Bald Ibis, Black-winged Kite, Northern Black Korhaan, Blue Korhaan, Black-winged Lapwing, Western Osprey, Marsh Owl, African Grass Owl, Black Sparrowhawk and White Stork.
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7.2 Displacement due to disturbance

- The displacement of birds from areas within and surrounding wind farms due to visual intrusion and disturbance in effect can amount to habitat loss. Displacement may occur during both the construction and operation phases of wind farms and may be caused by the presence of the turbines themselves through visual, noise and vibration impacts, or as a result of vehicle and personnel movements related to site maintenance. The scale and degree of disturbance will vary according to site- and species-specific factors and must be assessed on a site-by-site basis (Drewitt & Langston 2006).

- Unfortunately, few studies of displacement due to disturbance are conclusive, often because of the lack of before- and-after and control-impact (BACI) assessments. Indications are that Great Bustard *Otis tarda* could be displaced by wind farms up to one kilometre from the facility (Langgemach 2008). An Austrian study found displacement for Great Bustards up to 600m (Wurm & Kollar as quoted by Raab *et al.* 2009). However, there is also evidence to the contrary; information on Great Bustard received from Spain points to the possibility of continued use of leks at operational wind farms (Camiña 2012b). The same situation seems to prevail at wind farms in the Eastern Cape where Denham's Bustard are still using wind farm sites as leks.[5] Research on small grassland species in North America indicates that permanent displacement is uncommon and very species specific (e.g. see Stevens et.al 2013, Hale et.al 2014). There also seems to be little evidence for a persistent decline in passerine populations at wind farm sites in the UK (despite some evidence of turbine avoidance), with some species, including Skylark, showing increased populations after wind farm construction (see Pierce-Higgins et. al 2012). Populations of Thekla Lark *Galerida theklae* were found to be unaffected by wind farm developments in Southern Spain (see Farfan *et al*. 2009).

- The consequences of displacement for breeding productivity and survival are crucial to whether or not there is likely to be a significant impact on population size. However, studies of the impact of wind farms on breeding birds are also largely inconclusive or suggest lower disturbance distances, though this apparent lack of effect may be due to the high site fidelity and long life-span of the breeding species studied. This might mean that the true impacts of disturbance on breeding birds will only be evident in the longer term, when new recruits replace existing breeding birds. Few studies have considered the possibility of displacement for short-lived passerines (such as larks), although Leddy *et al.* (1999) found increased densities of breeding grassland passerines with increased distance from wind turbines, and higher densities in the reference area than within 80m of the turbines. A review of minimum avoidance distances of 11 breeding passerines were found to be generally <100m from a wind turbine ranging from 14 – 93m (Hötker *et al.* 2006). A comparative study of nine wind farms in Scotland (Pearce-Higgens *et al.* 2009) found unequivocal evidence of displacement: Seven of the 12 species studied exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with equivocal evidence of turbine avoidance in a further two. No species were more likely to occur close to the turbines. Levels of turbine avoidance suggest breeding bird densities may be reduced within a 500m buffer of the turbines by 15– 53%, with Common Buzzard *Buteo buteo*, Hen Harrier *Circus cyaneus*, Golden Plover *Pluvialis apricaria*, Snipe *Gallinago gallinago*, Curlew *Numenius arquata* and Wheatear *Oenanthe oenanthe* most affected. In a follow-up study, monitoring data from wind farms located on unenclosed upland habitats in the United Kingdom were collated to test whether breeding densities of upland birds were reduced as a result of wind farm construction or during wind farm operation. Red Grouse *Lagopus lagopus scoticus*, Snipe *Gallinago gallinago* and Curlew *Numenius arquata* breeding densities all declined on wind farms during construction. Red Grouse breeding densities recovered after construction, but Snipe and Curlew densities did not. Post-construction Curlew breeding densities on wind farms were also significantly lower than reference sites. Conversely, breeding densities of Skylark *Alauda arvensis* and Stonechat *Saxicola torquata* increased on wind farms during construction. Overall, there was little evidence for consistent post-construction population declines in any species, suggesting that wind farm construction can have greater impacts upon birds than wind farm operation (Pierce-Higgens *et al.* 2012).
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[5] Personal communication by Wessel Rossouw, bird monitor based in Jeffreys Bay, from on personal observations in the Kouga municipal area.

It is inevitable that a measure of displacement will take place for all priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species in the remaining high-quality grassland, wetlands and wetland fringes the most, as this could temporarily disrupt their reproductive cycle. Some species might be able to recolonise the area after the completion of the construction phase, but for some species, this might only be partially the case, resulting in lower densities than before once the WEF is operational, due to the disturbance factor of the operational turbines, and the habitat fragmentation. In summary, the following species could be impacted by disturbance during the construction phase: Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Grey Crowned Crane, Spotted Eagle-Owl, Grey-winged Francolin, Northern Black Korhaan, Blue Korhaan, Marsh Owl and African Grass Owl.

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7.3 Displacement due to habitat loss

- The scale of permanent habitat loss resulting from the construction of a wind farm and associated infrastructure depends on the size of the project but, in general, it is likely to be small per turbine base. Typically, actual habitat loss amounts to 2–5% of the total development site (Fox *et al.* 2006 as cited by Drewitt & Langston 2006), though effects could be more widespread where developments interfere with hydrological patterns or flows on wetland or peatland sites (unpublished data). Some changes could also be beneficial. For example, habitat changes following the development of the Altamont Pass wind farm in California led to increased mammal prey availability for some species of raptor (for example through greater availability of burrows for Pocket Gophers *Thomomys bottae* around turbine bases), though this may also have increased collision risk (Thelander *et al.* 2003 as cited by Drewitt & Langston 2006).

