Appendix G2 – Avifaunal Impact Assessment

AVIFAUNAL IMPACT ASSESSMENT

Visserspan Grid Connection for the authorised Visserspan Photovoltaic Solar Energy Facilities located near Dealesville in the Free State Province

September 2021

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

EXECUTIVE SUMMARY

Mulilo Energy Holdings (Pty) Ltd in partnership with Keren Energy is proposing the construction and operation of grid connection infrastructure for four Photovoltaic (PV) Solar Energy Facilities (SEF) authorised for development. The PV SEFs will be connected to the National Eskom grid via a dedicated grid connection solution, to be known as Visserspan Grid Connection. The proposed Visserspan Grid Connection is located approximately 10km northwest of Dealesville in the Tokologo Local Municipality (Lejweleputswa District) of the Free State Province of South Africa, on the farms Visserspan No. 40, Mooihoek No. 1547, Vasteveld No. 1548 and Kinderdam No. 1685.

The proposed grid connection is comprised of the following:

- The combined Visserspan switching station and high voltage (HV) substation to be constructed on Visserspan Farm No. 40;
- The Kinderdam Main Transmission Substation (MTS) to be constructed on Kinderdam No. 1685;
- A 132kV steel monopole (30m in height) or 275kV or 400kV pylons (40m in height) overhead power line;
- Associated equipment, infrastructure and buildings;
- Access via existing farm and fence maintenance roads; and
- Temporary and permanent laydown areas.

The proposed Visserspan switching station/HV substation will serve as a single collection point for electricity evacuated from the Visserspan Solar PV facilities (No's. 1 to 4). From this single substation facility, electricity will be fed via a power line towards the east and turning north-east to traverse the northern boundary of Mooihoek Farm No. 1547 and Vasteveld Farm No. 1548 before turning north-east again and running along the southern boundary of Kinderdam Farm No. 1685 connecting to the Kinderdam MTS. The estimated total length of the grid connection power line is approximately 6km. Grid tie-in will be to the existing Theseus-Perseus 400kV or Everest-Perseus 275kV transmission power lines which feed to Eskom's existing Perseus substation.

The proposed Visserspan switching station, Kinderdam MTS and grid connection power line is the subject of this impact assessment report.

1.1 Project alternatives

The following three alternative alignments (Figure 1) have been identified for the proposed grid connection power line:

- Preferred Route: approximately in 6km length, extending from the proposed Visserspan Switching Station to the proposed Kinderdam MTS;
- Preferred Route (landowner consultation): a similar route alignment to the aforementioned Preferred Route and was delineated based on landowner consultation. This route is approximately 6.4km in length and extends from the proposed Visserspan Switching Station to the proposed Kinderdam MTS; and
- Alternate Route: approximately 2.5km in length, extending southwards from the proposed Visserspan Switching Station to the existing Eskom Perseus MTS.

Clearance of vegetation will only occur for substation and pylon/monopole footprints and not the entire servitude corridor. The assessment of the grid connection infrastructure considers a corridor width of up to 55m. Due to the proximity to Eskom's Perseus substation and the number of existing HV lines feeding in to it, a single potential alternative route for grid connection was identified (i.e. Alternate Route). This alternate route alignment lies directly to the south of Visserspan Farm No. 40 and will require negotiation with the Independent Power Producer (IPP), who is developing a PV SEF project between the Visserspan property and the existing Perseus MTS.

Avifauna

The SABAP2 data indicates that a total of 178 bird species could potentially occur within the study area and immediate surroundings – Appendix 1 provides a comprehensive list of all the species. Of these, 44 species are classified as priority species (see definition of priority species in section 4) and nine of these are South African Red List species. Of the priority species, 32 are likely to occur regularly at the study area and immediate surrounding area, and another 12 could occur sporadically.

The site visit produced a combined list of 39 species, covering both the study area and to a limited extent, the surrounding area. Secretarybird, was the only Red List species observed within the study area. All other observations were of small passerine and game bird species that are common to this area. Each of the aforementioned species has the potential to be displaced by the proposed Visserspan switching station, Kinderdam MTS and power line grid connection as a result of habitat transformation and disturbance. However, these species have persisted despite existing disturbance (i.e., pastoral and residential activities and vehicle disturbance within the study area). This resilience, coupled with the fact that similar habitat is available throughout the broader area, means that the displacement impact will not be of regional or national significance. In addition, no raptor nests or other possible Red List breeding sites were noted during the site survey.

POTENTIAL IMPACTS

The following impacts have been identified in the Avifauna Specialist Assessment.

Construction Phase

- Displacement due to disturbance associated with the construction of the Visserspan switching station, Kinderdam MTS and Visserspan grid connection power line.
- Displacement due to habitat transformation associated with the construction of the Visserspan switching station, Kinderdam MTS and Visserspan grid connection power line.

Operational Phase

- Displacement due to habitat transformation associated with the operation of the Visserspan switching station, Kinderdam MTS and Visserspan grid connection power line.
- Collisions with the Visserspan grid connection power line.
- Electrocutions within the Visserspan switching station and Kinderdam MTS.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the Visserspan switching station, Kinderdam MTS and Visserspan grid connection power line.

Cumulative Impacts

- Displacement due to disturbance associated with the construction and decommissioning of the Visserspan switching station, Kinderdam MTS and grid connection power line.
- Displacement due to habitat transformation associated with the Visserspan switching station and Kinderdam MTS.
- Collisions with the overhead power line.
- Electrocutions within the Visserspan switching station and Kinderdam MTS

ENVIRONMENTAL SENSITIVITIES

The following environmental sensitivities were identified from an avifaunal perspective for the proposed Visserspan grid connection power line.

- **High sensitivity – Mark with Bird Flight Diverters:**

  Intact grassland vegetation and pans are likely to attract large terrestrial and waterbird species that are susceptible to collisions.

MANAGEMENT ACTIONS

The following management actions have been proposed in this assessment:

Construction phase

- Conduct a pre-construction inspection to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed.
- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.

Operational phase

- Vegetation clearance should be limited to what is absolutely necessary.
- The mitigation measures proposed by the vegetation specialist must be strictly enforced.
- The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of power line that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.
- The hardware within the proposed switching station and MTS yards is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List priority species are unlikely to frequent the switching station and MTS infrastructure.

De-commissioning phase

- Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.
- The existing transmission lines must be inspected for active raptor nests prior to the commencement of the decommissioning activities. Should any active nests be present, decommissioning activities during the breeding season should be avoided if possible.

STATEMENT AND REASONED OPINION

The table below indicates the overall impact significance for each phase before and after mitigation, as well as cumulative impacts.

Environmental parameter	Issues	Rating prior to mitigation	Rating post mitigation
Avifauna	*Displacement of priority species due to disturbance associated with construction of the Visserspan switching station, Kinderdam MTS and grid connection power line*	40 medium	20 low
	Displacement of priority species due to habitat transformation associated with construction of the Visserspan switching station, Kinderdam MTS and grid connection power line	52 medium	18 low
	Mortality of priority species due to collisions with the Visserspan grid connection power line	52 medium	33 low
	Electrocution of priority species within the Visserspan switching station and Kinderdam MTS	36 low	11 low
	Displacement of priority species due to disturbance associated with the Visserspan switching station, Kinderdam MTS and grid connection power line	40 medium	20 low
	Average	**44 medium**	**20 low**

Cumulative impacts

The proposed Visserspan grid connection equates to a maximum of 6.4km, depending on which of the alternatives are used. There are approximately 440kms of existing high voltage lines within the 30km radius around the Visserspan project (counting parallel lines as one). The Visserspan grid connection grid project will thus increase the total number of existing high voltage lines by approximately 1.4%. The contribution of the proposed Visserspan grid connection to the cumulative impact of all the high voltage lines is thus low. However, the combined cumulative impact of the existing and proposed power lines on avifauna within a 30km radius is considered to be moderate.

The cumulative impact of displacement due to disturbance and habitat transformation in the switching station and MTS associated with the Visserspan PV project is considered to be low, due to the small size of the footprint, and the availability of similar habitat within the 30km radius area. The cumulative impact of potential electrocutions within the switching station and MTS yards is also likely to be low as it is expected to be a rare event.

No-Go alternative

The no-go alternative will result in the current status quo being maintained at the proposed development site as far as the avifauna is concerned. The development site itself consist mostly of natural grassland and pans. The no-go option would maintain the natural habitat which would be beneficial to the avifauna currently occurring there.

Comparison of alternatives

From an avifaunal perspective, Alternative 3 is preferred power line alternative because it is the shortest alternative. However, neither Alternative 1 nor Alternative 2 are fatally flawed and can be utilised with appropriate mitigation.

Concluding statement

The expected impacts of the Visserspan switching station, Kinderdam MTS and grid connection power line were rated to be of Medium significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of the identified impacts should be reduced to Low negative (see Table 3 above). No fatal flaws were discovered in the course of the investigation. It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 9 of the report) and the EMPr (Appendix 3) are strictly implemented.

CONTENTS

DETAILS OF THE SPECIALIST AND EXPERTISE TO COMPILE A SPECIALIST REPORT

Chris van Rooyen (Avifaunal Specialist)

Chris has 24 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 (Avifaunal 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.

Megan Diamond (Field Monitor)

Megan completed a Bachelor of Science degree in Environmental Management from the University of South Africa and has been involved in the environmental sector for 20 years. She has 14 years' worth of experience in the field of bird interactions with electrical infrastructure and during this time has completed impact assessments for over 140 projects. Megan currently owns and manages *Feathers Environmental Services* and is tasked with providing guidance to industry through the development of best practice procedures and avifaunal specialist studies for various developments. Megan has attended and presented at several conferences and facilitated workshops, as a subject expert, since 2007. Megan has authored and co-authored several academic papers, research reports and energy industry related guidelines. She chaired the Birds and Wind Energy Specialist Group in South Africa (2011/2012) and the IUCN/SSC Crane Specialist Group's Crane and Powerline Network (2013-2015). She is currently a member of the IUCN Stork, Ibis and Spoonbill Specialist Group and the Eskom-EWT Strategic Partnership Ludwig's Bustard Working Group.

SPECIALIST DECLARATION

I, Chris van Rooyen as duly authorised representative of Chris van Rooyen Consulting, and working under the supervision of and in association with Albert Froneman (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003, hereby confirm my independence (as well as that of Chris van Rooyen Consulting) as a specialist and declare that neither I nor Chris van Rooyen Consulting have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Savannah Environmental was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Basic Assessment for the proposed Visserspan Grid Connection project.

Full Name: Chris van Rooyen

Position: Director

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6)

Section in EIA Regulations 2014 (as amended)		Clause	Section in Report
Appendix 6	(1)	A specialist report prepared in terms of these Regulations must contain —	
	(a)	details of –	
		(i) the specialist who prepared the report; and	Pg.8
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae.	Pg.8
	(b)	A declaration that the person is independent in a form as may be specified by the competent authority;	Pg.8
	(c)	An indication of the scope of, and the purpose for which, the report was prepared;	Section 2
	(cA)	An indication of the quality and age of base data used for the specialist report;	Section 3
	(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8
	(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 7
	(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process; inclusive of equipment and modelling used;	Section 3
	(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Sections 6 - 9
	(g)	An indication of any areas to be avoided, including buffers;	Not applicable
	(h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Not applicable
	(i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
	(j)	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Sections 9 and 10
	(k)	Any mitigation measures for inclusion in the EMPr;	Section 9
	(l)	Any conditions for inclusion in the environmental authorization;	Section 9 Appendix 3
	(m)	Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Not applicable
	(n)	A reasoned opinion –	
		(i) as to whether the proposed activity, activities or portions thereof should be authorized;	Sections 9 -10

		(iA) regarding the acceptability of the proposed activity or activities; and	Sections 9 -10
		(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 10
	(o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 3
	(p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	No comments received
	(q)	Any other information requested by the authority.	Not applicable
	(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not applicable

1. INTRODUCTION

Mulilo Energy Holdings (Pty) Ltd in partnership with Keren Energy is proposing the construction and operation of grid connection infrastructure for four Photovoltaic (PV) Solar Energy Facilities (SEF) authorised for development. The PV SEFs will be connected to the National Eskom grid via a dedicated grid connection solution, to be known as Visserspan Grid Connection. The proposed Visserspan Grid Connection is located approximately 10km northwest of Dealesville in the Tokologo Local Municipality (Lejweleputswa District) of the Free State Province of South Africa, on the farms Visserspan No. 40, Mooihoek No. 1547, Vasteveld No. 1548 and Kinderdam No. 1685 (Figure 1).

