AVIFAUNAL IMPACT ASSESSMENT

Hendrina Green Hydrogen and Ammonia Facility and associated 132kV powerline, Mpumalanga Province

February 2023

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EXECUTIVE SUMMARY

ENERTRAG SA proposes to develop the Hendrina Renewable Energy Complex, the complex comprises of five separate projects. The projects are:

- Hendrina North Wind Energy Facility (up to 200MW) over 3600ha;
- Hendrina South Wind Energy Facility (up to 200MW) over 2900ha;
- Hendrina North Grid Infrastructure (132kV);
- Hendrina South Grid Infrastructure (up to 275kV);
- Green Hydrogen and Ammonia Facility (up to 25ha).

Each of these projects are being assessed, as part of the Complex development, and involve the undertaking of Listed Activities identified in the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) and as such require an Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) before being undertaken.

This report pertains specifically to the Green Hydrogen and Ammonia Facility and associated 132kV powerline. The project is located 17km west of Hendrina, in the Steve Tshwete Local Municipality, of the Nkangala District Municipality, Mpumalanga Province.

AVIFAUNA

The SABAP2 data indicates that a total of 173 bird species could potentially occur within the broader area – i.e. an area of four pentad grid cells where the project area of impact (PAOI) is located. Appendix 1 provides a comprehensive list of all the species. Of these, 63 species are classified as target species i.e species of conservation concern (SCC) and powerline sensitive species. Of the target species, 57 are likely to occur regularly in the PAOI (see Tables 3 and 4).

Table 1: Summary of anticipated impacts

CONSTRUCTION PHASE			
Impact 1	**Nature of Impact**	**Significance post-mitigation**	**Mitigation measures**
Displacement of SCC due to habitat transformation associated with the construction of the GH & A facility.	The construction of the facility will impact on birds breeding, foraging and roosting in the facility footprint through transformation of habitat, which could result in permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the habitat within the construction footprint of the facility is unavoidable. However, the impact of habitat loss for SCC due to direct habitat transformation associated with the construction of the proposed facility is likely to be limited, due to the relatively small size of the footprint (25 ha), and the fact that almost no natural grassland will be affected, which is the most important habitat type for SCC. In the case of Site Alternatives 1 and 3, it will result in the removal of stands of alien trees, which could potentially serve as a nest location for Secretarybird and Lanner Falcon, although no such breeding was recorded during the year of pre-construction monitoring for the proposed wind energy facilities. It is highly unlikely that SCC will be significantly affected by this potential impact, but species that are potentially vulnerable to this impact are African Grass Owl, Blue Korhaan, Denham's Bustard, Grey Crowned Crane, Lanner Falcon, Martial Eagle, Secretarybird, and Southern Bald Ibis.	Very low	• Vegetation clearance should be limited to what is absolutely necessary. • The mitigation measures proposed by the biodiversity specialist must be strictly enforced

Impact 2	Nature of Impact	Significance post-mitigation	Mitigation measures
Displacement of SCC due to disturbance of breeding birds associated with the construction of the GH & A facility.	In the case of Site Alternatives 1 and 3, it will necessitate the removal of stands of alien trees, which could potentially serve as a nest location for Secretarybird and Lanner Falcon, although no such breeding was recorded during the year of pre-construction monitoring for the proposed wind energy facilities. There is a possibility that Blue Korhaan could use natural grassland in the PAOI for breeding, but very little of this habitat is impacted by the proposed facilities, therefore the likelihood of breeding birds being disturbed by construction activities are remote. SCC which are potentially vulnerable to this impact are Secretarybird, Lanner Falcon, Blue Korhaan	Very Low	• Conduct an inspection to identify SCC that may be breeding within the facility 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 as far as possible. • Access to the surrounding area should be strictly controlled to prevent unnecessary disturbance of SCC. • Measures to limit noise and dust should be applied according to current best practice in the industry.
Impact 3	**Nature of Impact**	**Significance post-mitigation**	**Mitigation measures**
Displacement due to habitat transformation associated with the construction of the 132kV power line.	These activities could impact on birds breeding, foraging and roosting in in the powerline servitude through transformation of habitat, which could result in temporary or permanent displacement. The loss of habitat for SCC due to direct habitat transformation associated with clearing of vegetation in the servitude is likely to be minimal due to the	Very Low	• Vegetation clearance should be limited to what is absolutely necessary. • The mitigation measures proposed by the biodiversity

	nature of the vegetation and the small footprint of the poles. The powerline sensitive species which could occur in the PAOI and are potentially vulnerable to displacement due to habitat transformation are African Grass Owl, Blue Korhaan, Denham's Bustard, Secretarybird, Southern Bald Ibis, Helmeted Guineafowl.		specialist must be strictly enforced.
Impact 4	**Nature of Impact**	**Significance post-mitigation**	**Mitigation measures**
Displacement due to disturbance associated with the construction of the 132kV power line.	Apart from direct habitat destruction, construction activities also impact on birds through displacement caused by 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 due to demanding construction schedules. Terrestrial species and owls, and raptors and crows breeding on existing high voltage lines running next to the proposed alignments, are most likely to be affected by displacement due to disturbance associated with the construction of the 132kV grid line. The powerline sensitive species which could occur in the PAOI and are potentially vulnerable to displacement due to disturbance are African Grass Owl, Blue Korhaan, Denham's Bustard, Lanner Falcon. Secretarybird, Greater Kestrel, Helmeted Guineafowl, Pied Crow, Rock Kestrel.	Low	• Conduct an inspection to identify SCC 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 as far as possible. • Access to the surrounding area should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to limit noise and dust should be applied according to current best practice in the industry.

OPERATIONAL PHASE			
Impact 5	**Nature of Impact**	**Significance post-mitigation**	**Mitigation measures**
Mortality of priority species due to collisions with 132kV power line.	Collisions could the biggest threat posed by overhead powerlines to birds in southern Africa. 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. The priority species which are potentially vulnerable to this impact are the following: African Grass Owl (SCC), Blue Korhaan (SCC), Denham's Bustard (SCC), Greater Flamingo (SCC), Grey Crowned Crane (SCC), Lesser Flamingo (SCC), Maccoa Duck (SCC), Secretarybird (SCC), Southern Bald Ibis (SCC), Yellow-billed Stork (SCC), African Black Duck, African Darter, African Sacred Ibis, African Spoonbill, African Swamphen, Black-headed Heron, Black-necked Grebe, Cape Shoveler, Cape Teal, Egyptian Goose, Glossy Ibis, Goliath Heron, Great Crested Grebe, Great Egret, Grey Heron, Hadada Ibis, Hamerkop, Intermediate Egret, Little Egret, Little Grebe, Marsh Owl, Purple Heron, Red-billed Teal, Red-knobbed Coot, Reed Cormorant, South African Shelduck, Southern Pochard, Spotted Eagle-Owl, Spur-winged Goose, Squacco Heron, Western Barn Owl, Western Cattle Egret, White Stork, White-backed Duck, White-breasted Cormorant, White-faced Whistling Duck, Yellow-billed Duck.	Low	• Bird Flight Diverters must be fitted to the whole powerline according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines).

DECOMMISSIONING PHASE			
Impact 6	**Nature of Impact**	**Significance**	**Mitigation measures**
Displacement of SCC due to disturbance of breeding birds associated with the decommissioning of the H & E facility	There is a possibility that Blue Korhaan could use natural grassland in the PAOI for breeding, but very little of this habitat is impacted by the proposed facilities, therefore the likelihood of breeding birds being disturbed by decommissioning activities are remote.	Very Low	• Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. • Access to the surrounding area should be strictly controlled to prevent unnecessary disturbance of SCC. • Measures to limit noise and dust should be applied according to current best practice in the industry.
Impact 7	**Nature of Impact**	**Significance**	**Mitigation measures**
Displacement due to disturbance associated with the construction of the 132kV power line.	Apart from direct habitat destruction, construction activities also impact on birds through displacement caused by disturbance; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Decommissioning 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 activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement due to demanding construction schedules. Terrestrial species and owls, and raptors and crows breeding on existing high voltage	Low	• Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. • Access to the surrounding area should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to limit noise and dust should be applied according to current best practice in the industry. •

	lines running next to the proposed alignments, are most likely to be affected by displacement due to disturbance associated with the decommissioning of the 132kV power line. The powerline sensitive species which could occur in the PAOI and are potentially vulnerable to displacement due to disturbance are African Grass Owl, Blue Korhaan, Denham's Bustard, Lanner Falcon. Secretarybird, Greater Kestrel, Helmeted Guineafowl, Pied Crow, Rock Kestrel.		

SELECTING A PREFERRED ALTERNATIVE

Ammonia and hydrogen facility

The preferred alternatives are Site Alternatives 1 and 2 for the following reasons:

- Both site alternatives are situated in highly transformed habitat which is of lesser importance to SCC.

Site Alternative 3 is also acceptable, but less so because there are still areas of natural grassland, and the stand of alien trees could potentially be used by used certain SCC for breeding and roosting.

132kV powerline

Assuming that either Site Alternative 1 or 2 will be utilised, the shortest powerline would be preferable from an avifaunal impact perspective. In the case of Site Alternative 1, that would be Option 1. In the case of site Alternative 2, that would be Option 3.