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

The construction of additional roads is likely to result in further habitat fragmentation, although the site already has a large number of access roads, most of which will be upgraded and utilised for the wind farm development. This, together with the disturbance factor of the operating turbines, could have an effect on the density of several species, particularly larger terrestrial species which would utlise the remaining high quality grassland, wetlands and wetland fringes as breeding habitat. Given the conceptual turbine layout and associated road infra-structure, it is not expected that any priority species will be permanently displaced from the development site, but densities may be reduced. In summary, the following species are likely to be affected by habitat transformation: Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Northern Black Korhaan, Blue Korhaan, Marsh Owl, African Grass Owl, Black-winged Lapwing and Secretarybird.

7.4 Electrocution on the medium voltage network

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- 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 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 electricity could potentially pose an electrocution risk to several priority species that could on occasion perch on these poles. In summary, the following priority species are potentially vulnerable to electrocution in this manner: Grey Crowned Crane, Marsh Owl, African Grass Owl, Spotted Eagle-Owl, Common Buzzard, Peregrine Falcon, Black Harrier, Jackal Buzzard, Brown Snake Eagle, Black-chested Snake Eagle, Long-crested Eagle, Martial Eagle, Lanner Falcon, Montagu's Harrier, African Marsh Harrier, African Harrier-Hawk, Cape Vulture, African Fish Eagle, Southern Bald Ibis, Black-winged Kite, Western Osprey and Black Sparrowhawk.
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7.5 Collisions with the medium voltage network

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 national incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa (see Figure 5 below).

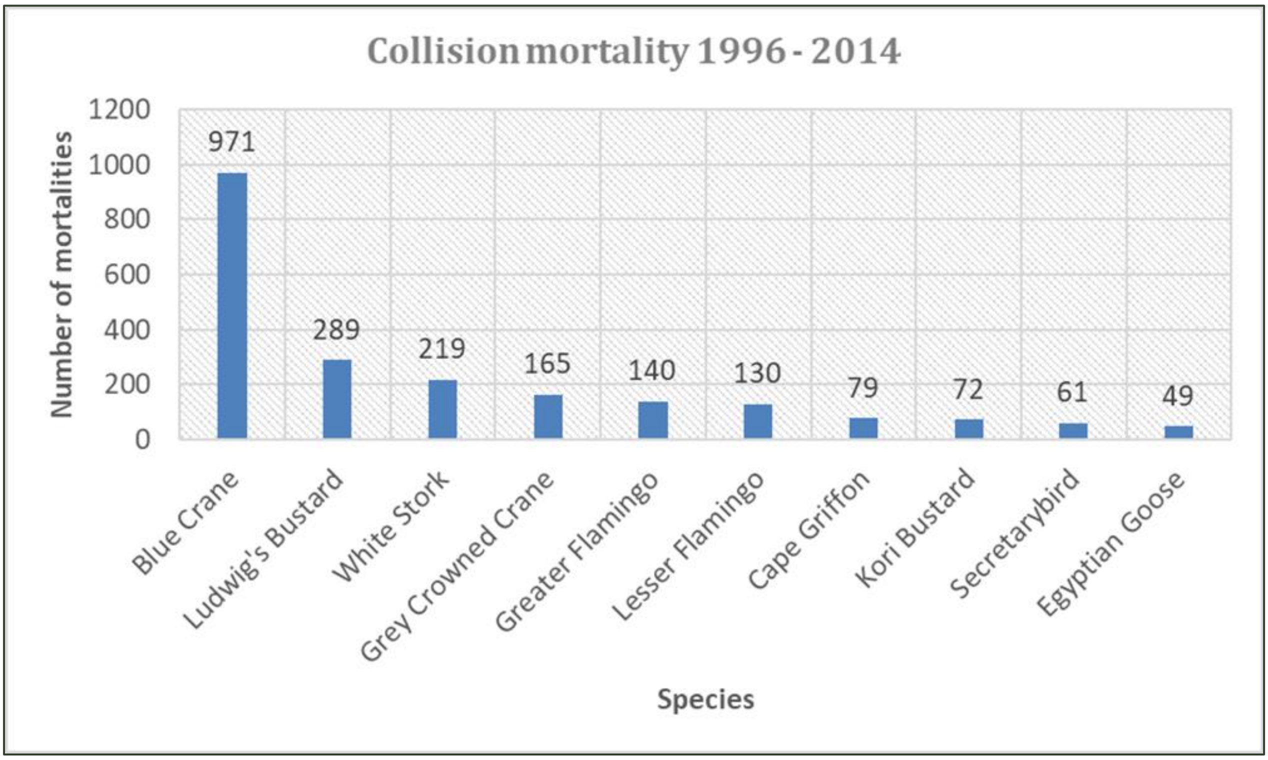

Figure 6: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

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 wind farm, there are areas where the lines will run above ground. Priority species which most at risk of collisions with the medium voltage powerlines are the following: Grey Crowned Crane, Marsh Owl, African Grass Owl, Spotted Eagle-Owl, Cape Vulture, Southern Bald Ibis, Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Northern Black Korhaan, Blue Korhaan, Secretarybird, Greater Flamingo, Lesser Flamingo and White Stork.

8. IMPACT RATING

Table 4 below is a summarised scoping level assessment of the anticipated impacts.

Table 4: Summarised scoping level assessment of the anticipated impacts

Impact	Nature of Impact	Extent of Impact	Significance (pre-mitigation)	No-Go Areas	Mitigation measures
During construction: Displacement due to disturbance associated with the construction of the wind turbines and associated infrastructure.	It is inevitable that a measure of displacement will take place for all priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species in the remaining high-quality grassland, wetlands and wetland fringes the most, as this could temporarily disrupt their reproductive cycle. Some species might be able to recolonise the area after the completion of the construction phase, but for some species, this might only be partially the case, resulting in lower densities than before once the WEF is operational, due to the disturbance factor of the operational turbines, and the habitat fragmentation. In summary, the following species could be impacted by disturbance during the construction phase: Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Grey Crowned Crane, Spotted Eagle-Owl, Grey-winged Francolin, Northern Black Korhaan, Blue Korhaan, Marsh Owl and African Grass Owl.	Local	High	• 100m buffer around wetlands – all infrastructure • 1km buffer around pans – turbines only	• 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. • Measures to control noise and dust should be applied according to current best practice in the industry. • 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.
During operation: Displacement of priority species due to habitat transformation as a result of the operation of the wind turbines and associated infrastructure.	The network of roads is likely to result in significant habitat fragmentation. This, together with the disturbance factor of the operating turbines, could have an effect on the density of several species, particularly larger terrestrial species which is breeding in the remaining high-quality grassland, wetlands, and wetland fringes. Given the conceptual turbine layout and associated road infra-structure, it is not expected that any priority species will be	Local	Medium	• 100m buffer around wetlands – all infrastructure • 1km buffer around pans – turbines only	• Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. • Development in the remaining high sensitivity grassland must be limited as far as possible. Where possible, infrastructure must be located near margins,