The proposed grid connection is comprised of the following:

- The combined Visserspan switching station and high voltage (HV) substation to be constructed on Visserspan Farm No. 40;
- The Kinderdam Main Transmission Substation (MTS) to be constructed on Kinderdam No. 1685;
- A 132kV steel monopole (30m in height) or 275kV or 400kV pylons (40m in height) overhead power line;
- Associated equipment, infrastructure and buildings;
- Access via existing farm and fence maintenance roads; and
- Temporary and permanent laydown areas.

The proposed Visserspan switching station/HV substation will serve as a single collection point for electricity evacuated from the Visserspan Solar PV facilities (No's. 1 to 4). From this single substation facility, electricity will be fed via an power line towards the east and turning north-east to traverse the northern boundary of Mooihoek Farm No. 1547 and Vasteveld Farm No. 1548 before turning north-east again and running along the southern boundary of Kinderdam Farm No. 1685 connecting to the Kinderdam MTS. The estimated total length of the grid connection power line is approximately 6km. Grid tie-in will be to the existing Theseus-Perseus 400kV or Everest-Perseus 275kV transmission power lines which feed to Eskom's existing Perseus substation.

The proposed Visserspan switching station, Kinderdam MTS and grid connection power line is the subject of this impact assessment report.

1.2 Project alternatives

The following three alternative alignments (Figure 1) have been identified for the proposed grid connection power line:

- Preferred Route: approximately in 6km length, extending from the proposed Visserspan Switching Station to the proposed Kinderdam MTS;
- Preferred Route (landowner consultation): a similar route alignment to the aforementioned Preferred Route and was delineated based on landowner consultation. This route is approximately 6.4km in length and extends from the proposed Visserspan Switching Station to the proposed Kinderdam MTS; and
- Alternate Route: approximately 2.5km in length, extending southwards from the proposed Visserspan Switching Station to the existing Eskom Perseus MTS.

Clearance of vegetation will only occur for substation and pylon/monopole footprints and not the entire servitude corridor. The assessment of the grid connection infrastructure considers a corridor width of up to 55m. Due to the proximity to Eskom's Perseus substation and the number of existing HV lines feeding in to it, a single potential alternative route for grid connection was identified (i.e. Alternate Route). This alternate route alignment lies directly to the south of Visserspan Farm No. 40 and will require negotiation with the Independent Power Producer (IPP), who is developing a PV SEF project between the Visserspan property and the existing Perseus MTS.

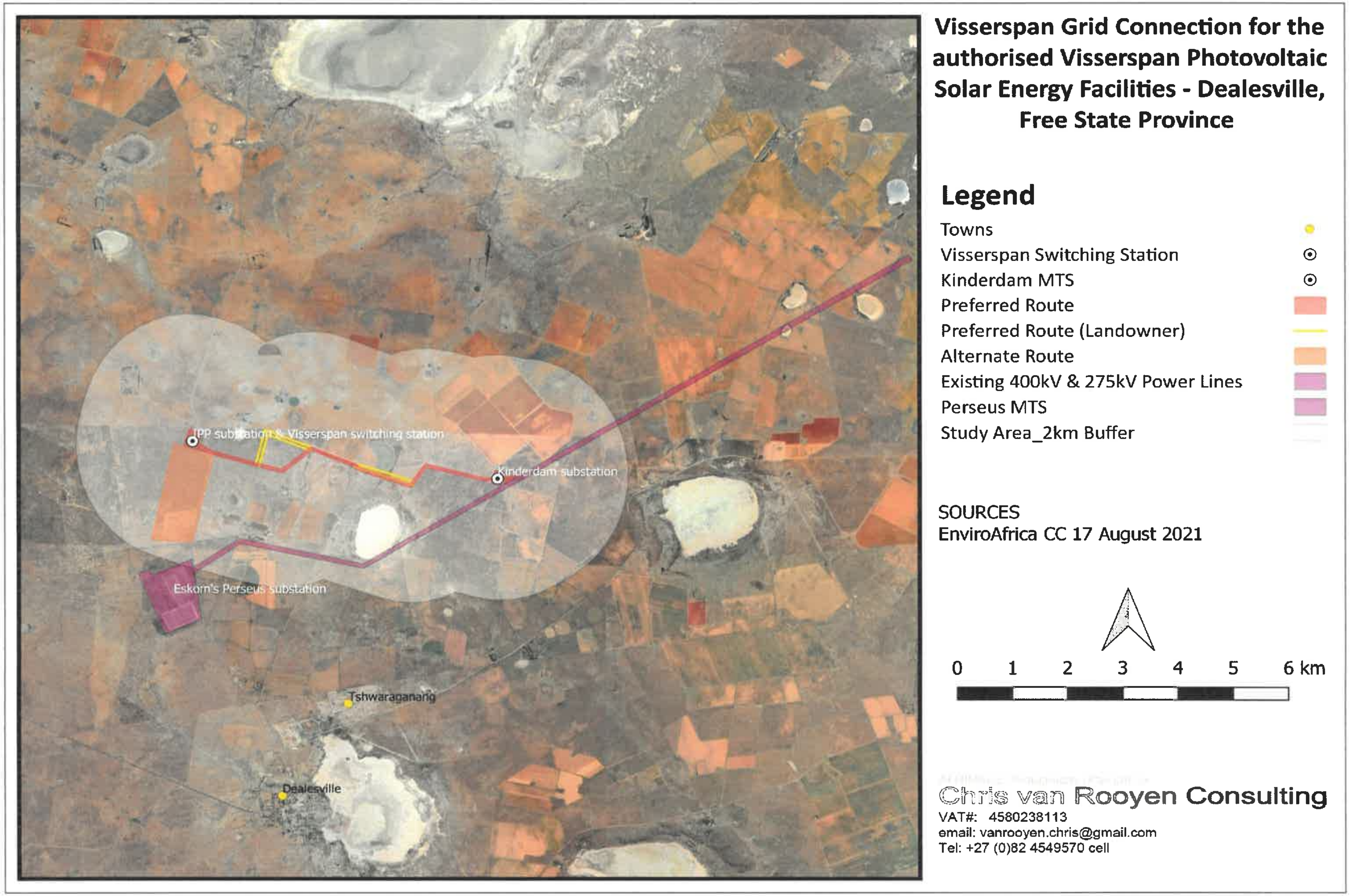

Figure 1: Locality map of the study area indicating the location of the Visserspan switching station, Kinderdam MTS and the three power line route options for the grid connection.

2 PROJECT SCOPE

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

- Conduct a site sensitivity verification through the use of a desk top analysis and an on-site inspection;
- Describe the affected environment from an avifaunal perspective;
- Discuss gaps in baseline data and other limitations;
- List and describe the expected impacts associated with the proposed switching station, MTS and power line grid connection;
- Perform an assessment of the potential impacts; and
- Recommend mitigation measures to reduce the significance 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 six pentads some of which intersect and others that are near the study area. The decision to include multiple pentads around the study area was influenced by the fact that the pentads within which the proposed development is located have few completed full protocol surveys. The additional pentads and their data augment the bird distribution data. The six pentad grid cells are the following: 2830_2540, 2830_2545, 2835_2540, 2835_2545, 2840_2540, and 2840_2545 (see Figure 22). A total of 24 full protocol lists (i.e. bird listing surveys lasting a minimum of two hours each) and 20 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed to date for the six pentads where the study area is located. The SABAP2 data is 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 survey and general knowledge of the area.
- A classification of the vegetation types in the study area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the latest (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).
- 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 study area relative to National Protected Areas in the Free State.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the study area (September, 2021).
- A one-day site visit was conducted on 23 August 2021. Data was collected by means of incidental counts.

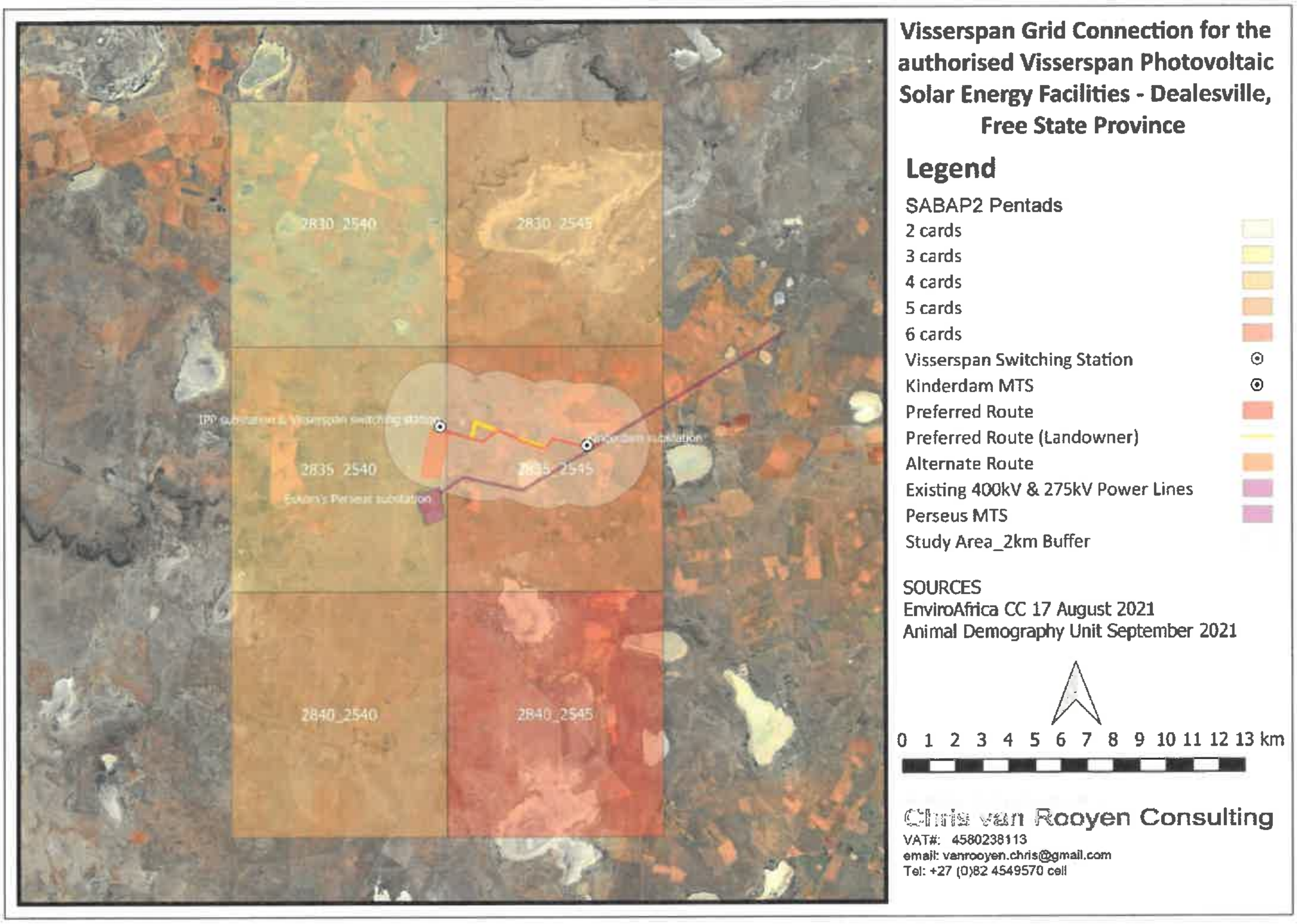

Figure 2: Location of the six South African Bird Atlas Project 2 (SABAP2) pentad grid cells that were considered for the proposed Visserspan grid connection.

4 ASSUMPTIONS AND LIMITATIONS

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

- The focus of the study was primarily on the potential impacts of the proposed switching station, MTS and power line grid connection on priority species. Priority species were defined as species which could potentially be impacted by power line collisions or electrocutions, based on specific morphological and/or behavioural characteristics. Priority species were further subdivided into raptors, waterbirds and terrestrial birds.
- The assessment of impacts is based on the baseline environment as it currently exists in the study area.
- Cumulative impacts include all solar PV projects with grid connections within a 30km radius that currently have open applications or have been approved by the Competent Authority as per the 2021 Q1 database from the DFFE.
- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The study area was defined as a 2km zone around the proposed switching station, MTS and power line grid connection.

5 LEGISLATIVE CONTEXT

5.1 Agreements and conventions

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

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

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

[1] (BirdLife International (2021) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa. Checked: 2021-08-27).

5.2 National legislation

5.2.1 Constitution of the Republic of South Africa, 1996

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

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

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

  (i) prevent pollution and ecological degradation;

  (ii) promote conservation; and

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

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

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

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species was published on 30 October 2020. This protocol applies also for the assessment of impacts caused by power lines on avifauna.

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

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

5.3 Provincial Legislation

The current legislation applicable to the conservation of fauna and flora in the Free State Province is the Nature Conservation Ordinance 8 of 1969. There are no specific regulations pertaining to the conservation of avifauna, except to classify all birds as wild animals with the exception of a list of species in Schedule 1, which is exempted from a general hunting ban.

