Avifauna Impact Assessment for the proposed Highveld SPP Project

Emalahleni, Mpumalanga Province

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CLIENT

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Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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1 Introduction

1.1 Background

The Biodiversity Company (TBC) was appointed to undertake an avifauna assessment for the proposed Highveld Solar Power Plants (SPP) Solar Photovoltaic (PV) project. The proposed project involves the development of a solar facility and associated infrastructure, located 15 km northwest of Emalahleni in the Mpumalanga province (Figure 1-2 and Figure 1-3).

The National Web-based Environmental Screening Tool (Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended) indicated that the Animal Species Theme Sensitivity was rated as 'High'. Accordingly, The Biodiversity Company was sub-contracted to undertake an Avifauna Impact Assessment to inform on the impact of the proposed PV to the avifauna community within the receiving environment. The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March and 30 October 2020: "*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 the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria). Based on the size of the PV and the risk associated with it, a Regime 1 assessment was undertaken (BirdLife South Africa, 2017).

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

1.2 Technical information

The following technical information was provided by Environamics:

The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun through a process known as the Photovoltaic Effect. This refers to light energy placing electrons into a higher state of energy to create electricity. Each PV cell is made of silicon (i.e. semiconductors), which is positively and negatively charged on either side, with electrical conductors attached to both sides to form a circuit. This circuit captures the released electrons in the form of an electric current (direct current). The key components of the proposed project are described below:

- PV Panel Array - To produce up to 329MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels will be required to form the solar PV arrays which will comprise the PV facility. The PV panels will be tilted at a northern angle in order to capture the most sun or using one-axis tracker structures to follow the sun to increase the Yield.

- Wiring to Inverters - Sections of the PV array will be wired to inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the voltage from 480V to 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is 480V and this is fed into step up transformers to 132kV. An onsite substation will be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid via the proposed power line. It is expected that generation from the facility will link to the Eskom Vulcan 400kV MTS Substation. The connection will be assessed within the 250m wide (up to 690m in some instances) grid connection corridor. Connection will be limited to the grid connection

corridor. The Highveld SPP will inject up to 250MW into the National Grid. The installed capacity will be approximately 329MW (Figure 1-1).

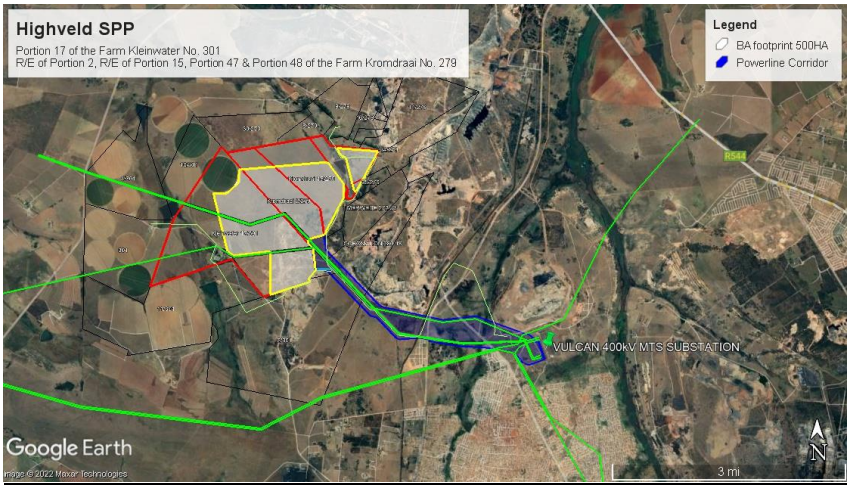


Figure 1-1 Power Line corridor

- Electrical reticulation network – An internal electrical reticulation network will be required and will be lain ~2-4m underground as far as practically possible.
- Supporting Infrastructure – The supporting infrastructure such as the auxiliary buildings will be situated in an area measuring up to 4 ha.
- Battery storage – A Battery Storage Facility with a maximum height of 8m and a maximum volume of 1,740 m^3 of batteries and associated operational, safety and control infrastructure.
- Roads – Access will be obtained via an unnamed road off of the N4 to the south of the site and via another unnamed road to the east of the site. An internal site road network will also be required to provide access to the solar field and associated infrastructure. The access and internal roads will be constructed within a 25- meter corridor. Access Points: coordinates 25°49'14.48"S; 29° 3'4.95"E and 25°48'55.80"S; 29° 3'43.84"E.
- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm. Fencing with a height of 2.5 meters will be used.

Table 1.2: **Technical details for the proposed facility**

Component	Description / dimensions
Height of PV panels	6 meters
Area of PV Array	500 hectares (Development footprint)
Number of inverters required	Minimum 50
Area occupied by inverter / transformer stations / substations / BESS	Central inverters+ LV/MV trafo: 750 m^2 HV/MV substation with switching station: 15 000 m^2 BESS: 40 000 m^2
Capacity of on-site substation	132kV
Capacity of the powerline	132kV
Area occupied by both permanent and construction laydown areas	Total Footprint Area: 500 hectares Construction laydown area: within ~ 5.74 ha
Area occupied by buildings	Security Rooms (3): ~405 m^2 O&M laydown: Within 5.74 ha
Battery storage facility	Maximum height: 8m Maximum volume: 1740 m^3 Capacity: Up to 500 MW
Length of internal roads	Approximately 16.41 km
Width of internal roads	Between 4 and 6 meters
Proximity to grid connection	Approximately 5.3km
Grid connection corridor width	Between 250 and 690 m
Grid connection corridor length	Approximately 5.3km
Powerline servitude width	32m
Height of fencing	Approximately 2.5 meters

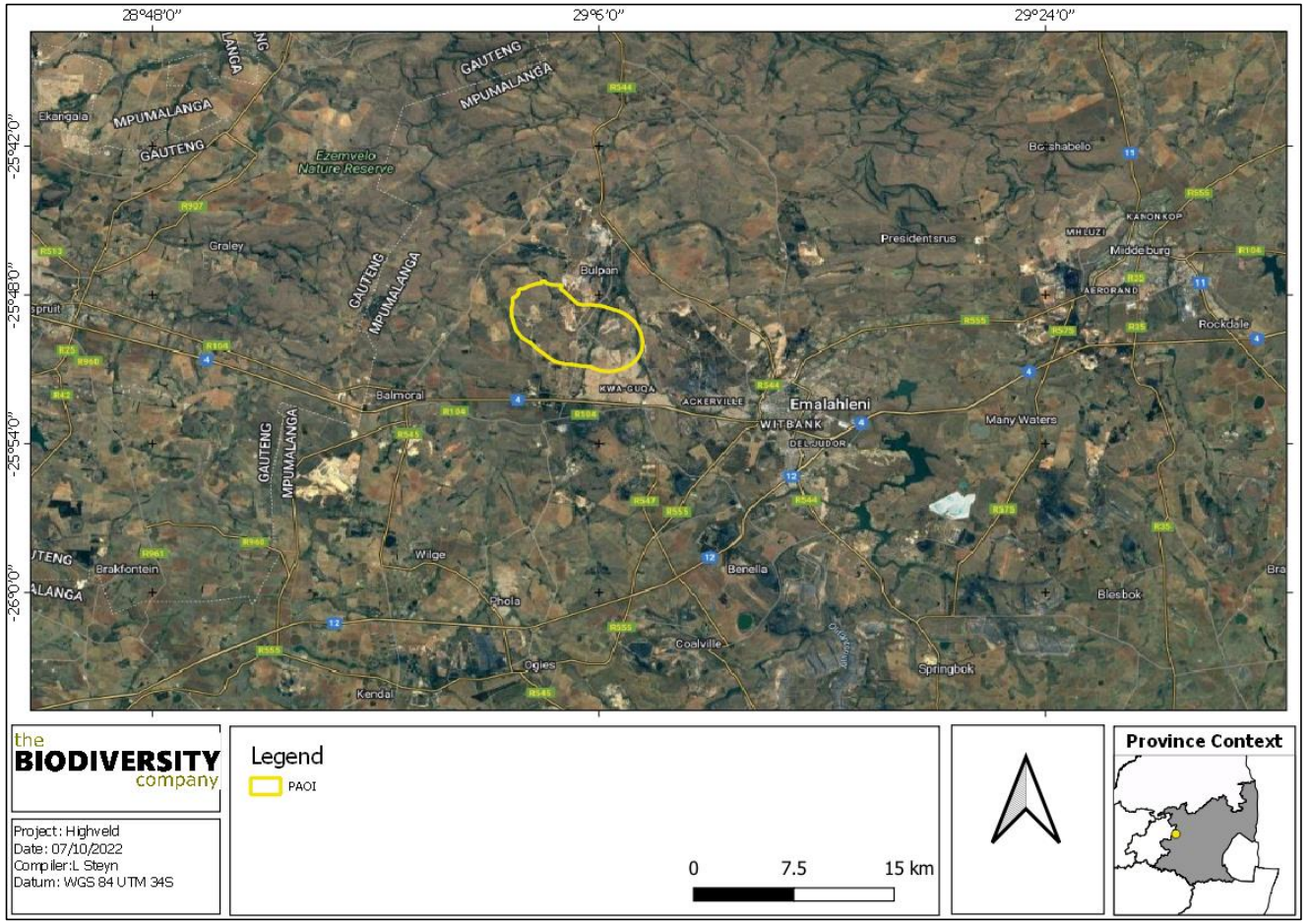


Figure 1-2 Map illustrating the location of the proposed PV Project

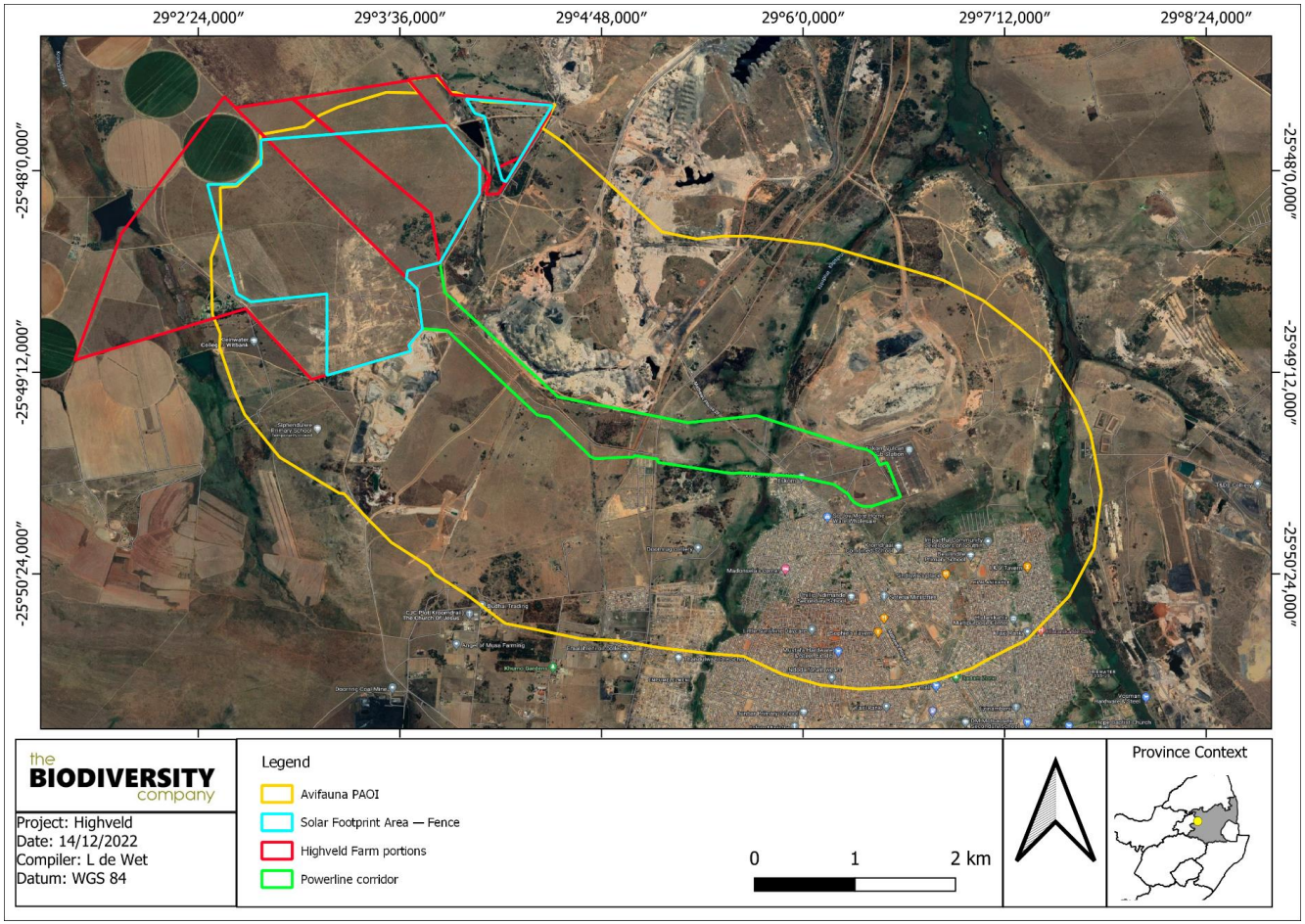


Figure 1-3 Highveld SPP Solar Energy Facility broad layout

1.3 Scope of Work

The assessment was achieved according to the above-mentioned legislation and the best-practice guidelines and principles for Avifaunal Impact Assessments within the context of PVs as outlined by BirdLife South Africa (2017). The scope of the Avifaunal Impact Assessment included the following:

- Desktop assessment to identify the relevant ecologically important geographical features within the Project Area of Influence (PAOI) and surrounding landscape
- Desktop assessment to compile an expected species list and possible avifauna Species of Conservation Concern (SCC) (Figure 1-4) that potentially occur within the PAOI;
- Description of the baseline avifauna species and Functional Feeding Guild (FFG) composition assemblage within the PAOI;
- Delineate site sensitivity or sensitivities i.e., the Site Ecological Importance (SEI) within the context of the avifauna species assemblage of the PAOI;
- Identify the manner that the proposed development impacts the avifauna community and evaluate the level of risk of these potential impacts; and
- Provide mitigation measures to prevent or reduce the possible impacts.

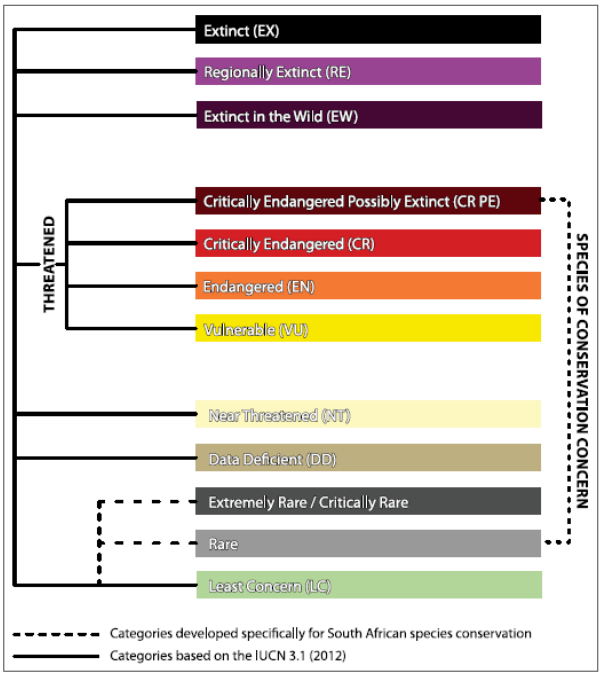


Figure 1-4 ***The different categories of Species of Conservation Concern modified from the IUCN's extinction risk categories. Source: SANBI (2020)***

1.4 Assumptions and Limitations

The following assumptions and limitations should be noted for the assessment:

- The PAOI was based on the project footprint area as provided by the client, as well as a 2 km assessment area around the powerlines. Any alterations to the area and/or missing GIS information pertaining to the assessment area would have affected the area surveyed and hence the results of this assessment;
- Details of the design and layouts were not available at the time of the completion of the report;
- Whilst every effort was made to cover as much of the PAOI as possible it is possible that some species that are present within the PAOI were not recorded during the field investigations due to their secretive behaviour;
- The habitats presented in this report is solely from an avifauna perspective and will likely differ from a terrestrial or wetland perspective; and
- The GPS used in the assessment has an accuracy of 5 m and consequently any spatial features delineated may be offset by up to 5 m.

1.5 Key Legislative Requirements

The legislation, policies and guidelines listed below in Table 1-1 are applicable to the proposed project. The list below, although extensive, may not be complete and other legislation, policies and guidelines may apply in addition to those listed below.

Table 1-1 A list of key legislative requirements relevant to biodiversity and conservation in the Mpumalanga Province

Region	Legislation / Guideline
National	Constitution of the Republic of South Africa (Act No. 108 of 1996)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)
	The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004), Threatened or Protected Species Regulations
	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 the National Environmental Management Act, 1998, GNR 320 of Government Gazette 43310 (March 2020)
	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 the National Environmental Management Act, 1998, GNR 1150 of Government Gazette 43855 (October 2020)
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989)
	National Protected Areas Expansion Strategy (NPAES)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Framework (NBF, 2009)
	National Forest Act (Act No. 84 of 1998)
	National Veld and Forest Fire Act (101 of 1998)
	National Water Act (NWA) (Act No. 36 of 1998)
	National Spatial Biodiversity Assessment (NSBA)
	World Heritage Convention Act (Act No. 49 of 1999)

	Municipal Systems Act (Act No. 32 of 2000)
	Alien and Invasive Species Regulations and, Alien and Invasive Species List 20142020, published under NEMBA
	South Africa's National Biodiversity Strategy and Action Plan (NBSAP)
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA)
	Sustainable Utilisation of Agricultural Resources (Draft Legislation).
	White Paper on Biodiversity
Provincial	Mpumalanga Parks Board Act 6 of 1995
	Mpumalanga Conservation Act, 1998 (Act 10 of 1998)
	Mpumalanga Tourism and Parks Agency Act, No 5 of 2005
	Mpumalanga Biodiversity Sector Plan

2 Methods

2.1 Project Area

2.1.1 Climate

The climate of the project area is classified as a warm and temperate (Cwb) according to the Köppen–Geiger climate classification system (climate-data.org).

In Emalahleni the average annual temperature is 16.3°C and precipitation here is about 760 mm per year. Precipitation is the lowest in July, with an average of 5 mm with the highest precipitation in January, with an average of 134 mm (Figure 2-1). January is the hottest month of the year with an average temperature of 19.9 °C and the lowest average temperature occurs in July at 10.1°C (Figure 2-1).

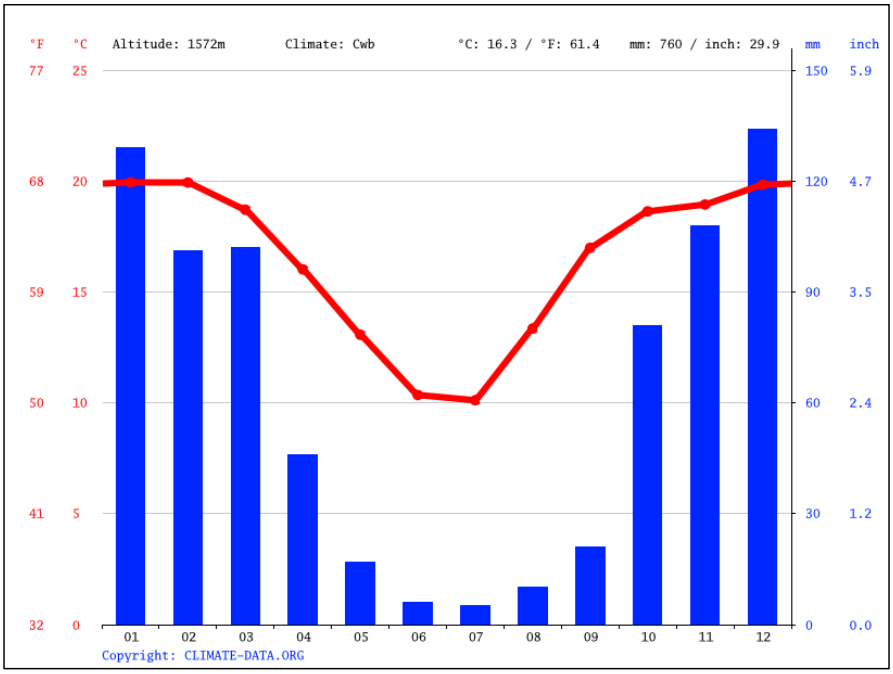


Figure 2-1 ***Column and line plot illustrating climatic characteristics of Emalahleni (source: https://en.climate-data.org/)***

2.1.2 Biome

The project area is situated within the grassland biome. This biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

a) Seasonal precipitation; and
b) The minimum temperatures in winter (Mucina & Rutherford, 2006).