	permanently displaced from the development site, but densities may be reduced. In summary, the following species are likely to be affected by habitat transformation: Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Grey Crowned Crane, Grey-winged Francolin, Northern Black Korhaan, Blue Korhaan, Marsh Owl, African Grass Owl, Black-winged Lapwing and Secretarybird.				with shortest routes taken from the existing roads.
During operation: Mortality of priority species due to collisions with wind turbines.	The proposed WEF will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species and occasional long-distance fliers i.e., bustards, cranes, flamingos, storks, Southern Bald Ibis and Secretarybird, although bustards and cranes generally seem to be not as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species, i.e., species such as Cape Vulture and a variety of raptors, including several species of eagles, are highly vulnerable to the risk of collisions. In summary, the following priority species could be at risk of collisions with the turbines: Common Buzzard, Jackal Buzzard, Blue Crane, Brown Snake Eagle, Black-chested Snake Eagle, Long-crested Eagle, Martial Eagle, Peregrine Falcon, Lanner Falcon, Greater Flamingo, Lesser Flamingo, Montagu's Harrier, African Marsh Harrier, Black Harrier, African Harrier-Hawk, Cape Vulture, Secretarybird, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Wattled Crane, Grey Crowned Crane, African Fish Eagle, Spotted Eagle-Owl, Amur Falcon, Grey-winged Francolin, Southern Bald Ibis, Black-winged Kite, Northern Black Korhaan, Blue Korhaan, Black-winged Lapwing, Western Osprey, Marsh Owl, African Grass Owl, Black Sparrowhawk and White Stork.	Regional	High	• 100m buffer around wetlands – all infrastructure • 1km buffer around pans – turbines only	It is recommended that suitable pro-active mitigation be implemented at all turbines, which could include shut down on demand or other proven mitigation measures. This is recommended for the following reasons: • The site is wedged between three IBAs. 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 at risk of collisions they leave to forage or breed beyond the borders of the IBA at the project site. • Cape Vultures have been recorded at the site. The species could occur sporadically, and they are highly vulnerable to turbine collisions. • The habitat at the site is used by a variety of Red List priority species. This includes not only natural grassland, but also agriculture e.g.,

					Southern Bald Ibis forage extensively in agricultural fields.
During operation: Mortality of priority species due to electrocution on the medium voltage internal reticulation network	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 electricity could potentially pose an electrocution risk to several priority species that could on occasion perch on these poles. In summary, the following priority species are potentially vulnerable to electrocution in this manner: Grey Crowned Crane, Marsh Owl, African Grass Owl, Spotted Eagle-Owl, Common Buzzard, Peregrine Falcon, Black Harrier, Jackal Buzzard, Brown Snake Eagle, Black-chested Snake Eagle, Long-crested Eagle, Martial Eagle, Lanner Falcon, Montagu's Harrier, African Marsh Harrier, African Harrier-Hawk, Cape Vulture, African Fish Eagle, Southern Bald Ibis, Black-winged Kite, Western Osprey and Black Sparrowhawk.	Regional	High	• 100m buffer around wetlands – all infrastructure	A raptor-friendly pole design must be used, and the pole design must be approved by the avifaunal specialist.
During operation: Mortality of priority species due to collisions with the medium voltage internal reticulation network	While the intention is to place the majority of the medium voltage reticulation network underground at the wind farm, there are areas where the lines will run above ground. Priority species which most at risk of collisions with the medium voltage powerlines are the following: Grey Crowned Crane, Marsh Owl, African Grass Owl, Spotted Eagle-Owl, Cape Vulture, Southern Bald Ibis, Blue Crane, Black-bellied Bustard, White-bellied Bustard, Denham's Bustard, Northern Black Korhaan, Blue Korhaan, Secretarybird, Greater Flamingo, Lesser Flamingo and White Stork.	Regional	High	• 100m buffer around wetlands – all infrastructure	All internal medium voltage lines must be marked with Eskom approved Bird Flight Diverters according to the Eskom standard.

9. ENVIRONMENTAL SENSITIVITIES

The following specific environmental sensitivities were identified from an avifaunal perspective:

- **100m all infrastructure exclusion zone around drainage lines and associated wetlands.** 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).
- **1km turbine exclusion zone around large pans**. The most significant landscape features from a collision risk perspective are the large pans. Pans attract many birds, including Red List species such as Greater Flamingo (SA status Near-threatened), Lesser Flamingo (SA status near-threatened), Martial Eagle (SA Status Endangered), Cape Vulture (SA Status Endangered) and Secretarybird (SA status Vulnerable).
- **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).

See Figure 6 for the avifaunal sensitivities identified from a wind energy perspective.