6 BASELINE ASSESSMENT

6.1 Important Bird Areas

There are no Important Bird Areas (IBA) within the confines of the study area. The closest IBA (Soetdoring Nature Reserve) is located a 30km south-east of the authorised Visserspan SEF and the proposed Visserspan grid connection (Figure 3). It is therefore highly unlikely that the proposed Visserspan switching station, Kinderdam MTS and grid connection power line will have a negative impact on the IBAs within the broader area due to the distance from the project.

6.2 DFFE National Screening Tool

The DFFE National Screening Tool classifies parts of the study area as moderately sensitive from an animal species theme perspective, due to the potential presence of Ludwig's Bustard *Neotis ludwigii* and Secretarybird *Sagittarius serpentarius*. A site sensitivity verification was conducted through the use of both a desktop analysis and an on-site inspection, conducted on 23 August 2021 (Figure 4). The desktop analysis and on-site inspection confirmed and concur with the MEDIUM sensitivity rating assigned to the study area, based on the grassland habitat available to Ludwig's Bustard and Secretarybird and the confirmed presence of Secretarybird on the Kinderdam property.

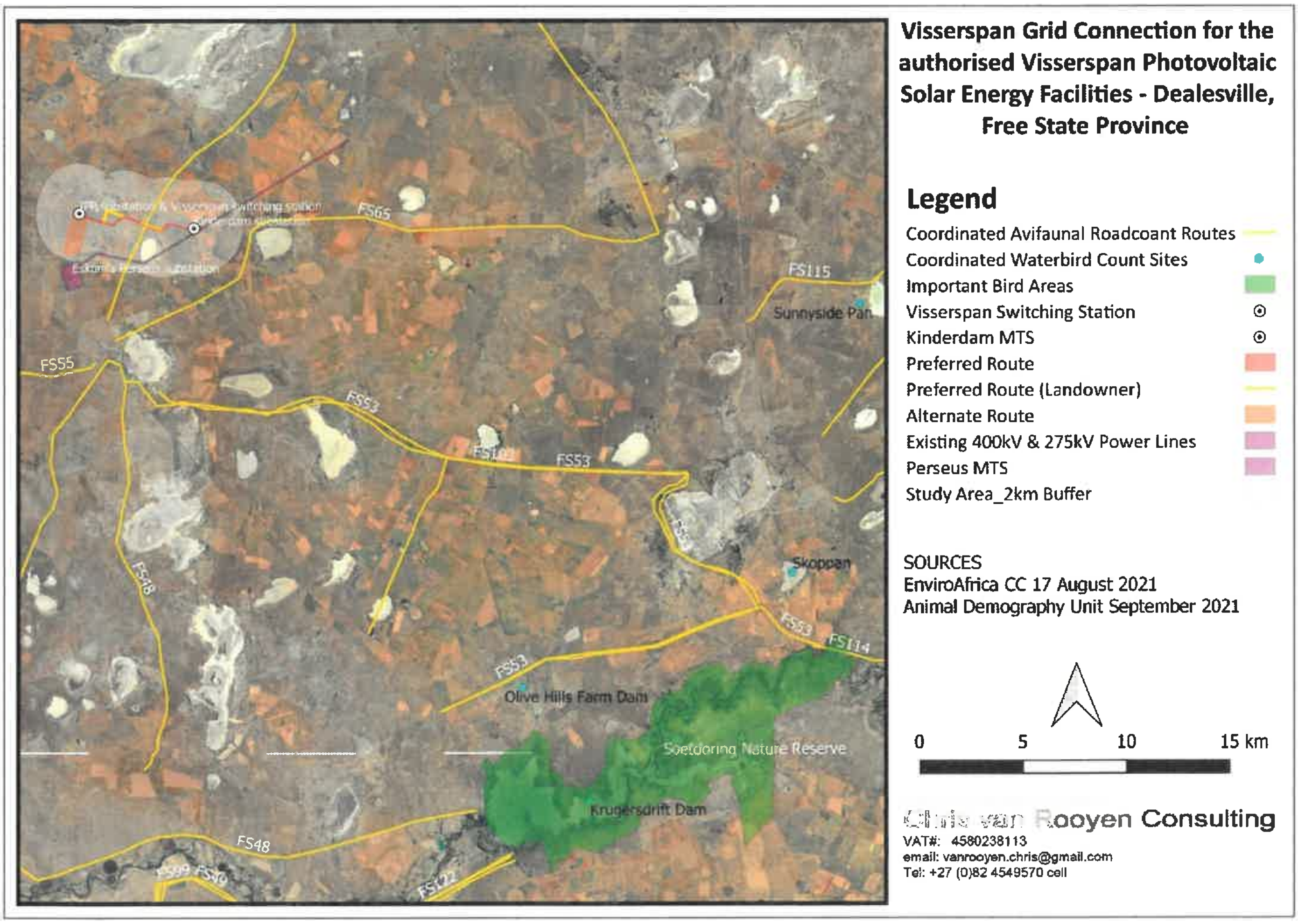

Figure 3: Regional map detailing the location of the proposed Visserspan grid connection in relation to Important Bird Areas (IBAs), Coordinated Avifaunal Roadcounts and Coordinated Waterbird Count Sites

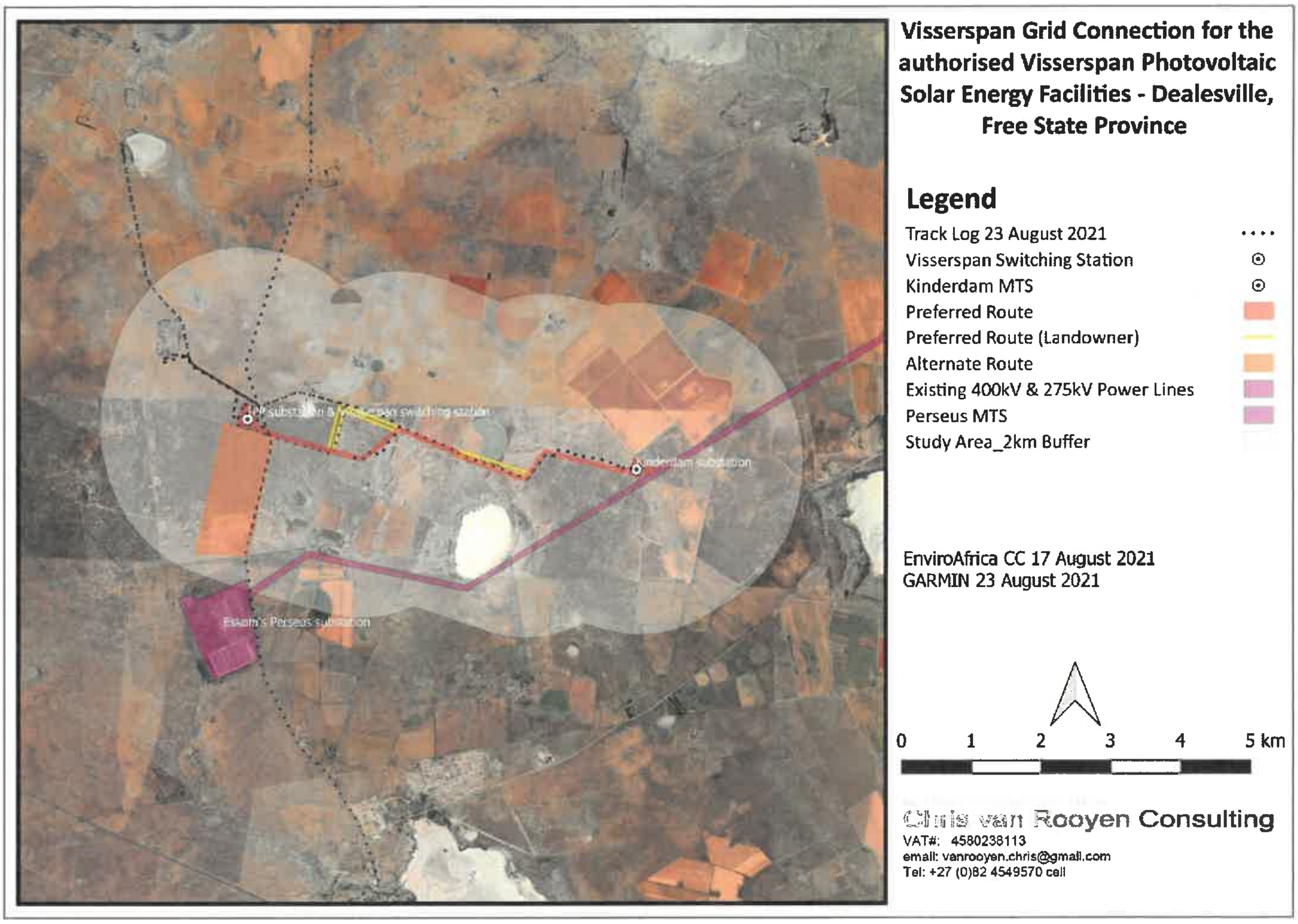

Figure 4. Routes surveyed during the field survey to the study area conducted on 23 August 2021

6.3 Biomes and vegetation types

The study area is situated approximately 10km northwest of Dealesville, in the Free State Province, and is located in the grassland biome, specifically the Dry Highveld Grassland Bioregion (Mucina & Rutherford 2006). Only one vegetation type occurs in the study area, namely Vaal-Vet Sandy Grassland (Mucina & Rutherford 2006). Vaal-Vet Sandy Grassland occurs in North-West and Free State Provinces from its northern distribution, in an area south of Lichtenburg and Ventersdorp, stretching to Klerksdorp, Leeudoringstad, Bothaville and Brandfort in the south. It is situated in the summer rainfall region with a mean annual precipitation of ± 530 m, where summers are mild to hot and winters very cold with frequent frost. The landscape is dominated by plains with some scattered, slightly irregular undulating plains and hills. Low-tussock grasslands with strong karroid elements and the relative dominance of the grass species *Themeda triandra* are important features of Vaal-Vet Sandy Grassland. This vegetation type is described as endangered with approximately 63% having been transformed for commercial crop cultivation and grazing pressure from cattle and sheep. Only 0.3% of this vegetation type is statutorily conserved in Bloemhof Dam, Schoonspruit, Sandveld, Faan Meintjies, Wolwespruit and Soetdoring Nature Reserves (Mucina & Rutherford, 2006).

Whilst the distribution and abundance of the bird species in the study area and immediate surrounding environment are typical of the broad vegetation type, it is also necessary to examine bird habitats in more detail as it may influence the distribution and behaviour of priority species. These are discussed in more detail below. The priority species most likely associated with the various bird habitats are listed in Table 2.

6.4 Bird habitats

6.4.1 Grassland

The study area and immediate surrounding environment consists almost entirely of tall, dense, grassland. Of South Africa's 841 bird species, 350 occur in the Grassland Biome. This includes 29 species of conservation concern (i.e. those species declining in numbers), ten endemics, and as many as 40 specialist species that are exclusively dependent on grassland habitat. Despite pastoral and agricultural practices within both the study and broader areas, substantial tracts of intact grassland persist within the study area that provide suitable foraging and breeding habitat for Secretarybird, Ludwig's Bustard, Blue Korhaan *Eupodotis caerulescens*, Northern Black Korhaan *Afrotis afraoides*, Abdim's Stork *Ciconia abdimii,* Amur Falcon *Falco amurensis*, Lanner Falcon *Falco biarmicus*, Southern Pale Canting Goshawk *Melierax canorus*, Black-winged Pratincole *Glareola nordmanni*, Black-headed Heron *Ardea melanocephala*, Western Cattle Egret *Bubulcus ibis*, Yellow-billed Egret *Egretta intermedia*, Black-winged Kite *Elanus caeruleus*, Greater Kestrel *Falco rupicoloides* and Lesser Kestrel *Falco naumanni* recorded during the SABAP2 survey period.