PRELIMINARY CONCLUSIONS

According to the Terrestrial Animal Species Protocol, confirmed habitat, or the presence SCC within the PAOI, triggers a High sensitivity classification (see definition of High sensitivity in the protocol). The classification should therefore be High sensitivity for the PAOI, based on actual conditions recorded on the ground during surveys at the proposed wind energy facilities, which included the area covered by the PAOI. The following SCC were recorded in the PAOI: Secretarybird (Globally Endangered, Locally Vulnerable), Southern Bald Ibis (Locally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), Denham's Bustard (Globally Near-threatened, Regionally Vulnerable) Lanner Falcon (Regionally Vulnerable) and Lesser Flamingo (Globally and Regionally Near threatened).

The proposed facility will have an anticipated moderate to low pre-mitigation negative impact on priority avifauna, which is expected to be reduced to low and very low with appropriate mitigation.

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DETAILS OF THE SPECIALIST

Chris van Rooyen (Bird Specialist)

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

Albert Froneman (Bird and GIS Specialist)

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

1. INTRODUCTION

1.1 Background

ENERTRAG SA proposes to develop the Hendrina Renewable Energy Complex, the complex comprises of five separate projects. The projects are:

- Hendrina North Wind Energy Facility (up to 200MW) over 3600ha;
- Hendrina South Wind Energy Facility (up to 200MW) over 2900ha;
- Hendrina North Grid Infrastructure (up to 132kV);
- Hendrina South Grid Infrastructure (up to 132kV);
- Green Hydrogen and Ammonia Facility (up to 25ha).

Each of these projects are being assessed, as part of the Complex development, and involve the undertaking of Listed Activities identified in the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) and as such require an Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) before being undertaken.

This report pertains specifically to the Green Hydrogen and Ammonia Facility and associated powerline and water pipeline ("the Project"). The Project is located 17km west of Hendrina, in the Steve Tshwete Local Municipality, of the Nkangala District Municipality, Mpumalanga Province.

Table 1 below summarises the main features of the proposed facility from a potential avifaunal impact perspective.

Table 1: Hendrina Green Hydrogen and Ammonia Facility summary

No.	Component	Footprint (Ha)	Storage Capacity (m^3 / tons)	Maximum Throughput (m^3 / tpa)
1	Water Reservoir	2	6 800 / 6 800	800 / 800
2	Water Treatment Unit	1.5	N/A	192 000 / 192 000
3	Electrolyser Unit	1	N/A	(1 239 157 – 301 932 367) / 20 000
4	Air Separation Unit	0.5	N/A	92 905 405 / 110 000
5	Ammonia Processing Unit	2	N/A	149 253 / 100 000
6	Liquid Air Storage System (LAES)	1	3 983/ 3 505	460 227 / 405 000
7	Liquid Ammonia Storage Tank	2	2 273/ 1 523	261 194 / 175 000
8	Hydrogen and Oxygen Storage Tank Farm	12	59 566/ 800	5 576 208 / 90 000

9	Ancillary infrastructure	3	n/a	n/a
	Total Footprint	**25**		

The 132kV powerline will consist of the following:

- 1 x up to 132kV transmission line (either single or double circuit) between the Hendrina Green Hydrogen Facility and the onsite substation.
- The servitude width for 1x up to 132kV transmission line is 32m.
- For up to 132kV structures, concrete foundation sizes may vary depending on design type up to 80m² (10m by 8m), with depths reaching up to 3.5m typically in a rectangular 'pad' shape. The actual number of structures required will vary according to the final route alignment determined.

1.2 Site location

Three alternative Project locations are being investigated for the development of the proposed Project (Figures 1 – 3):

1.2.1 Site Alternative 1

Site Alternative 1 is located on Portion 3 of the Farm Dunbar 189IS, at the site of an old, abandoned farmyard and has three powerline options from the associated Hendrina North and South Wind Energy Facilities ("WEF") as follows:

- Powerline option 1 is up to 2km in length, to the Hendrina North WEF substation Option 1 on Portion 1 of the Farm Dunbar 189IS;
- Powerline option 2 is up to 7km in length, to the Hendrina North WEF substation Option 2 on Portion 3 of the Farm Hartebeestkuil 185IS;
- Powerline option 3 is up to 1.5km in length, to the Hendrina South WEF substation on Portion 3 of the Farm Dunbar 189IS.

Water supply to the Project will be via a new pipeline (up to 16km) from the Komati Power Station

Figure 1: Site Alternative 1 – layout of facility, water pipeline and 132kV powerline

1.2.2 Site Alternative 2

Site Alternative 2 is located on Portion 3 of the Farm Dunbar 189IS and Portion 18 of the Farm Weltevreden 193IS, adjacent to the proposed Hendrina South WEF substation and has three powerline options from the associated wind farms as follows:

- Powerline option 1 is up to 3km in length to the Hendrina North WEF Option 1 substation on Portion 1 of the Farm Dunbar 189IS;
- Powerline option 2 is up to 8km in length to the Hendrina North WEF substation Option 2 on Portion 3 of the Farm Hartebeestkuil 185IS;
- Powerline option 3 is up to 0.5km in length to the Hendrina South WEF substation on Portion 3 of the Farm Dunbar 189IS;

Water supply to the Project will be via a new pipeline (up to 16km) from the Komati Power Station

Figure 2: Site Alternative 2 – layout of facility, water pipeline and 132kV powerline

1.2.3 Site Alternative 3

Site Alternative 3 is located on Portions 14 and 15 of the Farm Weltevreden 193IS and has three powerline options from the associated wind farms as follows:

- Powerline option 1 is up to 5km in length to the Hendrina North WEF Option 1 substation on Portion 1 of the Farm Dunbar 189IS;
- Powerline option 2 is up to 5km in length to the Hendrina North WEF substation Option 2 on Portion 3 of the Farm Hartebeestkuil 185IS;
- Powerline option 3 is up to 7km in length to the Hendrina South WEF substation on Portion 3 of the Farm Dunbar 189IS.

Water supply to the Project will be via a new pipeline (up to 16km) from the Komati Power Station

Either option will connect to the BESS associated with either the Hendrina North or Hendrina South WEF – the connection is proposed to be achieved via underground cables.

Figure 3: Site Alternative 3 – layout of facility, water pipeline and 132kV powerline

2. TERMS OF REFERENCE

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

- Describe the affected environment from an avifaunal perspective.
- Discuss gaps in baseline data and other limitations and describe the expected impacts associated with the Project.
- Identify potential sensitive environments and receptors that may be impacted on by the proposed Project and the types of impacts that are most likely to occur.[1]
- Determine, assess and rate the significance of potential impacts during the construction, operational and decommissioning phases.
- Identify 'No-Go' areas, if applicable.
- Recommend mitigation measures to reduce the impact of the expected impacts.

3. OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following information sources were consulted to conduct this study:

[1] The construction of the pipeline should not have any significant impact on avifauna, therefore the impact assessment concentrated on the impacts associated with the facility itself and the associated 132kV powerline.

- The Project area of Impact (PAOI) is defined as a 2km radius around the ammonia facility and associated 132kV power lines, based primarily on the potential of the powerlines to impact birds using this zone.
- The assessment concentrated on the potential impact on target species, which were defined as species of conservation concern (SCC) and powerline sensitive species. Species of conservation concern (SCC) are those listed as SCC in the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species (2020). Powerline sensitive species are defined as species which could potentially be impacted by power line collisions or electrocutions, based on specific morphological and/or behavioural characteristics. In general, powerline sensitive species are raptors, waterbirds, and large terrestrial birds like bustards and korhaan and also include a number of SCC.
- 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 4 pentads which intersect with the PAOI, henceforth referred to as "the broader area" (see Figure 44). A total of 55 full protocol lists (i.e. bird listing surveys lasting a minimum of two hours each) and 8 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed to date for the 4 pentads where the PAOI is located. The SABAP2 data was therefore regarded as a reliable reflection of the avifauna which occurs in the area, but the data was also supplemented by data collected during the site surveys and general knowledge of the area.
- A classification of the vegetation types in the PAOI was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (SANBI 2018).
- The national threatened status of all target species was determined with the use of the most recent edition of the Red List Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all target species was determined by consulting the latest (2022.2) 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 © 2022) was used in order to view the broader area on a landscape level and to help identify bird habitat on the ground.
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the PAOI relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the Project area of Impact (PAOI).
- The following sources were consulted to determine the investigation protocol that is required for the site:
    - Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020). 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 the Project on birds.
- The main source of information on the avifaunal diversity and abundance at the PAOI is pre-construction surveys which were implemented at the proposed Hendrina North and South wind farms that also covered the Project PAOI (see Appendix 3).