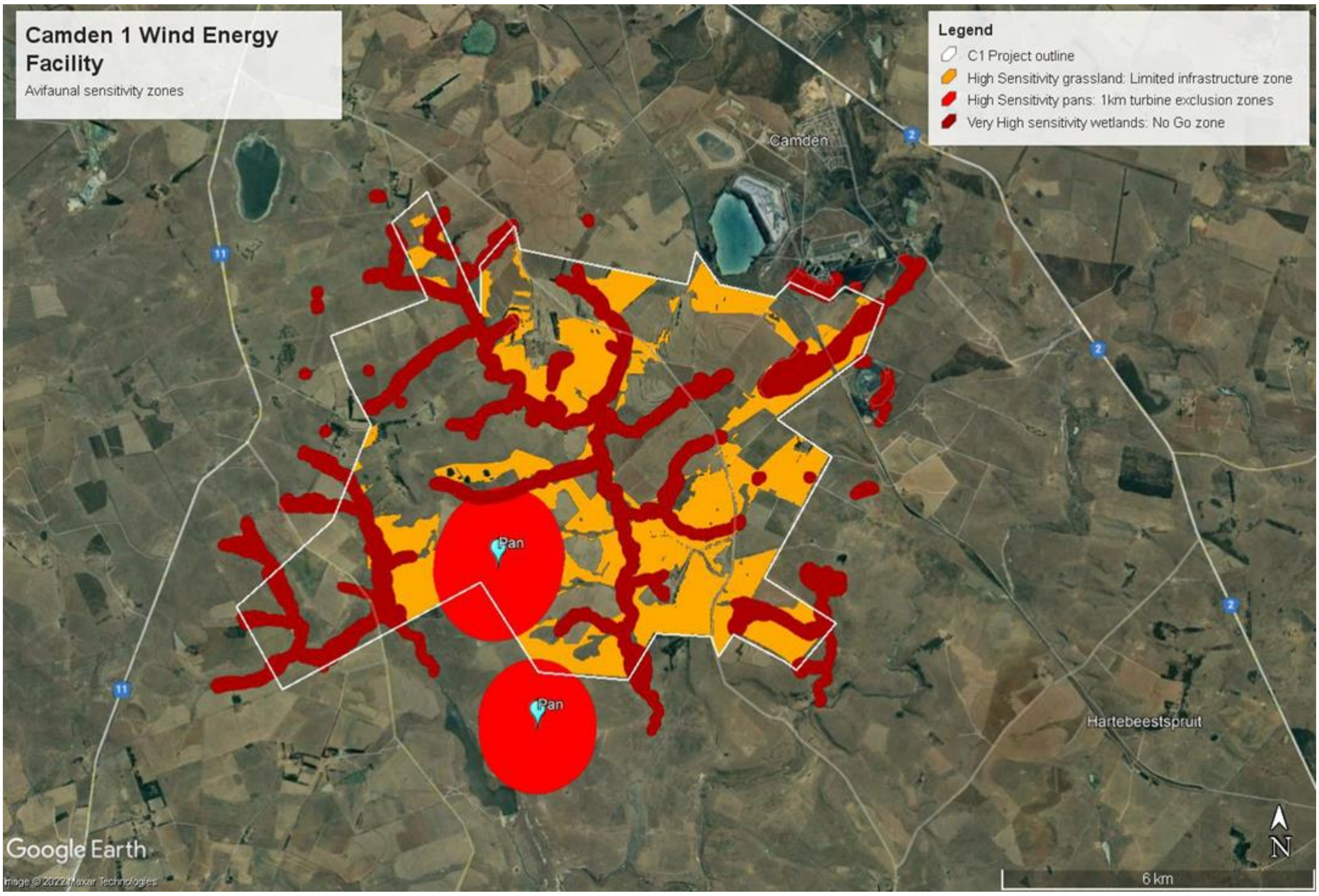

Figure 7: Avifaunal sensitivities

10. EIA PHASE

10.1 Plan of study

The following are proposed for the EIA Phase:

- The implementation of four avifaunal surveys, utilising transects, vantage point watches, focal points and incidental counts, to inform the assessment of the potential impacts of the planned infrastructure within the development footprint (see Appendix 3)[6]. The monitoring protocol is guided by the following:
  - Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020)
  - Protocol for the specialist assessment and minimum report content requirements for environmental impacts om avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).
  - Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa. Hereafter referred to as the wind guidelines.
- The avifaunal specialists report will be structured around the following terms of reference:
  - Description of the affected environment from an avifaunal perspective.
  - Discussion of gaps in baseline data and other limitations.
  - Description of the methodology that was used for the field surveys.
  - Comparison of the site sensitivity recorded in the field with the sensitivity classification in the DFFE National Screening Tool and adjustment if necessary.
  - Provision of an overview of all applicable legislation.
  - Provision of an overview of assessment methodology.
  - Identification and assessment of the potential impacts of the proposed development on avifauna including cumulative impacts.
  - Provision of sufficient mitigation measures to include in the Environmental Management Programme (EMPr).
  - Conclusion with an impact statement whether the facility is fatally flawed or may be authorised.

10.2 Environmental Management Programme

For each anticipated impact, management recommendations for the design, construction, and operational phase (where appropriate) will be drafted for inclusion in the project EMPRs.

11. PRELIMINARY CONCLUSIONS

According to the DFFE national screening tool, the habitat within the project site is classified as **Low** sensitivity for birds from a wind energy perspective. This classification is not accurate as far as the impact of the proposed Camden 1 Wind Energy Facility is concerned, based on actual conditions recorded on the ground during the 12-months of pre-construction monitoring. The classification should

[6] This has been completed.

be **High** based on the recorded presence of Red List priority species in the development area, namely Secretarybird (Globally Endangered, Locally Vulnerable) White-bellied Bustard (Locally Vulnerable), Blue Crane (Globally Vulnerable, Locally Near-threatened), Grey Crowned Crane (Globally and Locally Endangered), Martial Eagle (Globally and Locally Endangered), Lanner Falcon (Locally Vulnerable), Greater Flamingo (Locally Near-threatened), Lesser Flamingo (Globally and Locally Near-threatened), Black Harrier (Locally and Globally Endangered), Southern Bald Ibis (Locally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), African Grass Owl (Locally Vulnerable) and Cape Vulture (Globally and Locally Endangered).