6.4.2 Pans

Pans are endorheic wetlands having closed drainage systems; water usually flows in from small catchments but with no outflow from the pan basins themselves. They are typical of poorly drained, relatively flat and dry regions. Water loss is mainly through evaporation, sometimes resulting in saline conditions, especially in the most arid regions. Water depth is shallow (<3m) with flooding characteristically ephemeral (Harrison *et al.* 1997). When these pans hold water (which is only likely after exceptional rainfall events), they attract waterbirds, while large raptors could use them for bathing and drinking. When the pans are dry, they may be covered with grass, which is attractive to several large terrestrial species for foraging, roosting and breeding. Several pans occur within the study area, with two fairly noteworthy examples occurring within 500m of the proposed grid connection power line. Species recorded in the study area that may utilise the pans (when flooded) include Greater Flamingo *Phoenicopterus roseus*, Lesser *Flamingo Phoeniconaias minor*, Chestnut-banded Plover *Charadrius pallidus,* African Spoonbill *Platalea alba,* Grey Heron *Ardea cinerea,* Black-headed Heron, South African Shelduck *Tadorna cana*, Yellow-billed Duck *Anas undulata*, Egyptian Goose *Alopochen aegyptiacus*, African Sacred Ibis *Threskiornis aethiopicus*, Hadeda Ibis *Bostrychia hagedash,* Glossy Ibis *Plegadis falcinellus*, Spur-winged Goose *Plectropterus gambensis*, Western Cattle Egret, Little Egret *Egretta garzetta*, Yellow-billed Egret *Egretta intermedia*, White-faced Duck *Dendrocygna viduata*, White-breasted Cormorant *Phalacrocorax lucidus*, Reed Cormorant *Phalacrocorax africanus,* Red-knobbed Coot *Fulica cristata*, Red-billed Teal *Anas erythrorhyncha* and Little Grebe *Tachybaptus ruficollis.*

6.4.3 Cultivated Lands

Arable or cultivated land represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten by birds, or attract insects which are in turn eaten by birds. Relevant to this study, areas of commercial irrigated and dryland agriculture occur within the study area and are likely draw cards for several priority species e.g. Abdim's Stork, Blue Korhaan, Lanner Falcon, Lesser Kestrel, Northern Black Korhaan, African Sacred Ibis, Amur Falcon, Black-winged Pratincole, Black-winged Kite, Common Buzzard, Egyptian Goose, Spur-winged Goose, Helmeted Guineafowl , Hadeda Ibis, Cattle Egret and Black-headed Heron.

6.4.4 Exotic Tree Plantations

Although stands of *Eucalyptus* are strictly speaking invader species, they have become important refuges for certain species of raptors, particularly Amur Falcon, a Palearctic migrant, which will commonly roost in small stands of *Eucalyptus* in suburbs of small towns. Black Sparrowhawk *Accipiter melanoleucus* and Ovambo Sparrowhawk *Accipiter ovampensis* are another two species that use these trees for roosting and breeding purposes. Relevant to this project Amur Falcon, Lanner Falcon, Lesser Kestrel, Greater Kestrel and Black-chested Snake-Eagle *Circaetus pectoralis* may utilise this habitat type occasionally.

6.4.5 Fences

The study area contains a number of fences. Farm fences provide important perching substrate for a wide range of birds, as a staging post for territorial displays by small birds and also for perch hunting by some raptors.

See Appendix 2 for photographic record of the habitat in the study area.

7 AVIFAUNA IN THE STUDY AREA

7.1 South African Bird Atlas Project 2

The SABAP2 data indicates that a total of 178 bird species could potentially occur within the study area and immediate surroundings – Appendix 1 provides a comprehensive list of all the species. Of these, 44 species are classified as priority species (see definition of priority species in section 4) and nine of these are South African Red List species. Of the priority species, 32 are likely to occur regularly at the study area and immediate surrounding area, and another 12 could occur sporadically.

Table 2 below lists all the priority species and the possible impact on the respective species by the proposed Visserspan switching station, Kinderdam MTS and Visserspan power line grid connection. The following abbreviations and acronyms are used:

- NT = Near threatened
- End = South African Endemic
- N-End = South African near endemic
- H = High
- M = Medium
- L = Low

Table 2: Priority species potentially occurring at the site and immediate surroundings.

Species	Taxonomic name	Full protocol	Ad hoc protocol	Power line priority species	Red List status: International	Red List status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Terrestrial	Possibility of regular occurrence	Recorded during surveys	Grassland	Agriculture	Surface water (Pans)	Exotic Tree Plantations	Fences	Displacement – disturbance and habitat transformation	Electrocution (substations)	Collisions
Abdim's Stork	*Ciconia abdimii*	4.2	5.0	x	LC	NT				x	M		x	x						x
African Sacred Ibis	*Threskiornis aethiopicus*	16.7	5.0	x					x		H			x	x					x
African Spoonbill	*Platalea alba*	12.5	15.0	x					x		H				x					x
Amur Falcon	*Falco amurensis*	29.2	10.0	x				x			H		x	x		x	x		x	
Black-chested Snake-Eagle	*Circaetus pectoralis*	4.2	0.0	x				x			M					x			x	x
Black-headed Heron	*Ardea melanocephala*	25.0	15.0	x					x		H	x	x		x					x
Black-winged Kite	*Elanus caeruleus*	33.3	10.0	x				x			H	x	x				x	x	x	
Black-winged Pratincole	*Glareola nordmanni*	8.3	0.0	x	NT	NT				x	H		x	x	x			x		
Blue Korhaan	*Eupodotis caerulescens*	12.5	0.0	x	NT	LC	x			x	L		x	x				x		x
Cape Shoveler	*Anas smithii*	8.3	5.0	x			x		x		M				x					x
Cape Teal	*Anas capensis*	0.0	5.0	x					x		L				x					x
Chestnut-banded Plover	*Charadrius pallidus*	4.2	0.0	x	NT	NT			x		M				x					
Common Buzzard	*Buteo vulpinus*	16.7	5.0	x				x			H		x	x			x		x	
Common Moorhen	*Gallinula chloropus*	16.7	5.0	x					x		H				x					x
Egyptian Goose	*Alopochen aegyptiacus*	20.8	15.0	x					x		H	x		x	x					x
Glossy Ibis	*Plegadis falcinellus*	8.3	2.0	x					x		H		x		x					x
Great Egret	*Egretta alba*	4.2	0.0	x					x		H		x		x					x
Greater Flamingo	*Phoenicopterus ruber*	16.7	0.0	x	LC	NT			x		L				x					x
Greater Kestrel	*Falco rupicoloides*	4.2	5.0	x				x			H		x	x		x	x	x	x	
Grey Heron	*Ardea cinerea*	29.2	15.0	x					x		H				x					x
Hadeda Ibis	*Bostrychia hagedash*	37.5	5.0	x					x		H	x	x	x	x				x	x
Helmeted Guineafowl	*Numida meleagris*	70.8	20.0	x						x	H	x	x	x					x	x
Lanner Falcon	*Falco biarmicus*	4.2	0.0	x	LC	VU		x			H		x	x		x	x	x	x	x
Lesser Flamingo	*Phoenicopterus minor*	12.5	0.0	x	NT	NT			x		L				x					x
Lesser Kestrel	*Falco naumanni*	37.5	40.0	x				x			H		x	x		x	x		x	x

Species	Taxonomic name	Full protocol	Ad hoc protocol	Power line priority species	Red List status: International	Red List status: Regional	Endemic/near endemic - South Africa	Raptor	Waterbird	Terrestrial	Possibility of regular occurrence	Recorded during surveys	Grassland	Agriculture	Surface water (Pans)	Exotic Tree Plantations	Fences	Displacement – disturbance and habitat transformation	Electrocution (substations)	Collisions
Little Egret	*Egretta garzetta*	4.2	0.0	x					x		H				x					x
Little Grebe	*Tachybaptus ruficollis*	29.2	5.0	x					x		H				x					x
Ludwig's Bustard	*Neotis ludwigii*	4.2	0.0	x	EN	EN	x			x	M		x					x		x
Melodious Lark	*Mirafra cheniana*	12.5	5.0	x	LC	LC	x			x	H	x						x		
Northern Black Korhaan	*Afrotis afraoides*	83.3	50.0	x						x	H	x	x	x				x		x
Pale Chanting Goshawk	*Melierax canorus*	20.8	0.0	x			x	x			M		x	x			x		x	x
Red-billed Teal	*Anas erythrorhyncha*	25.0	10.0	x					x		H				x					x
Red-knobbed Coot	*Fulica cristata*	29.2	10.0	x					x		H				x					x
Reed Cormorant	*Phalacrocorax africanus*	8.3	0.0	x					x		H				x					x
Rock Kestrel	*Falco rupicolus*	4.2	0.0	x				x			L		x			x			x	x
Secretarybird	*Sagittarius serpentarius*	25.0	5.0	x	EN	VU				x	H	x	x					x		x
South African Shelduck	*Tadorna cana*	16.7	20.0	x			x		x		H				x					x
Spur-winged Goose	*Plectropterus gambensis*	33.3	15.0	x					x		H		x	x	x					x
Western Cattle Egret	*Bubulcus ibis*	25.0	15.0	x					x		H	x	x	x	x					x
White-backed Vulture	*Gyps africanus*	4.2	0.0	x	CR	CR		x			M		x						x	x
White-breasted Cormorant	*Phalacrocorax carbo*	8.3	0.0	x					x		H				x					x
White-faced Duck	*Dendrocygna viduata*	25.0	5.0	x					x		H				x					x
Yellow-billed Duck	*Anas undulata*	37.5	10.0	x					x		H				x					x
Yellow-billed Egret	*Egretta intermedia*	4.2	0.0	x					x		H		x		x					x

7.2 Co-ordinated Avifaunal Roadcount Data

Cranes, bustards, storks and other large birds that spend most of their time on the ground, need wide, open spaces and are certainly not restricted to protected areas. Agricultural habitats are used extensively for feeding, roosting and breeding, often because no natural, pristine habitats are available, and sometimes because the agricultural habitats are especially attractive to birds. The Coordinated Avifaunal Roadcounts (CAR) project monitors the populations of 36 species of large terrestrial birds in agricultural habitats, in addition to gamebirds, raptors and corvids along 350 fixed routes covering over 19 000km (http://car.adu.org.za/). Although CAR road counts do not give an absolute count of all the individuals in a population, they do provide a measure of relative abundance in a particular area. Four CAR routes intersect with or are located within close proximity to the proposed Visserspan grid connection (Figure 3).

White Stork *Ciconia ciconia* (n=1757), Abdim's Stork (n=1221), Northern Black Korhaan (n=677), Spur-winged Goose (n=94) and Yellow-billed Stork *Mycteria ibis* (n=93) have been recorded frequently and in abundance within the broader study area. Other notable observations along the vehicle transects include Secretarybird, Blue Korhaan, Blue Crane *Anthropoides paradiseus* and Wattled Crane *Bugeranus carunculatus*. Each of these is susceptible to interactions with the proposed power line infrastructure through collision or electrocution. Three of aforementioned species were observed during the field survey i.e. Secretarybird, Black-winged Kite and Northern Black Korhaan.

7.3 Co-ordinated Waterbird Count Data

A CWAC site is any body of water, other than the oceans, which supports a significant number (set at approximately 500 individual waterbirds, irrespective of the number of species) of birds which use the site for feeding, and/or breeding and roosting (Harrison et al, 2004). This definition includes natural pans, vleis, marshes, lakes, rivers, as well as a range of manmade impoundments (i.e. sewage works). The presence of a CWAC site within the study area is an indication of a large number of waterbird species occurring there and the overall sensitivity of the area.

There are no CWAC sites located within the study area. The closest CWAC sites (Olive Hills Farm Dam, Krugersdrift Dam, Skoppan and Sunnyside Pan) are located within a 35km radius of the proposed Visserspan grid connection study area (Figure 3). At least six Red List species have been recorded across the four CWAC locations namely Greater Flamingo, Maccoa Duck *Oxyura maccoa*, Yellow-billed Stork, African Marsh Harrier *Circus ranivorus* and Black Harrier *Circus maurus*. Species recorded in relatively significant numbers include Red-knobbed Coot, Yellow-billed Duck, White-backed Duck *Thalassornis leuconotus*, Reed Cormorant, Cattle Egret and African Sacred Ibis

While these CWAC sites may provide an indication of the waterbird species that could be supported by similar natural and artificial impoundments located along the proposed Visserspan power line route alignment, these sites will not have a significant impact on the sensitivity rating for the proposed Visserspan switching station, Kinderdam MTS and Visserspan grid connection power line. Each of the species mentioned above are susceptible to collisions with power line infrastructure. However, none of the species recorded in significant numbers are of conservation concern and are commonly found in wetland habitats.

7.4 On-site surveys

A single late winter survey was conducted on 23 August 2021 within the study area. In order to describe the avifaunal community present, a concerted effort was made to observe the various species in all of the primary habitats that were available within the proposed Visserspan switching station, Kinderdam MTS and power line grid connection study area.

The site visit produced a combined list of 39 species (Appendix 1 - highlighted in grey), covering both the study area and to a limited extent, the surrounding area. Secretarybird, was the only Red List species observed within the study area. All other observations were of small passerine and game bird species that are common to this area. Each of the aforementioned species has the potential to be displaced by the proposed Visserspan switching station, Kinderdam MTS and power line grid connection as a result of habitat transformation and disturbance. However, these species have persisted despite existing disturbance (i.e., pastoral and residential activities and vehicle disturbance within the study area). This resilience, coupled with the fact that similar habitat is available throughout the broader area, means that the displacement impact will not be of regional or national significance. In addition, no raptor nests or other possible Red List breeding sites were noted during the site survey.