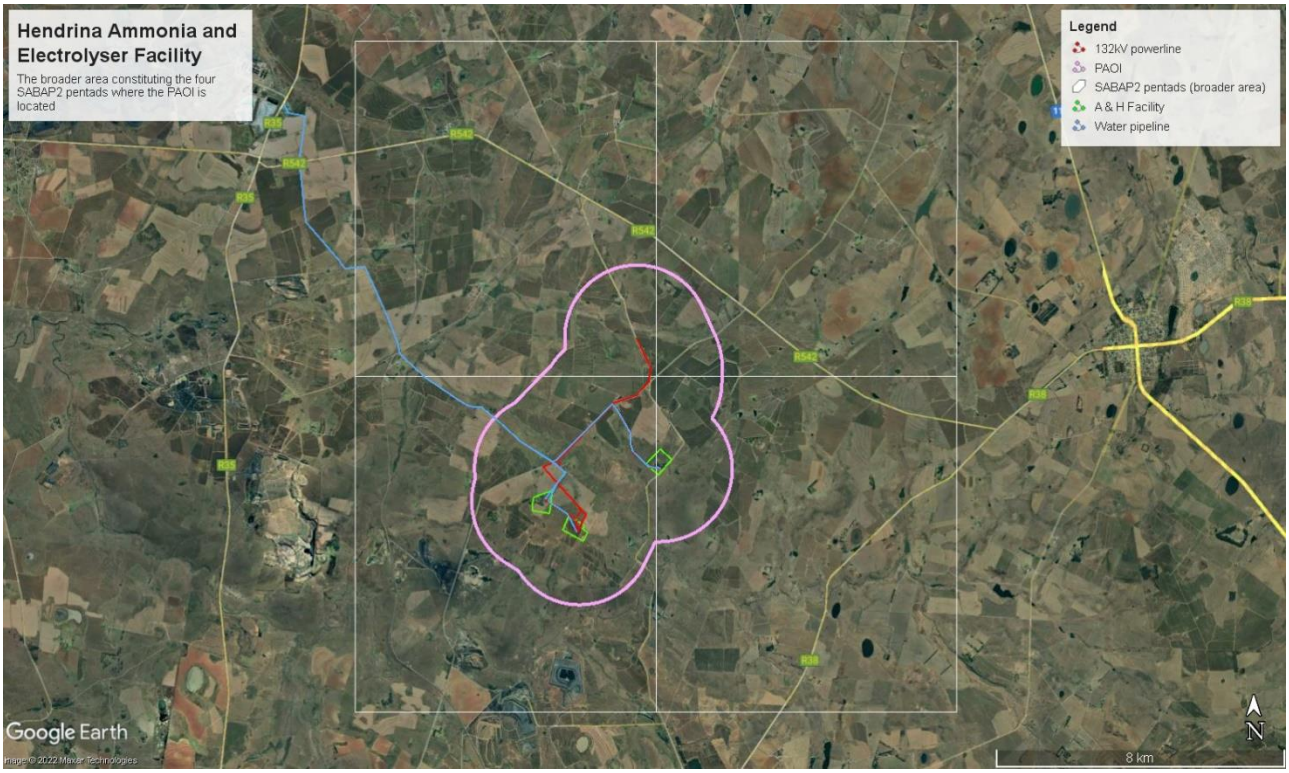


Figure 4: Area covered by the four SABAP2 pentad grid cells (broader area).

4. ASSUMPTIONS AND LIMITATIONS

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

- The SABAP2 dataset is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, and the results of the pre-construction monitoring which was conducted over 12 months at the two proposed Hendrina wind farms.
- Conclusions in this specialist report are based on experience of these and similar species at wind farm developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.
- The precautionary principle was applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: “in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation.”

5. LEGISLATIVE CONTEXT

There is no South African legislation pertaining specifically to the impacts of electricity infrastructure in avifauna. The legislation pertaining to the conservation of avifauna in South Africa in general are listed below.

5.1 Agreements and conventions

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

Table 2: Agreements and conventions which South Africa is party to and which are relevant to the conservation of avifauna.

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

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

5.2 National legislation

5.2.1 Constitution of the Republic of South Africa, 1996

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

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

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

  (i) prevent pollution and ecological degradation;

  (ii) promote conservation; and

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

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

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

Procedures for the Assessment and Minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of NEMA when applying for Environmental Authorisation (Gazetted October 2020). 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 any activity requiring environmental authorisation.

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

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

5.5 Provincial Legislation

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

6. BASELINE ASSESSMENT

6.1 Important Bird Areas

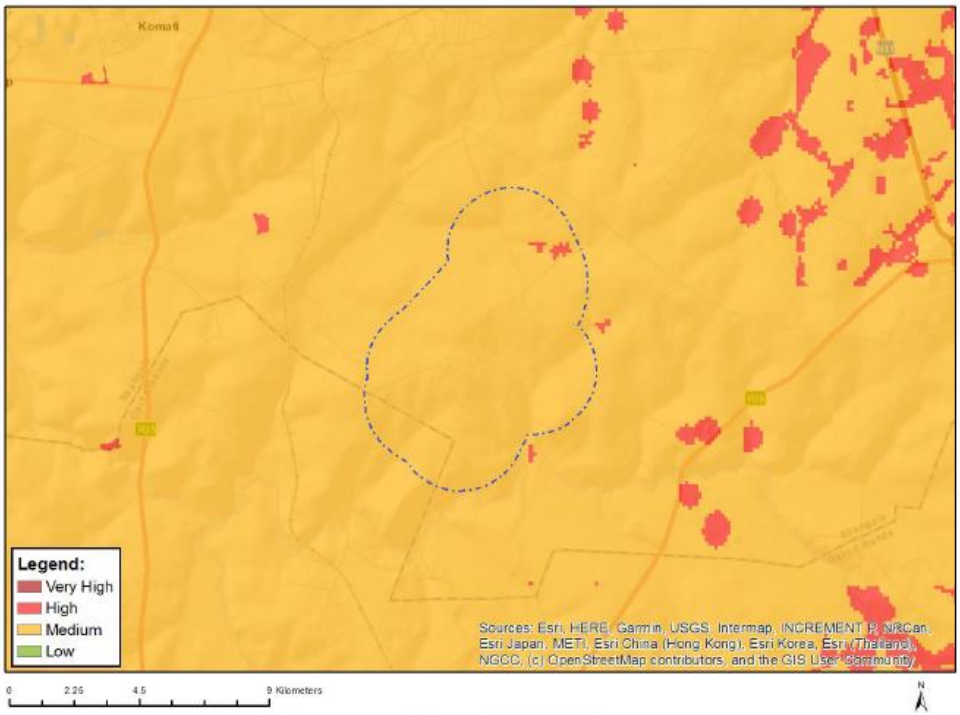
The PAOI is not located in an Important Bird Area (IBA). The closest IBA to the PAOI is the Amersfoort-Bethal-Carolina IBA SA018, which is located approximately 3.5km to the east of the PAOI. The key species within this IBA is the globally threatened Botha's Lark, but the species was not recorded in the PAOI during four seasons of monitoring for the proposed wind energy facilities. However, due to the close proximity of the sites to the IBA, it is possible that some highly mobile target species which are also IBA trigger species, and which occur either permanently or sporadically in the IBA, might be impacted by the project when they leave to forage or breed beyond the borders of the IBA. Species that were recorded in the broader area and fall within this category are the following:

- Secretarybird *Sagittarius serpentarius*
- Denham's Bustard *Neotis denhami*
- Martial Eagle *Polemaetus bellicosus*
- Black Harrier *Circus maurus*
- African Grass Owl *Tyto capensis*
- Lanner Falcon *Falco biarmicus*
- Southern Bald Ibis *Geronticus calvus*

7. DFFE NATIONAL SCREENING TOOL

According to the DFFE national screening tool, the habitat within the broader area is classified as mostly Medium sensitivity with a two small High sensitivity areas according to the Animal Species theme (see Figure 5). According to the Terrestrial Animal Species Protocol, confirmed habitat, or the presence SCC within the PAOI, triggers a High sensitivity classification (see definition of High sensitivity in the protocol). The classification should therefore be High sensitivity for the PAOI, based on actual conditions recorded on the ground during the four seasons of pre-construction monitoring at the proposed wind energy facilities, which included the area covered by the PAOI. The following SCC were recorded in the PAOI: Secretarybird (Globally Endangered, Locally Vulnerable), Southern Bald Ibis (Locally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), Denham's Bustard (Globally Near-threatened, Regionally Vulnerable) Lanner Falcon (Regionally Vulnerable) and Lesser Flamingo (Globally and Regionally Near threatened).

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Mycteria ibis
Medium	Aves-Hydroprogne caspia
Medium	Aves-Eupodotis senegalensis
Medium	Aves-Tyto capensis
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Hydrictis maculicollis
Medium	Mammalia-Ourebia ourebi ourebi

Figure 5: The National Web-Based Environmental Screening Tool map of the broader PAOI, indicating sensitivities for the Animal Species theme. The High classification is linked to Yellow-billed Stork *Mycteria ibis*, and the medium classification is linked to Caspian Tern *Hydroprogne caspia*, White-bellied Korhaan *Eupodotis senegalensis* and African Grass Owl *Tyto capensis*.

7.1 Protected Areas

According to the South African Protected Areas database (SAPAD), the closest protected area is the Heyns Private Nature Reserve, which is located approximately 27km north-east of the PAOI. No further information

could be obtained about the nature reserve. However, from an avifaunal perspective the state of the habitat and land use at PAOI is more important than the legal status.

7.2 Biomes and vegetation types

The PAOI are situated in the Grassland Biome, in the Mesic Highveld Grassland (SANBI 2018). Natural vegetation in the broader area consists of Eastern Highveld Grassland. The broader area comprises of undulating grassland plains, low hills and pan depressions. The vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn (SANBI 2018). There are several stands of alien trees which act as wind breaks and a number of earth dams in drainage lines. The PAOI is bisected by two high voltage lines, namely the Camden Duvha 1 400kV line and the Camden Komati 1 275kV transmission lines.