The proposed Camden 1 Wind Energy Facility will have an anticipated medium to high pre-mitigation negative impact on priority avifauna, which is expected to be reduced to medium and low with appropriate mitigation.

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APPENDIX 1: SABAP 2 SPECIES LIST FOR THE BROADER AREA

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Bokmakierie	*Telophorus zeylonus*	64.85	4.41
Hamerkop	*Scopus umbretta*	11.52	0.00
Mallard	*Anas platyrhynchos*	0.61	0.44
Neddicky	*Cisticola fulvicapilla*	7.88	0.00
Quailfinch	*Ortygospiza atricollis*	47.88	1.76
Ruff	*Calidris pugnax*	1.82	0.44
Secretarybird	*Sagittarius serpentarius*	13.33	0.00
Bar-throated Apalis	*Apalis thoracica*	5.45	0.00
Pied Avocet	*Recurvirostra avosetta*	4.85	0.00
Black-collared Barbet	*Lybius torquatus*	28.48	0.88
Crested Barbet	*Trachyphonus vaillantii*	3.03	0.00
Cape Batis	*Batis capensis*	0.61	0.00
European Bee-eater	*Merops apiaster*	0.61	0.00
Southern Red Bishop	*Euplectes orix*	84.24	12.33
Yellow-crowned Bishop	*Euplectes afer*	34.55	3.96
Southern Boubou	*Laniarius ferrugineus*	15.15	0.88
Dark-capped Bulbul	*Pycnonotus tricolor*	50.30	3.96
Cape Bunting	*Emberiza capensis*	13.94	0.44
Cinnamon-breasted Bunting	*Emberiza tahapisi*	1.82	0.00
Golden-breasted Bunting	*Emberiza flaviventris*	5.45	0.44
Black-bellied Bustard	*Lissotis melanogaster*	0.61	0.00
Denham's Bustard	*Neotis denhami*	1.82	0.00
White-bellied Bustard	*Eupodotis senegalensis*	7.88	0.00
Common Buttonquail	*Turnix sylvaticus*	0.61	0.00
Common Buzzard	*Buteo buteo*	27.88	9.25
Jackal Buzzard	*Buteo rufofuscus*	19.39	2.20
Black-throated Canary	*Crithagra atrogularis*	67.88	2.20
Cape Canary	*Serinus canicollis*	75.15	7.05
Yellow Canary	*Crithagra flaviventris*	15.76	0.44
Yellow-fronted Canary	*Crithagra mozambica*	9.09	0.88
Ant-eating Chat	*Myrmecocichla formicivora*	89.70	12.33
Buff-streaked Chat	*Campicoloides bifasciatus*	5.45	0.44
Familiar Chat	*Oenanthe familiaris*	0.61	0.00
Cloud Cisticola	*Cisticola textrix*	7.88	0.88
Lazy Cisticola	*Cisticola aberrans*	4.85	0.00
Levaillant's Cisticola	*Cisticola tinniens*	73.94	5.73
Pale-crowned Cisticola	*Cisticola cinnamomeus*	21.21	0.00
Wailing Cisticola	*Cisticola lais*	9.09	0.00
Wing-snapping Cisticola	*Cisticola ayresii*	45.45	6.17
Zitting Cisticola	*Cisticola juncidis*	41.21	2.64
Red-knobbed Coot	*Fulica cristata*	58.18	4.85

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Reed Cormorant	*Microcarbo africanus*	63.64	4.85
White-breasted Cormorant	*Phalacrocorax lucidus*	11.52	0.88
Temminck's Courser	*Cursorius temminckii*	1.82	0.00
Black Crake	*Zapornia flavirostra*	9.09	0.00
Blue Crane	*Grus paradisea*	11.52	0.44
Grey Crowned Crane	*Balearica regulorum*	5.45	0.00
Wattled Crane	*Grus carunculata*	0.61	0.00
Cape Crow	*Corvus capensis*	17.58	0.44
Pied Crow	*Corvus albus*	11.52	3.52
Diederik Cuckoo	*Chrysococcyx caprius*	24.24	0.88
Red-chested Cuckoo	*Cuculus solitarius*	4.85	0.44
African Darter	*Anhinga rufa*	16.36	2.20
Cape Turtle Dove	*Streptopelia capicola*	92.12	23.79
Laughing Dove	*Spilopelia senegalensis*	45.45	7.49
Namaqua Dove	*Oena capensis*	1.82	0.00
Red-eyed Dove	*Streptopelia semitorquata*	64.24	12.33
Rock Dove	*Columba livia*	6.06	4.41
Fork-tailed Drongo	*Dicrurus adsimilis*	10.30	0.44
African Black Duck	*Anas sparsa*	10.91	0.00
Domestic Duck	*Anas platyrhynchos domestica*	0.61	0.00
Fulvous Whistling Duck	*Dendrocygna bicolor*	0.00	0.44
White-backed Duck	*Thalassornis leuconotus*	6.67	0.00
White-faced Whistling Duck	*Dendrocygna viduata*	0.61	0.00
Yellow-billed Duck	*Anas undulata*	61.82	4.41
African Fish Eagle	*Haliaeetus vocifer*	12.12	0.88
Black-chested Snake Eagle	*Circaetus pectoralis*	3.03	0.44
Brown Snake Eagle	*Circaetus cinereus*	1.82	0.00
Long-crested Eagle	*Lophaetus occipitalis*	6.67	9.25
Martial Eagle	*Polemaetus bellicosus*	2.42	0.00
Spotted Eagle-Owl	*Bubo africanus*	9.09	0.88
Great Egret	*Ardea alba*	7.88	1.32
Intermediate Egret	*Ardea intermedia*	13.94	1.76
Little Egret	*Egretta garzetta*	4.24	1.32
Western Cattle Egret	*Bubulcus ibis*	44.85	12.33
Amur Falcon	*Falco amurensis*	29.09	6.61
Lanner Falcon	*Falco biarmicus*	7.27	0.00
Peregrine Falcon	*Falco peregrinus*	1.21	0.00
Cuckoo Finch	*Anomalospiza imberbis*	1.21	0.00
Red-headed Finch	*Amadina erythrocephala*	1.82	0.00
Southern Fiscal	*Lanius collaris*	92.12	15.42
Greater Flamingo	*Phoenicopterus roseus*	3.64	4.41
Lesser Flamingo	*Phoeniconaias minor*	3.64	1.32
Red-chested Flufftail	*Sarothrura rufa*	0.61	0.00
African Paradise Flycatcher	*Terpsiphone viridis*	4.85	0.00
Fiscal Flycatcher	*Melaenornis silens*	16.97	0.88
Spotted Flycatcher	*Muscicapa striata*	4.24	0.44