8 IMPACT ASSESSMENT

8.1 General

Negative impacts on avifauna by electricity infrastructure generally take two main forms namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins *et al.* 2010). Displacement due to habitat destruction and disturbance associated with the construction of the electricity infrastructure is another impact that could potentially impact on avifauna.

8.2 Electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the pole/tower design. In the case of the proposed Visserspan grid connection power line, the electrocution risk is envisaged to be low because the proposed design of the 132kV line, namely the steel monopole and the clearance distances between the live and earthed components of the proposed 275kV and 400kV structures. The Visserspan grid connection power line should not pose an electrocution threat to the priority species which are likely to occur in the study area and immediate surrounding environment. Electrocutions within the proposed Visserspan switching station and Kinderdam MTS substation yard are possible but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls and certain species of waterbirds. The priority species which are potentially vulnerable to this impact are listed in Table 2, and below:

- Amur Falcon
- Black-chested Snake-Eagle
- Black-winged Kite
- Common Buzzard
- Glossy Ibis
- Greater Kestrel
- Hadeda Ibis
- Helmeted Guineafowl
- Lanner Falcon
- Lesser Kestrel
- Rock Kestrel
- Southern Pale Chanting Goshawk
- White-backed Vulture

8.3 Collisions

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

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

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

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

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

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

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

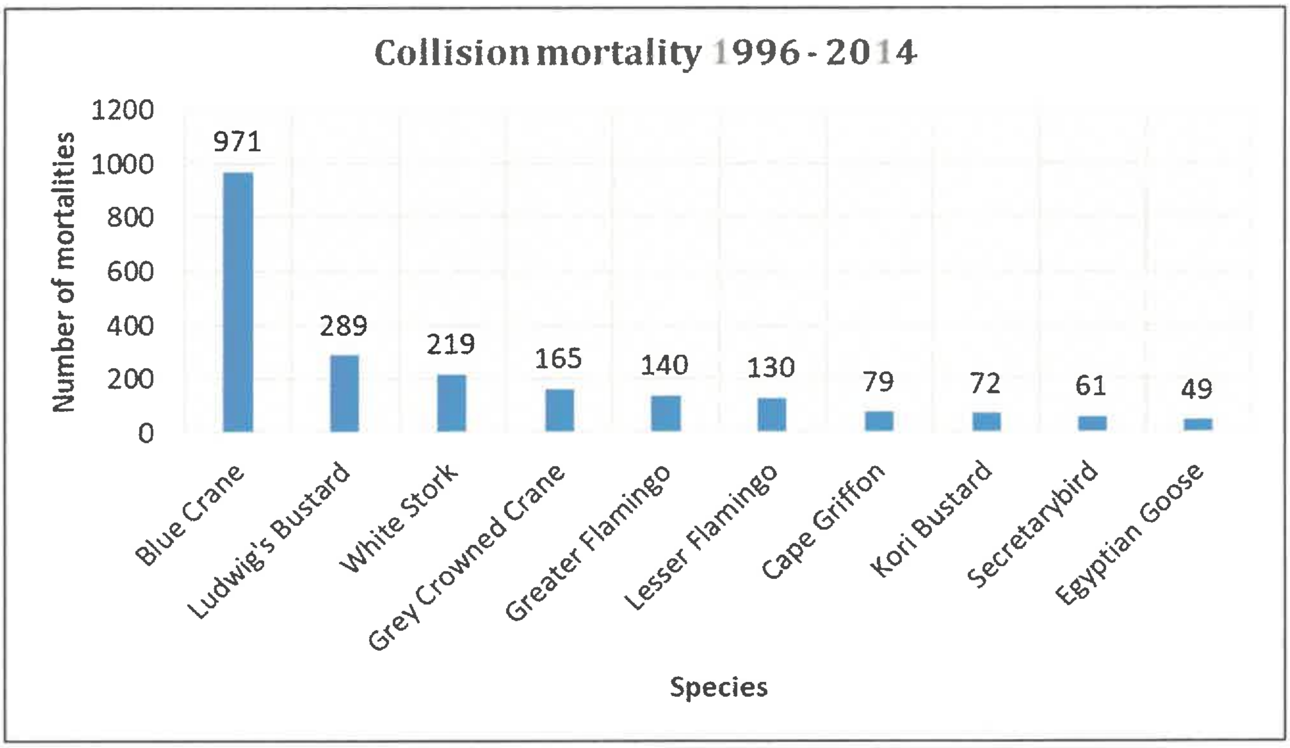

Figure 3: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

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

Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins *et al.* 2010; Martin *et al.* 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (e.g. Bernardino *et al.* 2018; Sporer *et al.* 2013, Barrientos *et al.* 2011; Jenkins *et al.* 2010; Alonso & Alonso 1999; Koops & De Jong 1982), including to some extent for bustards (Barrientos *et al.* 2012; Hoogstad 2015 pers.comm). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. Barrientos *et al.* (2011) reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease of 55–94%

in bird mortalities. Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5m, whereas using the same devices at 10m intervals only reduces the mortality by 57%. Barrientos *et al.* (2012) found that larger BFDs were more effective in reducing Great Bustard collisions than smaller ones. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

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

The most likely Red List candidates for potential collision mortality with the proposed power line are Ludwig's Bustard, Secretarybird, Greater Flamingo, Lesser Flamingo and Abdim's Stork. The priority species which are potentially vulnerable to this impact are listed in Table 2, and below:

- Pale Chanting Goshawk
- Spur-winged Goose
- African Sacred Ibis
- African Spoonbill
- Black-headed Heron
- Blue Korhaan
- Cape Shoveler
- Cape Teal
- Common Moorhen
- Egyptian Goose
- Glossy Ibis
- Great Egret
- Greater Flamingo
- Grey Heron
- Hadeda Ibis
- Helmeted Guineafowl
- Lesser Flamingo
- Little Egret
- Little Grebe
- Northern Black Korhaan
- Red-billed Teal
- Red-knobbed Coot
- Reed Cormorant
- South African Shelduck
- Spur-winged Goose
- Western Cattle Egret
- White-backed Vulture
- White-breasted Cormorant
- White-faced Duck
- Yellow-billed Duck

- Yellow-billed Egret

8.4 Displacement due to habitat destruction and disturbance

During the construction of power lines, service roads (jeep tracks) and substations, habitat destruction/transformation inevitably takes place. The construction activities will constitute the following:

- Site clearance and preparation;
- Construction of the infrastructure (i.e. the switching station, MTS and overhead power line);
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site;
- Removal of vegetation for the proposed switching station and MTS and stockpiling of topsoil and cleared vegetation;
- Excavations for infrastructure;

These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed switching station and MTS through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the switching station and substation yard is unavoidable. The habitat in the study area is relatively uniform from a bird impact perspective, with fairly large expanses of intact grassland. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the proposed Visserspan switching station, Kinderdam MTS and Visserspan grid connection power line is likely to be fairly minimal. The species most likely to be directly affected by this impact would be Secretarybird and the non-Red List terrestrial species.

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through **disturbance**; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Terrestrial species are most likely to be affected by displacement due to disturbance.

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

- Secretarybird
- Blue Korhaan
- Ludwig's Bustard
- Northern Black Korhaan
- Melodious Lark
- Lanner Falcon
- Greater Kestrel

9 IMPACT RATING

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

9.1 Determination of Significance of Impacts

Direct, indirect and cumulative impacts of the issues identified through the EIA process, as well as all other issues identified due to the amendment were assessed in terms of the following criteria:

- The nature, which includes a description of what causes the effect, what will be affected and how it will be affected.
- The extent, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The duration, wherein is indicated whether:
  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2
  - medium-term (5–15 years) – assigned a score of 3
  - long term (> 15 years) - assigned a score of 4 or
  - permanent - assigned a score of 5
- The consequences (magnitude), quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The significance, which is determined through a synthesis of the characteristics described above and is assessed as low, medium or high; and
- The status, which is described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

The significance is calculated by combining the criteria in the following formula:
$S = (E+D+M)P$
S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The significance weightings for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

9.2 Impact Assessments

The impact assessments are summarised in the tables below.

9.2.1 Construction Phase

Nature: Displacement of priority species due to disturbance associated with construction of the Visserspan switching station, Kinderdam MTS and Visserspan grid connection power line		
	Without mitigation	**With mitigation**
Extent	1 local	1 local
Duration	1 very short	1 very short
Magnitude	8 high	8 high
Probability	3 probable	2 improbable
Significance	**40 medium**	**20 low**
Status (positive or negative)	negative	negative
Reversibility	Medium	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: • Conduct a pre-construction inspection (avifaunal walk-through) of the final switching station and Kinderdam MTS layouts, road and power line routes to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed. • Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.		
Residual Risks: The residual risk of displacement will be reduced to a low level after mitigation, if the proposed mitigation is implemented.		

Nature: Displacement of priority species due to habitat transformation associated with construction of the Visserspan switching station, Kinderdam MTS and Visserspan grid connection power line		
	Without mitigation	**With mitigation**
Extent	1 local	1 local
Duration	4 long term	4 long term
Magnitude	8 high	4 low
Probability	4 highly probable	2 improbable
Significance	**52 medium**	**18 low**
Status (positive or negative)	negative	negative
Reversibility	high	high

Irreplaceable loss of resources?	no	no
Can impacts be mitigated?	To a limited extent	
Mitigation: • Vegetation clearance should be limited to what is absolutely necessary. • The mitigation measures proposed by the vegetation specialist must be strictly enforced.		
Residual Risks: The residual risk of displacement, which is already low, will be further reduced after mitigation		

9.2.2 Operational Phase

Nature: Displacement of priority species due to habitat transformation associated with the operation of the Vissерspan switching station, Kinderdam MTS and Visserspan grid connection power line		
	Without mitigation	**With mitigation**
Extent	1 local	1 local
Duration	4 long term	4 long term
Magnitude	4 low	4 low
Probability	3 probable	2 improbable
Significance	**27 low**	**18 low**
Status (positive or negative)	negative	negative
Reversibility	high	high
Irreplaceable loss of resources?	no	no
Can impacts be mitigated?	To a limited extent	
Mitigation: • Vegetation clearance should be limited to what is absolutely necessary. • The mitigation measures proposed by the vegetation specialist must be strictly enforced.		
Residual Risks: The residual risk of displacement, which is already low, will be further reduced after mitigation		

Nature: Mortality of priority species due to collisions with the Visserspan grid connection power line		
	Without mitigation	**With mitigation**
Extent	1 local	1 local
Duration	4 long term	4 long term
Magnitude	8 high	6 moderate
Probability	4 highly probable	3 probable
Significance	**52 medium**	**33 medium**
Status (positive or negative)	negative	negative
Reversibility	high	high
Irreplaceable loss of resources?	yes	yes

Can impacts be mitigated?	To a limited extent	To a limited extent

Mitigation:

- The avifaunal specialist must conduct a walk-through prior to implementation to demarcate sections of powerline that need to be marked with Eskom approved bird flight diverters. The bird flight diverters should be installed on the full span length on the earthwire (according to Eskom guidelines - five metres apart). Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.

Residual Risks:

There will be an ongoing residual risk of collisions with the grid connection power line, but mitigation should make a marked difference.

Nature: Electrocution of priority species on the Visserspan switching station & Kinderdam MTS infrastructure

	Without mitigation	**With mitigation**
Extent	1 local	1 local
Duration	4 long term	4 long term
Magnitude	8 high	6 moderate
Probability	2 improbable	1 very improbable
Significance	**36 medium**	**11 low**
Status (positive or negative)	negative	negative
Reversibility	high	high
Irreplaceable loss of resources?	yes	yes
Can impacts be mitigated?	yes	

Mitigation:

- The hardware within the proposed switching station and main transmission substation yard are too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List priority species are unlikely to frequent the switching station and substation and be electrocuted.

Residual Risks:

The residual risk of electrocution will be low once mitigation is implemented.

9.2.3 Decommissioning Phase

Nature: Displacement of priority species due to disturbance associated with decommissioning of the switching station, MTS and overhead power line

	Without mitigation	**With mitigation**
Extent	1 local	1 local
Duration	1 very short	1 very short
Magnitude	8 high	8 high
Probability	4 highly probable	2 improbable

Significance	**40 medium**	**20 low**
Status (positive or negative)	negative	negative
Reversibility	Medium	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: • Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. • The existing transmission lines must be inspected for active raptor nests prior to the commencement of the decommissioning activities. Should any active nests be present, decommissioning activities during the breeding season should be avoided if possible.		
Residual Risks: The residual risk of displacement will be reduced to a low level after mitigation, if the proposed mitigation is implemented.		