Hendrina has a temperate climate. January is the warmest month with a maximum temperature of 27 C°. June and July are the coldest months, with a minimum temperature of around 5 C°. The driest month is July with an average of 1.74 mm of precipitation. Most of the precipitation falls in December, averaging 161 mm. The average annual precipitation is around 482 mm (meteoblue.com 2021). The topography in the PAOI is characterised by gentle undulating plains.

The predominant land use for this area is livestock (sheep, cattle and pigs) and crop farming, mostly maize, peanuts, sunflowers and soya beans.

7.3 Bird habitat

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

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

7.3.1 Grassland

There are areas of natural grassland remaining in the PAOI. The grassland varies from dense stands of relatively high grass to areas of heavily grazed short grass. The target species which could potentially use the natural grassland in the PAOI are the following:

- African Grass Owl (SCC)
- Denham's Bustard (SCC)
- Lanner Falcon (SCC)
- Secretarybird (SCC)
- Southern Bald Ibis (SCC)
- Blue Korhaan (SCC)
- Martial Eagle (SCC)
- African Harrier Hawk
- Amur Falcon

- Black-chested Snake Eagle
- Black-headed Heron
- Black-winged Kite
- Common Buzzard
- Greater Kestrel
- Helmeted Guineafowl
- Long-crested Eagle
- Marsh Owl
- Montagu's Harrier
- Pied Crow
- Rock Kestrel
- Spotted Eagle-Owl
- Western Barn Owl
- Western Cattle Egret
- White Stork

7.3.2 Drainage lines and wetlands

There are a number of wetlands in the PAOI, most of which are associated with drainage lines. The target species which could potentially use the wetlands in the PAOI are the following:

- African Grass Owl (SCC)
- Grey Crowned Crane (SCC)
- African Black Duck
- African Sacred Ibis
- African Spoonbill
- African Swamphen
- Black-headed Heron
- Cape Shoveler
- Common Moorhen
- Egyptian Goose
- Glossy Ibis
- Great Egret
- Grey Heron
- Hadada Ibis
- Hamerkop
- Intermediate Egret
- Little Egret
- Marsh Owl
- Purple Heron
- Red-billed Teal
- Spur-winged Goose
- Squacco Heron
- White-faced Whistling Duck
- Yellow-billed Duck

7.3.3 Agricultural lands

The PAOI contain a patchwork of agricultural fields. Some fields are lying fallow or are in the process of being re-vegetated by grass. The target species which could potentially use the agricultural fields in the PAOI are the following:

- Lanner Falcon (SCC)
- Southern Bald Ibis (SCC)
- Grey Crowned Crane (SCC)
- Martial Eagle (SCC)
- Amur Falcon
- Black-headed Heron
- Common Buzzard
- Egyptian Goose
- Hadada Ibis
- Helmeted Guineafowl
- Pied Crow
- Spur-winged Goose
- Western Barn Owl
- Western Cattle Egret

7.3.4 Alien trees

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

- Lanner Falcon (SCC)
- Secretarybird (SCC)
- Southern Bald Ibis (SCC)
- Grey Crowned Crane (SCC)
- Martial Eagle (SCC)
- African Fish Eagle
- African Harrier Hawk
- African Sacred Ibis
- African Spoonbill
- Amur Falcon
- Black Sparrowhawk
- Black-chested Snake Eagle
- Black-headed Heron
- Black-winged Kite
- Common Buzzard
- Greater Kestrel
- Grey Heron
- Hadada Ibis
- Helmeted Guineafowl

- Long-crested Eagle
- Pied Crow
- Rock Kestrel
- Spotted Eagle-Owl
- Western Cattle Egret
- White Stork
- White-breasted Cormorant

7.3.5 Dams and pans

The PAOI contains many earth dams located in drainage lines. There are also a number of small pans which are a potential drawcard for many target species. Lesser and Greater Flamingos could use pans for foraging and roosting. Large raptors could use the dams and pans for bathing and drinking. The target species which could potentially use the pans and dams in the PAOI are the following:

- Lanner Falcon (SCC)
- Secretarybird (SCC)
- Greater Flamingo (SCC)
- Maccoa Duck (SCC)
- Martial Eagle (SCC)
- Yellow-billed Stork
- African Black Duck
- African Darter
- African Fish Eagle
- African Spoonbill
- Black-chested Snake Eagle
- Black-necked Grebe
- Cape Shoveler
- Cape Teal
- Common Moorhen
- Egyptian Goose
- Goliath Heron
- Great Crested Grebe
- Great Egret
- Grey Heron
- Hamerkop
- Intermediate Egret
- Little Egret
- Little Grebe
- Long-crested Eagle
- Purple Heron
- Red-billed Teal
- Red-knobbed Coot
- Reed Cormorant
- South African Shelduck
- Southern Pochard
- Spur-winged Goose

- Squacco Heron
- White-backed Duck
- White-breasted Cormorant
- White-faced Whistling Duck
- Yellow-billed Duck

7.3.6 High voltage lines

The project areas are intersected by two high voltage transmission lines, i.e. Camden Duvha 1 400kV line and the Camden Komati 1 275kV, as well as several reticulation lines. The target species which could potentially perch, and roost on the transmission towers and powerlines in the PAOI are the following:

- Lanner Falcon (SCC)
- Southern Bald Ibis (SCC)
- Martial Eagle (SCC)
- Amur Falcon
- Black-chested Snake Eagle
- Black-headed Heron
- Black-winged Kite
- Common Buzzard
- Egyptian Goose
- Greater Kestrel
- Hadada Ibis
- Helmeted Guineafowl
- Long-crested Eagle
- Pied Crow
- Rock Kestrel
- White Stork

See Appendix 2 for photographic record of habitat features in the PAOI.

7.4 AVIFAUNA

7.4.1 South African Bird Atlas Project 2

The SABAP2 data indicates that a total of 173 bird species could potentially occur within the broader area – Appendix 1 provides a comprehensive list of all the species. Of these, 63 species are classified as target species (see definition of target species in section 3). Of the target species, 57 are likely to occur regularly in the PAOI (see Tables 3 and 4 below).

Table 3 below lists all the SCC that could occur in the PAOI and the possible impact by the proposed hydrogen and ammonia facility. Table 4 list the same for the powerline sensitive species and the impacts that could be caused by the powerline.

The following abbreviations and acronyms are used:

- NT = Near threatened VU = Vulnerable EN = Endangered

Table 3: SCC potentially occurring at the PAOI and potential impacts by the proposed hydrogen and ammonia facility on them.

		Abundance and status				Occurrence in the PAOI		Habitat						Potential impacts	
Species name	Scientific name	SABAP 2 Full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	Regional status	Recorded during monitoring	Likelihood of occurrence in the PAOI	Grassland	Agriculture	Alien trees	Pans and dams	Drainage lines and wetlands	High voltage lines	Displacement - habitat transformation: A & H Facility	Displacement - disturbance (breeding): A & H Facility
African Grass Owl	*Tyto capensis*	0.0		-	VU		M	x				x		x	
Blue Korhaan	*Eupodotis caerulescens*	20.00	0.00	NT	LC	x	H	x						x	x
Denham's Bustard	*Neotis denhami*	4.00	3.03	NT	VU	x	H	x						x	
Greater Flamingo	*Phoenicopterus roseus*	22.67	3.03	-	NT	x	L				x				
Grey Crowned Crane	*Balearica regulorum*	0.00	3.03	EN	EN	x	L		x	x		x		x	
Lanner Falcon	*Falco biarmicus*	4.00	0.00	-	VU	x	M	x	x	x	x		x	x	x
Lesser Flamingo	*Phoeniconaias minor*	9.33	0.00	NT	NT	x	M								
Maccoa Duck	*Oxyura maccoa*	13.33	0.00	VU	NT		M				x				
Martial Eagle	*Polemaetus bellicosus*	1.33	0.00	EN	EN		L	x	x	x	x		x	x	
Secretarybird	*Sagittarius serpentarius*	8.00	0.00	EN	VU	x	H	x		x	x			x	x
Southern Bald Ibis	*Geronticus calvus*	2.67	0.00	VU	VU	x	M	x	x	x			x	x	
Yellow-billed Stork	*Mycteria ibis*	4.00	0.00	-	EN	x	M				x				

Table 4: Powerline sensitive species potentially occurring at the PAOI and potential impacts by the proposed 132kV powerline on them.