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Grey-winged Francolin	*Scleroptila afra*	27.27	2.20
Red-winged Francolin	*Scleroptila levaillantii*	24.85	1.32
Egyptian Goose	*Alopochen aegyptiaca*	78.18	6.17
Spur-winged Goose	*Plectropterus gambensis*	44.24	1.76
Cape Grassbird	*Sphenoeacus afer*	24.85	0.88
Black-necked Grebe	*Podiceps nigricollis*	0.61	0.44
Little Grebe	*Tachybaptus ruficollis*	38.79	3.08
Common Greenshank	*Tringa nebularia*	5.45	0.00
Helmeted Guineafowl	*Numida meleagris*	49.09	3.08
Grey-headed Gull	*Chroicocephalus cirrocephalus*	3.64	0.44
African Marsh Harrier	*Circus ranivorus*	0.61	0.00
Black Harrier	*Circus maurus*	0.00	0.88
Montagu's Harrier	*Circus pygargus*	1.21	0.00
African Harrier-Hawk	*Polyboroides typus*	11.52	1.76
Black Heron	*Egretta ardesiaca*	0.61	0.00
Black-crowned Night Heron	*Nycticorax nycticorax*	0.61	0.00
Black-headed Heron	*Ardea melanocephala*	52.12	3.96
Goliath Heron	*Ardea goliath*	2.42	0.00
Grey Heron	*Ardea cinerea*	24.85	3.52
Purple Heron	*Ardea purpurea*	4.24	0.00
Squacco Heron	*Ardeola ralloides*	1.21	0.00
Lesser Honeyguide	*Indicator minor*	0.61	0.00
African Hoopoe	*Upupa africana*	12.73	0.88
African Sacred Ibis	*Threskiornis aethiopicus*	47.88	6.17
Glossy Ibis	*Plegadis falcinellus*	4.24	1.76
Hadada Ibis	*Bostrychia hagedash*	89.70	13.66
Southern Bald Ibis	*Geronticus calvus*	23.03	3.08
African Jacana	*Actophilornis africanus*	1.82	1.32
Rock Kestrel	*Falco rupicolus*	5.45	0.88
Giant Kingfisher	*Megaceryle maxima*	4.85	0.00
Malachite Kingfisher	*Corythornis cristatus*	7.27	0.00
Pied Kingfisher	*Ceryle rudis*	12.73	0.44
Black-winged Kite	*Elanus caeruleus*	60.61	12.78
Yellow-billed Kite	*Milvus aegyptius*	2.42	0.00
Blue Korhaan	*Eupodotis caerulescens*	6.06	0.00
Northern Black Korhaan	*Afrotis afraoides*	0.61	0.00
African Wattled Lapwing	*Vanellus senegallus*	23.03	0.44
Black-winged Lapwing	*Vanellus melanopterus*	14.55	0.00
Blacksmith Lapwing	*Vanellus armatus*	67.88	7.05
Crowned Lapwing	*Vanellus coronatus*	61.21	3.08
Eastern Clapper Lark	*Mirafra fasciolata*	6.67	0.00
Eastern Long-billed Lark	*Certhilauda semitorquata*	4.85	0.00
Red-capped Lark	*Calandrella cinerea*	56.36	2.20
Rufous-naped Lark	*Mirafra africana*	1.21	0.88
Spike-heeled Lark	*Chersomanes albofasciata*	48.48	1.32

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Cape Longclaw	*Macronyx capensis*	86.67	10.13
Banded Martin	*Riparia cincta*	42.42	3.08
Brown-throated Martin	*Riparia paludicola*	46.67	3.96
Common House Martin	*Delichon urbicum*	6.06	0.00
Rock Martin	*Ptyonoprogne fuligula*	13.94	1.76
Sand Martin	*Riparia riparia*	1.21	0.44
Common Moorhen	*Gallinula chloropus*	32.73	1.76
Lesser Moorhen	*Paragallinula angulata*	0.61	0.44
Red-faced Mousebird	*Urocolius indicus*	4.24	0.44
Speckled Mousebird	*Colius striatus*	25.45	0.88
Common Myna	*Acridotheres tristis*	21.21	10.13
Black-headed Oriole	*Oriolus larvatus*	13.94	1.76
Western Osprey	*Pandion haliaetus*	0.61	0.00
Common Ostrich	*Struthio camelus*	21.82	1.32
African Grass Owl	*Tyto capensis*	2.42	0.00
Marsh Owl	*Asio capensis*	5.45	0.44
Western Barn Owl	*Tyto alba*	3.03	0.44
Speckled Pigeon	*Columba guinea*	67.27	13.22
African Pipit	*Anthus cinnamomeus*	74.55	8.37
Nicholson's Pipit	*Anthus nicholsoni*	1.82	0.44
Plain-backed Pipit	*Anthus leucophrys*	1.21	0.00
Kittlitz's Plover	*Charadrius pecuarius*	7.27	0.44
Three-banded Plover	*Charadrius tricollaris*	35.15	0.88
Southern Pochard	*Netta erythrophthalma*	9.09	0.00
Black-chested Prinia	*Prinia flavicans*	16.36	0.00
Drakensberg Prinia	*Prinia hypoxantha*	18.79	0.00
Tawny-flanked Prinia	*Prinia subflava*	0.61	0.44
Common Quail	*Coturnix coturnix*	29.09	0.44
Red-billed Quelea	*Quelea quelea*	38.79	1.76
African Rail	*Rallus caerulescens*	5.45	0.00
Cape Robin-Chat	*Cossypha caffra*	60.00	3.52
Chorister Robin-Chat Robin-Chat	*Cossypha dichroa*	1.21	0.00
Common Sandpiper	*Actitis hypoleucos*	1.21	0.00
Wood Sandpiper	*Tringa glareola*	6.06	0.00
Streaky-headed Seedeater	*Crithagra gularis*	9.09	0.44
South African Shelduck	*Tadorna cana*	30.30	3.52
Cape Shoveler	*Spatula smithii*	18.79	0.00
Lesser Grey Shrike	*Lanius minor*	0.61	0.00
Red-backed Shrike	*Lanius collurio*	0.61	0.00
African Snipe	*Gallinago nigripennis*	20.00	0.88
Cape Sparrow	*Passer melanurus*	81.82	6.61
House Sparrow	*Passer domesticus*	20.00	9.25
Southern Grey-headed Sparrow	*Passer diffusus*	57.58	4.41
Black Sparrowhawk	*Accipiter melanoleucus*	12.12	0.88