The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees.

2.2 Desktop Assessment

The desktop assessment was principally undertaken using a Geographic Information System (GIS) to access the latest available spatial datasets to develop digital cartographs and species lists. These datasets and their date of publishing are provided below.

2.2.1 Ecologically Important Landscape Features

Existing ecologically relevant data layers were incorporated into a GIS to establish how the proposed development might interact with any ecologically important entities. Emphasis was placed around the following spatial datasets:

- Protected areas:
    - South Africa Protected Areas Database (SAPAD) (DFFE, 2021a) – The South African Protected Areas Database (SAPAD) contains spatial data for the conservation of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. SAPAD is updated on a continuous basis and forms the basis for the Register of Protected Areas which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003.
    - National Protected Areas Expansion Strategy (NPAES) (DFFE, 2021b) – The National Protected Area Expansion Strategy (NPAES) provides spatial information on areas that are suitable for terrestrial ecosystem protection. These focus areas are large, intact and unfragmented and are therefore, of high importance for biodiversity, climate resilience and freshwater protection.
- Important Bird and Biodiversity Areas (BirdLife South Africa, 2022) – Important Bird and Biodiversity Areas (IBAs) constitute a global network of over 13 500 sites, of which 112 sites are found in South Africa. IBAs are sites of global significance for bird conservation, identified through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria;
- Coordinated Water Bird Counts (CWAC) – The Animal Demography Unit (ADU) launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part South Africa's commitment to international waterbird conservation. The primary aim of CWAC is to act as an effective long-term waterbird monitoring tool. This is being done by means of a programme of regular mid-summer and mid-winter censuses at several wetlands. The database is located at https://cwac.birdmap.africa/index.php.
- Coordinated Avifaunal Roadcounts (CAR) – The Coordinated Avifaunal Roadcounts (CAR) were pioneered in July 1993 in a joint Cape Bird Club/ADU project to monitor the populations of two threatened species: *Anthropoides paradiseus* (Blue Crane) and *Neotis denhamii* (Denham's Bustard). Presently it monitors 36 species of large terrestrial birds along 350 fixed routes covering over 19 000 km using a standardised method.
- Mpumalanga Biodiversity Sector Plan -The key output of this systematic biodiversity plan is a map of biodiversity priority areas (MTPA, 2014). The MBSP CBA map delineates Critical Biodiversity Areas, Ecological Support Areas, Other Natural Areas, Protected Areas, and areas that have been irreversibly modified from their natural state (MTPA, 2014). The MBSP uses the following terms to categorise the various land used types according to their biodiversity and environmental importance:
    - Critical Biodiversity Area (CBA);
    - Ecological Support Area (ESA);
    - Other Natural Area (ONA);
    - Protected Area (PA); and

- Moderately or Heavily Modified Areas (MMA's or HMA's).

CBAs are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014). Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014).

The Mpumalanga Biodiversity Sector Plan (MBSP) specifies two different CBA areas, **Irreplaceable CBA's and Optimal CBA's**. Irreplaceable CBA's include: (1) areas required to meet targets and with irreplaceability biodiversity values of more than 80%; (2) critical linkages or pinch-points in the landscape that must remain natural; or (3) critically Endangered ecosystems (MTPA, 2014).

ESAs are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services. Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic (SANBI-BGIS, 2017).

ONAs consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs. A biodiversity sector plan or bioregional plan must not specify the desired state/management objectives for ONAs or provide land-use guidelines for ONAs (SANBI-BGIS, 2017).

Moderately or Heavily Modified Areas (sometimes called 'transformed' areas) are areas that have been heavily modified by human activity so that they are by-and-large no longer natural, and do not contribute to biodiversity targets (MTPA, 2014). Some of these areas may still provide limited biodiversity and ecological infrastructural functions but, their biodiversity value has been significantly, and in many cases irreversibly, compromised.

- Hydrological Context
  - South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer *et al.,* 2018) – A South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was established during the National Biodiversity Assessment of 2018. It is a collection of data layers that represent the extent of river and inland wetland ecosystem types as well as pressures on these systems.
  - National Freshwater Ecosystem Priority Area (NFEPA) (Nel *et al.,* 2011) – The NFEPA database provides strategic spatial priorities for conserving the country's freshwater ecosystems and associated biodiversity as well as supporting sustainable use of water resources.

2.2.2 Desktop Avifauna Assessment

The avifaunal desktop assessment comprised of compiling an expected avifauna list, generated from the South African Bird Atlas Project 2 (SABAP2) dataset using the 2550_2910; 2550_2905; 2550_2900; 2545_2910; 2545_2905; 2545_2900; 2540_2910; 2540_2905; 2540_2900 pentads.

Species of Conservation Concern were identified by either their regional (Taylor *et al*, 2015) or global (IUCN) conservation status.

2.3 Field Survey

Two field surveys were undertaken during the 7th – 9th of October 2022 (Early summer). Sampling consisted of standardized point counts as well as random diurnal incidental surveys. Standardised point counts (Buckland *et al*, 1993) were conducted to gather data on the species composition and relative abundance of species within the broad habitat types identified. The standardized point count technique was utilised as it was demonstrated to outperform line routes (Cumming & Henry, 2019). Each point count was run over a 10 min period. The horizontal detection limit was set at 200 m. At each point the observer would document the date, start time, and end time, habitat, numbers of each species, detection method (seen or heard), behaviour (perched or flying) and general notes on habitat and nesting suitability for conservation important species. To supplement the species inventory with cryptic and illusive species that may not be detected during the rigid point count protocol, diurnal and nocturnal incidental searches were conducted. This involved the opportunistic sampling of species between point count periods, random meandering and road cruising. Effort was made to cover all the different habitat types within the limits of time and access (Figure 2-2).

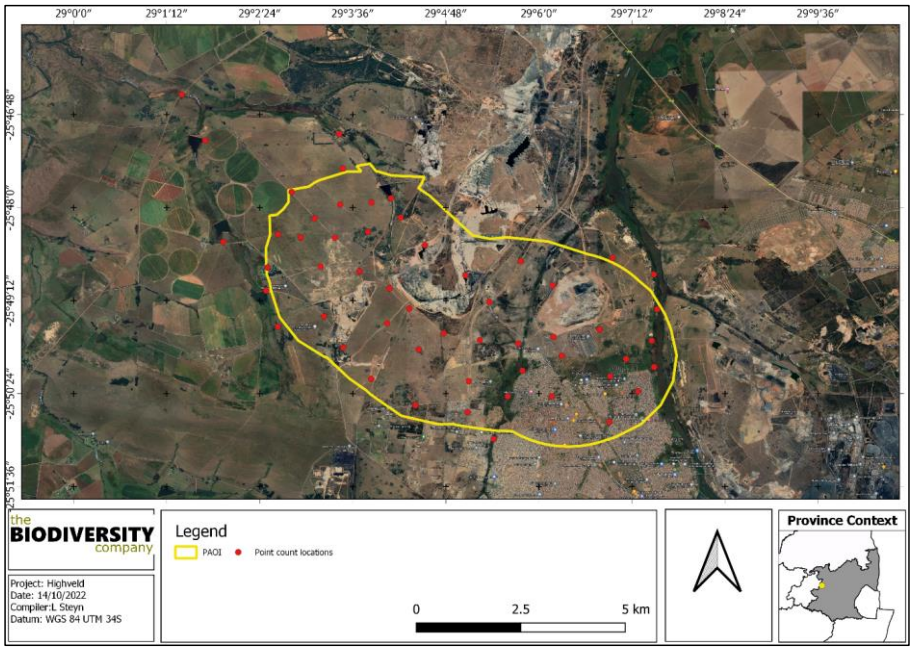


Figure 2-2 Map illustrating the field survey area and locations of standardised point counts for the proposed Solar PV PAOI

2.4 Data Analysis

The analyses described below only used the data collected from the standardised point counts. See Appendix B for the point count raw data.

Point count data was arranged into a matrix with point count samples in rows and species in columns. The table formed the basis of the various subsequent statistical analyses. This data was first used to distinguish similarities / differences in the species composition between the two identified avifaunal habitats, the matrix was converted into a Bray-Curtis dissimilarity matrix. The data was subject to fourth root transformation to downscale the contribution of very abundant species while upscaling the influence

of less abundant species. However, the effect was negligible and ultimately the raw data proved more informative. Thirdly, raw count data was converted to relative abundance values and used to establish dominant species and calculate the diversity of each habitat. Lastly, present, and potentially occurring species were assigned to 13 major trophic guilds loosely based on the classification system developed by González-Salazar *et al.* (2014). Species were first classified by their dominant diet (carnivore, herbivore, granivore, frugivore, nectarivore, omnivore), then by the medium upon / within which they most frequently forage (ground, water, foliage, air) and lastly by their activity period (nocturnal or diurnal).

2.5 Site Ecological Importance

The different habitat types within the project area were delineated and identified based on observations during the field assessment, and available satellite imagery. These habitat types will be assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of species of conservation concern and their ecosystem processes.

Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present on the site) and Receptor Resilience (RR) (its resilience to impacts) as follows.

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows. The criteria for the CI and FI ratings are provided in Table 2-1 and Table 2-2, respectively.

Table 2-1 Summary of Conservation Importance (CI) criteria

Conservation Importance	Fulfilling Criteria
Very High	Confirmed or highly likely occurrence of Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Extremely Rare or CR species that have a global extent of occurrence (EOO) of < 10 km^2. Any area of natural habitat of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent) of natural habitat of an EN ecosystem type. Globally significant populations of congregatory species (> 10% of global population).
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining. Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type. Presence of Rare species. Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	Confirmed or highly likely occurrence of populations of Near Threatened (NT) species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystem type with status of VU. Presence of range-restricted species. > 50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed or highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species. < 50% of receptor contains natural habitat with limited potential to support SCC.
Very Low	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

Table 2-2 Summary of Functional Integrity (FI) criteria

Functional Integrity	Fulfilling Criteria
Very High	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. No or minimal current negative ecological impacts, with no signs of major past disturbance.
High	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity, with potentially functional ecological corridors and a regularly used road network between intact habitat patches.

Functional Integrity	Fulfilling Criteria
	Only minor current negative ecological impacts, with no signs of major past disturbance and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts, with some major impacts and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (> 1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. Several minor and major current negative ecological impacts.
Very Low	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

BI can be derived from a simple matrix of CI and FI as provided in Table 2-3.

Table 2-3 Matrix used to derive Biodiversity Importance (BI) from Functional Integrity (FI) and Conservation Importance (CI)

Biodiversity Importance (BI)		Conservation Importance (CI)				
		Very high	**High**	**Medium**	**Low**	**Very low**
Functional Integrity (FI)	**Very high**	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor, as summarised in Table 2-4.

Table 2-4 Summary of Receptor Resilience (RR) criteria

Resilience	Fulfilling Criteria
Very High	Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
Medium	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of: (i) remaining at a site even when a disturbance or impact is occurring, or (ii) returning to a site once the disturbance or impact has been removed.
Very Low	Habitat that is unable to recover from major impacts, or species that are unlikely to: (i) remain at a site even when a disturbance or impact is occurring, or (ii) return to a site once the disturbance or impact has been removed.

Subsequent to the determination of the BI and RR, the SEI can be ascertained using the matrix as provided in Table 2-5.

Table 2-5 Matrix used to derive Site Ecological Importance from Receptor Resilience (RR) and Biodiversity Importance (BI)

Site Ecological Importance		Biodiversity Importance (BI)				
		Very high	High	Medium	Low	Very low
Receptor Resilience (RR)	Very Low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very High	Medium	Low	Very low	Very low	Very low

Interpretation of the SEI in the context of the proposed project is provided in Table 2-6.

Table 2-6 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

The SEI evaluated for each taxon can be combined into a single multi-taxon evaluation of SEI for the assessment area. Either a combination of the maximum SEI for each receptor should be applied, or the SEI may be evaluated only once per receptor but for all necessary taxa simultaneously. For the latter, justification of the SEI for each receptor is based on the criteria that conforms to the highest CI and FI, and the lowest RR across all taxa. For the purposes of this assessment, only avifauna were considered.

3 Results & Discussion

3.1 Desktop Assessment

3.1.1 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed project to ecologically important landscape features is summarised in Table 3-1.

Table 3-1 Summary of relevance of the proposed project to ecologically important landscape features

Desktop Information Considered	Relevance	Section
Protected Areas	Irrelevant – The nearest protected area (John Cairns Private Nature Reserve) is located 11 km from the project area.	-
National Protected Areas Expansion Strategy	Relevant – The PAOI overlaps with a priority focus area.	3.1.1.8
Mpumalanga Biodiversity Sector Plan	Relevant – The PAOI overlaps with CBA, HMA, ESA and ONA features	3.1.1.1
Important Bird and Biodiversity Area	Irrelevant – The closest IBA (Loskop Dam Nature Reserve) is 30.5 km away from the PAOI.	3.1.1.2

Coordinated Water Bird Counts	Irrelevant – The PAOI is 19 km away from the closest CWAC site	3.1.1.3
Coordinated Avifaunal Roadcounts	Irrelevant – The closest CAR route is 10 km away from the PAOI.	3.1.1.4
South African Inventory of Inland Aquatic Ecosystems	Relevant – The PAOI overlaps with both a CR river and numerous CR wetlands	3.1.1.5
National Freshwater Ecosystem Priority Areas	Relevant – The PAOI overlap with unclassified wetlands and an unclassified river.	3.1.1.5
Strategic Transmission Corridors	Relevant- The PAOI overlaps with the International EGI corridor.	3.1.1.6
Renewable Energy Zones	Relevant - The project area falls within the Emalahleni Solar REDZ	3.1.1.7

3.1.1.1 Mpumalanga Biodiversity Sector Plan

The key output of this systematic biodiversity plan is a map of biodiversity priority areas (MTPA, 2014). The MBSP CBA map delineates Critical Biodiversity Areas, Ecological Support Areas, Other Natural Areas, Protected Areas, and areas that have been irreversibly modified from their natural state (MTPA, 2014). The MBSP uses the following terms to categorise the various land used types according to their biodiversity and environmental importance:

- Critical Biodiversity Area (CBA);
- Ecological Support Area (ESA);
- Other Natural Area (ONA);
- Protected Area (PA); and
- Moderately or Heavily Modified Areas (MMA's or HMA's).

Figure 3-1 indicates that the PAOI overlaps with CBA, HMA, ESA and ONA features.

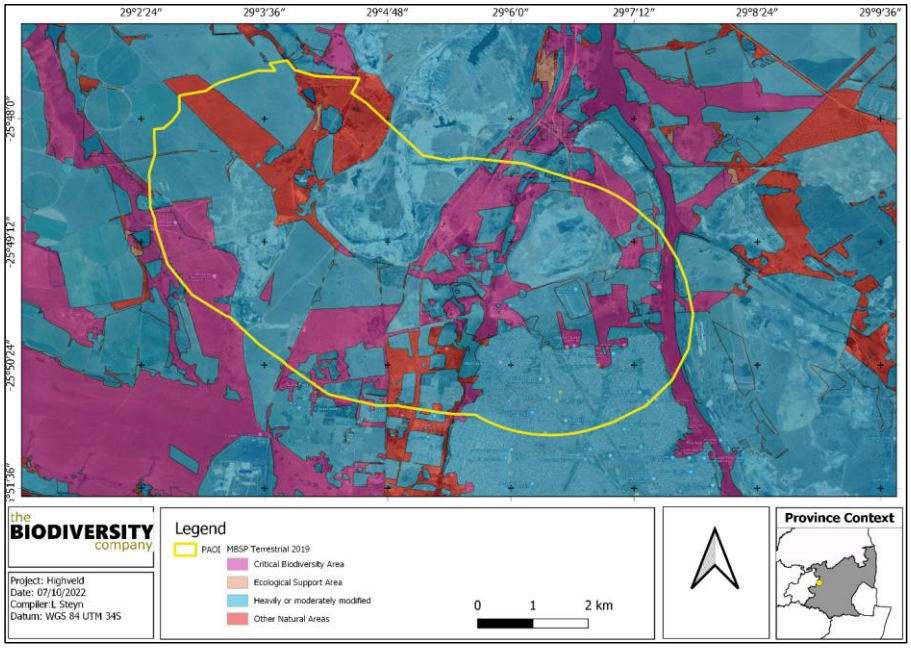


Figure 3-1 Map illustrating Mpumalanga Biodiversity Sector Plan features overlapping the proposed PAOI

3.1.1.2 Important Bird and Biodiversity Areas

Important Bird & Biodiversity Areas (IBAs) are the sites of international significance for the conservation of the world's birds and other conservation significant species as identified by BirdLife International. These sites are also all Key Biodiversity Areas; sites that contribute significantly to the global persistence of biodiversity.

The selection of IBAs is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels.

Figure 3-2 illustrates that the proposed development does not overlap any IBAs. The closest IBA (Loskop Dam Nature Reserve) is 30.5 km away from the PAOI.

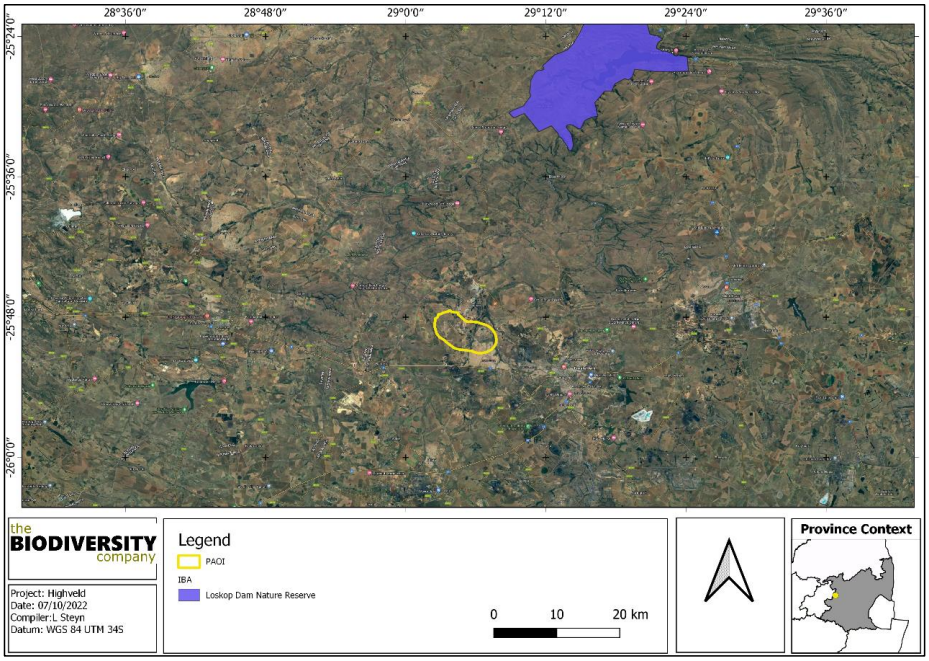


Figure 3-2 Map illustrating Important Bird and Biodiversity Areas in relation to the proposed PAOI

3.1.1.3 Coordinated Water Bird Counts (CWAC)

The PAOI is 19 km away from the closest CWAC site (Figure 3-3). It is therefore unlikely that the species recorded at this CWAC to be affected by the development.

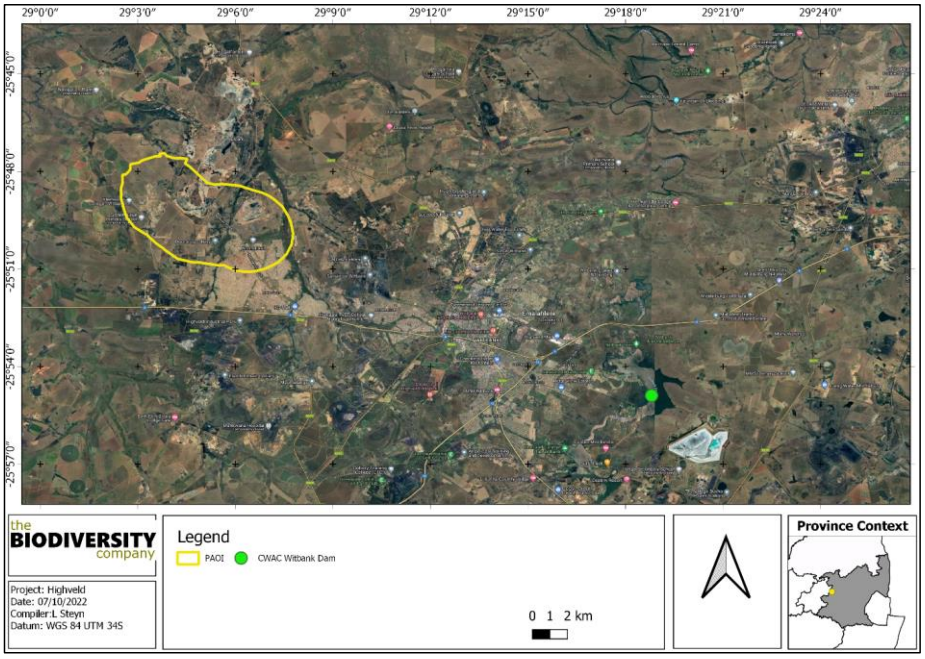


Figure 3-3 Map illustrating Coordinated Water Bird Counts (CWAC) locations in relation to the proposed PAOI

3.1.1.4 Coordinated Avifaunal Roadcounts (CAR)

Figure 3-4 illustrates the location of CAR routes in relation to the PAOI. The closest CAR route is 10 km away from the PAOI. No recent information is available for these routes.

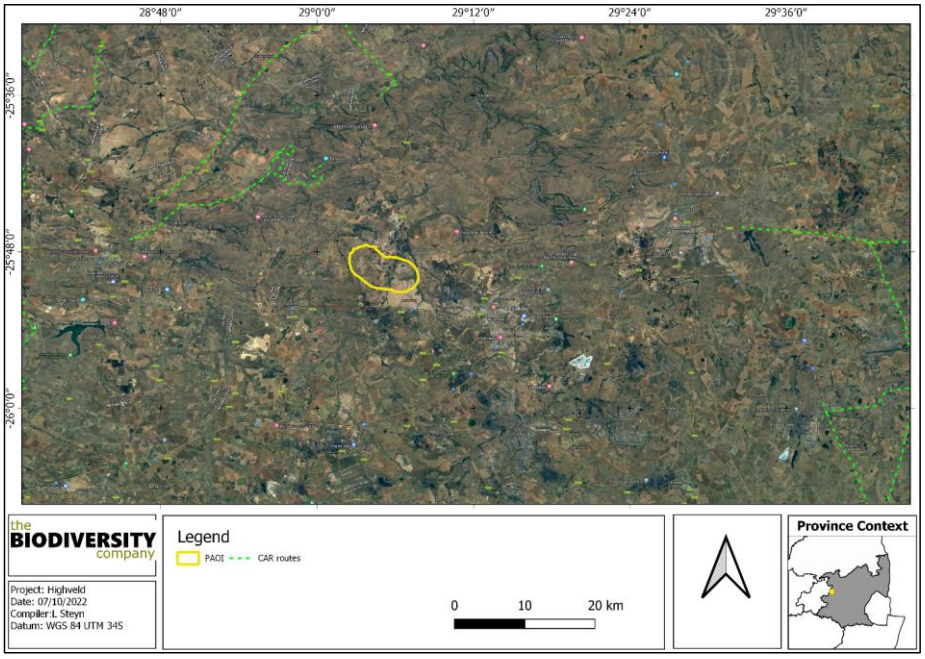


Figure 3-4 Map illustrating Coordinated Avifaunal Roadcounts (CAR) routes in relation to the proposed PAOI

3.1.1.5 Hydrological Context

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) was released with the National Biodiversity Assessment (NBA) 2018. Ecosystem threat status (ETS) of ecosystem types is based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT. Critically Endangered, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer *et al.,* 2019; Skowno *et al.,* 2019). The PAOI overlaps with both a CR river and numerous CR wetlands (Figure 3-5).

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al.,* 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals (Nel *et al.,* 2011).

Figure 3-5 illustrates that the PAOI overlap with unclassified wetlands and an unclassified river.

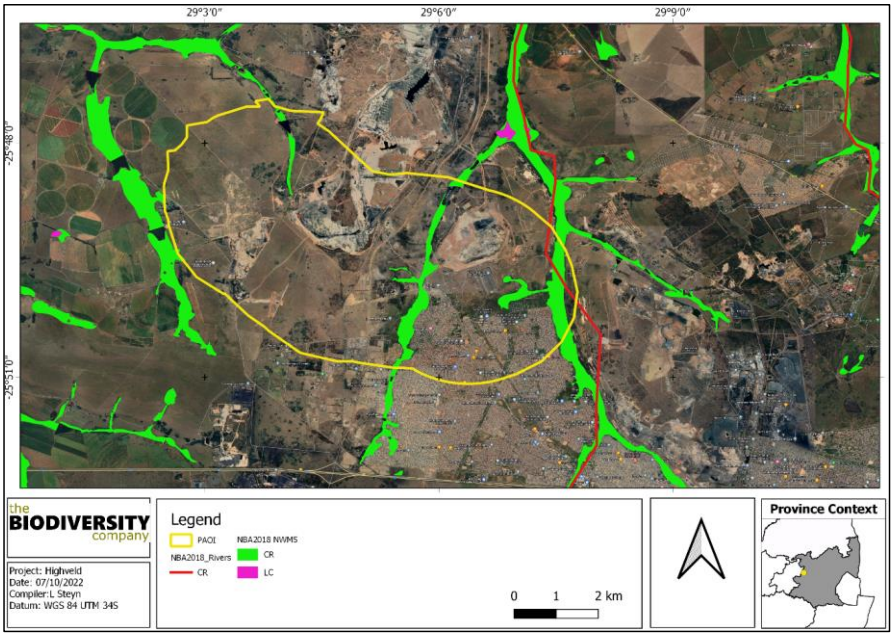


Figure 3-5 Map illustrating hydrological context (SAIIAE) of the proposed PAOI

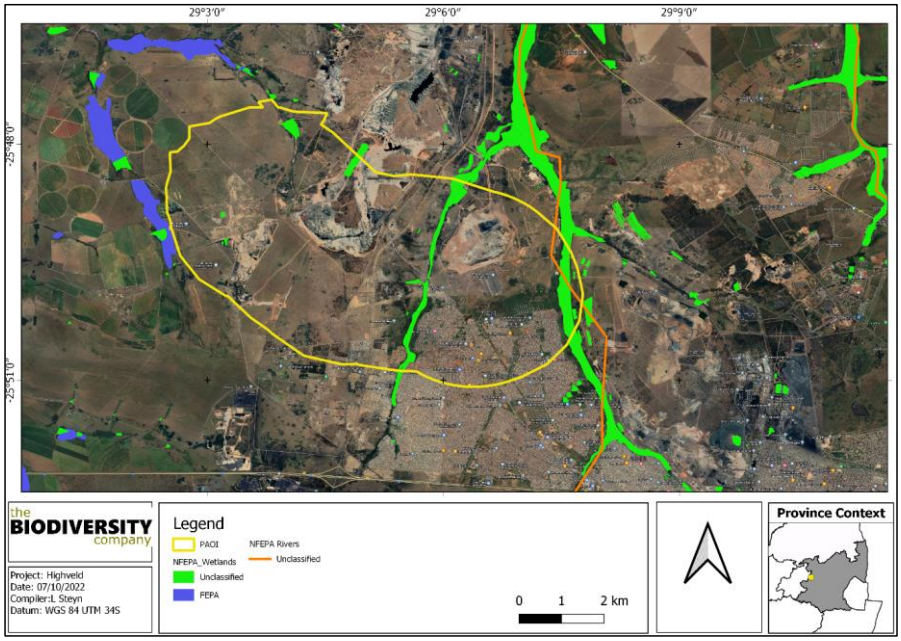


Figure 3-6 Map illustrating hydrological context (NFEPA) of the proposed PAOI

3.1.1.6 Strategic Transmission Corridors (EGI)

On the 16 February 2018 minister Edna Molewa published Government Notice No. 113 in Government Gazette No. 41445 which identified 5 strategic transmission corridors important for the planning of electricity transmission and distribution infrastructure as well as procedure to be followed when applying for environmental authorisation for electricity transmission and distribution expansion when occurring in these corridors.

On 29 April 2021, Minister Barbara Dallas Creecy published Government Notice No. 383 in Government Gazette No. 44504, which expanded the eastern and western transmission corridors and gave notice of the applicability of the application procedures identified in Government Notice No. 113, to these expanded corridors. More information on this can be obtained from https://egis.environment.gov.za/egi.

Figure 3-7 shows the PAOI overlaps with the International EGI corridor.

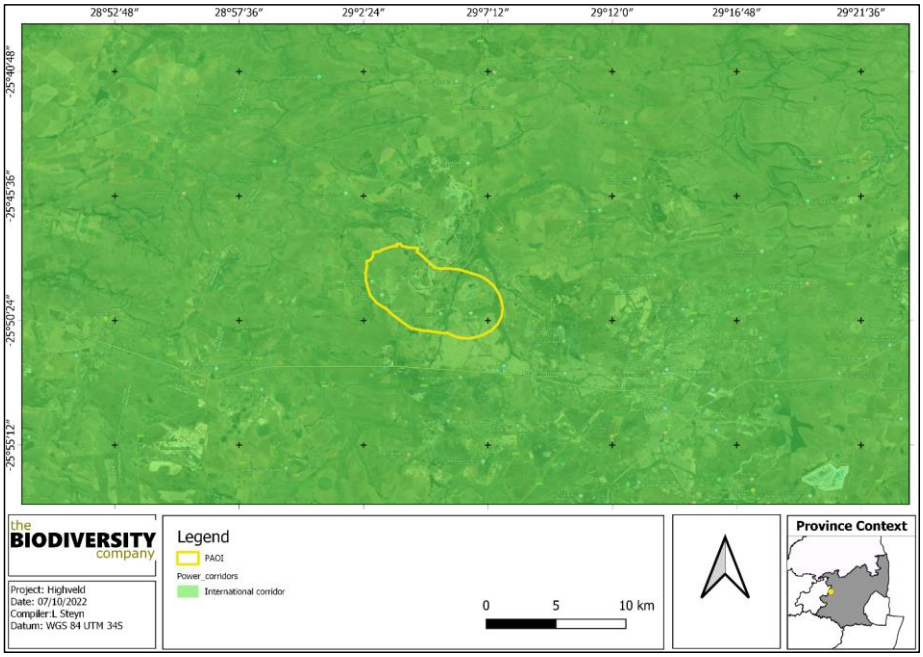


Figure 3-7 The project area in relation to the strategic transmission corridors

3.1.1.7 Renewable Energy Development Zones (REDZ)

In 2018 the Government Notice No. 114 in Government Gazette No. 41445 was published where 8 renewable energy development zones important for the development of large-scale wind and solar photovoltaic facilities were identified. In 2021 an additional 3 sites were included. The REDZs were identified through the undertaking of 2 Strategic Environmental Assessments.

More detailed information can be obtained from https://egis.environment.gov.za/redz. Information here includes the Government Notice No. 142, 144 and 145 in Government Gazette No. 44191 that specifies the procedures to be followed when applying for environmental authorisation for electricity transmission or distribution infrastructure or large-scale wind and solar photovoltaic energy facilities in these REDZs.

The project area falls within the Emalahleni Solar REDZ (Figure 3-8).

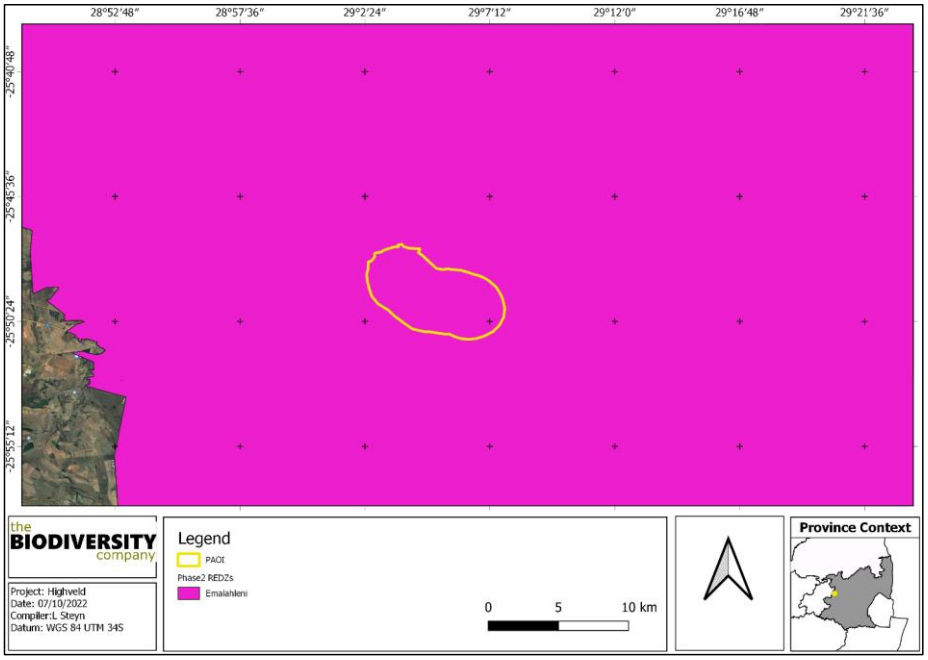


Figure 3-8 The project area in relation to the Renewable Energy Development Zone dataset

3.1.1.8 National Protected Area Expansion Strategy

National Protected Area Expansion Strategy 2018 (NPAES) were identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for finescale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities (NPAES, 2018). Figure 3-9 shows the PAOI overlaps with a priority focus area.

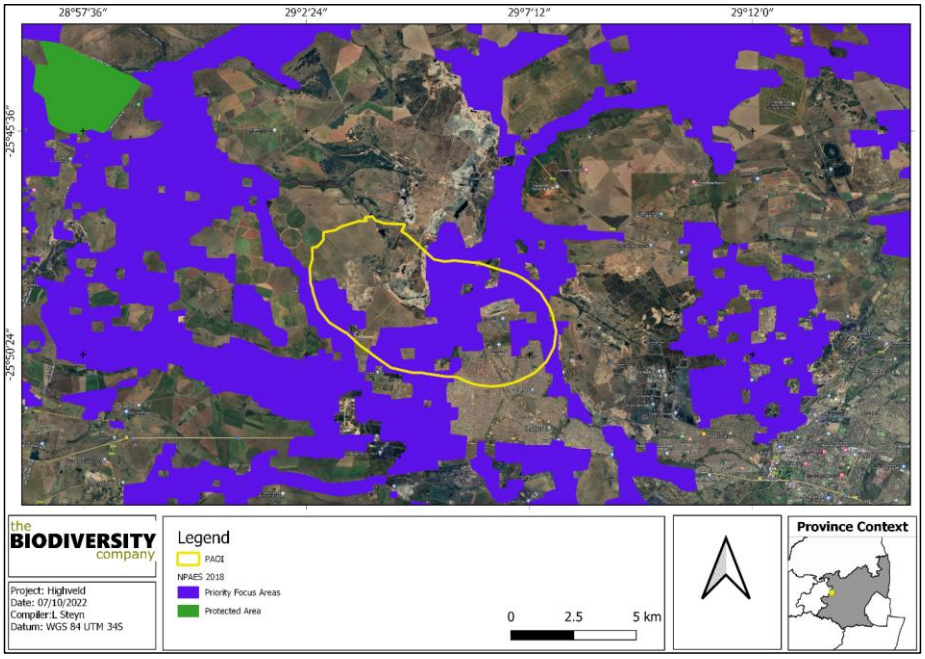


Figure 3-9 The project area in relation to the NPAES areas

3.1.2 Expected Species of Conservation Concern

The SABAP2 Data lists 276 indigenous avifauna species that could be expected to occur within the PAOI and surrounding landscape (Appendix B). Twelve (12) of these expected species are regarded as SCC (Table 3-2). Two species were given a low likelihood of occurrence based on the lack of suitable habitat and nesting sites.

Table 3-2 Threatened avifauna species that are expected to occur within the project area EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2021)	
Aquila verreauxii	Eagle, Verreaux's	VU	LC	Low
Circus ranivorus	Marsh-harrier, African	EN	LC	Observed
Coracias garrulus	Roller, European	NT	LC	High
Eupodotis senegalensis	Korhaan, White-bellied	VU	LC	High
Falco biarmicus	Falcon, Lanner	VU	LC	High
Grus paradisea	Crane, Blue	NT	VU	Moderate
Mirafra cheniana	Lark, Melodious	LC	NT	Moderate
Neotis denhami	Bustard, Denham's	VU	NT	Moderate
Oxyura maccoa	Duck, Maccoa	NT	VU	Moderate
Polemaetus bellicosus	Eagle, Martial	EN	EN	Low
Sagittarius serpentarius	Secretarybird	VU	EN	High
Tyto capensis	Grass-owl, African	VU	LC	High

Circus ranivorus (African Marsh Harrier) is listed as EN in South Africa (ESKOM, 2014). This species has an extremely large distributional range in sub-equatorial Africa. South African populations of this species are declining due to the degradation of wetland habitats, loss of habitat through over-grazing and human disturbance and possibly, poisoning owing to over-use of pesticides (IUCN, 2017). This species breeds in wetlands and forages primarily over reeds and lake margins. This species were recorded just outside of the PAOI along the Klipspruit.

Coracias garrulous (European Roller) is a summer migrant with the population from South-central Europe and Asia occurring throughout sub-Saharan Africa. The European Roller has a preference for bushy plains and dry savannah areas. It is globally listed as LC (BirdLife International, 2019a) but NT on a regional scale (Taylor *et al,* 2015). Threats include persecution on migration in some Mediterranean countries and numerous individuals are killed for food in Oman and India. The loss of suitable breeding habitat due to changing agricultural practices, conversion to monoculture, loss of nest sites, and use of pesticides (reducing food availability) are the main threats to the species in Europe (BirdLife International, 2019a). It is sensitive to loss of hedgerows and riparian forest in Europe which provide essential habitats for perching and nesting. Suitable habitat can be found in the project area as such the likelihood of occurrence is rated as high.

Eupodotis senegalensis (White-bellied Korhaan) is Near-endemic to South Africa, occurring from the Limpopo Province and adjacent provinces, south through Swaziland to KwaZulu-Natal and the Eastern Cape. It generally prefers tall, dense sour or mixed grassland, either open or lightly wooded, occasionally moving into cultivated or burnt land (Hockey *et al,* 2005), which does seem present in the project area thus likelihood of occurrence was rated as high.

Falco biarmicus (Lanner Falcon) is native to South Africa and inhabits a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). They may occur in groups up to 20 individuals, but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins. The likelihood of incidental records of this species in the project area is rated as high due to the natural veld condition and the presence of many bird species on which Lanner Falcons may predate.

Grus paradiseus (Blue Crane) is listed as NT on a regional scale and as VU on a global scale. This species has declined, largely owing to direct poisoning, power-line collisions and loss of its grassland breeding habitat owing to afforestation, mining, agriculture and development (IUCN, 2017). This species breeds in natural grass- and sedge-dominated habitats, preferring secluded grasslands at high elevations where the vegetation is thick and short. The habitat in the project area is not regarded as ideal therefore a moderate likelihood of occurrence is appointed to this species.

Mirafra cheniana (Melodious Lark) is seen as NT on a global scale. This species is a non endemic species that can be found in the central South African regions. The species inhabits grassland slopes, preferring open areas with open spaces between tussocks, typically where grass is shorter than 50 cm, but avoids wetter lowlands. It is threatened by habitat loss and change (IUCN, 2019). This species has a moderate likelihood of occurring.

Neotis denhami (Denhams Bustard) is listed as VU on a regional scale and NT on a global scale. It occurs in flat, arid, mostly open country such as grassland, karoo, bushveld, thornveld, scrubland and savanna but also including modified habitats such as wheat fields and firebreaks Collisions with power lines may be a significant threat in parts of the range, particularly South Africa (IUCN, 2007). The habitat at the project area does provide marginally suitable habitat for this species and therefore it's likelihood of occurrence is rated as moderate.

Oxyura maccoa (Maccoa Duck) has a large northern and southern range, South Africa is part of its southern distribution. During the species' breeding season, it inhabits small temporary and permanent inland freshwater lakes, preferring those that are shallow and nutrient-rich with extensive emergent vegetation such as reeds (*Phragmites* spp.) and cattails (*Typha* spp.) on which it relies for nesting (IUCN,

2017). The likelihood of occurrence of this species was rated as moderate based on the river found in the PAOI.

Sagittarius serpentarius (Secretarybird) is listed as EN on a global scale (BirdLife International, 2020). The species has a wide distribution across sub-Saharan Africa but surveyed densities suggest that the total population size does not exceed a five-figure number. Ad-hoc records, localised surveys and anecdotal observations indicate apparent declines in many parts of the species' range, especially in South Africa where reporting rates decreased by at least 60% of quarter degree grid cells used in Southern African Bird Atlas Projects. Threats include excessive burning of grasslands that may suppress populations of prey species, whilst the intensive grazing of livestock is also probably degrading otherwise suitable habitat. Disturbance by humans is likely to negatively affect breeding. The species is captured and traded; however, it is unknown how many deaths occur in captivity and transit. Direct hunting and nest-raiding for other uses and indiscriminate poisoning at waterholes are also further threats. A proposed conservation action is that landowners of suitable properties should join biodiversity stewardship initiatives and to manage their properties in a sustainable way for the species' populations. The habitat is very suitable for the species therefore the likelihood of occurrence is high.

Tyto capensis (African Grass-owl) is rated as VU on a regional basis. The distribution of the species includes the eastern parts of South Africa. The species is generally solitary, but it does also occur in pairs, in moist grasslands where it roosts (IUCN, 2017). The species prefers thick grasses around wetlands and rivers which are not present in the project area. Furthermore, this species specifically has a preference for nesting in dense stands of the grass species *Imperata cylindrica*. Numerous areas of suitable habitat can be found in the PAOI, especially along the Klipspruit, therefore the likelihood of occurrence is rated as high.

4 Field Assessment

During the assessment performed in the summer (7th – 9th of October 2022) 99 species were recorded during the point counts (Appendix B) and 4 additional species during the incidental counts (Appendix C). The total number of individual species accounts for approximately 36% of the total number of expected species (Table 4-1). The disturbed nature of the project area and surrounds is most likely a contributing factor to the numbers recorded.

One of the species recorded was an SCC, the African Marsh Harrier (*Circus ranivorus*) was recorded along the Klipspruit River just outside of the PAOI. The overall state of the river appeared to be somewhat modified but overall, in a healthy state based on the diversity of water fowl observed. Table 4-1 lists the species recorded, Figure 4-1 are photographic evidence of the specie while Figure 4-2 shows the location of the observed specie.

Table 4-1 The avifauna specie of conservation concern recorded within the proposed PAOI during the field survey.

Scientific Name	Common Name	Regional Status	International Status
African Marsh Harrier	*Circus ranivorus*	EN	LC

Figure 4-1 The African Marsh Harrier recorded in the assessment

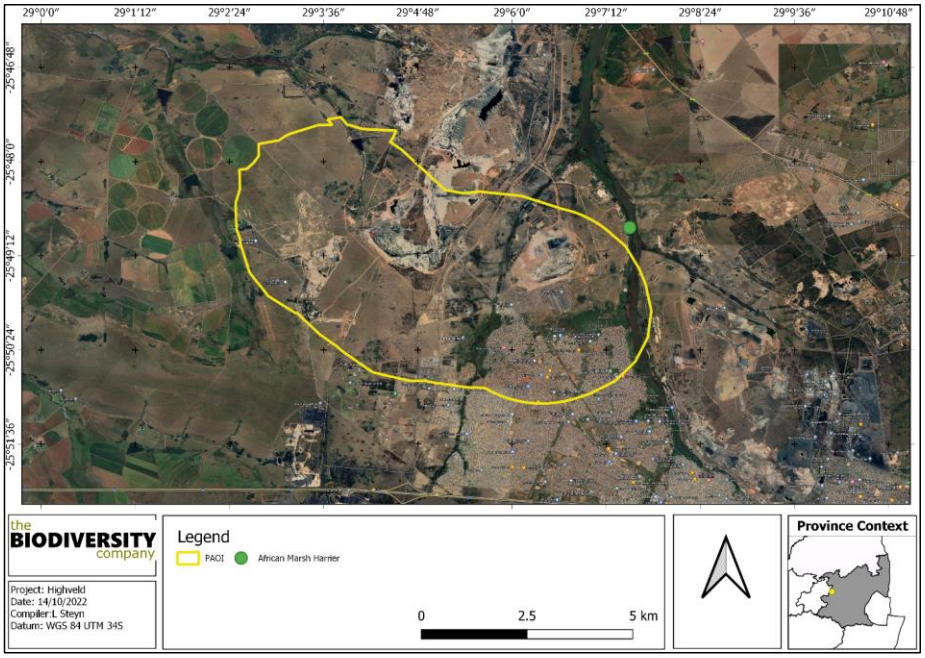


Figure 4-2 Location of the African Marsh Harrier sighting

4.1 Priority Species

'Priority Species' are those avifauna that are particularly susceptible to energy developments, and although these priority species were developed for Wind Energy developments (Ralston Paton *et al*, 2017), the type of impact is congruent with solar energy facilities, i.e., collision, electrocution, and habitat loss. The priority species influenced by the powerlines as per the Eskom and EWT birds and powerline (2015) poster were also considered. Even though the panels may not pose an extensive collision risk for larger avifauna species, powerlines associated with the infrastructure, guidelines (anchor lines) and connection lines do pose a risk. The fence could also pose a collision risk for various species. Eleven of the species observed within the PAOI are regarded as priority species (Table 4-2). The location of some of these species within the PAOI and surrounds are provided in Figure 4-4, while photographs of some of the species are shown in Figure 4-3. Some of these species were recorded outside of the PAOI however, these are likely to fly over the PAOI and thus be impacted by the proposed infrastructure.

Table 4-2 Summary of Priority Species recorded within and around the proposed Highveld Solar PV

Scientific Name	Common Name	Collisions	Electrocutions	Habitats Loss
Spur-winged Goose	*Plectropterus gambensis*	x		
Egyptian Goose	*Alopochen aegyptiaca*	x	x	
Reed Cormorant	*Microcarbo africanus*		x	
Pied Crow	*Corvus albus*		x	
Black-headed Heron	*Ardea melanocephala*	x	x	
African Marsh Harrier	*Circus ranivorus*	x	x	x
African Sacred Ibis	*Threskiornis aethiopicus*		x	
Purple Heron	*Ardea purpurea*	x	x	
Black Sparrowhawk	*Accipiter melanoleucus*		x	
Greater Kestrel	*Falco rupicoloides*		x	x
Northern Black Korhaan	*Afrotis afraoides*	x		

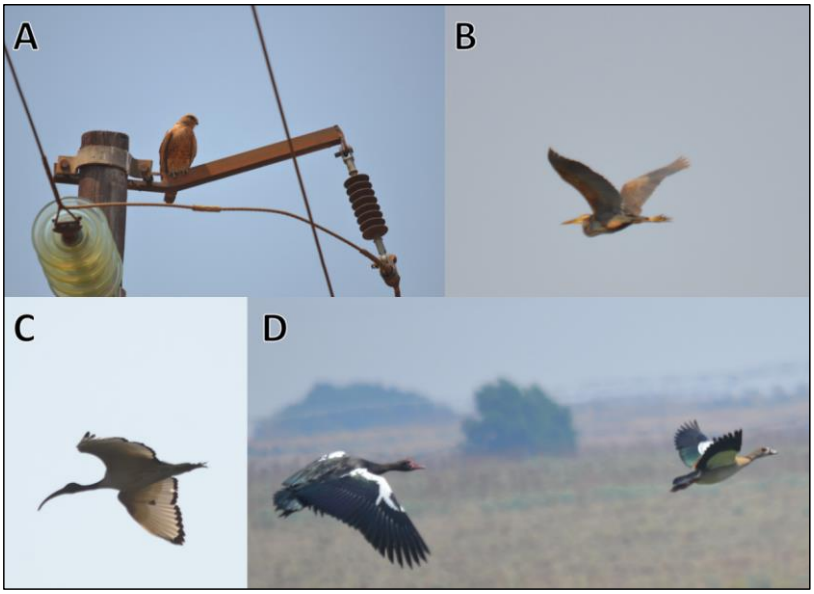


Figure 4-3 ***Some of the risk species identified; A) Greater Kestrel, B) Purple Heron, C) African Sacred Ibis and D) Spur-winged Goose and Egyptian Goose***

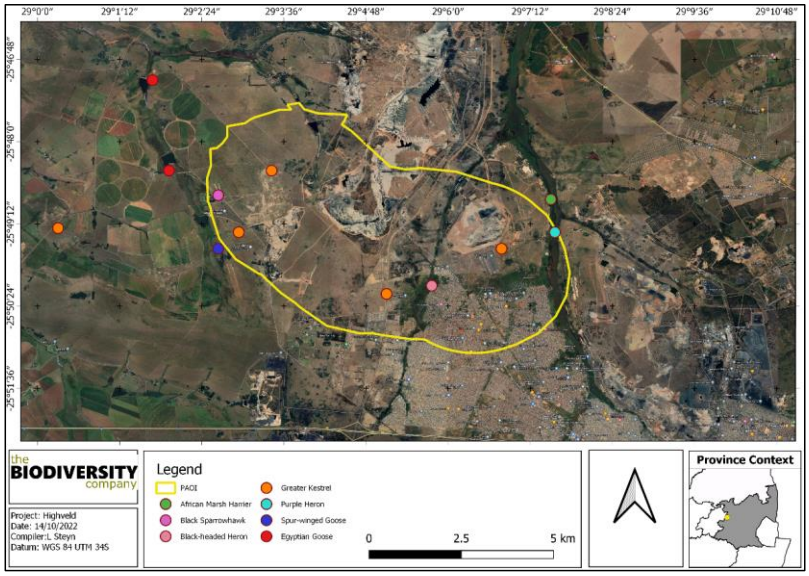


Figure 4-4 ***Map illustrating the location of some of the priority avifauna species within and around the proposed PAOI***

4.2 Dominant Species

Table 4-3 provides the relative abundance of the dominant species as well as the frequency with which each species appeared in the point count samples. Twenty-seven of the recorded species accounted for more than 72% of the total number of individuals recorded. The most abundant species was *Quelea quelea* (Red-billed Quelea) with a relative abundance of 0.18 and a frequency of occurrence of 1.9%. Additional ubiquitous species comprised of *Ploceus velatus* (Southern Masked Weaver) and *Streptopelia capicola* (Cape Turtle Dove), with a frequency of occurrence of 53.8% and 42.3%, respectively. Some of these species were recorded in point counts outside of the PAOI, as they occur within proximity of the PAOI they are highly likely to fly over the PAOI and thus be impacted by the proposed infrastructure.

Table 4-3 Relative abundance and frequency of occurrence of dominant avifauna species recorded within the PAOI during the field survey. Dominant species cumulatively account for more than 72% of the overall abundance. Only data from the standardized point counts were considered.

Common Name	Scientific Name	Regional (SANBI, 2016)	IUCN (2017)	Relative abundance	Frequency (%)
Red-billed Quelea	*Quelea quelea*	Unlisted	LC	0,176	1,923
Southern Masked Weaver	*Ploceus velatus*	Unlisted	LC	0,049	53,846
Cape Turtle Dove	*Streptopelia capicola*	Unlisted	LC	0,039	42,308
Desert Cisticola	*Cisticola aridulus*	Unlisted	LC	0,039	42,308
Helmeted Guineafowl	*Numida meleagris*	Unlisted	LC	0,037	15,385
Rufous-naped Lark	*Mirafra africana*	Unlisted	LC	0,032	34,615
Spur-winged Goose	*Plectropterus gambensis*	Unlisted	LC	0,026	5,769
Egyptian Goose	*Alopochen aegyptiaca*	Unlisted	LC	0,023	11,538
Levaillant's Cisticola	*Cisticola tinniens*	Unlisted	LC	0,021	23,077
Rock Dove	*Columba livia*	Unlisted	LC	0,021	7,692
Cloud Cisticola	*Cisticola textrix*	Unlisted	LC	0,019	21,154
Black-chested Prinia	*Prinia flavicans*	Unlisted	LC	0,019	21,154
Western Cattle Egret	*Bubulcus ibis*	Unlisted	LC	0,019	13,462
Long-tailed Widowbird	*Euplectes progne*	Unlisted	LC	0,018	19,231
Southern Fiscal	*Lanius collaris*	Unlisted	LC	0,018	19,231
Neddicky	*Cisticola fulvicapilla*	Unlisted	LC	0,018	19,231
African Stonechat	*Saxicola torquatus*	Unlisted	LC	0,016	17,308
African Pipit	*Anthus cinnamomeus*	Unlisted	LC	0,016	17,308
Cape Sparrow	*Passer melanurus*	Unlisted	LC	0,016	13,462
Common Myna	*Acridotheres tristis*	Unlisted	LC	0,016	17,308
Pied Starling	*Lamprotornis bicolor*	Unlisted	LC	0,014	13,462
Blacksmith Lapwing	*Vanellus armatus*	Unlisted	LC	0,012	13,462
White-fronted Bee-eater	*Merops bullockoides*	Unlisted	LC	0,012	13,462
Reed Cormorant	*Microcarbo africanus*	Unlisted	LC	0,011	3,846
Cape Longclaw	*Macronyx capensis*	Unlisted	LC	0,011	11,538
African Wattled Lapwing	*Vanellus senegallus*	Unlisted	LC	0,011	11,538
Speckled Pigeon	*Columba guinea*	Unlisted	LC	0,011	11,538

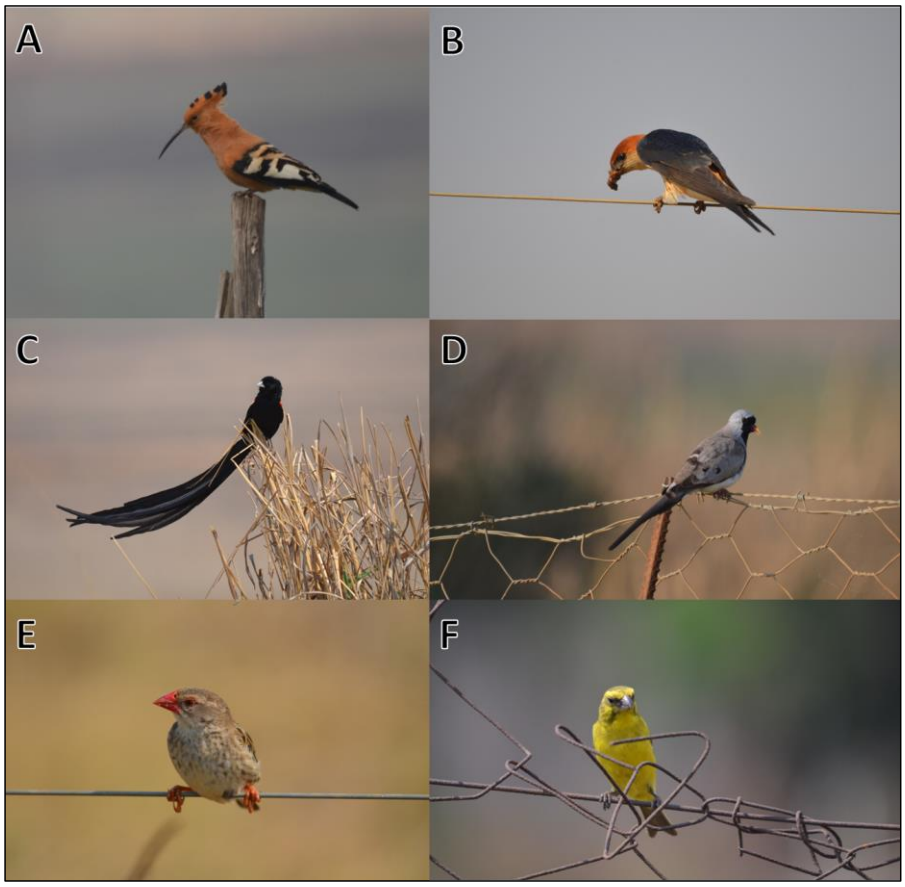


Figure 4-5 ***Some of the species recorded in the project area; A) African Hoopoe, B) Greater Striped Swallow, C) Long-tailed Widowbird, D) Namaqua Dove, E) Red-billed Quelea and F) Yellow Canary***

4.3 Trophic Guilds

Trophic guilds are defined as a group of species that exploit the same class of environmental resources in a similar way (González-Salazar *et al,* 2014). The guild classification used in this assessment is as per González-Salazar *et al* (2014); they divided avifauna into 13 major groups based on their diet, habitat, and main area of activity. Although species to tend to exhibit varied diet with invertivores consuming fruit and frugivores consuming insects for example, the dominant composition of the diet was considered.

The analysis of the major avifaunal guilds reveals that the species composition during the survey was dominated by insectivorous birds that feed on the ground during the day (IGD). Followed by Granivores (GGD) and Omnivores (OMD) (Figure 4-6). Due to the safety concerns in the area no night assessment were conducted, therefore the nocturnal species would only be included if observed by chance during the day.

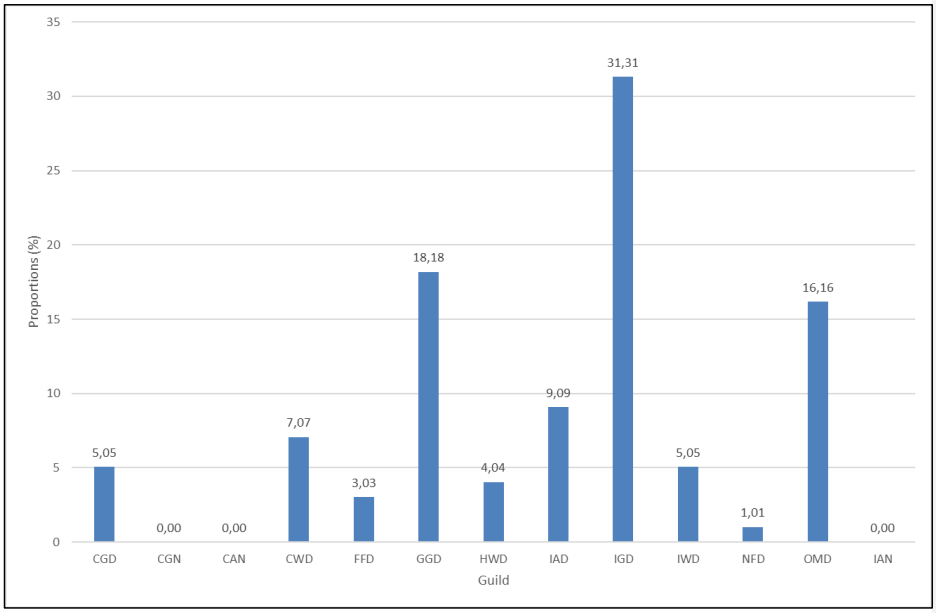


Figure 4-6 ***Column plot illustrating the proportion of each Functional Feeding Guild to the total abundance (Avifaunal trophic guilds. CGD, carnivore ground diurnal; CGN, carnivore ground nocturnal, CAN, carnivore air nocturnal, CWD, carnivore water diurnal; FFD, frugivore foliage diurnal; GGD, granivore ground diurnal; HWD, herbivore water diurnal; IAD, insectivore air diurnal; IGD, insectivore ground diurnal; IWD, insectivore water diurnal; NFD, nectivore foliage diurnal; OMD, omnivore multiple diurnal; IAN, Insectivore air nocturnal.***

4.4 Flight and Nest Analysis

Observing and monitoring flight paths and nesting sites of SCC and/or priority species are important in ascertaining habitat sensitivity and evaluating the impact risk significance of any proposed development. Flight analysis is also important for species that exhibit diel movement between roosting and foraging sites to prevent the risk of collision with infrastructure.

No dominant flight directions were observed in the assessment, nests of priority species or SCC were also not recorded in the survey.

5 Fine-Scale Habitat Use

Fine-scale habitats within the landscape are important in supporting a diverse avifauna community as they provide differing nesting, foraging and reproductive opportunities. Four different habitat types were delineated within the PAOI, comprising of Degraded Grassland and old agricultural fields, Tree Clumps, Water Resources and Transformed (Figure 5-5). Some water resources outside of the direct footprint were also included, their locations are shown.

Degraded Grassland and Old Agricultural Fields

This habitat consist of degraded grasslands in various states of disturbance. Some areas are more intact while others are old agricultural fields that were left for a few years unploughed (Figure 5-1). The habitat were grouped as it presented the same composition of avifauna species.

This habitat contributed to a large number of avifauna species recorded. Avifauna species observed in this habitat include: Long-tailed Widowbirds, Cape Longclaw, Swainson's Spurfowl, Desert Cisticola and Helmeted Guineafowl.

Figure 5-1 An example of the Degraded grassland and old agricultural habitat observed in the PAOI

Tree Clumps

The tree clumps were dominated by alien tree species however some areas of indigenous trees does exist (Figure 5-2). Alien tree species observed in the PAOI included *Eucalyptus* sp. and *Acacia mearnsii*.

This habitat contributed to lower numbers of avifauna species. No nests were also recorded in the trees, even though they do provide habitat for the nesting for some species. Species observed here included Dark-capped Bulbul and Cape Turtle Doves.

Figure 5-2 Example of the tree clump habitat observed in the PAOI

Water Resources

The water resources considered in this assessment included the onsite mine dams, the Saalboomspruit river, the Klipspruit river and some wetlands both natural and artificial (Figure 5-3). It is important to note

the onsite water resource delineations were done from an avifauna perspective and is not representative of the wetlands found on site. For the wetland outlines refer to the Wetland TBC 2022 report.

Avifauna species recorded in this habitat includes: Greater-crested Grebe, Red-knobbed Coot, Whiskered Tern, Common Moorhen, African Marsh Harrier and Spur-winged Goose.

Figure 5-3 Some of the water resources assessed in the avifauna assessment

Transformed

The transformed area consisted of urban development, mining areas, existing power stations as well as existing powerlines that transverse the PAOI (Figure 5-4). These areas were mostly void of avifauna species, with the only species recorded here being Laughing Dove, Speckled Pigeon, Common Myna and Cattle Egrets.

Figure 5-4 An example of the disturbed habitats observed in the PAOI

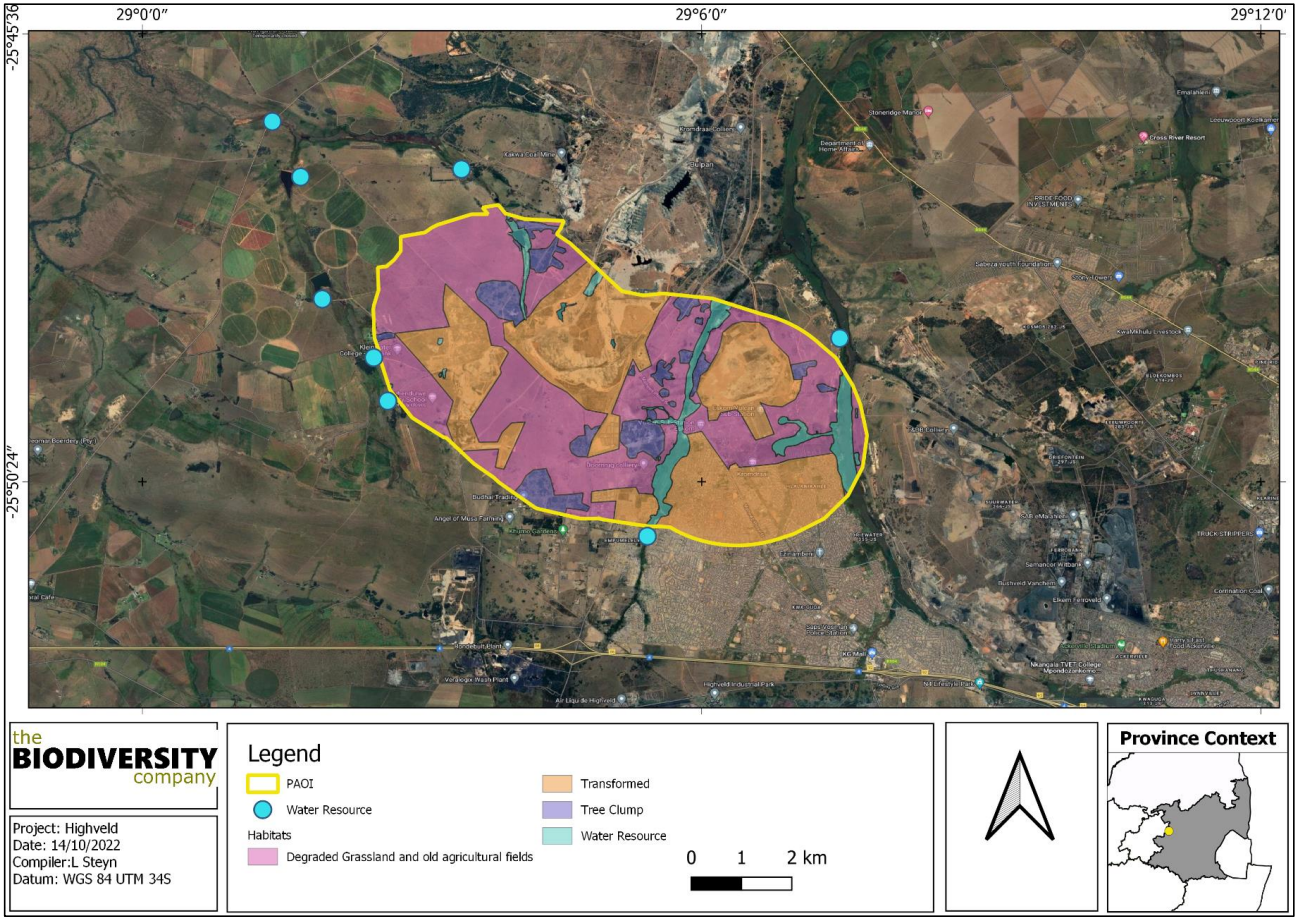
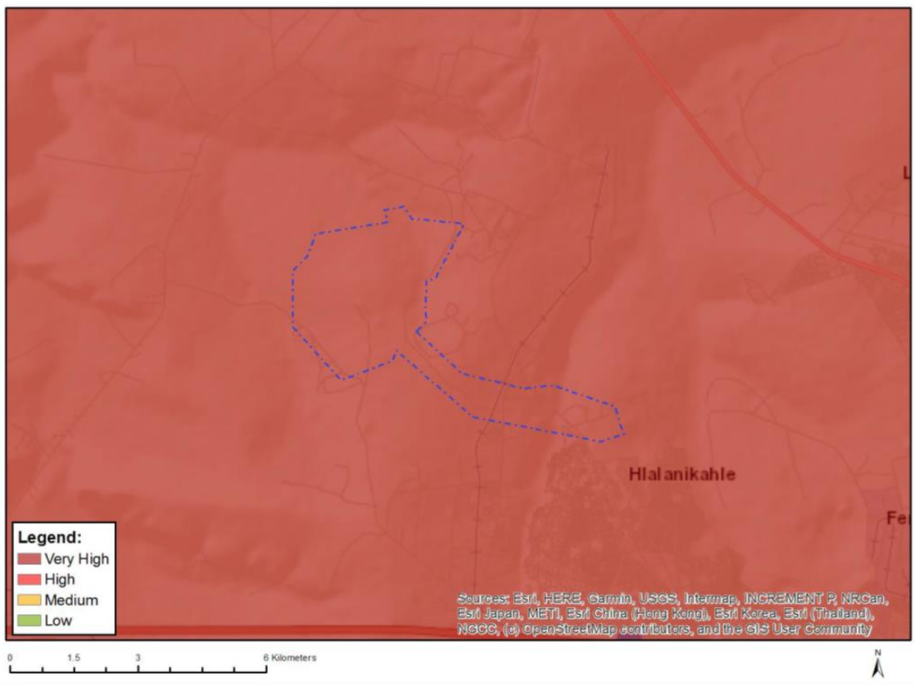


Figure 5-5 Map illustrating the habitat types delineated within the proposed PAOI

6 Site Ecological Importance (SEI)

6.1 Environmental Screening Tool

The terrestrial biodiversity theme sensitivity as indicated by the screening tool report for the project area was derived to be 'Very High' (Figure 6-1), due to the CBA1 and CBA 2 status, the overlap with a NPAES area as well as the VU ecosystem it falls in.



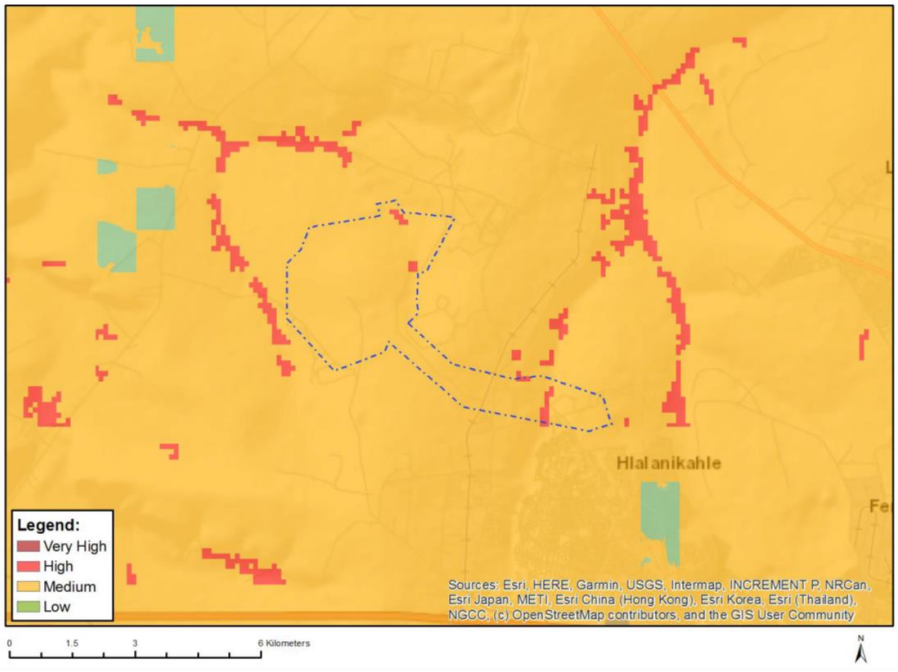
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Critical biodiveristy area 1
Very High	Critical biodiveristy area 2
Very High	Ecological support area: local corridor
Very High	Protected Areas Expansion Strategy
Very High	Vulnerable ecosystem

Figure 6-1 Terrestrial Biodiversity Theme Sensitivity, National Web based Environmental Screening Tool

The Animal Species Theme sensitivity, as indicated in the screening report, was derived to be 'High' (Figure 6-2). The High sensitivity was due to the likely presence of the high and moderate sensitivities to African Marsh Harrier (*Circus ranivorus*), African Grass owl (*Tyto capensis*), Caspian Tern (*Hydroprogne caspia*), Secretary Bird (*Sagittarius serpentarius*) and White-bellied Bustard (*Eupodotis senegalensis*).



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Circus ranivorus
Medium	Aves-Tyto capensis
Medium	Aves-Hydroprogne caspia
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Eupodotis senegalensis
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Dasymys robertsii
Medium	Mammalia-Hydrictis maculicollis
Medium	Mammalia-Ourebia ourebi ourebi
Medium	Reptilia-Kinixys lobatsiana

Figure 6-2 Fauna Theme Sensitivity, National Web based Environmental Screening Tool

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6.2 Site Ecological Importance (SEI)

Based on the criteria provided in Section 2.5 of this report, all habitats within the assessment area of the proposed project were allocated a sensitivity or SEI category (Table 6-1). The SEI of the PAOI within an avifauna context was based on both, the field results and desktop information. The SEI of the habitat types delineated are illustrated in Figure 6-3. The water resources were given a very high rating based on the presence of the EN African Marsh Harrier and the high likelihood of occurrence of other SCCs. The functionality of the Degraded grassland and old agricultural fields habitat has been altered from the original state, if not for that the SEI would have been rated higher as the likelihood of SCCs occurring in this habitat is high.

Table 6-1 SEI Summary of habitat types delineated within field assessment area of project area

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Water Resources	High Confirmed or highly likely occurrence of CR, EN, VU species. Presence of Rare species	High Only minor current negative ecological impacts with no signs of major past disturbance and good rehabilitation potential.	**High**	Low Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality	**Very High**
Degraded Grassland and Old Agricultural fields	High Confirmed or highly likely occurrence of CR, EN, VU species. Presence of Rare species	Medium Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity	**Medium**	Medium Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality	**Medium**
Tree Clumps	Low No confirmed or highly likely populations of SCC.	Low Low rehabilitation potential	**Low**	High Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality	**Very Low**
Transformed	Very Low No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species.	Very Low Several major current negative ecological impacts.	**Very Low**	Very High Habitat that can recover rapidly	**Very Low**

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
	No natural habitat remaining.				

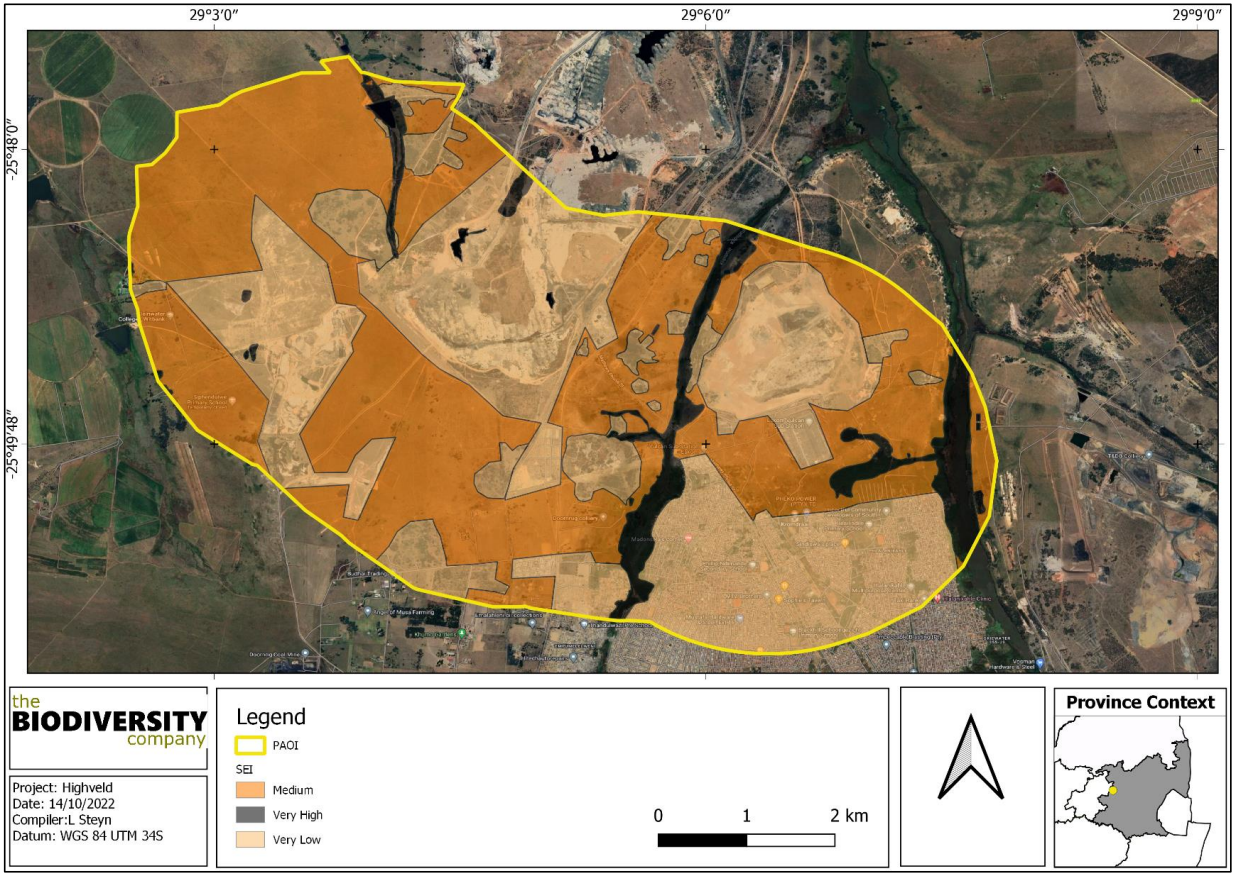

Figure 6-3 Map illustrating the Site Ecological Importance of the proposed PAOI within an avifauna context

Interpretation of the SEI in the context of the proposed project is provided in Table 6-2.

Table 6-2 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

Site Ecological Importance	Interpretation in relation to proposed development activities
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

7 Impact Assessment

Potential impacts were evaluated against the data captured during the fieldwork and from a desktop perspective to identify relevance to the PAOI, specifically the proposed development footprint area. The assessment of the significance of direct, indirect and cumulative impacts was undertaken using the method as provided by Environamics Environmental Consultants. Bennun *et al* (2021) describes three broad types of impacts associated with solar energy development:

- Direct impacts – Impacts that result from project activities or operational decisions that can be predicted based on planned activities and knowledge of local biodiversity, such as habitat loss under the project footprint, habitat frag- mentation as a result of project infrastructure and species disturbance or mortality as a result of project operations.
- Indirect impacts – Impacts induced by, or 'by-products' of, project activities within a project's area of influence.
- Cumulative impacts – Impacts that result from the successive, incremental and/or combined effects of existing, planned and/or reasonably anticipated future human activities in combination with project development impacts.

The assessment of impact significance considers pre-mitigation as well as implemented post-mitigation scenarios. Three phases were considered for the impact assessment:

- Construction Phase;
- Operational Phase; and
- Decommissioning/Rehabilitation Phase.

7.1 Present Impacts to Avifauna

In consideration that there are anthropogenic activities and influences are present within the landscape, there are several negative impacts to biodiversity, including avifauna. These include:

- Existing energy infrastructure;
- Minor and major gravel roads and associated vehicle traffic;
- Invasive Alien Plants;
- Livestock agriculture;
- Mining activities;
- Housing developments;

- Erosion and solid waste dumping; and
- Fences and associated infrastructure.

Figure 7-1 ***Photographs illustrating examples of impacts observed within the Highveld Solar PV PAOI. A) Existing powerlines, B) Solid waste dumps, C) Roads and alien plants, and D) Erosion***

7.2 Anticipated Impacts

This section describes the potential impacts on avifauna associated with the construction and operational phases of the proposed development and is only relevant to the PV site and associated infrastructure.

During the construction phase vegetation clearing for the associated infrastructure will lead to direct habitat loss. Vegetation clearing will create a disturbance and will therefore potentially lead to the displacement of avifaunal species. The operation of construction machinery on site will generate noise pollution. Increased human presence can lead to poaching and the increase in vehicle traffic and heavy machinery will potentially lead to roadkill.

The principal impacts of the operational phase are electrocution, collisions, fencing, chemical pollution due to chemical cleaning of the PV panels and habitat loss. Solar panels have been implicated as a potential risk for bird collisions. Collisions are thought to arise when birds (particularly waterbirds) mistake the panels for waterbodies, known as the "lake effect" (Lovich & Ennen, 2011), or when migrating or dispersing birds become disorientated by the polarised light reflected by the panels. This "lake-effect" hypothesis has not been substantiated or refuted to date (Visser *et al,* 2019). It can however be said that the combination of powerlines, fencing and large infrastructure will influence avifauna species. Visser *et al* (2019) performed a study at a utility-scale PV Solar energy facility in the Northern Cape and found that most of the species affected by the facility were passerine species. This is due to collisions with solar panels from underneath. During a predator attack while foraging under the panels, individuals may alight and then collide with the panel. Larger species were said to be more influenced by the facilities when they were found foraging close by and were disturbed by predators which resulted in collisions with infrastructure.

Large passerines are particularly susceptible to electrocution because owing to their relatively large bodies, they are able to touch conductors and ground/earth wires or earthed devices simultaneously. The chances of electrocution are increased when feathers are wet, during periods of high humidity or during defecation. Prevailing wind direction also influences the rate of electrocution casualties.

Fencing of the PV site can influence birds in six ways (BirdLife South Africa, 2015):

- Snagging – occurs when a body part is impaled on one or more barbs or razor points of a fence;
- Snaring – when a bird's foot/leg becomes trapped between two overlapping wires;
- Impact injuries – birds flying into a fence, the impact may kill or injure the bird;
- Snarling – when birds try and push through a mesh or wire stands, ultimately becoming trapped (uncommon);
- Electrocution – electrified fence can kill or severely injure birds; and
- Barrier effect – fences may limit flightless birds including moulting waterfowl from resources.

Chemical pollution from PV cleaning, if not environmentally friendly will result in either acute or chronic affects. Should this chemical penetrate into the surrounding environment, it would impact populations on a larger scale and not just species found in and around the PV footprint.

7.3 Alternatives Considered

The DEAT 2006 guidelines on 'assessment of alternatives and impacts' proposes the consideration of four types of alternatives namely, the no-go, location, activity, and design alternatives. It is however, important to note that the regulation and guidelines specifically state that only 'feasible' and 'reasonable' alternatives should be explored. It also recognizes that the consideration of alternatives is an iterative process of feedback between the developer and EAP, which in some instances culminates in a single

preferred project proposal. An initial site assessment was conducted by the developer the affected properties and the farm portions were found favorable due to its proximity to grid connections, solar radiation, ecology and relative flat terrain. These factors were then taken into consideration and avoided as far as possible.

The following alternatives were considered in relation to the proposed activity (as provided by Environamics):

No-go alternative

This alternative considers the option of 'do nothing' and maintaining the status quo. The site is currently zoned for agricultural and mining land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for agricultural purposes. The potential opportunity costs in terms of alternative land use income through rental for energy facility and the supporting social and economic development in the area would be lost if the status quo persist.

Location alternatives

No other possible sites were identified on Portion 17 of the Farm Kleinwater No. 301, Remaining Extent of Portion 2, Remaining Extent of Portion 15, Portion 47 and 48 of the Farm Kromdraai No. 279. This site is referred to as the preferred site. Some limited sensitive features occur on the site. The size of the site makes provision for the exclusion of any sensitive environmental features that may arise through the EIA proses.

Technical alternatives: Powerlines

Generation from the facility will link to the Eskom Vulcan 400kV MTS Substation. The connection alternatives will be assessed within the 250m wide (up to 690m in some instances) grid connection corridor. Connection will be limited to the grid connection corridor. The Highveld SPP will inject up to 250MW into the National Grid. The installed capacity will be approximately 329MW.

Battery storage facility

It is proposed that a nominal up to 500 MWh Battery Storage Facility for grid storage would be housed in stacked containers, or multi-storey building, with a maximum height of 8m and a maximum volume of 1,740m^3 of batteries and associated operational, safety and control infrastructure. Three types of battery technologies are being considered for the proposed project: Lithium-ion, Sodium-sulphur or Vanadium Redox flow battery. The preferred battery technology is Lithium-ion.

Battery storage offers a wide range of advantages to South Africa including renewable energy time shift, renewable capacity firming, electricity supply reliability and quality improvement, voltage regulation, electricity reserve capacity improvement, transmission congestion relief, load following and time of use energy cost management. In essence, this technology allows renewable energy to enter the base load and peak power generation market and therefore can compete directly with fossil fuel sources of power generation and offer a truly sustainable electricity supply option.

Design and layout alternatives

Design alternatives will be considered throughout the planning and design phase and specialist studies are expected to inform the final layout of the proposed development.

Technology alternatives

There are several types of semiconductor technologies currently available and in use for PV solar panels. Two, however, have become the most widely adopted, namely crystalline silicon (Mono-facial and Bi-facial) and thin film. The technology that (at this stage) proves more feasible and reasonable with respect to the proposed solar facility is crystalline silicon panels, due to it being non-reflective, more efficient, and with a higher durability. However, due to the rapid technological advances being

made in the field of solar technology the exact type of technology to be used, such as bifacial panels, will only be confirmed at the onset of the project.

7.1 Loss of Irreplaceable Resources

The proposed development will lead to the loss of the following irreplaceable resources:

- Critical Biodiversity Area and Ecological Support Areas;
- NPAES priority areas;
- CR rivers and CR wetlands which is regarded as important habitat for waterfowl; and
- Habitat and possible nesting sites for avifauna SCC.

7.2 Assessment of Impact Significance

The assessment of impact significance considers pre-mitigation as well as implemented of post-mitigation scenarios. Although different species and groups will react differently to the development, the risk assessment was undertaken bearing in mind the potential impacts to the priority species listed in this report. All the alternatives were assessed collectively as they do not result in any variation in the impacts that are relevant to avifauna.

7.2.1 Impact Assessment Method

Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed. Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e., site, local, national or global whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

In assessing the significance of each impact, the following criteria is used:

Geographical Extent		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.

Probability		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).

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Duration		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.

Intensity/ Magnitude		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

Reversibility		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

Irreplaceable Loss of Resources		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.

Cumulative Effect		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.

3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects

Significance		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

7.2.2 Construction Phase

7.2.2.1 Habitat destruction within the project footprint

Habitat destruction of the proposed development is inevitable. Pre-mitigation the significance of the impact is a Negative High Impact but with the implementation of mitigation measures can be reduced to a Negative Medium Impact.

Pre Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	4	3	3	4	3	3	
Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Complete loss of resources: The impact is result in a complete loss of all resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative High Impact**
Post Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	4	3	2	4	3	2	
Site: The impact will only affect the site.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Complete loss of resources: The impact is result in a complete loss of all resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Medium Impact**

Mitigation Actions:

- Solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both fossorial and epigeic biodiversity (Bennun *et al,* 2021). If concrete foundations are used that would increase the impact of the project as there would be direct impacts to soil permeability and characteristics, thereby influencing inhabitant fauna. In addition, stormwater runoff and runoff from cleaning the panels would be increased, increasing erosion in the surrounding areas;
- Indigenous vegetation to be maintained under the solar panels to ensure biodiversity is maintained and to prevent soil erosion (Beatty *et al,* 2017; Sinha *et al,* 2018). The photographs below are sourced from these documents;


- Vegetation clearing to commence only after the necessary permits have been obtained; and
- Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities.

7.2.2.2 Destruction,degradation and fragmentation of surrounding habitats

Construction activities can lead to destruction of surrounding habitats. Pre-mitigation this impact has a Negative High significance, but with the implementation of mitigation measures the significance can be reduced to a Negative Low Impact.

Pre-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
2	4	4	4	3	3	3	

Local/district: Will affect the local area or district	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Permanent: The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.	Irreversible: The impact is irreversible and no mitigation measures exist.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	Negative High Impact
Post-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
1	1	1	1	1	1	1	1
Site: The impact will only affect the site.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	Negative Low Impact

Mitigation Actions:

- Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, remaining within demarcated construction areas etc.
- All solid waste must be managed in accordance with the Solid Waste Management Plan. Recycling is encouraged;
- All construction activity and roads to be within the clearly defined and demarcated areas;
- Temporary laydown areas should be clearly demarcated and rehabilitated with indigenous vegetation subsequent to end of use;
- Appropriate dust control measures to be implemented;

- Suitable sanitary facilities to be provided for construction staff as per the guidelines in Health and Safety Act;
- No cement/concrete may be mixed within 200m of a water source and must not be m,ixed directly on the ground to ensure the water sources does not get polluted and that successful rehabilitation of the construction areas can take place; and
- All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner.

7.2.2.3 Displacement/emigration of avifauna community (including SCC) due to noise pollution

Noise pollution generated from construction activities will lead to the displacement/emigration of the local avifauna community including the proximal surrounding area. This will include SCC that occur or are likely to occur within the area.

Pre-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
2	3	2	1	2	3	3	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	Negative Medium Impact
Post-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
2	3	2	2	2	2	2	1
Local/district: Will affect the local	Probable: The impact will likely occur (Between a 50% to 75%	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct	Partly reversible: The impact is partly reversible but more intense mitigation	Marginal loss of resource: The impact will result in	Low cumulative impact: The impact would result in	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	Negative Low Impact

area or district.	chance of occurrence).	human action or by natural processes thereafter (2 – 10 years).	measures are required.	marginal loss of resources.	insignificant cumulative effects.		

Mitigation Actions:

- Noise pollution is difficult to mitigate against.
- No construction activity is to occur at night, as nocturnal species are highly dependent on sound and/or vocalisations for behavioural processes;
- All vehicles speed must be restricted to 20 km/h, to reduce the noise emitted by them; and
- If generators are to be used these must be soundproofed.

7.2.2.4 Direct mortality from persecution or poaching of avifauna species and collection of eggs

There is the possibility of construction staff poaching avifauna species and collecting eggs from the project footprint and proximal surrounding area. There is also the possibility of persecution of species that are deemed as negative in folklore. This impact was determined to have a Negative Medium Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Pre-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
2	3	2	3	2	4	3	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	High cumulative impact: The impact would result in significant cumulative effects	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	Negative Medium Impact
Post-Mitigation							

Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	Significance
2	1	1	1	1	1	1	
Local/district: Will affect the local area or district.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	Negative Low Impact

Mitigation Actions:

- All personnel should undergo environmental awareness training that includes educating on not poaching/persecuting species and collecting eggs;
- Prior to commencing work each day, two individuals should traverse the working area in order to disturb any avifauna and so they have a chance to vacate the area; and
- Any avifauna threatened by the construction activities that does not vacate the area should be removed safely by an appropriately qualified environmental officer or removal specialist.

7.2.2.5 Direct mortality from increased vehicle and heavy machinery traffic

The increased vehicle and heavy machinery traffic associated with construction activities will lead to roadkill. This impact was determined to have a Negative Medium Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Pre-Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	Significance

2	3	2	3	3	3	2	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	Negative Medium Impact
Post-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
2	2	2	1	2	1	1	
Local/district: Will affect the local area or district.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	Negative Low Impact

Mitigation Actions:

- All personnel should undergo environmental induction with regards to awareness about speed limits and roadkill; and
- All construction vehicles should adhere to a speed limit of maximum 20 km/h to avoid collisions. Appropriate speed control measures and signs must be erected.

7.2.3 Operational Phase

7.2.3.1 Collisions with infrastructure associated with the PV Facility

The proposed PV comprises of components that pose a collision risk to avifauna species. This includes collisions with PV panels, any overhead lines/cables and fences. This impact was determined to have a Negative Very High significance but can be reduced to a Negative Medium significance with the implementation of appropriate mitigation measures. The pre-mitigation rating in very high due to the presence of large amounts of water resources in the PAOI.

Pre Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	4	4	4	4	4	4	
Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Permanent: The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.	Irreversible: The impact is irreversible and no mitigation measures exist.	Complete loss of resources: The impact is result in a complete loss of all resources.	High cumulative impact: The impact would result in significant cumulative effects	Very high: Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.	**Negative Very High Impact**
Post Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	3	3	3	3	3	3	

Site: The impact will only affect the site.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative Medium Impact**

Mitigation Actions:

- The design of the proposed solar plant must be of a type or similar structure as endorsed by the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa;
- Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used. This would involve using existing/approved pylons and associated infrastructure for different lines;
- Non-polarising white tape can be used around and/or across panels to minimise reflection (Bennun *et al,* 2021). This is especially pertinent to waders and aquatic species that may recognise the panel array as water bodies (lake effect as described above) and collide with the panels, causing mortality;
- Overhead cables/lines must be fitted with industry standard bird flight diverters in order to make the lines as visible as possible to collision-susceptible species. Shaw *et al* (2021) demonstrated that large avifauna species mortality was reduced by 51% (95% CI: 23–68%). Recommended bird diverters such as flapping devices (dynamic device) and thickened wire spirals (static device) that increase the visibility of the lines should be fitted 5 m apart. The Inotec BFD88 bird diverter is highly recommended due to its visibility under low light conditions when most species move from roosting to feeding sites;

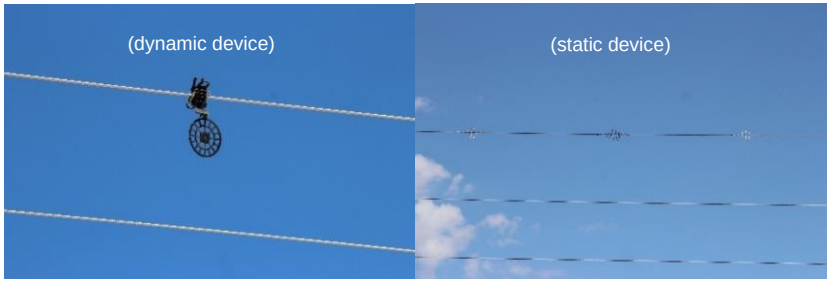
Commented [HS1]: This might impact the output of the panels significantly if it is to be used over the panels?

Commented [HS2R1]:

Commented [HS3R1]: Solar panels are actually not very reflective, see figure in comment above. They absorb more light than they reflect.

Commented [HS4]: This has been disproven in recent years (I could be mistaken but please confirm)

Commented [LADW|T5R4]: This is a standard recommendation made by the authorities and must be included for all solar developments hence it has been retained.



- Fencing mitigations:
    - Top 2 strands must be smooth wire;
    - Routinely retention loose wires;
    - Minimum distance between wires is 300 mm; and
    - Place markers on fences.

7.2.3.2 Electrocution due to infrastructure associated with the PV Facility

Electrocution with solar electricity facility connections and associated pylons pose a risk to avifauna. Several species that occur within the area that exhibit a high probability of electrocution by powerlines. This impact was determined to have a Negative High significance but can be reduced to a Negative Low significance with the implementation of appropriate mitigation measures.

Pre-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
1	4	3	3	3	3	4	
Site: The impact will only affect the site.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Very high: Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.	Negative High Impact
Post-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
1	2	3	1	2	2	2	
Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	Negative Low Impact

Mitigation Actions:

- The design of the proposed solar plant and grid lines must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa;

- Insulation where energised parts and/or grounded parts are covered with materials appropriate for providing incidental contact protection to birds. It is best to use suspended insulators and vertical disconnectors, if upright insulators or horizontal disconnectors are present, these should be covered; and
- Perch discouragers can be used such as perch guards or spikes. Considerable success achieved by providing artificial bird safe perches, which are placed at a safe distance from the energised parts (Prinsen *et al,* 2012).

7.2.3.3 Direct mortality from persecution or poaching of avifauna species and collection of eggs

There is the possibility of operational staff poaching avifauna species and collecting eggs from the project footprint and proximal surrounding area. There is also the possibility of persecution of species that are deemed as negative in folklore. This impact was determined to have a Negative Medium Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Pre-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
2	3	2	2	2	4	3	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component, and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	Negative Medium Impact
Post-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
2	1	1	1	1	1	1	
Local/district: Will affect the local area or district.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	Negative Low Impact

		be entirely negated (0 – 2 years).					

Mitigation Actions:

- All personnel should undergo environmental awareness training that includes educating on not poaching/persecuting avifauna species and collecting eggs; and
- Signs must be put up to enforce this, should someone be caught a R1000 fine must be enforced.

7.2.3.4 Direct mortality by roadkill during maintenance procedures

There is the likelihood that species are likely to be killed by vehicle use during maintenance procedures. This impact was determined to have a Negative Medium Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Pre-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
2	3	2	3	3	3	2	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	Negative Medium Impact
Post-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**

2	2	2	1	2	1	1	
Local/district: Will affect the local area or district.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	Marginal loss of resource: The impact will result in marginal loss of resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	Negative Low Impact

Mitigation Actions:

- All personnel should undergo environmental induction with regards to awareness about speed limits and roadkill; and
- All vehicles should adhere to a speed limit of maximum 20 km/h to avoid collisions. Appropriate speed control measures and signs must be erected.

7.2.3.5 Pollution of water sources and surrounding habitat due to cleaning productes of the PV panels

Should the panels be cleaned with chemicals in addition to water, the impact was determined to have a Negative High Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Pre Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	3	3	3	3	3	3	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative High Impact**

		thereafter (10 – 30 years).					
Post Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	1	1	1	1	1	1	
Site: The impact will only affect the site.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	**Negative Low Impact**

Mitigation Actions:

- Only environmentally friendly chemicals are to be used for cleaning of the panels.

7.2.3.6 Heat radiation from the PV panels

Heat radiation form the infrastructure can result in an overall increase in the surrounding area, it can also lead to veld fires. This impact was determined to have a Negative Medium Impact significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Pre Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**

1	2	3	3	3	3	3	
Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative Medium Impact**
Post Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
1	1	3	2	2	2	2	
Site: The impact will only affect the site.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Long term: The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

Mitigation Actions:

- A fire management plan needs to be put in place; and
- Grass must be kept under the panels to ensure that additional reflection is not taking place from the surface below the panels.

7.2.3.7 Encroachment of Invasive Alien Plants into disturbed areas

Invasive Alien Plants (IAPs) tend to encroach into disturbed areas and outcompete/displace indigenous vegetation. This will lead to a shift in the vegetation composition and structure, and consequently will cause a negative shift in the wellbeing of the avifauna community. This impact was determined to have a Negative Very High significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Pre-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
2	4	4	3	4	4	4	
Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Permanent: The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Complete loss of resources: The impact is result in a complete loss of all resources.	High cumulative impact: The impact would result in significant cumulative effects	Very high: Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.	Negative Very High Impact
Post-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
1	1	1	1	1	1	1	
Site: The impact will only affect the site.	Unlikely: The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Completely reversible: The impact is reversible with implementation of minor mitigation measures.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	Negative Low Impact

Mitigation Actions:

- An IAP Management Plan must be written and implemented for the development. The developer must contract a specialist to develop the plan and the developer is responsible for its implementation;
- Regular monitoring for IAP encroachment during the operation phase to ensure that no alien invasion problems have developed as result of the disturbance. This should be every 3 months during the first two years of the operation phase and every six months for the life of the project; and
- All IAP species must be removed/controlled using the appropriate techniques as indicated in the IAP management plan.

7.2.4 Decommissioning Phase

7.2.4.1 Direct mortality due to earthworks, vehicle collisions and persecution

Decommissioning activity will likely lead to direct mortality of avifauna due to earthworks, vehicle collisions and persecution. This impact was determined to have a Negative Medium significance but can be reduced to a Negative Low Impact significance with the implementation of mitigation actions.

Pre Mitigation							
Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
2	3	2	3	3	3	2	
Local/district: Will affect the local area or district.	Probable: The impact will likely occur (Between a 50% to 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	Medium cumulative impact: The impact would result in minor cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Medium Impact**
Post-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
1	2	1	2	1	1	1	

Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Short term: The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	No loss of resource: The impact will not result in the loss of any resources.	Negligible cumulative impact: The impact would result in negligible to no cumulative effects.	Low: Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.	Negative Low Impact

Mitigation Actions:

- All personnel should undergo environmental awareness including educating about not harming or collecting species;
- Prior to commencing work each day, two individuals should traverse the working area in order to disturb any fauna and so they have a chance to vacate;
- Any avifauna threatened by the construction activities should be removed safely by an appropriately qualified environmental officer or removal specialist;
- All construction vehicles should adhere to a speed limit of maximum 20 km/h to avoid collisions. Appropriate speed control measures and signs must be erected;
- All hazardous materials, if any, should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner;
- All infrastructure including powerlines must be removed if the facility is decommissioned; and
- The project area must be rehabilitated, and a management plan must be in place to ensure that it is done successfully.

7.2.4.2 Continued habitat degradation due to Invasive Alien Plant encroachment and erosion

Disturbance created during decommissioning will leave the development area vulnerable to erosion and alien plant invasion for several years.

Pre-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**

2	4	4	4	4	4	4	
Local/district: Will affect the local area or district.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Permanent: The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.	Irreversible: The impact is irreversible, and no mitigation measures exist.	Complete loss of resources: The impact is result in a complete loss of all resources.	High cumulative impact: The impact would result in significant cumulative effects	Very high: Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.	Negative Very High Impact
Post-Mitigation							
Extent	**Probability**	**Duration**	**Reversibility**	**Irreplaceability**	**Cumulative Effect**	**Magnitude/ Intensity**	**Significance**
1	2	2	2	2	2	2	
Site: The impact will only affect the site.	Possible: The impact may occur (Between a 25% to 50% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Marginal loss of resource: The impact will result in marginal loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	Negative Low Impact

Mitigation Actions:

- Rehabilitation in accordance with the Rehabilitation Plan for the development must be undertaken in areas disturbed during the decommissioning phase;
- Monitoring of the rehabilitated area must be undertaken at quarterly intervals for 3 years after the decommissioning phase;
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques; and
- There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous flora.

7.3 Unplanned Events

The planned activities will have anticipated impacts as discussed above; however, unplanned events may occur on any project, and these could lead to potential impacts which will require appropriate management.

Table 7-1 is a summary of the findings of an unplanned event assessment conducted from a terrestrial ecology perspective. Note that not all potential unplanned events may be captured herein, and this process must therefore be managed throughout all phases and according to events that take place or have a high likelihood of taking place.

Table 7-1 Summary of unplanned events, potential impacts and mitigations

Unplanned Event	Potential Impact	Mitigation
Spills into the surrounding environment	Contamination of habitat as well as water resources associated with a spillage.	A spill response kit must be available at all times. The incident must be reported on, and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Fire	Uncontrolled/unmanaged fire that spreads to the surrounding natural savannah.	An appropriate fire management plan needs to be compiled and implemented.
Erosion caused by water runoff from the surface	Erosion on the side of the roads and cleared areas.	A storm water management plan must be compiled and implemented.

7.4 Cumulative Impacts

Cumulative impacts are assessed within the context of the extent of the proposed PAOI other developments and activities in the area (existing and proposed) and general habitat loss and disturbance resulting from any other anthropogenic activities in the area. The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development or disturbance activities. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a specific point in time may actually represent a significant change from the original state of the system. This section describes the potential cumulative impacts of the project on the local and regional avifauna community.

Localised cumulative impacts include those from operations that are close enough to potentially cause additive effects on the local environment or any sensitive receivers (such as nearby large road networks, other solar PV facilities, and power infrastructure). Relevant activities and impacts include dust deposition, noise and vibration, loss of corridors or habitat, disruption of waterways, groundwater drawdown, groundwater and surface water depletion, and transport activities. Long-term cumulative impacts associated with the site development activities can lead to the loss of endemic and threatened species, including natural habitat and vegetation types, and these impacts can even lead to the degradation of conserved areas such as the adjacent game parks and reserves.

The total area within the 30 km buffer around the PAOI amounts to 356472.98 ha, but when considering the transformation (189422.9 ha) that has taken place within this radius, 167050.11 ha of intact habitat remains according to the 2018 National Biodiversity Assessment. Therefore, the area within 30 km of the project has experienced approximately 53.13 % loss in natural habitat. Considering this context, the PAOI is 3859.43 ha (according to the provided layout, along with the 2 km EGI buffer), and similar project exists in the 30 km region measuring a maximum of 1894.1 ha (as per the latest South African Renewable Energy EIA Application Database). This means that the total amount of remaining habitat lost as a result of solar projects in the region amounts to 9.6% (the sum of all related developments as a percentage of the total remaining habitat). Table 7-2 outlines the calculation procedure for the spatial assessment of cumulative impacts.

Table 7-2 Loss of habitat within a 30 km radius of the project

	Total Habitat (ha)	Total Loss (ha)	Tot. Remaining Habitat (ha) (Remnants)	Total Historical Loss	Similar Projects (ha)	Tot. Remaining Habitat (ha)	Cumulative Habitat Lost due to Solar development
Approximate Solar development cumulative effects (Spatial)	356472.98	189422.9	167050.11	**53.13 %**	1894.1	161296.7	**9.6 %**

The overall cumulative impact assessment is presented in Table 7-3 and Table 7-4 below. Note that this also accounts for the relative importance of the habitats within and adjacent to the project area, in the context of the value of the regional habitat. Approximately 53.13% of the habitat has already been lost, and as discussed above the proposed solar developments will result in a cumulative loss of approximately 9.6 % from only similar developments (Solar, approved and in process) in the area, as such the cumulative impact from the proposed development is rated as “high”, with overall medium significance (Figure 7-2). This is further supported by the VU threat status of the ecosystem and the poorly protected protection level. This means that the careful spatial management and planning of the entire region must be a priority, and existing large infrastructure projects must be carefully monitored over the long term.

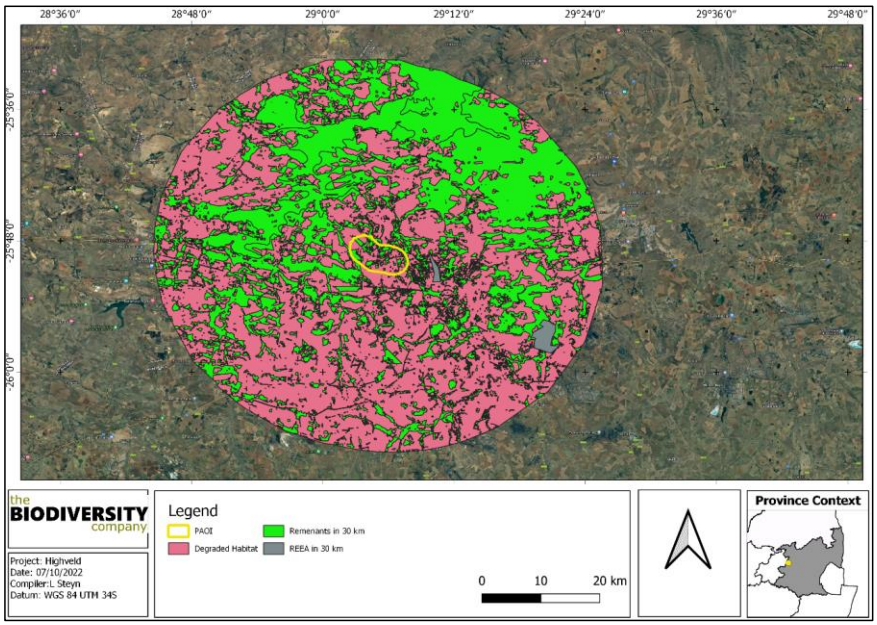


Figure 7-2 ***Map illustrating the additional renewable energy developments within the landscape overlaid onto the remnant vegetation types***

Table 7-3 Cumulative Impacts to avifauna associated with the proposed project – Project in Isolation

Impact	Project in Isolation							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
	1	4	2	2	3	2	2	
Loss of habitat, increase in collision and electrocution risks, water pollution and increase in road collisions	Site: The impact will only affect the site.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Medium term: The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).	Partly reversible: The impact is partly reversible but more intense mitigation measures are required.	Significant loss of resources: The impact will result in significant loss of resources.	Low cumulative impact: The impact would result in insignificant cumulative effects.	Medium: Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).	**Negative Low Impact**

Table 7-4 Cumulative Impacts to avifauna associated with the proposed project – Cumulative Effect

	Post Mitigation							
	Extent	Probability	Duration	Reversibility	Irreplaceability	Cumulative Effect	Magnitude/ Intensity	**Significance**
	3	4	4	3	3	4	3	
Loss of habitat, increase in collision and electrocution risks, water pollution and increase in road collisions	Province/region: Will affect the entire province or region.	Definite: Impact will certainly occur (Greater than a 75% chance of occurrence).	Permanent: The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.	Barely reversible: The impact is unlikely to be reversed even with intense mitigation measures.	Significant loss of resources: The impact will result in significant loss of resources.	High cumulative impact: The impact would result in significant cumulative effects	High: Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.	**Negative High Impact**

8 Avifauna Impact Management Actions

The purpose of the Biodiversity Impact Management Actions of is to present the mitigations in such a way that they can be incorporated into the Environmental Management Programme (EMPr), allowing for more successful implementation and auditing of the mitigations and monitoring guidelines.

Table 8-1 presents the recommended mitigation measures and the respective timeframes, targets, and performance indicators pertaining to the avifaunal component.

Table 8-1 Summary of management outcomes pertaining to impacts to avifauna and their habitats

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Management outcome: Habitats				
The areas to be developed must be specifically demarcated to prevent movement into surrounding environments.	Life of operation	Project Manager Environmental Officer	Development footprint	Ongoing
Very High sensitivity areas must be declared No-go areas, they must be demarcated to ensure no vehicles or people move in these areas. The powerline may span the area but no poles are to be planted inside the area.	Life of operation	Project Manager Environmental Officer	Development footprint	Ongoing
Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further.	Life of operation	Project Manager Environmental Officer	Areas of indigenous vegetation	Ongoing
Solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both below and above-ground biodiversity.	Life of operation	Project Manager	Solar panels must be mounted on pile driven or screw foundations, such as post support spikes, rather than heavy foundations, such as trench-fill or mass concrete foundations, to reduce the negative effects on natural soil functioning, such as its filtering and buffering characteristics, while maintaining habitats for both below and above-ground biodiversity	Life of operation
Indigenous vegetation to be maintained under the solar panels to ensure biodiversity is maintained and to prevent soil erosion (Beatty et al, 2017; Sinha et al, 2018).	Life of operation	Project Manager	Indigenous vegetation to be maintained under the solar panels to ensure biodiversity is maintained and to prevent soil erosion (Beatty et al, 2017; Sinha et al, 2018).	Life of operation
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion. This will also reduce the likelihood of encroachment by alien invasive	Decommissioning /Rehabilitation	Project Manager	Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent	Decommissioning /Rehabilitation

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
plant species. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are indigenous to this vegetation type.			erosion. This will also reduce the likelihood of encroachment by alien invasive plant species. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are indigenous to this vegetation type.	
A hydrocarbon spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g., accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them leaking and entering the environment.	Life of operation	Environmental Officer Contractor	Spill events, Vehicles dripping.	Ongoing
No cement/concrete may be mixed on site and must be brought in off site to ensure the water sources does not get polluted and that successful rehabilitation of the construction areas can take place	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Water pollution and restricted rehabilitation	During phase
Leaking equipment and vehicles must be repaired immediately or be removed from project area to facilitate repair.	Life of operation	Environmental Officer Contractor	Leaks and spills	Ongoing
A fire management plan needs to be complied to restrict the impact of fire.	Life of operation	Environmental Officer Contractor	Fire Management	During Phase

Management outcome: Avifauna

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species, and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.	Life of operation	Environmental Officer	Evidence of trapping etc	Ongoing

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
The duration of the construction should be kept to a minimum to avoid disturbing avifauna.	Construction/Operational Phase	Project Manager Environmental Officer	Construction/Closure Phase	Ongoing
Outside lighting should be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (red/green) lights should be used wherever possible.	Construction/Operational Phase	Project Manager Environmental Officer Design Engineer	Light pollution and period of light.	Ongoing
All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (20 km/h), to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited.	Life of Operation	Health and Safety Officer	Compliance to the training.	Ongoing
All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region	Construction/Operational Phase	Project Manager Environmental Officer	Noise	Ongoing
All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area, or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.	Construction	Environmental Officer	Presence of avifauna species and nests	During Phase
The design of the proposed PV and grid lines must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa (Jenkins *et al.*, 2015).	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of electrocuted birds or bird strikes	During Phase
Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.	Planning and Construction	Project Manager Environmental Officer Contractor Engineer	Presence of bird collisions	During phase
All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution	Planning and Construction	Environmental Officer Contractor Engineer	Presence of electrocuted birds	During phase
Use environmentally friendly cleaning and dust suppressant products	Construction and Operation	Environmental Officer Contractor Engineer	Chemicals used	During phase
Fencing mitigations: • Top 2 strands must be smooth wire • Routinely retention loose wires	Life of Operation	Project Manager Environmental Officer Contractor	Presence of birds stuck /dead in fences Monitor fences for slack wires	During phase

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
• Minimum 300 mm between wires • Place markers on fences		Design Engineer		
As far as possible power cables within the project area should be thoroughly insulated and preferably buried.	Construction and Operation	Project Manager Environmental Officer Design Engineer	Exposed cables	During phase
Any exposed parts must be covered (insulated) to reduce electrocution risk	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
Non-polarising white strips must be fitted along the edges of the panels to reduce reflection and therefore similarity to water and deter birds and insects (Horvath *et al,* 2010).	Operational	Project Manager Environmental Officer Design Engineer	Presence of dead birds in the PAOI. Monitoring must be undertaken in accordance with the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017). The precise location of any dead birds found should be recorded and mapped (using GPS). All carcasses should be photographed as found then placed in a plastic bag, labelled as to the location and date, and preserved (refrigerated or frozen) until identified. Feather spots (e.g., a group of feathers attached to skin) and body parts should also be collected.	During phase. The monitoring frequency is based on the collision rate.
In the areas overlapping with the Very high classification areas, the line must be fitted with bird diverters at 5 m intervals as described above	Operational	Project Manager Environmental Officer Design Engineer	Collisions. Monitoring must be undertaken in accordance with the BirdLife South Africa best practice guidelines for solar energy facilities (BirdLife South Africa, 2017).	During phase. The monitoring frequency is based on the collision rate.
There is little to no information on the recovery of the avifauna community subsequent to the closure of PVs within South Africa. A post-closure monitoring regime is recommended for the proposed project to document any impacts and this data must be used for improving rehabilitation measures	Closure/Rehabilitation	Project Manager Environmental Officer	Avifauna community	Wet-season and dry-season survey for the initial 3-5 years after closure.
All infrastructure including powerlines must be removed if the facility is decommissioned	Closure/Rehabilitation	Project Manager Environmental Officer	Infrastructure removal	During Process

9 Conclusion and Impact Statement

9.1 Conclusion

The PAOI falls in a CBA, HMA, ESA and ONA classified area it also overlaps with a CR river and numerous CR wetlands. Based on the SAPAB 2 dataset 276 indigenous avifauna species could be expected to occur within the PAOI and surrounding landscape. Of these twelve (12) are regarded as SCC, five of these have a high likelihood of occurrence, four a moderate likelihood of occurrence and one observed.

During the assessment performed in the summer (7th – 9th of October 2022) 99 species were recorded, one species the African Marsh Harrier were recorded just outside the PAOI along the Klipspruit. Eleven risk species were recorded in the survey, these are species at risk for collisions, electrocutions or highly sensitive to habitat loss. These species were recorded across four habitat types; Degraded Grassland and old agricultural fields, Tree Clumps, Water Resources and Transformed. Which were allocated a site ecological rating of Moderate, Very Low, Very High and Very Low respectively.

With the implementation of mitigations such as the installation of bird diverters on the powerline, as well as ensuring the infrastructure is appropriately insulated the impacts of collisions and electrocutions can successfully be reduced from high to moderate. The project will have a moderate- low overall impact should all the mitigations and recommendations be implemented successfully.

9.2 Impact Statement

The main expected impacts of the proposed PV and associated infrastructure will include the following:

- Habitat loss and fragmentation;
- Electrocutions; and
- Collisions.

Mitigation measures as described in this report can be implemented to reduce the significance of the risk to an acceptable residual risk level. Considering the above-mentioned information, it is the opinion of the specialist that the project may be favourably considered, on condition that all the mitigation and recommendations provided in this report and other specialist reports are implemented.

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11 Appendix Items

11.1 Appendix A: Summary of Expected species

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2021)
Accipiter melanoleucus	Sparrowhawk, Black	Unlisted	LC
Accipiter minullus	Sparrowhawk, Little	Unlisted	LC
Accipiter tachiro	Goshawk, African	Unlisted	LC
Acridotheres tristis	Myna, Common	Unlisted	LC
Acrocephalus arundinaceus	Reed-warbler, Great	Unlisted	LC
Acrocephalus baeticatus	Reed-warbler, African	Unlisted	Unlisted
Acrocephalus gracilirostris	Swamp-warbler, Lesser	Unlisted	LC
Acrocephalus palustris	Warbler, Marsh	Unlisted	LC
Actophilornis africanus	Jacana, African	Unlisted	LC
Afrotis afraoides	Korhaan, Northern Black	Unlisted	LC
Alopochen aegyptiaca	Goose, Egyptian	Unlisted	LC
Amadina erythrocephala	Finch, Red-headed	Unlisted	LC
Amandava subflava	Waxbill, Orange-breasted	Unlisted	Unlisted
Amblyospiza albifrons	Weaver, Thick-billed	Unlisted	LC
Anas capensis	Teal, Cape	Unlisted	LC
Anas erythrorhyncha	Teal, Red-billed	Unlisted	LC
Anas platyrhynchos	Duck, Mallard	Unlisted	LC
Anas sparsa	Duck, African Black	Unlisted	LC
Anas undulata	Duck, Yellow-billed	Unlisted	LC
Anhinga rufa	Darter, African	Unlisted	LC
Anomalospiza imberbis	Finch, Cuckoo	Unlisted	LC
Anthus cinnamomeus	Pipit, African	Unlisted	LC
Anthus leucophrys	Pipit, Plain-backed	Unlisted	LC
Anthus lineiventris	Pipit, Striped	Unlisted	LC
Anthus nicholsoni	Nicholson's pipit	Unlisted	LC
Anthus vaalensis	Pipit, Buffy	Unlisted	LC
Apalis thoracica	Apalis, Bar-throated	Unlisted	LC
Apus affinis	Swift, Little	Unlisted	LC
Apus apus	Swift, Common	Unlisted	LC
Apus barbatus	Swift, African Black	Unlisted	LC
Apus caffer	Swift, White-rumped	Unlisted	LC
Apus horus	Swift, Horus	Unlisted	LC
Aquila verreauxii	Eagle, Verreaux's	VU	LC
Ardea alba	Egret, Great	Unlisted	LC
Ardea cinerea	Heron, Grey	Unlisted	LC

Ardea goliath	Heron, Goliath	Unlisted	LC
Ardea intermedia	Egret, Yellow-billed (Intermediate)	Unlisted	LC
Ardea melanocephala	Heron, Black-headed	Unlisted	LC
Ardea purpurea	Heron, Purple	Unlisted	LC
Ardeola ralloides	Heron, Squacco	Unlisted	LC
Asio capensis	Owl, Marsh	Unlisted	LC
Aviceda cuculoides	Hawk, African Cuckoo	Unlisted	LC
Batis molitor	Batis, Chinspot	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Bradypterus baboecala	Rush-warbler, Little	Unlisted	LC
Bubo africanus	Eagle-owl, Spotted	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Buphagus erythrorynchus	Oxpecker, Red-billed	Unlisted	Unlisted
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC
Buteo buteo	Buzzard, Common (Steppe)	Unlisted	LC
Buteo rufofuscus	Buzzard, Jackal	Unlisted	LC
Calandrella cinerea	Lark, Red-capped	Unlisted	LC
Calendulauda sabota	Lark, Sabota	Unlisted	LC
Calidris pugnax	Ruff	Unlisted	LC
Campephaga flava	Cuckoo-shrike, Black	Unlisted	LC
Caprimulgus europaeus	Nightjar, European	Unlisted	LC
Caprimulgus pectoralis	Nightjar, Fiery-necked	Unlisted	LC
Caprimulgus rufigena	Nightjar, Rufous-cheeked	Unlisted	LC
Caprimulgus tristigma	Nightjar, Freckled	Unlisted	LC
Cecropis abyssinica	Swallow, Lesser Striped	Unlisted	LC
Cecropis cucullata	Swallow, Greater Striped	Unlisted	LC
Cecropis semirufa	Swallow, Red-breasted	Unlisted	LC
Centropus burchellii	Coucal, Burchell's	Unlisted	Unlisted
Cercotrichas leucophrys	Scrub-robin, White-browed	Unlisted	LC
Ceryle rudis	Kingfisher, Pied	Unlisted	LC
Chalcomitra amethystina	Sunbird, Amethyst	Unlisted	LC
Charadrius pecuarius	Plover, Kittlitz's	Unlisted	LC
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC
Chlidonias hybrida	Tern, Whiskered	Unlisted	LC
Chlidonias leucopterus	Tern, White-winged	Unlisted	LC
Chloropicus namaquus	Woodpecker, Bearded	Unlisted	LC
Chroicocephalus cirrocephalus	Gull, Grey-headed	Unlisted	LC
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC

Chrysococcyx klaas	Cuckoo, Klaas's	Unlisted	LC
Ciconia ciconia	Stork, White	Unlisted	LC
Cinnyricinclus leucogaster	Starling, Violet-backed	Unlisted	LC
Cinnyris afer	Sunbird, Greater Double-collared	Unlisted	LC
Cinnyris talatala	Sunbird, White-bellied	Unlisted	LC
Circaetus cinereus	Snake-eagle, Brown	Unlisted	LC
Circaetus pectoralis	Snake-eagle, Black-chested	Unlisted	LC
Circus pygargus	Montagu's Harrier	Unlisted	LC
Circus ranivorus	Marsh-harrier, African	EN	LC
Cisticola aberrans	Cisticola, Lazy	Unlisted	LC
Cisticola aridulus	Cisticola, Desert	Unlisted	LC
Cisticola ayresii	Cisticola, Wing-snapping	Unlisted	LC
Cisticola fulvicapilla	Neddicky, Neddicky	Unlisted	LC
Cisticola juncidis	Cisticola, Zitting	Unlisted	LC
Cisticola lais	Cisticola, Wailing	Unlisted	LC
Cisticola textrix	Cisticola, Cloud	Unlisted	LC
Cisticola tinniens	Cisticola, Levaillant's	Unlisted	LC
Clamator jacobinus	Cuckoo, Jacobin	Unlisted	LC
Colius striatus	Mousebird, Speckled	Unlisted	LC
Columba guinea	Pigeon, Speckled	Unlisted	LC
Columba livia	Dove, Rock	Unlisted	LC
Coracias caudatus	Roller, Lilac-breasted	Unlisted	LC
Coracias garrulus	Roller, European	NT	LC
Corvus albus	Crow, Pied	Unlisted	LC
Corvus capensis	Crow, Cape	Unlisted	LC
Corythornis cristatus	Kingfisher, Malachite	Unlisted	Unlisted
Cossypha caffra	Robin-chat, Cape	Unlisted	LC
Cossypha humeralis	Robin-chat, White-throated	Unlisted	LC
Coturnix coturnix	Quail, Common	Unlisted	LC
Coturnix delegorguei	Quail, Harlequin	Unlisted	LC
Creatophora cinerea	Starling, Wattled	Unlisted	LC
Crinifer concolor	Go-away-bird, Grey	Unlisted	LC
Crithagra atrogularis	Canary, Black-throated	Unlisted	LC
Crithagra gularis	Seedeater, Streaky-headed	Unlisted	LC
Crithagra mozambica	Canary, Yellow-fronted	Unlisted	LC
Cuculus clamosus	Cuckoo, Black	Unlisted	LC
Cuculus solitarius	Cuckoo, Red-chested	Unlisted	LC
Cursorius temminckii	Courser, Temminck's	Unlisted	LC
Cypsiurus parvus	Palm-swift, African	Unlisted	LC

Delichon urbicum	House-martin, Common	Unlisted	LC
Dendrocygna bicolor	Duck, Fulvous	Unlisted	LC
Dendrocygna viduata	Duck, White-faced Whistling	Unlisted	LC
Dendropicos fuscescens	Woodpecker, Cardinal	Unlisted	LC
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC
Dryoscopus cubla	Puffback, Black-backed	Unlisted	LC
Egretta garzetta	Egret, Little	Unlisted	LC
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC
Emberiza tahapisi	Bunting, Cinnamon-breasted	Unlisted	LC
Estrilda astrild	Waxbill, Common	Unlisted	LC
Euplectes afer	Bishop, Yellow-crowned	Unlisted	LC
Euplectes albonotatus	Widowbird, White-winged	Unlisted	LC
Euplectes ardens	Widowbird, Red-collared	Unlisted	LC
Euplectes axillaris	Widowbird, Fan-tailed	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Euplectes progne	Widowbird, Long-tailed	Unlisted	LC
Eupodotis senegalensis	Korhaan, White-bellied	VU	LC
Falco amurensis	Falcon, Amur	Unlisted	LC
Falco biarmicus	Falcon, Lanner	VU	LC
Falco naumanni	Kestrel, Lesser	Unlisted	LC
Falco peregrinus	Falcon, Peregrine	Unlisted	LC
Falco rupicoloides	Kestrel, Greater	Unlisted	LC
Falco rupicolus	Kestrel, Rock	Unlisted	LC
Fulica cristata	Coot, Red-knobbed	Unlisted	LC
Gallinago nigripennis	Snipe, African	Unlisted	LC
Gallinula chloropus	Moorhen, Common	Unlisted	LC
Geronticus calvus	Ibis, Southern Bald	VU	VU
Glaucidium perlatum	Owlet, Pearl-spotted	Unlisted	LC
Grus paradisea	Crane, Blue	NT	VU
Gymnoris superciliaris	Petronia, Yellow-throated	Unlisted	LC
Halcyon albiventris	Kingfisher, Brown-hooded	Unlisted	LC
Halcyon senegalensis	Kingfisher, Woodland	Unlisted	LC
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC
Hieraaetus wahlbergi	Eagle, Wahlberg's	Unlisted	LC
Himantopus himantopus	Stilt, Black-winged	Unlisted	LC
Hirundo albigularis	Swallow, White-throated	Unlisted	LC
Hirundo dimidiata	Swallow, Pearl-breasted	Unlisted	LC
Hirundo rustica	Swallow, Barn	Unlisted	LC
Iduna natalensis	Warbler, Dark-capped Yellow	Unlisted	LC

Indicator minor	Honeyguide, Lesser	Unlisted	LC
Ixobrychus minutus	Bittern, Little	Unlisted	LC
Jynx ruficollis	Wryneck, Red-throated	Unlisted	LC
Lagonosticta rubricata	Firefinch, African	Unlisted	LC
Lamprotornis bicolor	Starling, Pied	Unlisted	LC
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Laniarius atrococcineus	Shrike, Crimson-breasted	Unlisted	LC
Laniarius ferrugineus	Boubou, Southern	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Lanius collurio	Shrike, Red-backed	Unlisted	LC
Lanius minor	Shrike, Lesser Grey	Unlisted	LC
Lissotis melanogaster	Bustard, Black-bellied	Unlisted	LC
Lophoceros nasutus	Hornbill, African Grey	Unlisted	LC
Lybius torquatus	Barbet, Black-collared	Unlisted	LC
Macronyx capensis	Longclaw, Cape	Unlisted	LC
Megaceryle maxima	Kingfisher, Giant	Unlisted	Unlisted
Melaenornis mariquensis	Flycatcher, Marico	Unlisted	LC
Melaenornis pammelaina	Flycatcher, Southern Black	Unlisted	LC
Melaenornis silens	Flycatcher, Fiscal	Unlisted	LC
Melaniparus niger	Tit, Southern Black	Unlisted	Unlisted
Merops apiaster	Bee-eater, European	Unlisted	LC
Merops bullockoides	Bee-eater, White-fronted	Unlisted	LC
Merops pusillus	Bee-eater, Little	Unlisted	LC
Microcarbo africanus	Cormorant, Reed	Unlisted	LC
Micronisus gabar	Goshawk, Gabar	Unlisted	LC
Mirafra africana	Lark, Rufous-naped	Unlisted	LC
Mirafra cheniana	Lark, Melodious	LC	NT
Mirafra fasciolata	Lark, Eastern Clapper	Unlisted	LC
Mirafra rufocinnamomea	Lark, Flappet	Unlisted	LC
Motacilla capensis	Wagtail, Cape	Unlisted	LC
Muscicapa striata	Flycatcher, Spotted	Unlisted	LC
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC
Myrmecocichla monticola	Wheatear, Mountain	Unlisted	LC
Neotis denhami	Bustard, Denham's	VU	NT
Netta erythrophthalma	Pochard, Southern	Unlisted	LC
Nilaus afer	Brubru	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Oena capensis	Dove, Namaqua	Unlisted	LC
Oenanthe familiaris	Chat, Familiar	Unlisted	LC

Oenanthe pileata	Wheatear, Capped	Unlisted	LC
Onychognathus morio	Starling, Red-winged	Unlisted	LC
Oriolus larvatus	Oriole, Black-headed	Unlisted	LC
Ortygospiza atricollis	Quailfinch, African	Unlisted	LC
Oxyura maccoa	Duck, Maccoa	NT	VU
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Passer melanurus	Sparrow, Cape	Unlisted	LC
Pavo cristatus	Peacock, Common	Unlisted	LC
Peliperdix coqui	Francolin, Coqui	Unlisted	LC
Pernis apivorus	Honey-buzzard, European	Unlisted	LC
Petrochelidon spilodera	Cliff-swallow, South African	Unlisted	LC
Phalacrocorax lucidus	Cormorant, White-breasted	Unlisted	LC
Phoeniculus purpureus	Wood-hoopoe, Green	Unlisted	LC
Phylloscopus trochilus	Warbler, Willow	Unlisted	LC
Platalea alba	Spoonbill, African	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC
Plegadis falcinellus	Ibis, Glossy	Unlisted	LC
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC
Ploceus capensis	Weaver, Cape	Unlisted	LC
Ploceus cucullatus	Weaver, Village	Unlisted	LC
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC
Podiceps cristatus	Grebe, Great Crested	Unlisted	LC
Pogoniulus chrysoconus	Tinkerbird, Yellow-fronted	Unlisted	LC
Polemaetus bellicosus	Eagle, Martial	EN	EN
Polyboroides typus	Harrier-Hawk, African	Unlisted	LC
Porphyrio madagascariensis	Swamphen, African Purple	Unlisted	Unlisted
Prinia flavicans	Prinia, Black-chested	Unlisted	LC
Prinia subflava	Prinia, Tawny-flanked	Unlisted	LC
Prodotiscus regulus	Honeybird, Brown-backed	Unlisted	LC
Psalidoprocne pristoptera	Saw-wing, Black	Unlisted	LC
Pternistis natalensis	Spurfowl, Natal	Unlisted	LC
Pternistis swainsonii	Spurfowl, Swainson's	Unlisted	LC
Ptyonoprogne fuligula	Martin, Rock	Unlisted	Unlisted
Pycnonotus tricolor	Bulbul, Dark-capped	Unlisted	Unlisted
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Rallus caerulescens	Rail, African	Unlisted	LC
Riparia cincta	Martin, Banded	Unlisted	LC
Riparia paludicola	Martin, Brown-throated	Unlisted	LC

Riparia riparia	Martin, Sand	Unlisted	LC
Sagittarius serpentarius	Secretarybird	VU	EN
Sarkidiornis melanotos	Duck, Comb	Unlisted	LC
Sarothrura rufa	Flufftail, Red-chested	Unlisted	LC
Saxicola torquatus	Stonechat, African	Unlisted	LC
Scleroptila gutturalis	Francolin, Orange River	Unlisted	LC
Scleroptila levaillantii	Francolin, Red-winged	Unlisted	LC
Scopus umbretta	Hamerkop, Hamerkop	Unlisted	LC
Serinus canicollis	Canary, Cape	Unlisted	LC
Spatula hottentota	Teal, Hottentot	Unlisted	LC
Spermestes cucullata	Mannikin, Bronze	Unlisted	LC
Sphenoeacus afer	Grassbird, Cape	Unlisted	LC
Spilopelia senegalensis	Dove, Laughing	Unlisted	LC
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC
Struthio camelus	Ostrich, Common	Unlisted	LC
Sylvietta rufescens	Crombec, Long-billed	Unlisted	LC
Tachybaptus ruficollis	Grebe, Little	Unlisted	LC
Tachymarptis melba	Swift, Alpine	Unlisted	LC
Tchagra australis	Tchagra, Brown-crowned	Unlisted	LC
Tchagra senegalus	Tchagra, Black-crowned	Unlisted	LC
Telophorus zeylonus	Bokmakierie, Bokmakierie	Unlisted	LC
Terpsiphone viridis	Paradise-flycatcher, African	Unlisted	LC
Thalassornis leuconotus	Duck, White-backed	Unlisted	LC
Thamnolaea cinnamomeiventris	Cliff-chat, Mocking	Unlisted	LC
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Tringa glareola	Sandpiper, Wood	Unlisted	LC
Tringa nebularia	Greenshank, Common	Unlisted	LC
Tringa stagnatilis	Sandpiper, Marsh	Unlisted	LC
Turdoides jardineii	Babbler, Arrow-marked	Unlisted	LC
Turdus libonyana	Thrush, Kurrichane	Unlisted	Unlisted
Turdus litsitsirupa	Thrush, Groundscraper	Unlisted	Unlisted
Turdus smithi	Thrush, Karoo	Unlisted	LC
Turnix sylvaticus	Buttonquail, Kurrichane	Unlisted	LC
Tyto alba	Owl, Barn	Unlisted	LC
Tyto capensis	Grass-owl, African	VU	LC
Upupa africana	Hoopoe, African	Unlisted	LC
Urocolius indicus	Mousebird, Red-faced	Unlisted	LC

Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC
Vanellus senegallus	Lapwing, African Wattled	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC
Zapornia flavirostra	Crake, Black	Unlisted	LC
Zapornia pusilla	Crake, Baillon's	Unlisted	LC
Zosterops virens	White-eye, Cape	Unlisted	LC

11.2 Appendix A: Point count data of the assessment

Common Name	Scientific Name	Regional (SANBI, 2016)	IUCN (2017)	Guild code	Relative abundance	Frequency (%)
Great Crested Grebe	*Podiceps cristatus*	Unlisted	LC	CWD	0,004	3,846
Black-headed Oriole	*Oriolus larvatus*	Unlisted	LC	OMD	0,004	3,846
Spur-winged Goose	*Plectropterus gambensis*	Unlisted	LC	OMD	0,026	5,769
Ring-necked Dove	*Streptopelia capicola*	Unlisted	LC	GGD	0,039	42,308
Namaqua Dove	*Oena capensis*	Unlisted	LC	GGD	0,004	3,846
Egyptian Goose	*Alopochen aegyptiaca*	Unlisted	LC	HWD	0,023	11,538
Levaillant's Cisticola	*Cisticola tinniens*	Unlisted	LC	IGD	0,021	23,077
Red-eyed Dove	*Streptopelia semitorquata*	Unlisted	LC	GGD	0,005	5,769
Southern Masked Weaver	*Ploceus velatus*	Unlisted	LC	GGD	0,049	53,846
Long-tailed Widowbird	*Euplectes progne*	Unlisted	LC	GGD	0,018	19,231
Reed Cormorant	*Microcarbo africanus*	Unlisted	LC	CWD	0,011	3,846
Cape Longclaw	*Macronyx capensis*	Unlisted	LC	IGD	0,011	11,538
Swainson's Spurfowl	*Pternistis swainsonii*	Unlisted	LC	OMD	0,007	7,692
White-throated Swallow	*Hirundo albigularis*	Unlisted	LC	IAD	0,007	5,769
Red-knobbed Coot	*Fulica cristata*	Unlisted	LC	HWD	0,005	5,769
Blacksmith Lapwing	*Vanellus armatus*	Unlisted	LC	IGD	0,012	13,462
Little Grebe	*Tachybaptus ruficollis*	Unlisted	LC	CWD	0,004	3,846
Cape Wagtail	*Motacilla capensis*	Unlisted	LC	IGD	0,007	7,692
African Stonechat	*Saxicola torquatus*	Unlisted	LC	IGD	0,016	17,308
Black Sparrowhawk	*Accipiter melanoleucus*	Unlisted	LC	CGD	0,002	1,923
Cloud Cisticola	*Cisticola textrix*	Unlisted	LC	IGD	0,019	21,154
Spike-heeled Lark	*Chersomanes albofasciata*	Unlisted	LC	IGD	0,005	1,923
Ant-eating Chat	*Myrmecocichla formicivora*	Unlisted	LC	IGD	0,004	3,846
Desert Cisticola	*Cisticola aridulus*	Unlisted	LC	IGD	0,039	42,308
Tawny-flanked Prinia	*Prinia subflava*	Unlisted	LC	IGD	0,007	7,692
Helmeted Guineafowl	*Numida meleagris*	Unlisted	LC	OMD	0,037	15,385
Golden-tailed Woodpecker	*Campethera abingoni*	Unlisted	LC	IGD	0,002	1,923
Three-banded Plover	*Charadrius tricollaris*	Unlisted	LC	IWD	0,007	7,692
Greater Striped Swallow	*Cecropis cucullata*	Unlisted	LC	IAD	0,004	3,846
Cape Grassbird	*Sphenoeacus afer*	Unlisted	LC	IGD	0,007	7,692
Cape White-eye	*Zosterops virens*	Unlisted	LC	OMD	0,009	9,615
Rufous-naped Lark	*Mirafra africana*	Unlisted	LC	IGD	0,032	34,615
Pied Starling	*Lamprotornis bicolor*	Unlisted	LC	IGD	0,014	13,462
African Pipit	*Anthus cinnamomeus*	Unlisted	LC	IGD	0,016	17,308
Mountain Wheatear	*Myrmecocichla monticola*	Unlisted	LC	IGD	0,004	1,923

Pied Crow	*Corvus albus*	Unlisted	LC	OMD	0,005	5,769
Southern Fiscal	*Lanius collaris*	Unlisted	LC	IAD	0,018	19,231
Black-chested Prinia	*Prinia flavicans*	Unlisted	LC	IGD	0,019	21,154
Hadada Ibis	*Bostrychia hagedash*	Unlisted	LC	OMD	0,007	7,692
Neddicky	*Cisticola fulvicapilla*	Unlisted	LC	IGD	0,018	19,231
Pin-tailed Whydah	*Vidua macroura*	Unlisted	LC	GGD	0,004	3,846
Black-crowned Night Heron	*Nycticorax nycticorax*	Unlisted	LC	CWD	0,004	3,846
Red-chested Flufftail	*Sarothrura rufa*	Unlisted	LC	IWD	0,002	1,923
Little Swift	*Apus affinis*	Unlisted	LC	IAD	0,004	3,846
African Reed Warbler	*Acrocephalus baeticatus*	Unlisted	Unlisted	IWD	0,009	9,615
Southern Red Bishop	*Euplectes orix*	Unlisted	LC	GGD	0,007	7,692
Malachite Kingfisher	*Corythornis cristatus*	Unlisted	Unlisted	CWD	0,002	1,923
White-fronted Bee-eater	*Merops bullockoides*	Unlisted	LC	IAD	0,012	13,462
Red-throated Wryneck	*Jynx ruficollis*	Unlisted	LC	IGD	0,002	1,923
Black-throated Canary	*Crithagra atrogularis*	Unlisted	LC	OMD	0,004	3,846
Southern Grey-headed Sparrow	*Passer diffusus*	Unlisted	LC	GGD	0,002	1,923
Common Ostrich	*Struthio camelus*	Unlisted	LC	OMD	0,002	1,923
Zitting Cisticola	*Cisticola juncidis*	Unlisted	LC	IGD	0,004	3,846
Wing-snapping Cisticola	*Cisticola ayresii*	Unlisted	LC	IGD	0,002	1,923
Greater Kestrel	*Falco rupicoloides*	Unlisted	LC	CGD	0,005	5,769
Dark-capped Bulbul	*Pycnonotus tricolor*	Unlisted	Unlisted	OMD	0,004	3,846
Common Quail	*Coturnix coturnix*	Unlisted	LC	OMD	0,002	1,923
Cape Sparrow	*Passer melanurus*	Unlisted	LC	GGD	0,016	13,462
Western Cattle Egret	*Bubulcus ibis*	Unlisted	LC	IGD	0,019	13,462
Red-billed Quelea	*Quelea quelea*	Unlisted	LC	GGD	0,176	1,923
Orange-breasted Waxbill	*Amandava subflava*	Unlisted	Unlisted	GGD	0,002	1,923
Barn Swallow	*Hirundo rustica*	Unlisted	LC	IAD	0,005	3,846
Whiskered Tern	*Chlidonias hybrida*	Unlisted	LC	CWD	0,002	1,923
Common Myna	*Acridotheres tristis*	Unlisted	LC	OMD	0,016	17,308
Capped Wheatear	*Oenanthe pileata*	Unlisted	LC	IGD	0,004	3,846
Crowned Lapwing	*Vanellus coronatus*	Unlisted	LC	IGD	0,009	9,615
Black-crowned Tchagra	*Tchagra senegalus*	Unlisted	LC	OMD	0,002	1,923
African Hoopoe	*Upupa africana*	Unlisted	LC	IGD	0,002	1,923
Buffy Pipit	*Anthus vaalensis*	Unlisted	LC	IGD	0,002	1,923
Banded Martin	*Riparia cincta*	Unlisted	LC	IAD	0,004	3,846
Cape Robin-Chat	*Cossypha caffra*	Unlisted	LC	OMD	0,004	3,846
Eastern Clapper Lark	*Mirafra fasciolata*	Unlisted	LC	IGD	0,004	3,846
Streaky-headed Seedeater	*Crithagra gularis*	Unlisted	LC	GGD	0,002	1,923

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Cinnamon-breasted Bunting	*Emberiza tahapisi*	Unlisted	LC	GGD	0,002	1,923
African Wattled Lapwing	*Vanellus senegallus*	Unlisted	LC	IGD	0,011	11,538
Spotted Thick-knee	*Burhinus capensis*	Unlisted	LC	IGD	0,002	1,923
Bokmakierie	*Telophorus zeylonus*	Unlisted	LC	OMD	0,005	5,769
Speckled Pigeon	*Columba guinea*	Unlisted	LC	FFD	0,011	11,538
Common Waxbill	*Estrilda astrild*	Unlisted	LC	GGD	0,004	3,846
Speckled Mousebird	*Colius striatus*	Unlisted	LC	FFD	0,002	1,923
House Sparrow	*Passer domesticus*	Unlisted	LC	GGD	0,005	5,769
Rock Dove	*Columba livia*	Unlisted	LC	FFD	0,021	7,692
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	Unlisted	LC	IGD	0,005	5,769
African Palm Swift	*Cypsiurus parvus*	Unlisted	LC	IAD	0,005	5,769
Yellow Canary	*Crithagra flaviventris*	Unlisted	LC	GGD	0,002	1,923
Black-headed Heron	*Ardea melanocephala*	Unlisted	LC	CGD	0,002	1,923
Brown-throated Martin	*Riparia paludicola*	Unlisted	LC	IAD	0,007	7,692
Fan-tailed Widowbird	*Euplectes axillaris*	Unlisted	LC	GGD	0,007	7,692
Little Rush Warbler	*Bradypterus baboecala*	Unlisted	LC	IWD	0,007	7,692
Laughing Dove	*Spilopelia senegalensis*	Unlisted	LC	GGD	0,002	1,923
Common Moorhen	*Gallinula chloropus*	Unlisted	LC	HWD	0,005	5,769
Glossy Ibis	*Plegadis falcinellus*	Unlisted	LC	IWD	0,002	1,923
Amethyst Sunbird	*Chalcomitra amethystina*	Unlisted	LC	NFD	0,002	1,923
African Marsh Harrier	*Circus ranivorus*	EN	LC	CGD	0,002	1,923
Black Crake	*Zapornia flavirostra*	Unlisted	LC	OMD	0,004	3,846
African Swamphen	*Porphyrio madagascariensis*	Unlisted	Unlisted	HWD	0,002	1,923
African Sacred Ibis	*Threskiornis aethiopicus*	Unlisted	LC	CGD	0,005	1,923
Purple Heron	*Ardea purpurea*	Unlisted	LC	CWD	0,002	1,923
Wailing Cisticola	*Cisticola lais*	Unlisted	LC	IGD	0,002	1,923

11.3 Appendix C: Incidental records during the assessment

Scientific name	Common name
Accipiter melanoleucus	Black Sparrowhawk
Falco rupicoloides	Greater Kestrel
Afrotis afraoides	Northern Black Korhaan

11.4 Appendix D: Specialist Declaration of Independence

I, Lindi Steyn, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations, and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan, or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Lindi Steyn

Biodiversity Specialist

The Biodiversity Company

October 2022