		Abundance and status				Occurrence in the PAOI		Habitat						Potential impacts		
Species name	Scientific name	SABAP 2 Full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	Regional status	Recorded during monitoring	Likelihood of occurrence in the PAOI	Grassland	Agriculture	Alien trees	Pans and dams	Drainage lines and wetlands	High voltage lines	Displacement - habitat transformation: Powerline	Displacement - disturbance: Powerline	Collision mortality: Powerline
African Grass Owl	*Tyto capensis*	0.0		-	VU		M	x				x		x	x	x
Blue Korhaan	*Eupodotis caerulescens*	20.00	0.00	NT	LC	x	H	x						x	x	x
Denham's Bustard	*Neotis denhami*	4.00	3.03	NT	VU	x	H	x						x	x	x
Greater Flamingo	*Phoenicopterus roseus*	22.67	3.03	-	NT	x	L				x					x
Grey Crowned Crane	*Balearica regulorum*	0.00	3.03	EN	EN	x	L		x	x		x				x
Lanner Falcon	*Falco biarmicus*	4.00	0.00	-	VU	x	M	x	x	x	x		x		x	
Lesser Flamingo	*Phoeniconaias minor*	9.33	0.00	NT	NT	x	M									x
Maccoa Duck	*Oxyura maccoa*	13.33	0.00	VU	NT		M				x					x
Martial Eagle	*Polemaetus bellicosus*	1.33	0.00	EN	EN		L	x	x	x	x		x			
Secretarybird	*Sagittarius serpentarius*	8.00	0.00	EN	VU	x	H	x		x	x			x	x	x
Southern Bald Ibis	*Geronticus calvus*	2.67	0.00	VU	VU	x	M	x	x	x			x	x		x
Yellow-billed Stork	*Mycteria ibis*	4.00	0.00	-	EN	x	M				x					x
African Black Duck	*Anas sparsa*	1.33	3.03	-	-		L				x	x				x
African Darter	*Anhinga rufa*	26.67	6.06	-	-	x	M				x					x
African Fish Eagle	*Haliaeetus vocifer*	5.33	0.00	-	-	x	M			x	x					
African Harrier Hawk	*Polyboroides typus*	5.33	0.00	-	-	x	M	x		x						
African Sacred Ibis	*Threskiornis aethiopicus*	45.33	6.06	-	-	x	H			x		x				x
African Spoonbill	*Platalea alba*	32.00	21.21	-	-	x	H			x	x	x				x
African Swamphen	*Porphyrio madagascariensis*	4.00	0.00	-	-		M					x				x
Amur Falcon	*Falco amurensis*	5.33	0.00	-	-	x	M	x	x	x			x			

Species name	Scientific name	Abundance and status				Occurrence in the PAOI		Habitat						Potential impacts		
		SABAP 2 Full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	Regional status	Recorded during monitoring	Likelihood of occurrence in the PAOI	Grassland	Agriculture	Alien trees	Pans and dams	Drainage lines and wetlands	High voltage lines	Displacement - habitat transformation: Powerline	Displacement - disturbance: Powerline	Collision mortality: Powerline
Black Sparrowhawk	*Accipiter melanoleucus*	12.00	0.00	-	-	x	M			x						
Black-chested Snake Eagle	*Circaetus pectoralis*	6.67	0.00	-	-	x	M	x		x	x		x			
Black-headed Heron	*Ardea melanocephala*	65.33	9.09	-	-	x	H	x	x	x		x	x			x
Black-necked Grebe	*Podiceps nigricollis*	9.33	0.00	-	-		M				x					x
Black-winged Kite	*Elanus caeruleus*	82.67	21.21	-	-	x	H	x		x			x			
Cape Shoveler	*Spatula smithii*	52.00	6.06	-	-	x	H				x	x				x
Cape Teal	*Anas capensis*	16.00	0.00	-	-		M				x					x
Common Buzzard	*Buteo buteo*	22.67	3.03	-	-	x	H	x	x	x			x			
Common Moorhen	*Gallinula chloropus*	21.33	6.06	-	-		H				x	x				
Egyptian Goose	*Alopochen aegyptiaca*	88.00	24.24	-	-	x	H		x		x	x	x			x
Glossy Ibis	*Plegadis falcinellus*	24.00	6.06	-	-	x	H					x				x
Goliath Heron	*Ardea goliath*	6.67	0.00	-	-		M				x					x
Great Crested Grebe	*Podiceps cristatus*	10.67	3.03	-	-	x	M				x					x
Great Egret	*Ardea alba*	5.33	3.03	-	-	x	M				x	x				x
Greater Kestrel	*Falco rupicoloides*	1.33	0.00	-	-	x	L	x		x			x		x	
Grey Heron	*Ardea cinerea*	36.0	9.1	-	-	x	H			x	x	x				x
Hadada Ibis	*Bostrychia hagedash*	86.67	15.15	-	-	x	H		x	x		x	x			x
Hamerkop	*Scopus umbretta*	9.33	6.06	-	-	x	M				x	x				x
Helmeted Guineafowl	*Numida meleagris*	54.67	15.15	-	-	x	H	x	x	x			x	x	x	
Intermediate Egret	*Ardea intermedia*	30.67	6.06	-	-	x	H				x	x				x
Little Egret	*Egretta garzetta*	17.33	6.06	-	-	x	M				x	x				x
Little Grebe	*Tachybaptus ruficollis*	61.33	15.15	-	-	x	H				x					x

Species name	Scientific name	Abundance and status				Occurrence in the PAOI		Habitat						Potential impacts		
		SABAP 2 Full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	Regional status	Recorded during monitoring	Likelihood of occurrence in the PAOI	Grassland	Agriculture	Alien trees	Pans and dams	Drainage lines and wetlands	High voltage lines	Displacement - habitat transformation: Powerline	Displacement - disturbance: Powerline	Collision mortality: Powerline
Long-crested Eagle	*Lophaetus occipitalis*	4.00	3.03	-	-	x	M	x		x	x		x			
Marsh Owl	*Asio capensis*	20.00	0.00	-	-	x	H	x				x				x
Montagu's Harrier	*Circus pygargus*	1.33	0.00	-	-	x	M	x								
Pied Crow	*Corvus albus*	14.67	3.03	-	-	x	H	x	x	x			x		x	
Purple Heron	*Ardea purpurea*	13.33	9.09	-	-		M				x	x				x
Red-billed Teal	*Anas erythrorhyncha*	58.67	12.12	-	-	x	H				x	x				x
Red-knobbed Coot	*Fulica cristata*	78.67	27.27	-	-	x	H				x					x
Reed Cormorant	*Microcarbo africanus*	73.33	21.21	-	-	x	H				x					x
Rock Kestrel	*Falco rupicolus*	4.00	0.00	-	-	x	M	x		x			x		x	
South African Shelduck	*Tadorna cana*	10.67	0.00	-	-		M				x					x
Southern Pochard	*Netta erythrophthalma*	21.33	3.03	-	-	x	H				x					x
Spotted Eagle-Owl	*Bubo africanus*	2.67	0.00	-	-	x	M	x		x						x
Spur-winged Goose	*Plectropterus gambensis*	58.67	0.00	-	-	x	H		x		x	x				x
Squacco Heron	*Ardeola ralloides*	5.33	9.09	-	-		M				x	x				x
Western Barn Owl	*Tyto alba*	2.67	0.00	-	-		L	x	x							x
Western Cattle Egret	*Bubulcus ibis*	62.67	18.18	-	-	x	H	x	x	x						x
White Stork	*Ciconia ciconia*	5.33	0.00	-	-	x	H	x		x			x			x
White-backed Duck	*Thalassornis leuconotus*	8.00	3.03	-	-		M				x					x
White-breasted Cormorant	*Phalacrocorax lucidus*	26.67	15.15	-	-	x	M			x	x					x
White-faced Whistling Duck	*Dendrocygna viduata*	9.33	3.03	-	-	x	M				x	x				x
Yellow-billed Duck	*Anas undulata*	81.33	18.18	-	-	x	H				x	x				x

8. IMPACT ASSESSMENT

8.1 Ammonia and hydrogen facility

8.1.1 Displacement due to habitat transformation

During the construction of the green hydrogen and ammonia facility, habitat destruction/transformation will inevitably take place, as the 25 hectares that constitute the facility footprint will be completely transformed through the construction of the infrastructure which will result in the removal of all vegetation.

The construction of the facility will impact on birds breeding, foraging and roosting in the facility footprint 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 (other than offsets) as the total permanent transformation of the habitat within the construction footprint of the facility is unavoidable. However, the impact of habitat loss for SCC due to direct habitat transformation associated with the construction of the proposed facility is likely to be limited, due to the relatively small size of the footprint (25 ha), and the fact that almost no natural grassland will be affected, which is the most important habitat type for SCC. In the case of Site Alternatives 1 and 3, it will result in the removal of stands of alien trees, which could potentially serve as a nest location for Secretarybird and Lanner Falcon, although no such breeding was recorded during the year of pre-construction monitoring for the proposed wind energy facilities.

It is highly unlikely that SCC will be significantly affected by this potential impact, but species that are potentially vulnerable to this impact are listed in Table 3, and below:

- African Grass Owl
- Blue Korhaan
- Denham's Bustard
- Grey Crowned Crane
- Lanner Falcon
- Martial Eagle
- Secretarybird
- Southern Bald Ibis

8.1.2 Displacement due to disturbance

Apart from direct habitat destruction, the above-mentioned activities also impact on birds, including some SCC, through displacement due to disturbance; this could lead to breeding failure if the displacement 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, due to demanding construction schedules.

In the case of Site Alternatives 1 and 3, it will necessitate the removal of stands of alien trees, which could potentially serve as a nest location for Secretarybird and Lanner Falcon, although no such breeding was recorded during the year of pre-construction monitoring for the proposed wind energy facilities. There is a possibility that Blue Korhaan could use natural grassland in the PAOI for breeding, but very little of this habitat

is impacted by the proposed facilities, therefore the likelihood of breeding birds being disturbed by construction activities are remote.

SCC which are potentially vulnerable to this impact are listed in Table 3, and below:

- Secretarybird
- Lanner Falcon
- Blue Korhaan

8.2 132kV powerline

8.1.1 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 132kV powerline, the electrocution risk is envisaged to be negligible because of the clearance distances between the live and earthed components inherent in the design of such powerlines. The 132kV powerline should not pose an electrocution threat to the powerline sensitive species which are likely to occur in the study area and immediate surrounding environment.