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
African Spoonbill	*Platalea alba*	16.36	2.20
Swainson's Spurfowl	*Pternistis swainsonii*	61.21	2.64
Cape Starling	*Lamprotornis nitens*	6.06	0.00
Pied Starling	*Lamprotornis bicolor*	55.15	11.45
Red-winged Starling	*Onychognathus morio*	8.48	3.08
Wattled Starling	*Creatophora cinerea*	0.61	0.00
Black-winged Stilt	*Himantopus himantopus*	9.09	0.00
Little Stint	*Calidris minuta*	1.82	0.00
African Stonechat	*Saxicola torquatus*	87.88	10.57
White Stork	*Ciconia ciconia*	7.27	1.32
Amethyst Sunbird	*Chalcomitra amethystina*	11.52	0.44
Malachite Sunbird	*Nectarinia famosa*	11.52	0.44
Barn Swallow	*Hirundo rustica*	41.82	7.93
Greater Striped Swallow	*Cecropis cucullata*	55.76	7.93
Lesser Striped Swallow	*Cecropis abyssinica*	0.61	1.32
South African Cliff Swallow	*Petrochelidon spilodera*	38.18	3.52
White-throated Swallow	*Hirundo albigularis*	37.58	1.76
African Swamphen	*Porphyrio madagascariensis*	6.06	2.20
African Black Swift	*Apus barbatus*	3.03	0.44
African Palm Swift	*Cypsiurus parvus*	1.21	1.32
Horus Swift	*Apus horus*	1.21	0.00
Little Swift	*Apus affinis*	16.36	4.85
White-rumped Swift	*Apus caffer*	30.30	3.96
Blue-billed Teal	*Spatula hottentota*	1.21	0.00
Cape Teal	*Anas capensis*	3.03	0.00
Red-billed Teal	*Anas erythrorhyncha*	16.97	1.32
Whiskered Tern	*Chlidonias hybrida*	12.12	5.29
White-winged Tern	*Chlidonias leucopterus*	3.64	0.88
Spotted Thick-knee	*Burhinus capensis*	9.09	0.00
Groundscraper Thrush	*Turdus litsitsirupa*	0.61	0.00
Karoo Thrush	*Turdus smithi*	5.45	0.00
Kurrichane Thrush	*Turdus libonyana*	8.48	0.44
Olive Thrush	*Turdus olivaceus*	6.06	0.44
Sentinel Rock Thrush	*Monticola explorator*	2.42	0.00
Cape Wagtail	*Motacilla capensis*	78.18	3.52
African Reed Warbler	*Acrocephalus baeticatus*	3.03	0.44
African Yellow Warbler	*Iduna natalensis*	3.03	0.00
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	12.73	0.44
Little Rush Warbler	*Bradypterus baboecala*	6.67	0.88
Sedge Warbler	*Acrocephalus schoenobaenus*	0.61	0.00
Willow Warbler	*Phylloscopus trochilus*	4.24	0.00
Common Waxbill	*Estrilda astrild*	52.73	3.52
Orange-breasted Waxbill	*Amandava subflava*	9.70	0.00
Cape Weaver	*Ploceus capensis*	33.94	2.20

Species name	Scientific name	Full protocol reporting rate	Ad hoc protocol reporting rate
Southern Masked Weaver	*Ploceus velatus*	90.91	9.69
Village Weaver	*Ploceus cucullatus*	4.24	0.00
Capped Wheatear	*Oenanthe pileata*	10.30	0.00
Mountain Wheatear	*Myrmecocichla monticola*	4.85	0.88
Cape White-eye	*Zosterops virens*	35.15	1.32
Pin-tailed Whydah	*Vidua macroura*	44.85	2.64
Fan-tailed Widowbird	*Euplectes axillaris*	39.39	3.08
Long-tailed Widowbird	*Euplectes progne*	84.85	15.42
Red-collared Widowbird	*Euplectes ardens*	12.12	1.32
Green Wood Hoopoe	*Phoeniculus purpureus*	7.88	0.44
Cardinal Woodpecker	*Dendropicos fuscescens*	9.09	1.32
Olive Woodpecker	*Dendropicos griseocephalus*	3.03	0.00
Red-throated Wryneck	*Jynx ruficollis*	29.70	2.20
Cape Vulture	*Gyps coprotheres*	0.00	0.00

APPENDIX 2: HABITAT FEATURES AT THE PROJECT SITE

Figure 1: High sensitivity natural grassland

Figure 2: A large pan

Figure 3: An example of an earth dam

Figure 4: Agriculture


Figure 5: Drainage line and associated wetland


Figure 6: A borehole with a water reservoir at the project site

APPENDIX 3: PRE-CONSTRUCTION MONITORING

Monitoring was conducted in the following manner:

- One drive transect was identified totalling 10.2km on the development site and one drive transect in the control site with a total length of 10.5km.
- One monitor travelling slowly (± 10km/h) in a vehicle recorded all birds on both sides of the transect. The observer stopped at regular intervals (every 500m) to scan the environment with binoculars. Drive transects were counted three times per sampling session.
- In addition, 4 walk transects of 1km each were identified at the development site, and two at the control site, and counted 4 times per sampling season. All birds were recorded during walk transects.
- The following variables were recorded:
  - Species
  - Number of birds
  - Date
  - Start time and end time
  - Estimated distance from transect
  - Wind direction
  - Wind strength (estimated Beaufort scale)
  - Weather (sunny; cloudy; partly cloudy; rain; mist)
  - Temperature (cold; mild; warm; hot)
  - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground) and
  - Co-ordinates (priority species only)

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

- Four vantage points (VPs) were identified from which the majority of the buildable area can be observed, to record the flight altitude and patterns of priority species. One VP was also identified on the control site. The following variables were recorded for each flight:
  - Species
  - Number of birds
  - Date
  - Start time and end time
  - Wind direction
  - Wind strength (estimated Beaufort scale 1-7)
  - Weather (sunny; cloudy; partly cloudy; rain; mist)
  - Temperature (cold; mild; warm; hot)
  - Flight altitude (high i.e. >220m; medium i.e. 30m – 220m; low i.e. <30m)
  - Flight mode (soar; flap; glide; kite; hover) and
  - Flight time (in 15 second-intervals).

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

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

- FP1: A farm dam in a drainage line in the application site
- FP2: A large salt pan in the application site
- FP3: A large pan situated approximately 3.6km north-west of the application site on the farm Rietspruit 437 IS.

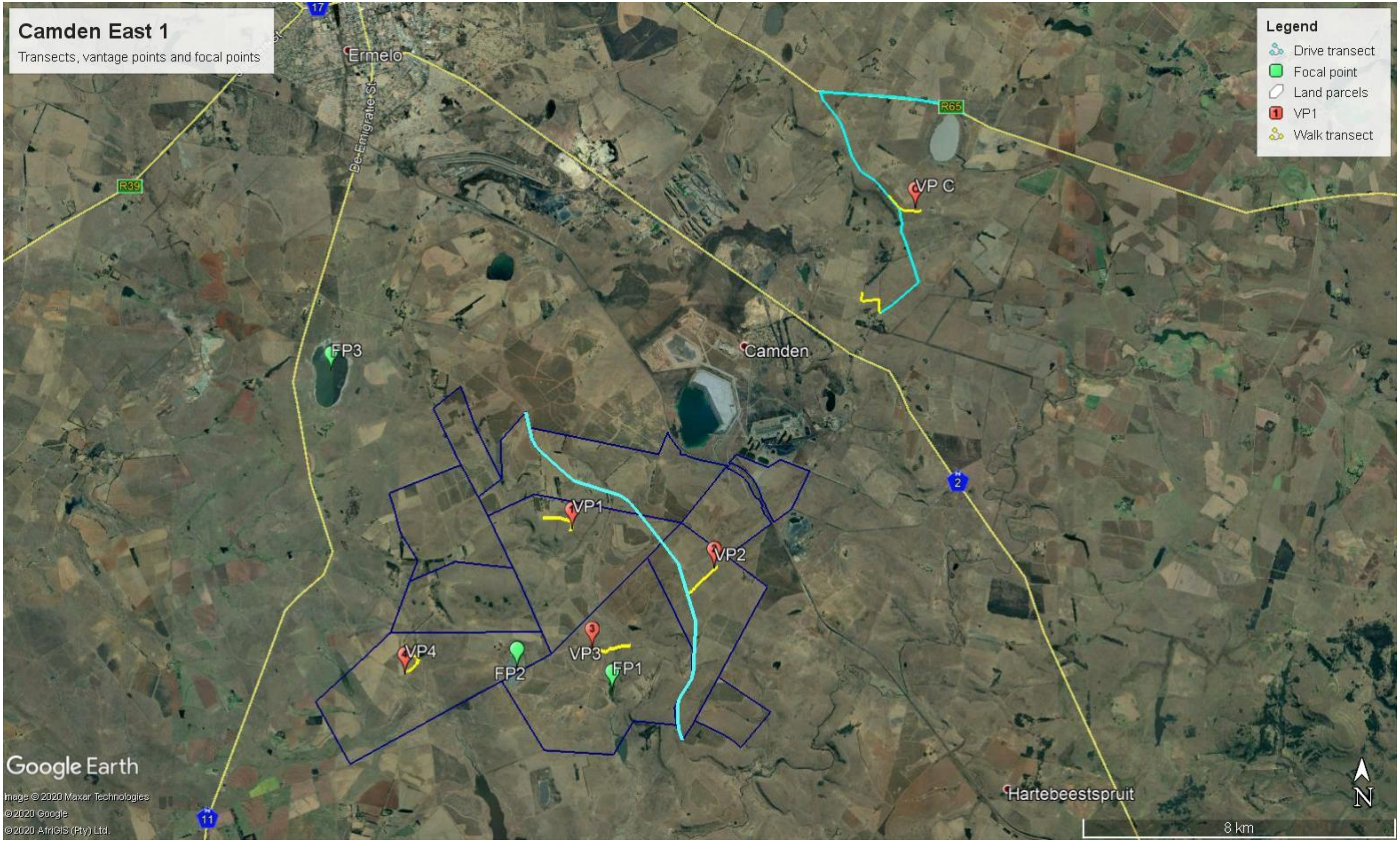

Figure 1: Area where monitoring is taking place, with position of VPs, focal points, drive transects, walk transects and land parcels (dark blue polygon). The area to the north-east of the land parcels is the control area.