The impacts were summarized, and a comparison made between pre-and post-mitigation phases as shown in Table 4 below. The rating of environmental issues associated with different parameters prior to, and post mitigation of a proposed activity was averaged. A comparison was then made to determine the effectiveness of the proposed mitigation measures. The comparison identified critical issues related to the environmental parameters.

Table 3: Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Rating post mitigation
Avifauna	*Displacement of priority species due to disturbance associated with construction of the Visserspan switching station, Kinderdam MTS and grid connection power line*	40 medium	20 low
	Displacement of priority species due to habitat transformation associated with construction of the Visserspan switching station, Kinderdam MTS and grid connection power line	52 medium	18 low

	Mortality of priority species due to collisions with the Visserspan grid connection power line	52 medium	33 low
	Electrocution of priority species within the Visserspan switching station and Kinderdam MTS	36 low	11 low
	Displacement of priority species due to disturbance associated with the Visserspan switching station, Kinderdam MTS and grid connection power line	40 medium	20 low
	Average	**44 medium**	**20 low**

9.3 Comparative assessment of alternative power line corridors

From an avifaunal perspective, the Alternate Route traversing southwards from the Visserspan switching station to the existing Perseus MTS is the preferred powerline alternative. This route is the shortest in length thereby reducing the potential collision impact, particularly if this section of power line is mitigated with bird flight diverters. This route also avoids the Kinderdam property where Secretarybird was observed during the field survey. However, the neither Preferred Alternative nor the Alternative 2 are fatally flawed and can be utilised with appropriate mitigation.

9.4 Cumulative impacts

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

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

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

According to the official database of DFFE, there were at least seven PV renewable energy projects, approximately 151km^2 in area, within a 30km radius around the proposed development at the beginning of 2021 (Figure 6)

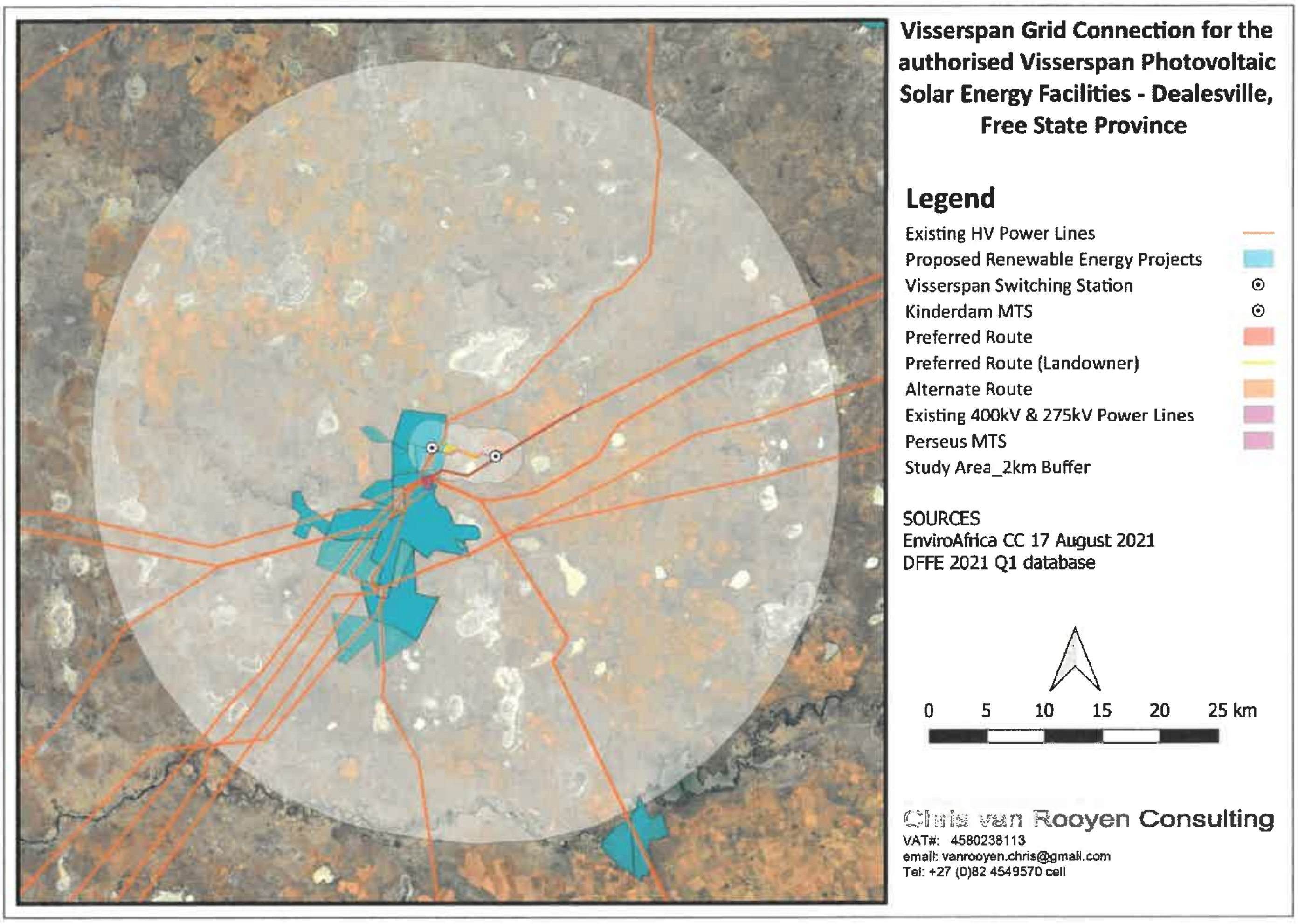

Figure 6: Renewable energy applications and existing high voltage power lines within 30km of the proposed Visserspan grid connection project

The proposed Visserspan grid connection equates to a maximum of 6.4km, depending on which of the alternatives are used. There are approximately 440kms of existing high voltage lines within the 30km radius around the Visserspan project (counting parallel lines as one). The Visserspan grid connection grid project will thus increase the total number of existing high voltage lines by approximately 1.4%. The contribution of the proposed Visserspan grid connection to the cumulative impact of all the high voltage lines is thus low. However, the combined cumulative impact of the existing and proposed power lines on avifauna within a 30km radius is considered to be moderate.

The cumulative impact of displacement due to disturbance and habitat transformation in the switching station and MTS associated with the Visserspan PV project is considered to be low, due to the small size of the footprint, and the availability of similar habitat within the 30km radius area. The cumulative impact of potential electrocutions within the switching station and MTS yards is also likely to be low as it is expected to be a rare event.

The tables below summarise the cumulative impacts associated with the proposed development.

Nature: Powerline collision mortality of priority avifauna due to the construction of the overhead power line.		
	Cumulative impact of the proposed grid connection (post mitigation) within a 30km radius (post mitigation).	**The combined cumulative impact of the proposed grid connection and all the other high voltage lines within a 30km radius (post mitigation)**
Extent	1 local	2 regional
Duration	4 long term	4 long term
Magnitude	2 minor	6 moderate
Probability	4 highly probable	4 highly probable
Significance	**28 low**	**48 medium**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Confidence in findings: Medium.		
Mitigation: Marking of all high risk sections of powerline with Bird Flight Diverters.		

Nature: (1) Displacement of priority avifauna due to disturbance and habitat transformation, and (2) mortality (electrocution) of priority avifauna due to the construction of the switching station and MTS		
	Overall impact of the proposed Visserspan PV switching station and MTS (post mitigation) within a 30km radius (post mitigation).	**Cumulative impact of the proposed Visserspan PV switching station and MTS and other planned and existing substations within a 30km radius (post mitigation)**
Extent	1 local	2 regional
Duration	4 long term	4 long term
Magnitude	2 minor	4 low
Probability	2 improbable	2 improbable
Significance	**14 low**	**20 low**
Status (positive/negative)	Negative	Negative
Reversibility	High	High
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, but only to some extent	Yes, but only to some extent
Confidence in findings:		

Medium.
Mitigation: • Conduct a pre-construction inspection (avifaunal walk-through) of the final switching station and Kinderdam MTS layouts, road and power line routes to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed. • Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. • The hardware within the proposed transmission substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site specific mitigation (insulation) be applied reactively. This is an acceptable approach because Red List priority species is unlikely to frequent the substation and be electrocuted.

9.5 No-Go Alternative

The no-go alternative will result in the current status quo being maintained at the proposed development site as far as the avifauna is concerned. The study area itself consists mostly of natural grassland and pans. The no-go option would maintain the natural habitat which would be beneficial to the avifauna currently occurring there.

9.6 Environmental sensitivities

The following environmental sensitivities were identified from an avifaunal perspective:

- **High sensitivity – Mark with Bird Flight Diverters**

  Grassland vegetation and pans are likely to attract large terrestrial and waterbird species that are susceptible to collisions (Figure 7).

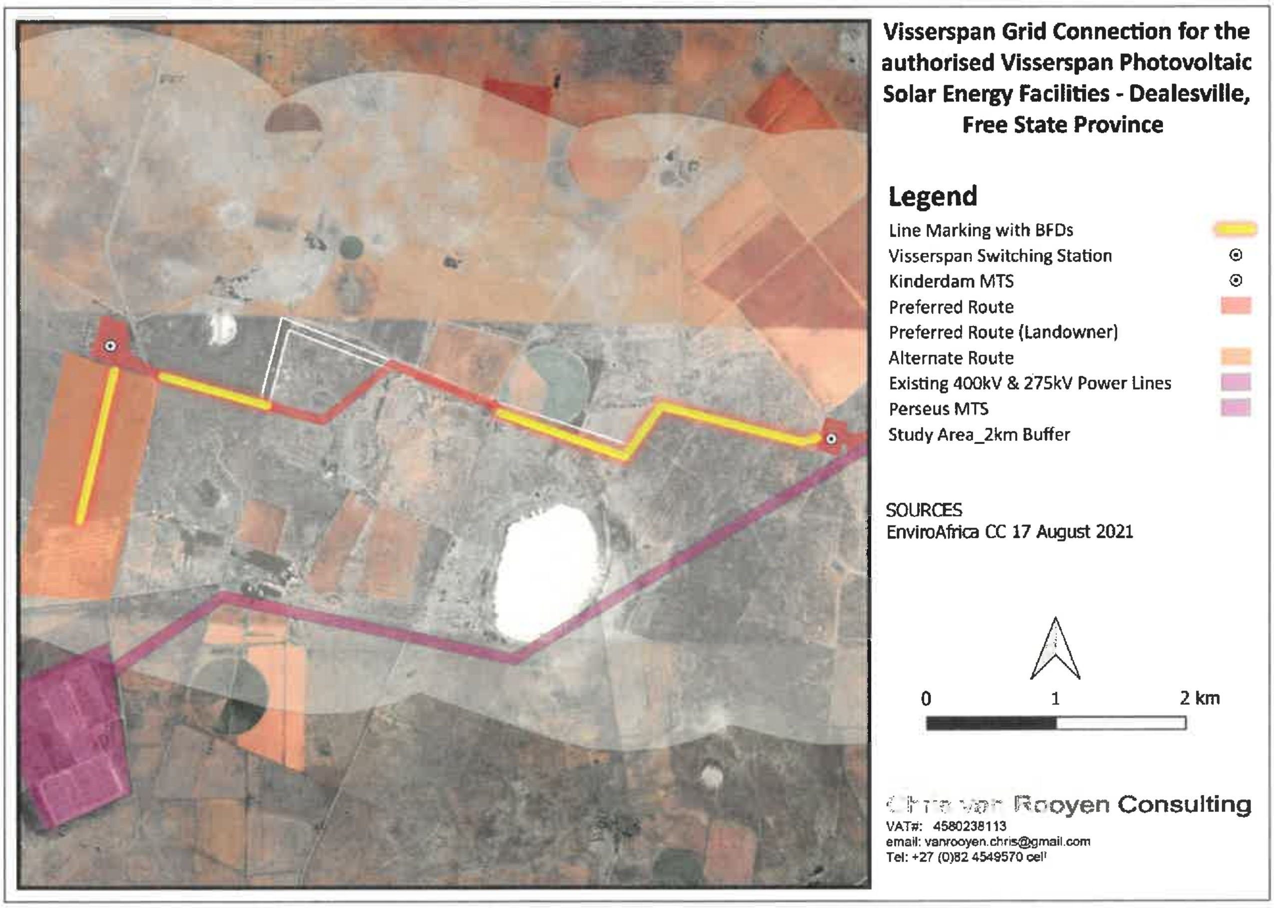

Figure 7: Avifaunal sensitivities within the proposed project area

10. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

Refer to Appendix 3 for a description of the key mitigation and monitoring recommendations for each applicable mitigation measure identified for all phases of the project.

11. FINAL SPECIALIST STATEMENT AND AUTHORISATION RECOMMENDATION

11.1 Statement and Reasoned Opinion

The expected impacts of the Visserspan switching station, Kinderdam MTS and grid connection power line were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of the identified impacts should be reduced to Low negative (see Table 3 above). No fatal flaws were discovered in the course of the investigation. It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the Impact Tables (Section 9 of the report) and the EMPr (Appendix 3) are strictly implemented.

11.2 EA Condition Recommendations

The proposed mitigation measures are detailed in the EMPr (Appendix 3).

12. REFERENCES

- ANIMAL DEMOGRAPHY UNIT. 2020. The southern African Bird Atlas Project 2. University of Cape Town. http://sabap2.adu.org.za.
- ALONSO, J. A. AND ALONSO, J. C. 1999 Collision of birds with overhead transmission lines in Spain. Pp. 57–82 in Ferrer, M. and Janss, G. F. E., eds. Birds and power lines: Collision, electrocution and breeding. Madrid, Spain: Quercus.Google Scholar
- AVIAN POWER LINE INTERACTION COMMITTEE (APLIC). 2012. Mitigating Bird Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute. Washington D.C.
- BARRIENTOS R, PONCE C, PALACIN C, MARTÍN CA, MARTÍN B, ET AL. 2012. Wire marking results in a small but significant reduction in avian mortality at power lines: A BACI Designed Study. PLoS ONE 7(3): e32569. doi:10.1371/journal.pone.0032569.
- BARRIENTOS, R., ALONSO, J.C., PONCE, C., PALACÍN, C. 2011. Meta-Analysis of the effectiveness of marked wire in reducing avian collisions with power lines. Conservation Biology 25: 893-903.
- BEAULAURIER, D.L. 1981. Mitigation of bird collisions with transmission lines. Bonneville Power Administration. U.S. Dept. of Energy.
- BERNARDINO, J., BEVANGER, K., BARRIENTOS, R., DWYER, J.F. MARQUES, A.T., MARTINS, R.C., SHAW, J.M., SILVA, J.P., MOREIRA, F. 2018. Bird collisions with power lines: State of the art and priority areas for research. https://doi.org/10.1016/j.biocon.2018.02.029. Biological Conservation 222 (2018) 1 – 13.
- ENDANGERED WILDLIFE TRUST. 2014. Central incident register for powerline incidents. Unpublished data.
- HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V & BROWN, C.J. (eds). 1997. The atlas of southern African birds. Vol 1 & 2. BirdLife South Africa, Johannesburg.
- HOBBS, J.C.A. & LEDGER J.A. 1986a. The Environmental Impact of Linear Developments; Power lines and Avifauna. Proceedings of the Third International Conference on Environmental Quality and Ecosystem Stability. Israel, June 1986.
- HOBBS, J.C.A. & LEDGER J.A. 1986b. Power lines, Birdlife and the Golden Mean. Fauna and Flora, 44:23-27.
- HOCKEY P.A.R., DEAN W.R.J., AND RYAN P.G. 2005. Robert's Birds of Southern Africa, seventh edition. Trustees of the John Voelcker Bird Book Fund, Cape Town.
- JENKINS, A. & SMALLIE, J. 2009. Terminal velocity: the end of the line for Ludwig's Bustard? Africa Birds and Birding. Vol 14, No 2.
- JENKINS, A., DE GOEDE, J.H. & VAN ROOYEN, C.S. 2006. Improving the products of the Eskom Electric Eagle Project. Unpublished report to Eskom. Endangered Wildife Trust.

- JENKINS, A.R., DE GOEDE, J.H., SEBELE, L. & DIAMOND, M. 2013. Brokering a settlement between eagles and industry: sustainable management of large raptors nesting on power infrastructure. Bird Conservation International 23: 232-246.
- JENKINS, A.R., SMALLIE, J.J. & DIAMOND, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conservation International 20: 263-278.
- KOOPS, F.B.J. & DE JONG, J. 1982. Vermindering van draadslachtoffers door markering van hoogspanningsleidingen in de omgeving van Heerenveen. Electrotechniek 60 (12): 641 – 646.
- KRUGER, R. & VAN ROOYEN, C.S. 1998. Evaluating the risk that existing power lines pose to large raptors by using risk assessment methodology: The Molopo Case Study. Proceedings of the 5th World Conference on Birds of Prey and Owls. August 4-8,1998. Midrand, South Africa.
- KRUGER, R. 1999. Towards solving raptor electrocutions on Eskom Distribution Structures in South Africa. Bloemfontein (South Africa): University of the Orange Free State. (M. Phil. Mini-thesis)
- LEDGER, J. 1983. Guidelines for Dealing with Bird Problems of Transmission Lines and Towers. Eskom Test and Research Division. (Technical Note TRR/N83/005).
- LEDGER, J.A. & ANNEGARN H.J. 1981. Electrocution Hazards to the Cape Vulture (Gyps coprotheres) in South Africa. Biological Conservation 20:15-24.
- LEDGER, J.A. 1984. Engineering Solutions to the Problem of Vulture Electrocutions on Electricity Towers. The Certificated Engineer, 57:92-95.
- LEDGER, J.A., J.C.A. HOBBS & SMITH T.V. 1992. Avian Interactions with Utility Structures: Southern African Experiences. Proceedings of the International Workshop on Avian Interactions with Utility Structures. Miami (Florida), Sept. 13-15, 1992. Electric Power Research Institute.
- MARNEWICK, M.D., RETIEF E.F., THERON N.T., WRIGHT D.R., ANDERSON T.A. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: Birdlife South Africa.
- MARTIN, G., SHAW, J., SMALLIE J. & DIAMOND, M. 2010. Bird's eye view – How birds see is key to avoiding power line collisions. Eskom Research Report. Report Nr: RES/RR/09/31613.
- MUCINA. L. & RUTHERFORD, M.C. (Eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- SHAW, J.M. 2013. Power line collisions in the Karoo: Conserving Ludwig's Bustard. Unpublished PhD thesis. Percy FitzPatrick Institute of African Ornithology, Department of Biological Sciences, Faculty of Science University of Cape Town May 2013.
- SHAW, J.M., PRETORIUS, M.D., GIBBONS, B., MOHALE, O., VISAGIE, R., LEEUWNER, J.L.& RYAN, P.G. 2017. The effectiveness of line markers in reducing power line collisions of large terrestrial birds at De Aar, Northern Cape. Eskom Research, Testing and Development. Research Report. RES/RR/17/1939422.
- SPORER, M.K., DWYER, J.F., GERBER, B.D, HARNESS, R.E, PANDEY, A.K. 2013. Marking Power Lines to Reduce Avian Collisions Near the Audubon National Wildlife Refuge, North Dakota. Wildlife Society Bulletin 37(4):796–804; 2013; DOI: 10.1002/wsb.329
- TAYLOR, M.R., PEACOCK F, & WANLESS R.W (eds.) 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg, South Africa.
- VAN ROOYEN, C.S. & LEDGER, J.A. 1999. Birds and utility structures: Developments in southern Africa. Pp 205-230, in Ferrer, M. & G.F.M. Janns. (eds.). Birds and Power lines. Quercus, Madrid (Spain). Pp 238.
- VAN ROOYEN, C.S. & TAYLOR, P.V. 1999. Bird Streamers as probable cause of electrocutions in South Africa. EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999. Charleston, South Carolina.
- VAN ROOYEN, C.S. 1998. Raptor mortality on power lines in South Africa. Proceedings of the 5th World Conference on Birds of Prey and Owls. Midrand (South Africa), Aug.4 – 8, 1998.
- VAN ROOYEN, C.S. 1999. An overview of the Eskom-EWT Strategic Partnership in South Africa. EPRI Workshop on Avian Interactions with Utility Structures Charleston (South Carolina), Dec. 2-3 1999.
- VAN ROOYEN, C.S. 2004. The Management of Wildlife Interactions with overhead lines. In: The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.
- VAN ROOYEN, C.S. 2000. An overview of Vulture Electrocutions in South Africa. Vulture News, 43: 5-22. (Vulture Study Group, Johannesburg, South Africa).
- VAN ROOYEN, C.S. 2007. Eskom-EWT Strategic Partnership: Progress Report April-September 2007. Endangered Wildlife Trust, Johannesburg.
- VAN ROOYEN, C.S. VOSLOO, H.F. & R.E. HARNESS. 2002. Eliminating bird streamers as a cause of faulting on transmission lines in South Africa. Proceedings of the IEEE 46th Rural Electric Power Conference. Colorado Springs (Colorado), May. 2002.

- VERDOORN, G.H. 1996. Mortality of Cape Griffons Gyps coprotheres and African Whitebacked Vultures *Pseudogyps africanus* on 88kV and 132kV power lines in Western Transvaal, South Africa, and mitigation measures to prevent future problems. Proceedings of the 2nd International Conference on Raptors: Urbino (Italy), Oct. 2-5, 1996.

13 APPENDICES

Appendix 1: Species List
Appendix 2: Habitat in the study area
Appendix 3: Environmental Management Plan

APPENDIX 1: SABAP 2 SPECIES LIST FOR THE STUDY AREA AND SURROUNDINGS

Species Name	Taxonomic name	RD Global	RD Regional	Full Protocol Report Rate	Adhoc Protocol Report Rate
Avocet, Pied	*Recurvirostra avosetta*			4.2	5.0
Barbet, Acacia Pied	*Tricholaema leucomelas*			54.2	5.0
Barbet, Crested	*Trachyphonus vaillantii*			29.2	5.0
Batis, Pririt	*Batis pririt*			25.0	0.0
Bee-eater, European	*Merops apiaster*			20.8	5.0
Bishop, Southern Red	*Euplectes orix*			45.8	25.0
Bishop, Yellow-crowned	*Euplectes afer*			25.0	10.0
Bokmakierie	*Telophorus zeylonus*			37.5	5.0
Bulbul, African Red-eyed	*Pycnonotus nigricans*			54.2	5.0
Bunting, Cinnamon-breasted	*Emberiza tahapisi*			20.8	0.0
Bustard, Ludwig's	*Neotis ludwigii*	EN	EN	4.2	0.0
Quail, Common	*Coturnix coturnix*			4.2	0.0
Buzzard, Steppe	*Buteo buteo*			16.7	5.0
Canary, Black-throated	*Crithagra atrogularis*			58.3	5.0
Canary, Yellow	*Crithagra flaviventris*			58.3	5.0
Chat, Anteating	*Myrmecocichla formicivora*			95.8	65.0
Chat, Familiar	*Cercomela familiaris*			12.5	0.0
Chat, Sickle-winged	*Cercomela sinuata*			4.2	0.0
Cisticola, Cloud	*Cisticola textrix*			54.2	20.0
Cisticola, Desert	*Cisticola aridulus*			54.2	20.0
Cisticola, Levaillant's	*Cisticola tinniens*			29.2	5.0
Cisticola, Zitting	*Cisticola juncidis*			37.5	5.0
Coot, Red-knobbed	*Fulica cristata*			29.2	10.0
Cormorant, Reed	*Phalacrocorax africanus*			8.3	0.0
Cormorant, White-breasted	*Phalacrocorax lucidus*			8.3	0.0
Courser, Bronze-winged	*Rhinoptilus chalcopterus*			4.2	0.0
Courser, Double-banded	*Rhinoptilus africanus*			8.3	0.0
Courser, Temminck's	*Cursorius temminckii*			4.2	0.0
Crake, Black	*Amaurornis flavirostra*			4.2	0.0
Crombec, Long-billed	*Sylvietta rufescens*			16.7	0.0
Crow, Pied	*Corvus albus*			45.8	25.0
Cuckoo, Diderick	*Chrysococcyx caprius*			25.0	0.0
Cuckoo, Jacobin	*Clamator jacobinus*			8.3	0.0
Turtle-Dove, Cape	*Streptopelia capicola*			70.8	20.0
Dove, Laughing	*Streptopelia senegalensis*			91.7	35.0
Dove, Namaqua	*Oena capensis*			62.5	30.0
Dove, Red-eyed	*Streptopelia semitorquata*			29.2	0.0
Dove, Rock	*Columba livia*			25.0	5.0
Drongo, Fork-tailed	*Dicrurus adsimilis*			8.3	0.0
Duck, White-faced	*Dendrocygna viduata*			25.0	5.0
Duck, Yellow-billed	*Anas undulata*			37.5	10.0
Snake-Eagle, Black-chested	*Circaetus pectoralis*			4.2	0.0
Egret, Great	*Egretta alba*			4.2	0.0
Egret, Yellow-billed	*Egretta intermedia*			4.2	0.0
Egret, Little	*Egretta garzetta*			4.2	5.0
Egret, Cattle	*Bubulcus ibis*			25.0	15.0
Eremomela, Yellow-bellied	*Eremomela icteropygialis*			4.2	0.0
Falcon, Amur	*Falco amurensis*			29.2	10.0

Species Name	Taxonomic name	RD Global	RD Regional	Full Protocol Report Rate	Adhoc Protocol Report Rate
Falcon, Lanner	*Falco biarmicus*	LC	VU	4.2	0.0
Finch, Red-headed	*Amadina erythrocephala*			29.2	10.0
Firefinch, Jameson's	*Lagonosticta rhodopareia*			4.2	0.0
Fiscal, Common	*Lanius collaris*			100.0	20.0
Flamingo, Greater	*Phoenicopterus roseus*	LC	NT	16.7	0.0
Flamingo, Lesser	*Phoeniconaias minor*	NT	NT	12.5	0.0
Flycatcher, Fiscal	*Sigelus silens*			41.7	0.0
Flycatcher, Spotted	*Muscicapa striata*			4.2	0.0
Francolin, Orange River	*Scleroptila gutturalis*			16.7	0.0
Goose, Egyptian	*Alopochen aegyptiaca*			20.8	15.0
Goose, Spur-winged	*Plectropterus gambensis*			33.3	15.0
Goshawk, Southern Pale Chanting	*Melierax canorus*			20.8	0.0
Grebe, Little	*Tachybaptus ruficollis*			29.2	5.0
Greenshank, Common	*Tringa nebularia*			4.2	10.0
Guineafowl, Helmeted	*Numida meleagris*			70.8	20.0
Gull, Grey-headed	*Chroicocephalus cirrocephalus*			16.7	0.0
Night-Heron, Black-crowned	*Nycticorax nycticorax*			8.3	0.0
Heron, Black-headed	*Ardea melanocephala*			25.0	15.0
Heron, Grey	*Ardea cinerea*			29.2	15.0
Ibis, African Sacred	*Threskiornis aethiopicus*			16.7	5.0
Ibis, Glossy	*Plegadis falcinellus*			8.3	5.0
Ibis, Hadeda	*Bostrychia hagedash*			37.5	5.0
Kestrel, Greater	*Falco rupicoloides*			4.2	5.0
Kestrel, Lesser	*Falco naumanni*			37.5	40.0
Kestrel, Rock	*Falco rupicolus*			4.2	0.0
Kingfisher, Giant	*Megaceryle maxima*			4.2	0.0
Kite, Black-shouldered	*Elanus caeruleus*			33.3	10.0
Korhaan, Blue	*Eupodotis caerulescens*	NT	LC	12.5	0.0
Korhaan, Northern Black	*Afrotis afraoides*			83.3	50.0
Lapwing, Blacksmith	*Vanellus armatus*			70.8	35.0
Lapwing, Crowned	*Vanellus coronatus*			75.0	20.0
Lark, Eastern Clapper	*Mirafra fasciolata*			75.0	10.0
Lark, Large-billed	*Galerida magnirostris*			8.3	5.0
Lark, Melodious	*Mirafra cheniana*	NT	LC	12.5	5.0
Lark, Monotonous	*Mirafra passerina*			4.2	0.0
Lark, Pink-billed	*Spizocorys conirostris*			0.0	10.0
Lark, Red-capped	*Calandrella cinerea*			25.0	0.0
Lark, Rufous-naped	*Mirafra africana*			54.2	20.0
Lark, Sabota	*Calendulauda sabota*			20.8	0.0
Lark, Spike-heeled	*Chersomanes albofasciata*			62.5	0.0
Longclaw, Cape	*Macronyx capensis*			33.3	15.0
Martin, Rock	*Hirundo fuligula*			12.5	0.0
Moorhen, Common	*Gallinula chloropus*			16.7	5.0
Mousebird, Red-faced	*Urocolius indicus*			29.2	5.0
Mousebird, White-backed	*Colius colius*			29.2	5.0
Myna, Common	*Acridotheres tristis*			20.8	5.0
Neddicky, Neddicky	*Cisticola fulvicapilla*			58.3	10.0
Ostrich, Common	*Struthio camelus*			25.0	5.0
Pigeon, Speckled	*Columba guinea*			79.2	30.0

Species Name	Taxonomic name	RD Global	RD Regional	Full Protocol Report Rate	Adhoc Protocol Report Rate
Pipit, African	*Anthus cinnamomeus*			83.3	15.0
Pipit, Buffy	*Anthus vaalensis*			20.8	0.0
Pipit, Plain-backed	*Anthus leucophrys*			4.2	0.0
Plover, Chestnut-banded	*Charadrius pallidus*	NT	NT	4.2	0.0
Plover, Kittlitz's	*Charadrius pecuarius*			0.0	5.0
Plover, Three-banded	*Charadrius tricollaris*			29.2	15.0
Pratincole, Black-winged	*Glareola nordmanni*	NT	NT	8.3	0.0
Prinia, Black-chested	*Prinia flavicans*			70.8	15.0
Pytilia, Green-winged	*Pytilia melba*			4.2	0.0
Quail, Common	*Coturnix coturnix*			12.5	0.0
Quailfinch, African	*Ortygospiza fuscocrissa*			41.7	20.0
Quelea, Red-billed	*Quelea quelea*			79.2	35.0
Robin-Chat, Cape	*Cossypha caffra*			20.8	0.0
Roller, Lilac-breasted	*Coracias caudatus*			4.2	0.0
Ruff	*Philomachus pugnax*			0.0	5.0
Sandgrouse, Namaqua	*Pterocles namaqua*			0.0	5.0
Sandpiper, Marsh	*Tringa stagnatilis*			8.3	0.0
Scimitarbill, Common	*Rhinopomastus cyanomelas*			12.5	0.0
Scrub-Robin, Kalahari	*Erythropygia paena*			37.5	5.0
Scrub-Robin, Karoo	*Erythropygia coryphoeus*			4.2	0.0
Secretarybird	*Sagittarius serpentarius*	VU	VU	25.0	5.0
Shelduck, South African	*Tadorna cana*			16.7	20.0
Shoveler, Cape	*Anas smithii*			8.3	5.0
Shrike, Lesser Grey	*Lanius minor*			20.8	5.0
Shrike, Red-backed	*Lanius collurio*			16.7	10.0
Snipe, African	*Gallinago nigripennis*			4.2	0.0
Sparrow, Cape	*Passer melanurus*			75.0	45.0
Sparrow, House	*Passer domesticus*			54.2	10.0
Sparrow, Southern Grey-headed	*Passer diffusus*			45.8	15.0
Sparrowlark, Chestnut-backed	*Eremopterix leucotis*			8.3	0.0
Sparrowlark, Grey-backed	*Eremopterix verticalis*			12.5	5.0
Sparrow-Weaver, White-browed	*Plocepasser mahali*			91.7	40.0
Spoonbill, African	*Platalea alba*			12.5	15.0
Spurfowl, Swainson's	*Pternistis swainsonii*			45.8	10.0
Starling, Cape Glossy	*Lamprotornis nitens*			8.3	0.0
Starling, Common	*Sturnus vulgaris*			0.0	5.0
Starling, Wattled	*Creatophora cinerea*			4.2	0.0
Stilt, Black-winged	*Himantopus himantopus*			12.5	15.0
Stonechat, African	*Saxicola torquatus*			20.8	10.0
Stork, Abdim's	*Ciconia abdimii*	LC	NT	4.2	5.0
Sunbird, Malachite	*Nectarinia famosa*			4.2	0.0
Sunbird, White-bellied	*Cinnyris talatala*			8.3	0.0
Swallow, Barn	*Hirundo rustica*			45.8	10.0
Swallow, Greater Striped	*Cecropis cucullata*			50.0	20.0
Swallow, Pearl-breasted	*Hirundo dimidiata*			0.0	5.0
Swallow, Red-breasted	*Cecropis semirufa*			20.8	5.0
Cliff-Swallow, South African	*Petrochelidon spilodera*			50.0	10.0
Swallow, White-throated	*Hirundo albigularis*			25.0	0.0
Palm-Swift, African	*Cypsiurus parvus*			12.5	0.0

Species Name	Taxonomic name	RD Global	RD Regional	Full Protocol Report Rate	Adhoc Protocol Report Rate
Swift, Common	*Apus apus*			4.2	0.0
Swift, Little	*Apus affinis*			54.2	10.0
Swift, White-rumped	*Apus caffer*			37.5	10.0
Tchagra, Brown-crowned	*Tchagra australis*			4.2	0.0
Teal, Cape	*Anas capensis*			0.0	5.0
Teal, Red-billed	*Anas erythrorhyncha*			25.0	10.0
Tern, Whiskered	*Chlidonias hybrida*			4.2	0.0
Thick-knee, Spotted	*Burhinus capensis*			8.3	0.0
Thrush, Karoo	*Turdus smithi*			12.5	0.0
Tit, Ashy	*Parus cinerascens*			0.0	5.0
Penduline-Tit, Cape	*Anthoscopus minutus*			8.3	0.0
Vulture, White-backed	*Gyps africanus*	CR	CR	4.2	0.0
Wagtail, Cape	*Motacilla capensis*			50.0	15.0
Tit-babbler, Chestnut-vented	*Sylvia subcaerulea*			33.3	0.0
Swamp-Warbler, Lesser	*Acrocephalus gracilirostris*			16.7	0.0
Warbler, Rufous-eared	*Malcorus pectoralis*			12.5	10.0
Warbler, Willow	*Phylloscopus trochilus*			0.0	5.0
Waxbill, Black-faced	*Estrilda erythronotos*			4.2	0.0
Waxbill, Common	*Estrilda astrild*			4.2	0.0
Finch, Scaly-feathered	*Sporopipes squamifrons*			20.8	15.0
Weaver, Sociable	*Philetairus socius*			8.3	0.0
Masked-Weaver, Southern	*Ploceus velatus*			95.8	20.0
Wheatear, Capped	*Oenanthe pileata*			12.5	5.0
Wheatear, Mountain	*Oenanthe monticola*			4.2	0.0
White-eye, Cape	*Zosterops virens*			4.2	0.0
White-eye, Orange River	*Zosterops pallidus*			8.3	0.0
Whydah, Pin-tailed	*Vidua macroura*			12.5	0.0
Widowbird, Long-tailed	*Euplectes progne*			66.7	10.0
Widowbird, White-winged	*Euplectes albonotatus*			4.2	0.0
Wood-Hoopoe, Green	*Phoeniculus purpureus*			0.0	5.0
Woodpecker, Cardinal	*Dendropicos fuscescens*			4.2	5.0
Wryneck, Red-throated	*Jynx ruficollis*			4.2	0.0

APPENDIX 2: HABITAT AT THE STUDY AREA

Figure 1: Grassland habitat occurring within the Alternate Route corridor.

Figure 2: Grassland occurring at the Visserspan switching station location


Figure 3: Grassland subjected to cattle grazing within the Preferred Route corridor


Figure 4: Grassland habitat at the proposed Kinderdam MTS location

Figure 5: Small wetland area occurring within the Preferred Route corridor

Figure 6: Dryland cultivation within the Preferred Route corridor

Figure 7: A typical pan occurring within the study area

Figure 8: Stands of exotic trees occur on the proposed Visserspan switching station property

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
None					

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	Conduct a pre-construction inspection to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed. A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	1. Walk-through by avifaunal specialist 2. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 3. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 4. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 5. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 6. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. Once-off 2. On a daily basis 3. Weekly 4. Weekly 5. Weekly 6. Weekly	1. Contractor 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO 6. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Mortality due to collision with the overhead power line					
Mortality of avifauna due to collisions with the overhead power line.	Reduction of avian collision mortality	Demarcate sections of the overhead power line.to be marked with Eskom approved Bird Flight Diverters (BFDs).	1. Walk-through by avifaunal specialist. 2. Fit Eskom approved Bird Flight Diverters on the earthwire at the demarcated sections of the OHL.	1. Once-off 2. Once-off	1. Contractor 2. Contractor and ECO

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to habitat transformation in the substations					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance in the onsite substations.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented where possible by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	1. Develop a Habitat Restoration Plan (HRP) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop HRP. 2. Site inspections to monitor progress of HRP. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year 3. As and when required	1. Facility operator
Avifauna: Mortality of avifauna due to collision with the overhead power line					
Mortality of avifauna due to collisions with the overhead power line.	Reduction of avian collision mortality	1. Monitor the collision mortality on the overhead power line. 2. Apply additional BFDs if collision hotspots are discovered.	1. Avifaunal specialist to conduct quarterly inspections of the overhead power line for a period of two years. 2. Apply additional BFDs if collision hotspots are discovered.	1. Quarterly 2. As and when required	1. Facility operator
Avifauna: Mortality of avifauna due to electrocution in the onsite substations					
Mortality of avifauna due to electrocutions in the substations	Reduction of avian electrocution mortality	1. Monitor the electrocution mortality in the substations. 2. Apply mitigation if electrocution happens regularly .	1. Regular inspections of the substation yard	1. Weekly	1. Facility operator

Management Plan for the Decommissioning Phase

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