8.1.2 Collisions

Collisions are perhaps the biggest threat posed by high voltage 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, Shaw *et al.* 2017). However, the short length of line (maximum 8km) significantly reduces the potential collision risk.

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (EWT) and Eskom tested the effectiveness of two types of line markers in reducing power line collision mortalities of large birds on three up to 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, with a 92% reduction in mortality, and large birds in general with a 56% reduction in mortality. The two different marking devices were approximately equally effective, namely spirals and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw et al. 2017).

The powerline sensitive species which could occur in the study area and are potentially vulnerable to powerline collision impacts are listed below and in Table 4:

- African Grass Owl (SCC)
- Blue Korhaan (SCC)
- Denham's Bustard (SCC)
- Greater Flamingo (SCC)
- Grey Crowned Crane (SCC)
- Lesser Flamingo (SCC)

- Maccoa Duck (SCC)
- Secretarybird (SCC)
- Southern Bald Ibis (SCC)
- Yellow-billed Stork (SCC)
- African Black Duck
- African Darter
- African Sacred Ibis
- African Spoonbill
- African Swamphen
- Black-headed Heron
- Black-necked Grebe
- Cape Shoveler
- Cape Teal
- Egyptian Goose
- Glossy Ibis
- Goliath Heron
- Great Crested Grebe
- Great Egret
- Grey Heron
- Hadada Ibis
- Hamerkop
- Intermediate Egret
- Little Egret
- Little Grebe
- Marsh Owl
- Purple Heron
- Red-billed Teal
- Red-knobbed Coot
- Reed Cormorant
- South African Shelduck
- Southern Pochard
- Spotted Eagle-Owl
- Spur-winged Goose
- Squacco Heron
- Western Barn Owl
- Western Cattle Egret
- White Stork
- White-backed Duck
- White-breasted Cormorant
- White-faced Whistling Duck
- Yellow-billed Duck

8.1.3 Displacement due to habitat destruction

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

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

These activities could impact on birds breeding, foraging and roosting in in the powerline servitude through transformation of habitat, which could result in temporary or permanent displacement. The loss of habitat for SCC due to direct habitat transformation associated with clearing of vegetation in the servitude is likely to be minimal due to the nature of the habitat and the small footprint of the poles.

The powerline sensitive species which could occur in the PAOI and are potentially vulnerable to displacement due to habitat transformation are listed below and in Table 4:

- African Grass Owl (SCC)
- Blue Korhaan (SCC)
- Denham's Bustard (SCC)
- Secretarybird (SCC)
- Southern Bald Ibis (SCC)
- Helmeted Guineafowl

8.1.4 Displacement due to disturbance

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through displacement caused by 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 due to demanding construction schedules. Terrestrial species and owls, and raptors and crows breeding on existing high voltage lines running next to the proposed alignments, are most likely to be affected by displacement due to disturbance associated with the construction of the 132kV grid line.

The powerline sensitive species which could occur in the PAOI and are potentially vulnerable to displacement due to habitat transformation are listed below and in Table 4:

- African Grass Owl (SCC)
- Blue Korhaan (SCC)
- Denham's Bustard (SCC)
- Lanner Falcon (SCC)
- Secretarybird (SCC)
- Greater Kestrel
- Helmeted Guineafowl

- Pied Crow
- Rock Kestrel

9. IMPACT ASSESSMENT

The tables below summarise the pre-mitigation and post-mitigation of the anticipated impacts (see Appendix 4 for the as assessment criteria). **No specific No-Go zones have been identified.**

Table 5: Rating of the anticipated impacts pre-mitigation and post-mitigation

CONSTRUCTION

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	GH& A Facility	Displacement of SCC due to habitat transformation associated with the construction of the H & E facility.	Construction	Negative	Low	3	1	3	4	2	**22**	**N2**	3	1	3	4	1	**11**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 2:	GH & A Facility	Displacement of SCC due to disturbance of breeding birds associated with the construction of the H & E facility.	Construction	Negative	Low	3	2	1	2	2	**16**	**N2**	2	2	1	2	2	**14**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 3:	132kV powerline	Displacement due to habitat transformation associated with the construction of the 132kV grid connection power line.	Construction	Negative	Low	3	1	1	2	2	**14**	**N1**	2	1	1	2	2	**12**	**N1**
					Significance	**N1 - Very Low**							**N1 - Very Low**						
Impact 4:	132kV powerline	Displacement due to disturbance associated with the construction of the 132Kv grid connection power line.	Construction	Negative	Low	3	2	1	2	3	**24**	**N2**	3	2	1	2	2	**16**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						
OPERATION																			

Impact 5:	132kV powerline	Mortality of priority species due to collisions with 132kV grid connection power line.	Operation	Negative	Medium	3	3	1	4	4	**44**	**N3**	3	3	1	4	2	**22**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
DECOMMISSIONING																			
Impact 6:	GH & A Facility	Displacement of SCC due to disturbance of breeding birds associated with the decommissioning of the H & E facility	Decommissioning	Negative	Low	3	2	1	2	2	**16**	**N2**	2	2	1	2	2	**14**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 7:	132kV powerline	Displacement due to disturbance associated with the decommissioning of the 132Kv grid connection power line.	Decommissioning	Negative	Low	3	2	1	2	3	**24**	**N2**	3	2	1	2	2	**16**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						

10. MITIGATION

The mitigation measures that are proposed to reduce the significance of the potential impacts on avifauna are discussed below.

10.1 Construction phase

10.1.1 Displacement of SCC due to habitat transformation associated with the construction of the GH & A facility.

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

10.1.2 Displacement of SCC due to disturbance of breeding birds associated with the construction of the GH & A facility.

- Avifaunal specialist to conduct an inspection to identify SCC that may be breeding within the facility 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 as far as possible.
- Access to the surrounding area should be strictly controlled to prevent unnecessary disturbance of SCC.
- Measures to limit noise and dust should be applied according to current best practice in the industry.

10.1.3 Displacement of SCC due to habitat transformation associated with the construction of the 132kV powerline.

- Vegetation clearance should be limited to what is absolutely necessary.
- The mitigation measures proposed by the biodiversity specialist must be strictly enforced in order to limit the impact of habitat transformation on avifauna as much as possible.

10.1.4 Displacement of SCC due to disturbance associated with the construction of the 132kV powerline.

- Avifaunal specialist to conduct an inspection to identify SCC 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 as far as possible.
- Access to the surrounding area should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to limit noise and dust should be applied according to current best practice in the industry.

10.2 Operational phase

10.2.1 Mortality of priority species due to collisions with 132kV powerline power line.

- Bird Flight Diverters must be fitted to the whole powerline according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines).

10.3 Decommissioning phase

10.3.1 Displacement of SCC due to disturbance of breeding birds associated with the decommissioning of the GH & A facility.

- Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the surrounding area should be strictly controlled to prevent unnecessary disturbance of SCC.
- Measures to limit noise and dust should be applied according to current best practice in the industry.

10.3.2 Displacement of SCC due to disturbance of breeding birds associated with the decommissioning of the 132kV powerline.

- Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the surrounding area should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to limit noise and dust should be applied according to current best practice in the industry.

11. SELECTING A PREFERRED ALTERNATIVE

11.1 Ammonia and hydrogen facility

The preferred alternatives are Site Alternatives 1 and 2 for the following reasons:

- Both site alternatives are situated in highly transformed habitat which is of lesser importance to SCC

Site Alternative 3 is also acceptable, but less so because there are still areas of natural grassland, and the stand of alien trees could potentially be used by used certain SCC for breeding and roosting.

11.2 132kV powerline

Assuming that either Site Alternative 1 or 2 will be utilised, the shortest powerline would be preferable from an avifaunal impact perspective. In the case of Site Alternative 1, that would be Option 1. In the case of site Alternative 2, that would be Option 3.

12. 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 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

When considered in isolation, the Hendrina Ammonia and hydrogen facility and associated powerline is expected to have a low to very low impact on the priority avifauna (see Section 9, Table 5) following recommended mitigation measures (detailed in Section 10); without appropriate mitigations measures, this development poses a low to moderate impact risk on priority avifauna (see Section 9, Table 5).

However, the potentially low impact of this development should be contextualised alongside related local/regional developments. According to the official database of DFFE and other documents in the public domain, there are currently at least five planned wind and solar energy facilities and associated grid connections within a 30km radius around the proposed development. These are the following:

- Solar photovoltaic power plant at ESKOM Duvha power station (DFFE Reg Nr. 14/12/16/3/3/2/759)
- Halfgewonnen Solar PV facility (DFFE Reg Nr. 14/12/16/3/3/2/2068)
- Hendrina North Wind Energy Facility (DFFE Reg Nr. 2017/143710/07)
- Hendrina South Wind Energy Facility (DFFE Reg Nr.14/12/16/3/3/2/2131)
- Arnot Solar PV facility (DFFE Reg Nr. 14/12/16/3/3/2/760)

The most serious potential impacts on avifauna associated with the proposed ammonia and hydrogen facility will be the potential impacts of the 132kV powerline i.e. mortality of SCC due to collisions with the overhead line. The potential displacement impact on avifauna due to habitat transformation is relatively negligible due to the small size of the footprint i.e. 26 ha, especially if Site Alternative 1 or 2 is utilised which consist mostly of transformed habitat. The combined length of the grid connections for the proposed Arnot and Halfgewonnen PV facilities and Hendrina North Wind Energy Facility renewable energy projects listed above is approximately 26km. The PV plant at the Duvha Power Station will be on the premises of power station. The proposed Hendrina South grid connection will be a maximum of 23.8km long. The existing high voltage lines in the 30km radius around the proposed Hendrina South grid connection extend for several hundred kilometres.

At a length of between 0.5 and 8km, depending on which alternative is utilised, the powerline associated with the proposed ammonia and hydrogen facility represents a comparatively **Low** contribution towards the total length of high voltage power lines within a 30km radius. However, this project will increase the density of planned and existing high voltage lines within a 30km radius, and the cumulative effect of all the existing and planned high voltage lines represent a potentially **Moderate** impact risk to priority avifauna.

13. ENVIRONMENTAL MANAGEMENT PLAN

For each anticipated impact, management recommendations for the design, construction, and operational phase (where appropriate) will be drafted for inclusion in the project EMPr (see Appendix 5).

14. CONCLUSIONS

According to the Terrestrial Animal Species Protocol, confirmed habitat, or the presence SCC within the PAOI, triggers a High sensitivity classification (see definition of High sensitivity in the protocol). The classification should therefore be High sensitivity for the PAOI, based on actual conditions recorded on the ground during surveys at the proposed wind energy facilities, which included the area covered by the PAOI. The following SCC were recorded in the PAOI: Secretarybird (Globally Endangered, Locally Vulnerable), Southern Bald Ibis (Locally and Globally Vulnerable), Blue Korhaan (Globally Near-threatened), Denham's Bustard (Globally Near-threatened, Regionally Vulnerable) Lanner Falcon (Regionally Vulnerable) and Lesser Flamingo (Globally and Regionally Near threatened).

The proposed facility will have an anticipated moderate to low pre-mitigation negative impact on priority avifauna, which is expected to be reduced to low and very low with appropriate mitigation.

15. REFERENCES

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APPENDIX 1: SABAP 2 SPECIES LIST FOR THE BROADER AREA

Species name	Scientific name	SABAP 2 Full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	Regional status
African Black Duck	*Anas sparsa*	1.33	3.03	-	-
African Darter	*Anhinga rufa*	26.67	6.06	-	-
African Fish Eagle	*Haliaeetus vocifer*	5.33	0.00	-	-
African Grass Owl	*Tyto capensis*	0.0		-	VU
African Harrier Hawk	*Polyboroides typus*	5.33	0.00	-	-
African Sacred Ibis	*Threskiornis aethiopicus*	45.33	6.06	-	-
African Spoonbill	*Platalea alba*	32.00	21.21	-	-
African Swamphen	*Porphyrio madagascariensis*	4.00	0.00	-	-
Amur Falcon	*Falco amurensis*	5.33	0.00	-	-
Black Sparrowhawk	*Accipiter melanoleucus*	12.00	0.00	-	-
Black-chested Snake Eagle	*Circaetus pectoralis*	6.67	0.00	-	-
Black-headed Heron	*Ardea melanocephala*	65.33	9.09	-	-
Black-necked Grebe	*Podiceps nigricollis*	9.33	0.00	-	-
Black-winged Kite	*Elanus caeruleus*	82.67	21.21	-	-
Blue Korhaan	*Eupodotis caerulescens*	20.00	0.00	NT	LC
Cape Shoveler	*Spatula smithii*	52.00	6.06	-	-
Cape Teal	*Anas capensis*	16.00	0.00	-	-
Common Buzzard	*Buteo buteo*	22.67	3.03	-	-
Common Moorhen	*Gallinula chloropus*	21.33	6.06	-	-
Denham's Bustard	*Neotis denhami*	4.00	3.03	NT	VU
Egyptian Goose	*Alopochen aegyptiaca*	88.00	24.24	-	-
Glossy Ibis	*Plegadis falcinellus*	24.00	6.06	-	-
Goliath Heron	*Ardea goliath*	6.67	0.00	-	-
Great Crested Grebe	*Podiceps cristatus*	10.67	3.03	-	-
Great Egret	*Ardea alba*	5.33	3.03	-	-
Greater Flamingo	*Phoenicopterus roseus*	22.67	3.03	-	NT
Greater Kestrel	*Falco rupicoloides*	1.33	0.00	-	-
Grey Crowned Crane	*Balearica regulorum*	0.00	3.03	EN	EN
Grey Heron	*Ardea cinerea*	36.0	9.1	-	-
Hadada Ibis	*Bostrychia hagedash*	86.67	15.15	-	-
Hamerkop	*Scopus umbretta*	9.33	6.06	-	-
Helmeted Guineafowl	*Numida meleagris*	54.67	15.15	-	-
Intermediate Egret	*Ardea intermedia*	30.67	6.06	-	-
Lanner Falcon	*Falco biarmicus*	4.00	0.00	-	VU
Lesser Flamingo	*Phoeniconaias minor*	9.33	0.00	NT	NT
Little Egret	*Egretta garzetta*	17.33	6.06	-	-
Little Grebe	*Tachybaptus ruficollis*	61.33	15.15	-	-
Long-crested Eagle	*Lophaetus occipitalis*	4.00	3.03	-	-
Maccoa Duck	*Oxyura maccoa*	13.33	0.00	VU	NT
Marsh Owl	*Asio capensis*	20.00	0.00	-	-
Martial Eagle	*Polemaetus bellicosus*	1.33	0.00	EN	EN
Montagu's Harrier	*Circus pygargus*	1.33	0.00	-	-
Pied Crow	*Corvus albus*	14.67	3.03	-	-
Purple Heron	*Ardea purpurea*	13.33	9.09	-	-

Species name	Scientific name	SABAP 2 Full protocol reporting rate	SABAP 2 Ad hoc protocol reporting rate	Global status	Regional status
Red-billed Teal	*Anas erythrorhyncha*	58.67	12.12	-	-
Red-knobbed Coot	*Fulica cristata*	78.67	27.27	-	-
Reed Cormorant	*Microcarbo africanus*	73.33	21.21	-	-
Rock Kestrel	*Falco rupicolus*	4.00	0.00	-	-
Secretarybird	*Sagittarius serpentarius*	8.00	0.00	EN	VU
South African Shelduck	*Tadorna cana*	10.67	0.00	-	-
Southern Bald Ibis	*Geronticus calvus*	2.67	0.00	VU	VU
Southern Pochard	*Netta erythrophthalma*	21.33	3.03	-	-
Spotted Eagle-Owl	*Bubo africanus*	2.67	0.00	-	-
Spur-winged Goose	*Plectropterus gambensis*	58.67	0.00	-	-
Squacco Heron	*Ardeola ralloides*	5.33	9.09	-	-
Western Barn Owl	*Tyto alba*	2.67	0.00	-	-
Western Cattle Egret	*Bubulcus ibis*	62.67	18.18	-	-
White Stork	*Ciconia ciconia*	5.33	0.00	-	-
White-backed Duck	*Thalassornis leuconotus*	8.00	3.03	-	-
White-breasted Cormorant	*Phalacrocorax lucidus*	26.67	15.15	-	-
White-faced Whistling Duck	*Dendrocygna viduata*	9.33	3.03	-	-
Yellow-billed Duck	*Anas undulata*	81.33	18.18	-	-
Yellow-billed Stork	*Mycteria ibis*	4.00	0.00	-	EN

APPENDIX 2: HABITAT FEATURES AT PAOI

Figure 1: A view of the habitat at Site Alternative 1 (disturbed grassland, alien trees and agriculture)

Figure 2: A view of the habitat at Site Alternative 2 (disturbed grassland and agriculture)

Figure 2: A view of the habitat at Site Alternative 3 (natural grassland and alien trees)

Figure 3: A dam in the PAOI

Figure 4: Grassland in the PAOI

Figure 5: Agriculture and high voltage powerlines in the PAOI

APPENDIX 3: PRE-CONSTRUCTION MONITORING

Monitoring was conducted in the following manner:

- One drive transect was identified totalling 12km on the development site and one drive transect in the control site with a total length of 7.7km.
- One monitor travelling slowly (± 10km/h) in a vehicle recorded all birds on both sides of the transect. The observer stopped at regular intervals (every 500m) to scan the environment with binoculars. Drive transects were counted three times per sampling session.
- In addition, 4 walk transects of 1km each were identified at the development site, and two at the control site, and counted 4 times per sampling season. All birds were recorded during walk transects.
- The following variables were recorded:
    - Species
    - Number of birds
    - Date
    - Start time and end time
    - Estimated distance from transect
    - Wind direction
    - Wind strength (estimated Beaufort scale)
    - Weather (sunny; cloudy; partly cloudy; rain; mist)
    - Temperature (cold; mild; warm; hot)
    - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground) and
    - Co-ordinates (target species only)

The aim with drive transects was primarily to record large target species (i.e. raptors and large terrestrial species), while walk transects were primarily aimed at recording small passerines.

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

The objective of vantage point counts was to measure the potential collision risk with the turbines of the proposed WEF, but it also gave useful data of the avifaunal variety in the PAOI.

A total of two potential avifaunal focal points (FPs) of bird activity were identified initially and monitored. This was reduced to one when the study area changed in August 2020. The focal points were as follows:

- FP1: Not applicable anymore
- FP2: A farm dam in a drainage line in the application site

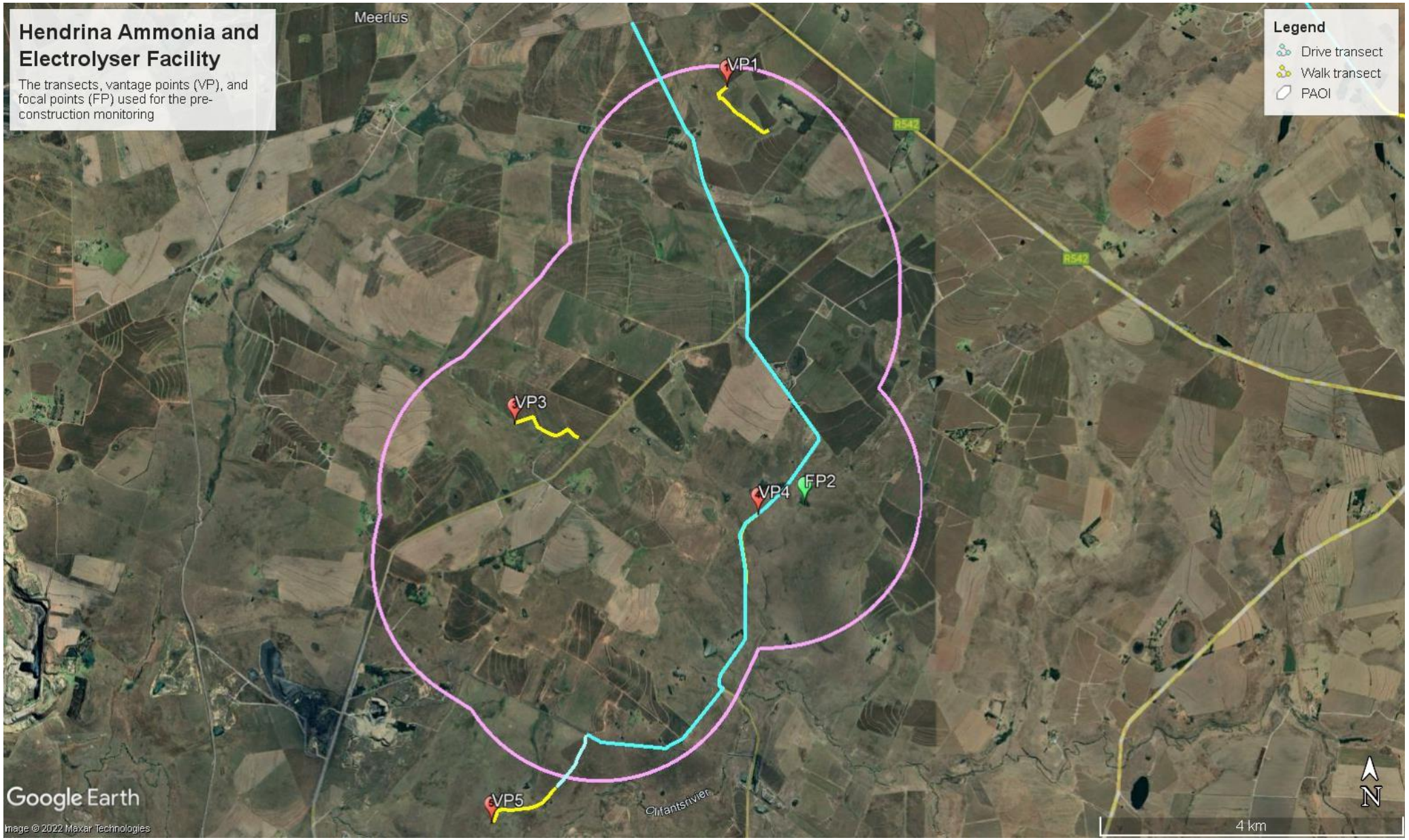

Figure 1: Area where monitoring is taking place, with position of VPs, focal points, drive transects, walk transects and the PAOI.

APPENDIX 4: ASSESSMENT CRITERIA PHASE

EIA PHASE

REPORTING REQUIREMENTS

- Project Description
- Legislative Context (as applicable)
- Assumptions and limitations
- Description of methodology (as required)
- Update and/or confirmation of Baseline Environment – including update and / or confirmation of sensitivity mapping
- Identification and description of Impacts
- Full impact assessment (including Cumulative)
- Mitigation measures
- Impact Statement

Ensure that all reports fulfil the requirements of the relevant Protocols.

ASSESSMENT OF IMPACTS AND MITIGATION

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

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[1], indirect[2], secondary[3] as well as cumulative[4] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[5] presented in **Table 0-5**.

Table 0-5: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes

[1] Impacts that arise directly from activities that form an integral part of the Project.
[2] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[3] Secondary or induced impacts caused by a change in the Project environment.
[4] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[5] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

IMPACT MITIGATION

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

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

The mitigation sequence/hierarchy is shown in **Figure 1** below.

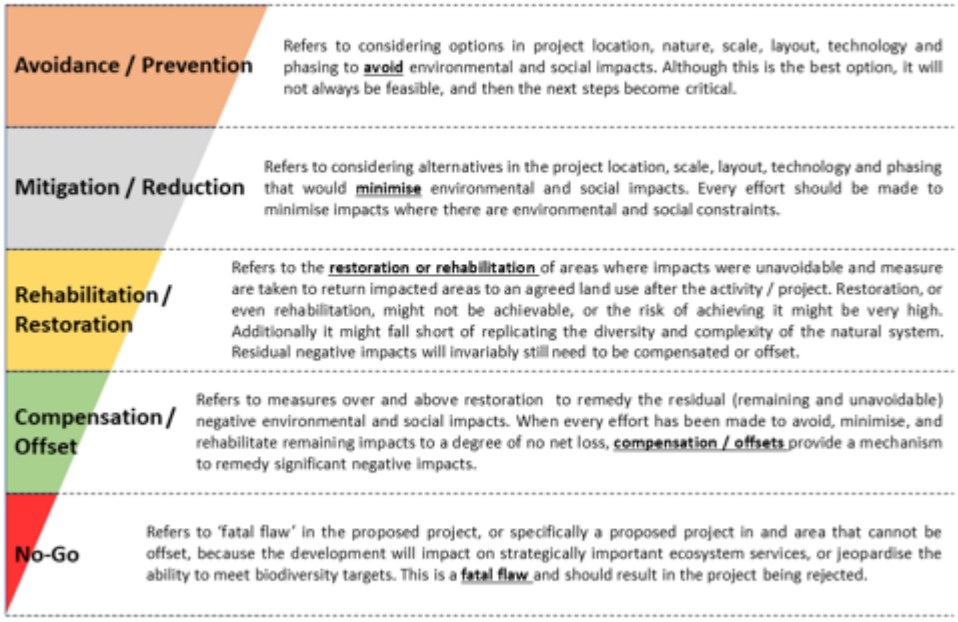

Figure 1: Mitigation Sequence/Hierarchy

APPENDIX 5: ENVIRONMENTAL MANAGEMENT PLAN

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 of the GH & A facility and associated 132kV powerline 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 Environmental Management Programme (EMPr.)	1. Conduct an inspection to identify SCC species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed. 2. Driving must be restricted to designated roads. Maximum use must be made of existing roads, where possible. New roads should only be constructed if existing roads cannot be utilised. 3. Measures to control noise and dust according to latest best practice must be implemented. 4. Access to the rest of the property must be restricted. 5. All recommendations in the biodiversity specialist report pertaining to the limitation of the footprint must be strictly implemented.	1. Walk-through by avifaunal specialist to record any SCC nests 2. Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections Report and record any non-compliance. 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 1. Monthly 2. Monthly 3. Monthly 4. Monthly	1. Developer 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO 6. Contractor and ECO
Avifauna: Displacement due to habitat transformation					
Total or partial displacement of avifauna due to habitat transformation associated with vegetation clearance in the footprint of the GH & A facility and associated 132kV powerline.	Prevent unnecessary displacement of avifauna by ensuring that rehabilitation of transformed areas is implemented where possible by an appropriately qualified rehabilitation specialist, according to the recommendations of the biodiversity specialist study.	1. Vegetation clearance should be limited to what is absolutely necessary. 2. The mitigation measures proposed by the biodiversity specialist must be strictly enforced. .	1. Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance.	1. Monthly 2. Monthly	1. 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	The overhead power line must be marked with Eskom approved Bird Flight Diverters (BFDs).	1. Fit Bird Flight Diverters on the earth-wire of the whole OHL according to the applicable Eskom Engineering Instruction (Eskom Unique Identifier 240 – 93563150: The utilisation of Bird Flight Diverters on Eskom Overhead Lines).	1. Once-off	1. Contractor and ECO

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance					
The noise and movement associated with the decommissioning activities of the GH & A facility and associated 132kV powerline will be a source of disturbance which would lead to the displacement of avifauna from the area.	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the EMPr.	1. Driving must be restricted to designated roads. Maximum use must be made of existing roads, where possible. New roads should only be constructed if existing roads cannot be utilised. 2. Measures to control noise and dust according to latest best practice must be implemented. 3. Access to the rest of the property must be restricted. 4. All recommendations in the biodiversity specialist report pertaining to the limitation of the footprint must be strictly implemented.	**1.** Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Repor and record any non-compliance. 2. Ensure that 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 activity area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. On a daily basis 2. Monthly 3. Monthly 4. Monthly 5. Monthly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO