Mobile: Sam - 072 437 1742
Mobile: Luke - 083 784 1997
Email: info@enviro-insight.co.za
Website: www.enviro-insight.co.za

Avifauna Final EIA Report

The development of a 400 MW Solar Photovoltaic (PV) facility and associated infrastructure (Phase 3) on the Remainder of Farm Goede Hoop 26C, Portion 3 of Farm Goede Hoop 26C and other properties, between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province, South Africa

October 2022

APPLICANT:

Soventix SA Pty Ltd

Enviro-Insight CC:

Sam Laurence (*Pr. Sci. Nat.*)

A.E. van Wyk (*Cand. Sci. Nat.*)

info@enviro-insight.co.za

Specialist Declaration

I, Sam Laurence *Pr. Sci. Nat.,* declare that the work presented in this report is our own and has not been influenced in any way by the developer or the EAP. At no point has the developer asked us as specialists to manipulate the results in order to make it more favourable for the proposed development. We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP) and the EIA Regulations (2014, as amended). We have the necessary qualifications and expertise (*Pr. Sci. Nat. Zoological Science)* in conducting this specialist report.

Sam Laurence Pr. Sci. Nat

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

GLOSSARY

Critical Biodiversity Area (CBA)	An area that must be maintained in a good ecological condition (natural or semi-natural state) in order to meet biodiversity targets. CBAs collectively meet biodiversity targets for all ecosystem types, as well as for species and ecological processes that depend on natural or semi-natural habitat that have not already

	been met in the protected area network. CBAs are identified through a systematic biodiversity planning process in a configuration that is complementary, efficient and avoids conflict with other land uses where possible.
Cumulative impact	Impacts on a species, ecosystem or resource as a result of the sum of actions in the past, present and foreseeable future, from multiple renewable energy projects or a renewable energy project in combination with other developments.
Ecological Support Area (ESA)	The ESA are supporting zones or areas which must be safeguarded as they are needed to prevent degradation of Critical Biodiversity Areas and formal Protected Areas.
Endemic	A species that is naturally restricted to a particular, well-defined region. This is not the same as the medical definition, which is 'occurring naturally in a region.
Environmental Impact Assessment (EIA)	The process of identifying environmental impacts due to activities and assessing and reporting these impacts
IBA	Important Bird and Biodiversity Area. Part of a global network of sites that are critical for the long-term viability of bird populations. Now known as Important Bird and Biodiversity Areas.
IUCN Red Listed Categories and Criteria	International Union for Conservation of Nature.
PAOI	Project Area of Influence
Preconstruction Phase	The period prior to the construction of a solar energy facility
Priority species	Threatened or rare birds (in particular those unique to the region and especially those which are possibly susceptible to solar energy impacts), which occur in the given development area at relatively high densities or have high levels of activity in the area. These species should be the primary (but not the sole) focus of all subsequent monitoring and assessment.
SABAP	The Southern African Bird Atlas Project. A project in which data on bird distribution and relative abundance are collected by volunteers. There have been two SABAP projects; i.e. SABAP1 (completed in 1991) and SABAP2 (started in 2007 and on-going). See http://sabap2.adu.org.za for more information.
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute

1 INTRODUCTION AND PROJECT BACKGROUND

Soventix SA (Pty) Ltd ('the Applicant') is proposing to develop the Soventix Solar Farm and associated infrastructure approximately 25 km north of the town Hanover in the Northern Cape Province.

In 2016 Ecoleges undertook a S&EIA for the development of a 225 MW Solar PV facility between Hanover and De Aar in the Northern Cape. Three alternative footprints (PV01, PV02, PV03) were investigated during the assessment process. The central footprint (PV02) was identified as the preferred option because of its lower environmental impact and proximity to an existing 400kV Eskom powerline when compared with PV01 and PV03. The National Department of Environmental Affairs granted an environmental authorisation (DEA Reference: 14/12/16/3/3/2/998) on 16th April 2018. The activity must commence on the PV02 footprint within a period of five years from the date of issue.

An amendment to increase the capacity (not the footprint) of the facility to 300 MW due to technological advancements in solar photovoltaic efficiency and electrical output was granted on 24th November 2020. A second amendment was granted in 2021 for the inclusion of containerised lithium-ion battery Storage and dual-fuel backup generators with associated fuel storage.

The competent authority was the National Department of Environmental Affairs because the application was part of the REIPPP or RMIPPP BID rounds, which formed part of a Strategic Infrastructure Project (SIP) as described in the National Development Plan, 2011. Soventix SA (Pty) Ltd was an unsuccessful bidder. However, the applicant has since partnered with another company, Solar Africa, with 1.5 GW in private renewable energy offtake agreements, making it economically feasible to develop two more 300 and 400 MW facilities (Phases 2 and 3, respectively).

Soventix will therefore apply for an environmental authorisation to develop an additional 300MW on the PV03 footprint (Phase 2) that was considered during the initial S&EIA. It is proposed to connect this second phase to the substation that forms part of the authorised facility on PV02.

Enviro-Insight CC was appointed to undertake the requisite avifauna assessment associated with the proposed Soventix Solar Farm. The aim of this report is to undertake a desktop analysis and compile the final study in compliance with the relevant regulations regarding solar development.

1.1 STUDY AREA

The extent of the study area is approximately 600 ha and is located on the Remainder of Farm Goede Hoop 26C and Portion 3 of Farm Goede Hoop 26C, between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province. The proposed study area is situated on the following coordinates, Latitude: 30°50'10.12"S, and Longitude: 24°21'25.37"E (Figure 1).

1.2 PROJECT DESCRIPTION

The project (known as Phase 3) is for the development of a 400 MW Solar Photovoltaic (PV) facility which includes four interconnected 100 MW solar PV plants (150 ha each), with associated infrastructure. The PV system will be connected via distribution lines to the authorised substation on Phase 1. The substation ties into the existing ESKOM 400kV overhead

powerlines. Existing roads will be used for main access, which may need to be enlarged to allow large equipment to access the site during construction. Given the size of the area required relative to the Site Area (both properties), only one (preferred) Alternative can be considered. The Site Area is bisected by sensitive watercourses. Consequently, two parts (Part 1 ±333 ha and Part 2 ±543ha) that make up the preferred alternative have been identified. Phase 3 will be connected to a previous Phase 2 and Phase 1 via an overhead powerline.

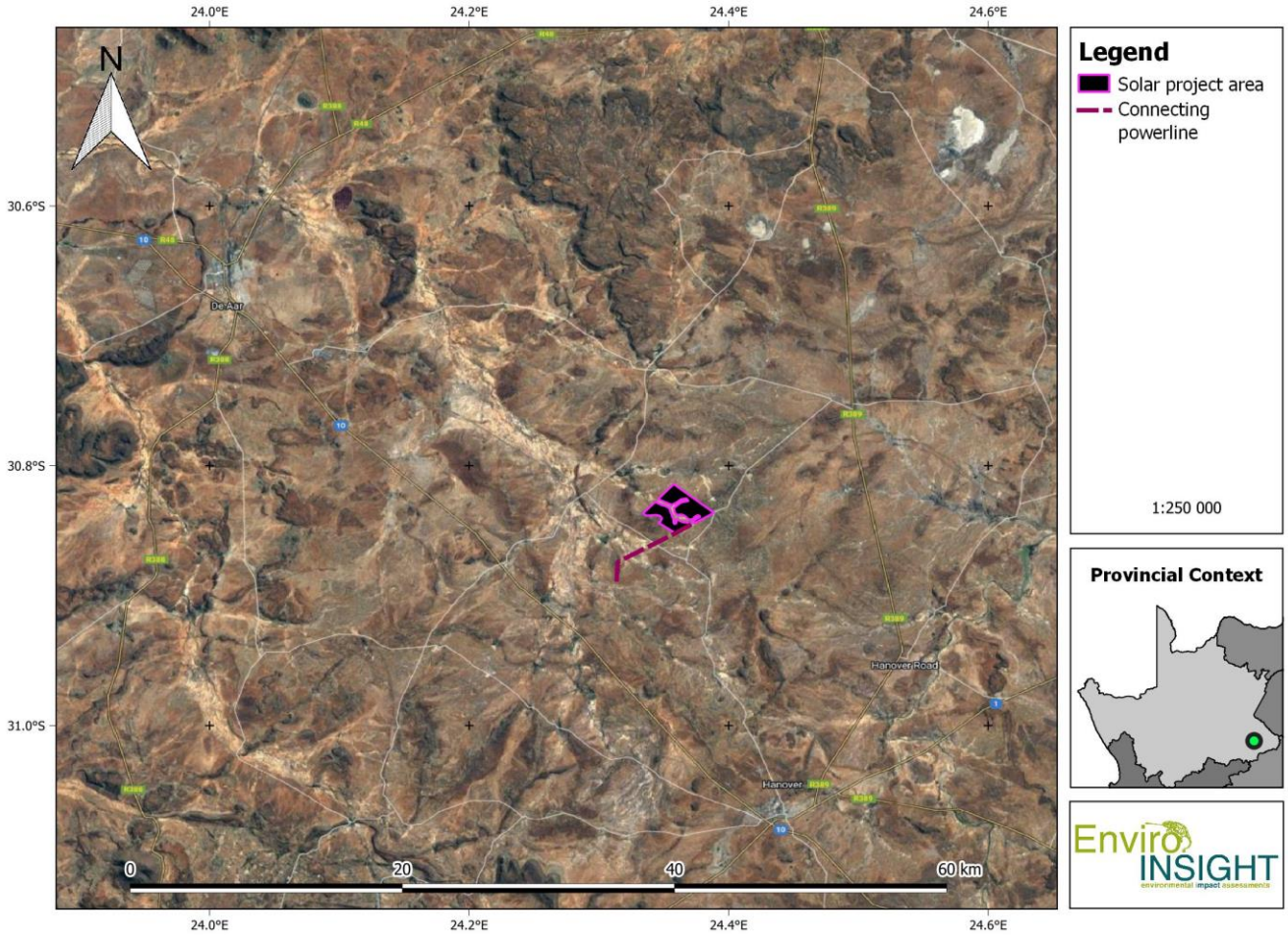

Figure 1: Locality map of the proposed study area.

1.3 OBJECTIVES

The principal aim of the avifaunal assessment was to determine how this development (and its separate elements) will impact on the terrestrial ecological integrity of the area (as it pertains to avifauna) and if necessary, demarcate appropriate ecological buffers around sensitive communities or receptors.

The main objectives were as follows:

- Provide quantitative information on the abundance, distribution, and risk to key avifaunal species or groups of species and serve to inform and improve mitigation measures.
- Determine how this development (and its separate elements) will impact on avifauna, particularly relating to habitat loss/fragmentation, alteration of habitat quality, species assemblage changes, microclimate disturbance and reduced connectivity between populations in some species.
- Include a corridor analysis for the migration of avifauna across the landscape, taking the cumulative impact of all three facilities (phases) into account.
- Identify actual and potential species of conservation concern/importance (protected – NEMBA, endemic, threatened). GPS the position of all sensitive receptors (protected, endemic and/or red data species) - the co-ordinates should be in degrees and decimal minutes. The minutes should have at least three decimals to ensure adequate accuracy. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection.
- Demarcate appropriate ecological buffers around sensitive ecological habitats, avifaunal communities or receptors.
- Identify and quantify the perceived impacts and propose mitigations to be included in the Environmental Management Programme (EMPr). The potential impacts and recommended mitigations must be identified for the planning and design, pre-construction, construction, and post-construction (e.g., monitoring rehabilitation of the construction site) only.
- The impacts must be assessed and evaluated according to the EIA Regulations, 2014 as amended (https://cer.org.za/wp-content/uploads/1999/01/EIA-Regulations.pdf) or the Impact Assessment Criteria and Matrix to be supplied by the client.
- Undertake a cumulative impact assessment of all three phases. Then, in addition to the development site, also take into consideration other similar facilities within a 30 km radius of the proposed development site. Information on the location of renewable energy developments can be accessed from https://egis.environment.gov.za/renewable_energy.

1.4 AVIFAUNA SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS

- Perform the Avifaunal Specialist Assessment according to the criteria provided by the Terrestrial Animal Species protocol published on 30 October 2020 in Government Gazette No. 43855.
- Write up the findings of the specialist assessment in an Avifaunal Specialist Assessment Report that contains the minimum report content requirements prescribed in the same protocol, and the applicable guidelines for solar developments.

- According to Regulation 13(1)(b) and 13(1)(e) read together with Regulation 18 of the amended EIA Regulations, 2014, Specialists must have knowledge of any guidelines that have relevance to the proposed activity and have regard to the need for and desirability of the undertaking of the proposed activity. BirdLife SA's Best Practice Guidelines on Birds and Solar Energy (Jenkins et al., 2017) was consulted when compiling the report.
- Ensure that the avifauna assessment and reporting meet all the requirements of the relevant protocol.

1.5 STUDY LIMITATIONS

- It is assumed that all third-party information acquired is correct (e.g. GIS data and scope of work); and
- Owing to the heavy rain occurring during the reconnaissance site visit in March 2022, certain areas of the property were not accessible.

2 LEGISLATIVE FRAMEWORK

2.1 NATIONAL ENVIRONMENTAL SCREENING TOOL AND ENVIRONMENTAL THEME PROTOCOLS

2.1.1 Screening Report

The Minister of Environment, Forestry and Fisheries, gave notice that the submission of a report generated from the national web-based environmental screening tool[1], as contemplated in Regulation 16(1)(b)(v) of the Environmental Impact Assessment Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, will be compulsory from 4 October 2019 when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the Environmental Impact Assessment Regulations, 2014.

In addition, a set of protocols that an applicant needs to adhere to in the Environmental Authorisation (EA) process were developed and on 20 March 2020 the Minister of Forestry, Fisheries and the Environment gazetted the Protocols for national implementation purposes. The gazette '*Procedures to be followed for the Assessment and Minimum Criteria for Reporting of Identified Environmental Themes in terms of Section 24(5)(a) and (h) of the National Environmental Management Act (1998) when Applying for Environmental Authorisation*', has protocols that have been developed for environmental themes which include agriculture, avifauna, biodiversity (Terrestrial and Aquatic Biodiversity), noise, defence and civil aviation.

The protocols set requirements for the assessment and reporting of environmental impacts of activities requiring EA. The higher the sensitivity rating of the features on the proposed site as identified by the screening tool report, the more rigorous the assessment and reporting requirements.

Based on the generated screening report, the avifauna theme was indicated as "medium" sensitivity, due to the probability of Ludwig Bustard (*Neotis ludwigii*) occurring within or around the study area (Figure 2). The Ludwig's Bustard is listed globally and regionally as Endangered. However, the fieldwork from the reconnaissance phase to the end of the survey period revealed multiple other SCC that warranted consideration within this report.

[1] https://screening.environment.gov.za/screeningtool/#/pages/welcome

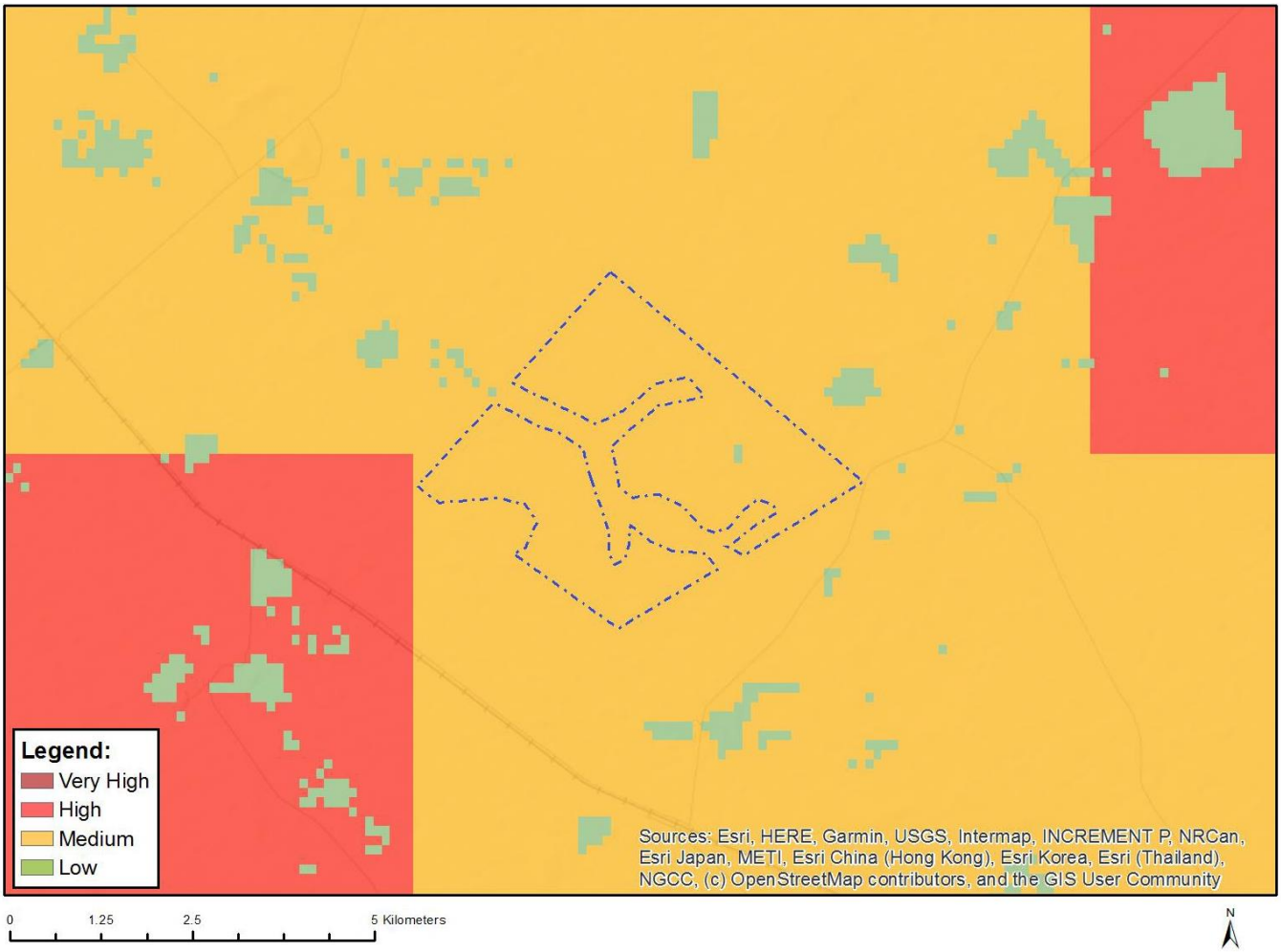

Figure 2: Screening Tool map of relative animal species theme sensitivity.

2.2 RENEWABLE ENERGY DEVELOPMENT ZONE

On 17 February 2016, Cabinet approved the Renewable Energy Development Zones (REDZs) for large scale wind and solar photovoltaic development and associated Strategic Transmission Corridors (STC) which support areas where long term electricity grid will be developed.

The procedure to be followed in applying for EA for a large-scale project in a REDZ or in a Power Corridor was formally gazetted on 16 February 2018 in GN113 and GN114. On 17 July 2020, Minister Barbara Dallas Creecy, published Government Gazette 43528, Notice 786 for consultation with the intention to identify three additional Renewable Energy Development Zones to the eight Renewable Energy Development Zones published under Government Notice No. 114 in Government Gazette No. 41445 of 16 February 2018. REDZs are also aligned with the powerline corridors that were identified in the Electricity Grid Infrastructure SEA completed in 2016 and gazetted as powerline corridors in February 2018. In this way, the combination of the REDZs and power corridors provides strategic guidance to Eskom on where to prioritise investment in grid infrastructure.

New renewable energy projects located within one of the 11 REDZ areas, and new electricity grid expansion within the 5 Strategic Transmission Corridors are subject to a Basic Assessment and not a full EIA process, as well as a shortened timeframe of 147 days (90-day BA process and 57 decision-making process).

The proposed Soventix Solar Farm is not located in a REDZ but is located in the Central Strategic Transmission Corridor.

2.3 BIRDS AND SOLAR ENERGY BEST-PRACTICE GUIDELINES (2017)

The "*Best-Practice Guidelines for assessing and monitoring the impact of solar energy facilities on birds in southern Africa*" (Jenkins *et al*., 2017) are followed in order to fulfil the outlined requirements.

As per Appendix 2 - *Minimum requirements for avifaunal impact assessment*, an avifaunal impact assessment for a SEF should follow a two-tier process:

1. **Scoping report**- process to identify issues that are likely to be important in the impact assessment process and to define the scope of work required in the assessment (e.g. timing, spatial extent and data collection methodologies). Largely based on desktop analysis of available data, but preferably also informed by a brief site visit.
2. **Preliminary assessment** – This is part of the planning for the EIA application, giving an overview on the biological context, likely impacts and potential red flags to the development, identifying alternatives and determining the appropriate assessment regime.
3. **In-depth Study** – Could including structured and repeated data collection on which to base the impact assessment report and provide a baseline against which post-construction monitoring can be compared.
4. **Impact assessment** - Informed by the data collected during the preliminary assessment.

3 METHODS

3.1 GIS

Existing data layers were incorporated into a GIS to establish how the proposed SEF layout and associated activities interact with important terrestrial entities. Emphasis was placed on the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018);
- Important Bird and Protected Areas (Marnewick *et al*., 2015);
- South African Protected Areas Database (SAPAD); and
- GIS layers of proposed layout provided by the client.

All mapping was performed using open-source GIS software (QGIS[2]).

3.2 DESKTOP AND LITERATURE SURVEY

A desktop survey is conducted to consider the best information available, in order to provide a better evaluation of all conditions present within the study area. An initial literature review was undertaken to assess which bird species could potentially occur in the vicinity of the Soventix SEF using data from the second South African Bird Atlas Project (SABAP 2[3]; [SABAP2, 2020]). SABAP 2 records were developed based on records per pentad (i.e., 5' X 5'). A list of species potentially occurring was developed from SABAP 2 data for the pentads within which the study area falls (3045_2415, 3045_2420, 3050_2415 and 3050_2420) (Figure 3). The expected species list is therefore based on an area much larger than the actual study area and was therefore subsequently refined. This approach was adopted to ensure that all species potentially occurring within the study area, whether resident, nomadic, or migratory, are identified.

Species were considered sensitive based on their abundance, flight characteristics, ecological role, population trend and conservation status.

The following main literature sources have been consulted for the avifauna study:

- The existing avifaunal impact assessments for the area (Simon Tod Consulting, 2017);
- Information relating to avifauna species of conservation concern (SCC) was obtained from Taylor *et al.* (2015) and the IUCN Red List of threatened species (IUCN, 2022);
- del Hoyo *et al.* (1992) and Hockey *et al.* (2005) were consulted for general information on the life history attributes of relevant bird species;
- Distributional data was sourced from the Southern Africa Bird Atlas Project (SABAP 2, 2021), del Hoyo *et al.* (1992) and Sinclair & Ryan (2010);
- iNaturalist and Virtual Museum (ADU) was used to source the distribution bird data in the area; and

[2] http://qgis.osgeo.org/en/site/
[3] http://sabap2.birdmap.africa/

- Nomenclature and taxonomy followed the IOC World Bird Names unless otherwise specified (see www.worldbirdnames.org; Gill & Donsker, 2012).

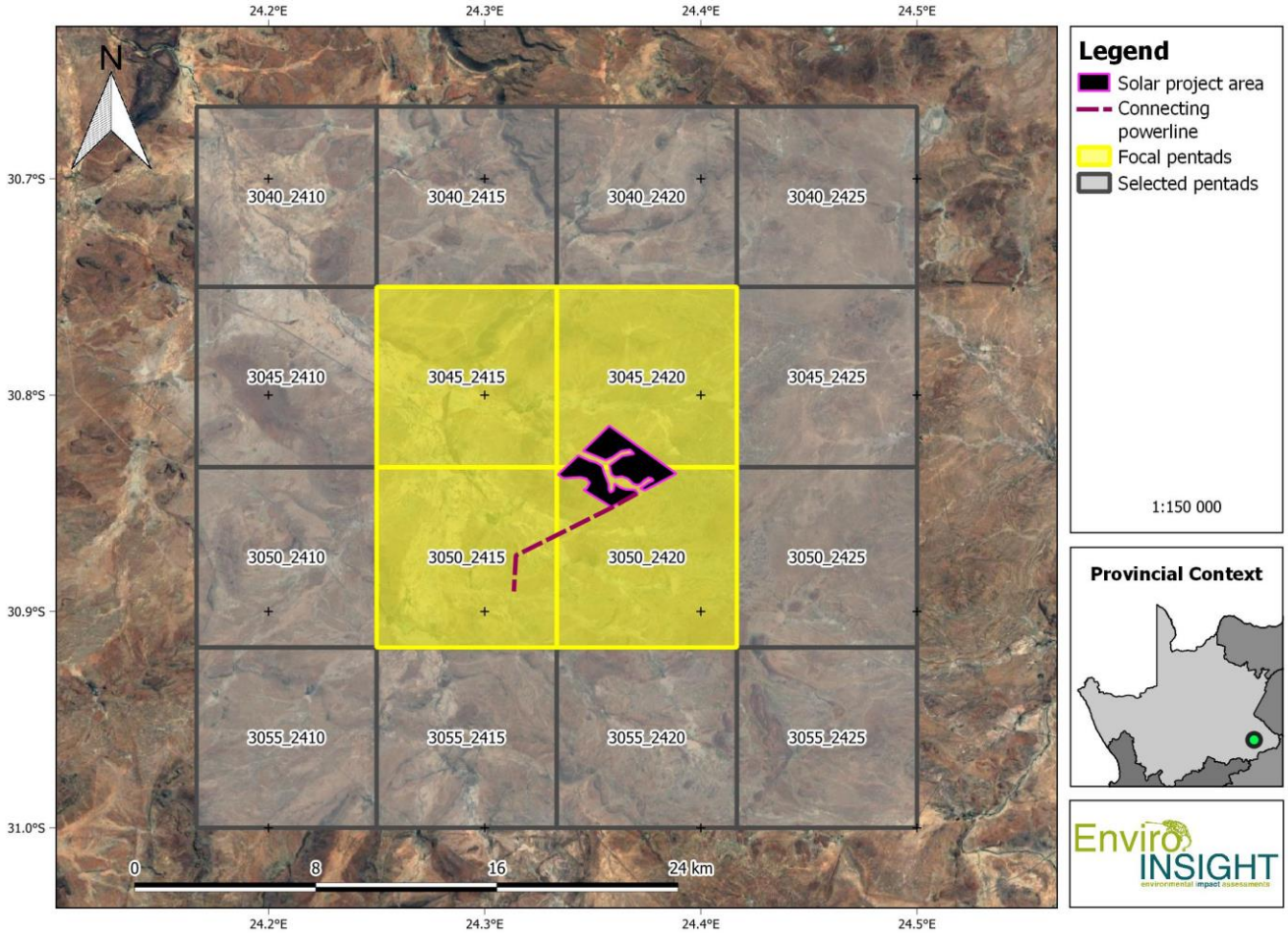

Figure 3: The proposed Soventix SEF in relation to the SABAP2 pentads.

3.3 PRECONSTRUCTION BIRD MONITORING SURVEY DESIGN

They proposed study area is classified as a Regime 2 based on the size of the study area (>150 ha), high avifaunal sensitivity and type of technology that will be used for the proposed project. The avifaunal sensitivity was determined based on the number of priority species occurring, or potentially present, within or around the study area, the regional or globally threat status of these species, avifaunal habitat found in the area, population of priority species, bird movement corridor and proximity to Important Bird and Critical Biodiversity Areas.

The duration, in terms of data collection, for this study was 6 months consisting of 3 visits of 3-5 days each, covering both the peak wet and dry seasons of the year. This complies with the requirements of the Best Practice Guidelines available at the time (Jenkins *et al*., 2017).

The first site visit was a site reconnaissance and verification survey conducted to identify site characteristic found within the study area such as habitats, important bird species and site sensitivities including sensitive habitats with their associated sensitive bird species and observation of nests of sensitive bird species. The site visit was conducted in March 2022, during optimal conditions where the area receives the most rainfall. During the site visit, sampling was done by means of walking and driving in and around the study area. Waterbodies in- and outside of the study area were identified and powerlines and pylons were scanned for any possible nests from sensitive bird species.

The second (June 2022) and third (September 2022) site visits were conducted during the additional seasons, formed part of the data sampling methods used as per the Best Practice Guidelines (Jenkins et al., 2017). Walking transects (WT) and driving transects (DT) were done based on the methodology determined after the first site visit (Table 1). Additional methods that commenced during the first site visit includes nesting sites and Coordinated Waterbird Counts, (CWAC).

Table 1: Avifauna monitoring sampling period for Soventix SEF and Control Site.

Date	Season	Methodology applied*
March 2022 (wet season) - scoping phase	Summer	WT, DT, NE, WB
Late June 2022	Winter	WT, DT, NE, WB
Early September 2022	Spring	WT, DT, NE, WB

*** WT – Walked transects; DT – Drive transects; NE – Nest searches, inspection, and monitoring; WB – Water body inspections.**

3.3.1 Walking Transects and Fixed-Point Counts

These methods are utilised to monitor small bird species within the major habitat types within a study area. Based on the variety of habitat types, transects and sample points were positioned at varying distances away from the proposed solar farm in order to maximize the comparative value of the data which was compared with the surveys from the post-construction phase results.

Linear transects are determined based upon habitat characteristics and are approximately 500 m each, conducted to characterize the passerine and small bird communities and ended with a fixed sample point. These transects are representative of the biotopes present within the study area. The survey locations were selected based on the representation of the different habitats covering the proposed study area, in proportion to their availability. All of them were positioned at varying distances from the central development area (Jenkins *et al*., 2017). Each linear transect was conducted by one expert bird observer at a time (more than one observer for all transects were used), who recorded all bird contacts (both seen and heard) by walking slowly along the predetermined transect. Observations are made on both the left and right side of the predetermined transect and 360 degrees at the final fixed sample point. As a guideline. birds were only recorded (seen or heard) within an estimated fixed maximum width of 200 m on either side of the transect line. The same transects were repeated in every season. Surveys commenced mostly after sunrise and were performed throughout the day to account for temporal variation in activity. As a general rule, transects were not walked in adverse conditions, such as heavy rain, strong winds, excessive heat or thick mist.

3.3.2 Driven Transects

Large terrestrial birds (e.g. cranes, bustards, storks, and most raptors) cannot be adequately surveyed using walked transects. Populations of such birds should be estimated on each visit to the project area by means of road counts (vehicle-based sampling; best applied for relatively large, proposed SEFs, especially those with good networks of roads and tracks).

Road counts of large terrestrial birds and raptors require that one or a few driven transects be executed (depending on site size, terrain and infrastructure), comprising one or a number of set routes, limited by the existing roadways but as far as possible directed to include a representative cross section of habitats within the project area of influence.

These transects were driven at a constant and slow speed (± 20km/h), and all sightings of large terrestrial birds and raptors were recorded in terms of the same data-capture protocols used for walked transects (above), and in general compliance with the road-count protocols described for large terrestrial species (Young et al., 2003) and raptors (Malan, 2009).

One observer was travelling slowly in a vehicle recording all species on both sides of the drive transect. The observer stopped at regular intervals (every 300 m) to scan the environment with binoculars. The number, distance and locations of each driving transects was determined during the first site visit in late summer.

3.3.3 Nesting sites

Any habitats within the broader impact zone of the proposed SEF, or an equivalent area around the site, deemed likely to support nest sites of key raptor and other species of conservation concern, including power lines, stands of large trees, marshes and drainage lines, was search for, monitored and surveyed. All potential breeding sites, once identified fully, were mapped, and checked during each survey to confirm occupancy, and all evidence of breeding and the outcomes of such activity, where possible, were recorded.

3.3.4 Waterbodies

Prior to the initiation of the preconstruction monitoring campaign, the main water bodies (including wetlands) present within the study area were identified during the site visit in March 2022 and were mapped on a Geographical Information System (GIS) by using 1:50 000 topographic maps and aerial photos. All identified water bodies continued to be surveyed to determine their level of utilisation by water birds.

Water birds, including potential roosting sites, were recorded by the observers during all the surveys. The observers were aided by a drone with high resolution cameras, a pair of binoculars and a spotting scope. Additional sites were added to the monitoring programme, where relevant.

3.3.5 Incidental Observations

All other sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) on the SEF and control site as well as within the broader study area were recorded, along with additional relevant information such as habitat type, abundance, habit and weather data. These observations were used as complementary data to characterise the bird community and its utilisation of the site, as recommended by the Best Practice Guidelines (Jenkins *et*

al., 2017).

3.4 SPECIES OF CONSERVATION CONCERN

The Red List of threatened species generated by the IUCN (http://www.iucnredlist.org/) provided the global conservation status of avifauna. However, Taylor *et al*. (2015) produced a regional conservation status assessment following the IUCN criteria which was used for this assessment. The first three categories i.e. Critically Endangered, Endangered and Vulnerable, are collectively called 'threatened' species.

The conservation status categories defined by the IUCN, which are considered here to represent species of conservation concern (SCC), are defined as follows:

- **Critically Endangered (CR)** - Critically Endangered refers to species facing immediate threat of extinction in the wild.
- **Endangered (EN)** - Endangered species are those facing a very high risk of extinction in the wild within the foreseeable future.
- **Vulnerable (VU)** - Vulnerable species are those facing a high risk of extinction in the wild in the medium-term.
- **Near Threatened (NT)** - any indigenous species which does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. NEMBA also deals with endangered, threatened and otherwise controlled species, under the Threatened or Protected Species Regulations (ToPS). A ToPS permit is required for any activities involving the removal or destruction of any ToPS-listed species.

Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

3.4.1 Flagship species for the region

Flagship species are defined as species that may be highly conspicuous, readily identifiable, of high conservation value (SCC), of high tourism value or are endemic to the region. This province hosts significant populations of arid-adapted large terrestrial birds which have been recorded (and are expected) within the PAOI such as Kori Bustard, Ludwig's Bustard and Karoo Korhaan. Additional "flagship" bird species include Martial Eagle, Verreaux's Eagle, Secretary Bird, Tawny Eagle and Blue Crane.

3.5 IMPACT ASSESSMENT

Once a potential impact has been determined it is necessary to identify which project activity will cause the impact, the probability of occurrence of the impact, and its magnitude and extent (spatial and temporal). This information is important for evaluating the significance of the impact, and for defining mitigation and monitoring strategies. Direct and indirect implications of the impacts identified during the specialist investigations were assessed in terms of five standard rating scales to determine their

significance.

Direct, indirect and cumulative impacts associated with the project are assessed in terms of the following criteria:

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

The **significance** is calculated by combining the criteria in the following formula:

$$S=(E+D+M)\,P$$

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

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

Assessment of Cumulative Impacts

As per DFFE's requirements, specialists are required to assess the cumulative impacts. In this regard, please refer to the methodology below that will need to be used for the assessment of Cumulative Impacts.

"Cumulative Impact", in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities[4].

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

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

The specialist is required to conclude if the proposed development will result in any unacceptable loss or impact considering all the projects proposed in the area.

4 RESULTS

4.1 SITE COVERAGE

The specialist coverage in relation to the Drive Transects, Walking Transects and the overall project area in shown as Figure 4.

[4] Unless otherwise stated, all definitions are from the 2014 EIA Regulations, GNR 326.

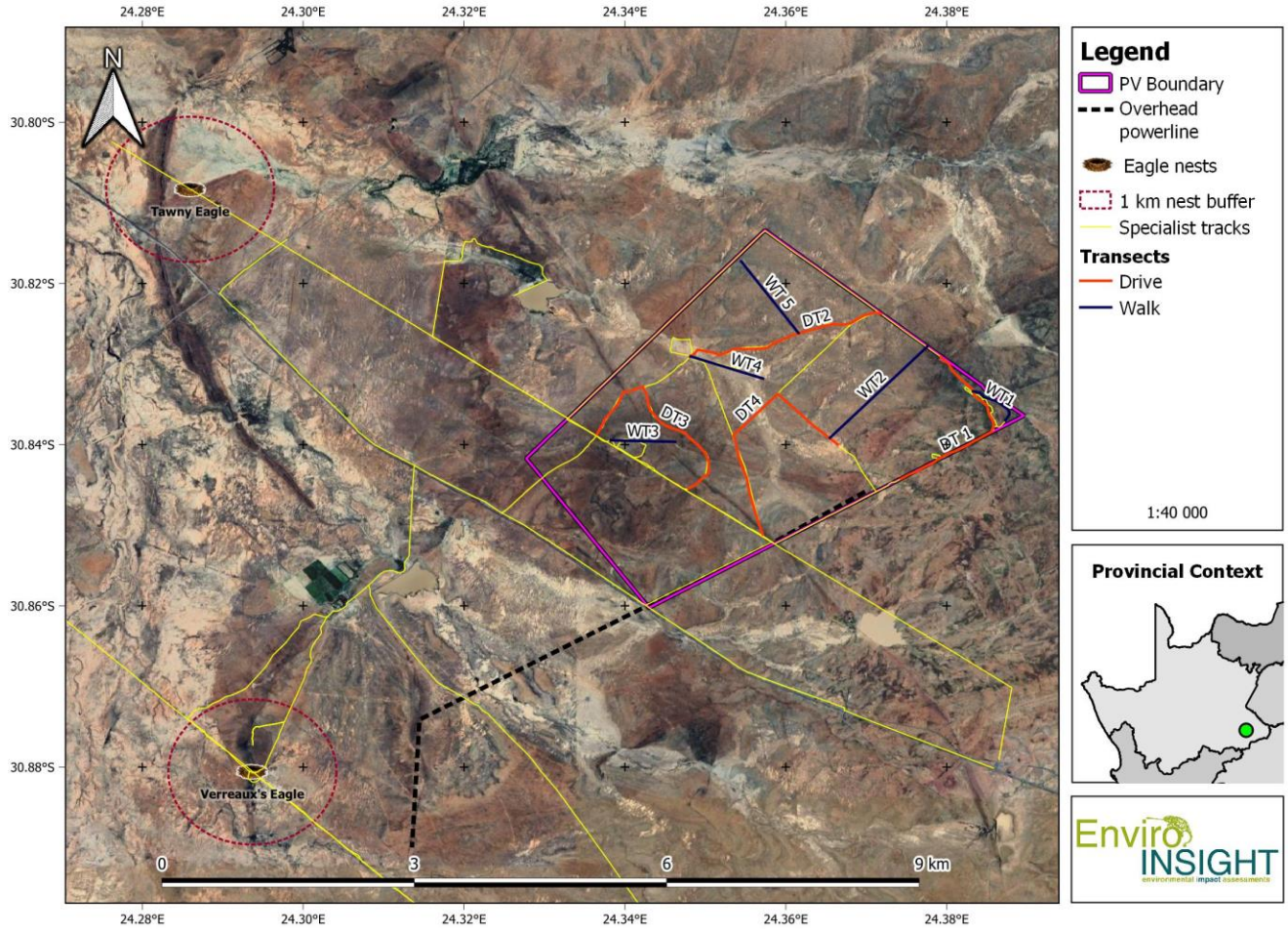

Figure 4: The specialist tracks in relation to the Walking Transects and Driving Transects

4.2 REGIONAL CONTEXT

The study area is located in the Nama-Karoo Biome and falls within the Northern Upper Karoo vegetation type (Mucina & Rutherford, 2006 – as amended), listed as Least threatened (Table 2; Figure 5).

Table 2: Attributes of the Northern Upper Karoo vegetation type (Mucina & Rutherford, 2006, as amended).

Name of vegetation type	Northern Upper Karoo
Code as used in the Book	Northern Upper Karoo
Conservation Target (percent of area) from NSBA	NKu3
Protected (percent of area) from NSBA	21%
Remaining (percent of area) from NSBA	0%
Description of conservation status from NSBA	96.6%
Description of the Protection Status from NSBA	Least threatened
Area (km^2) of the full extent of the Vegetation Type	Hardly protected
Name of the Biome	41829.17
Name of Group and Bioregion	Nama-Karoo Biome

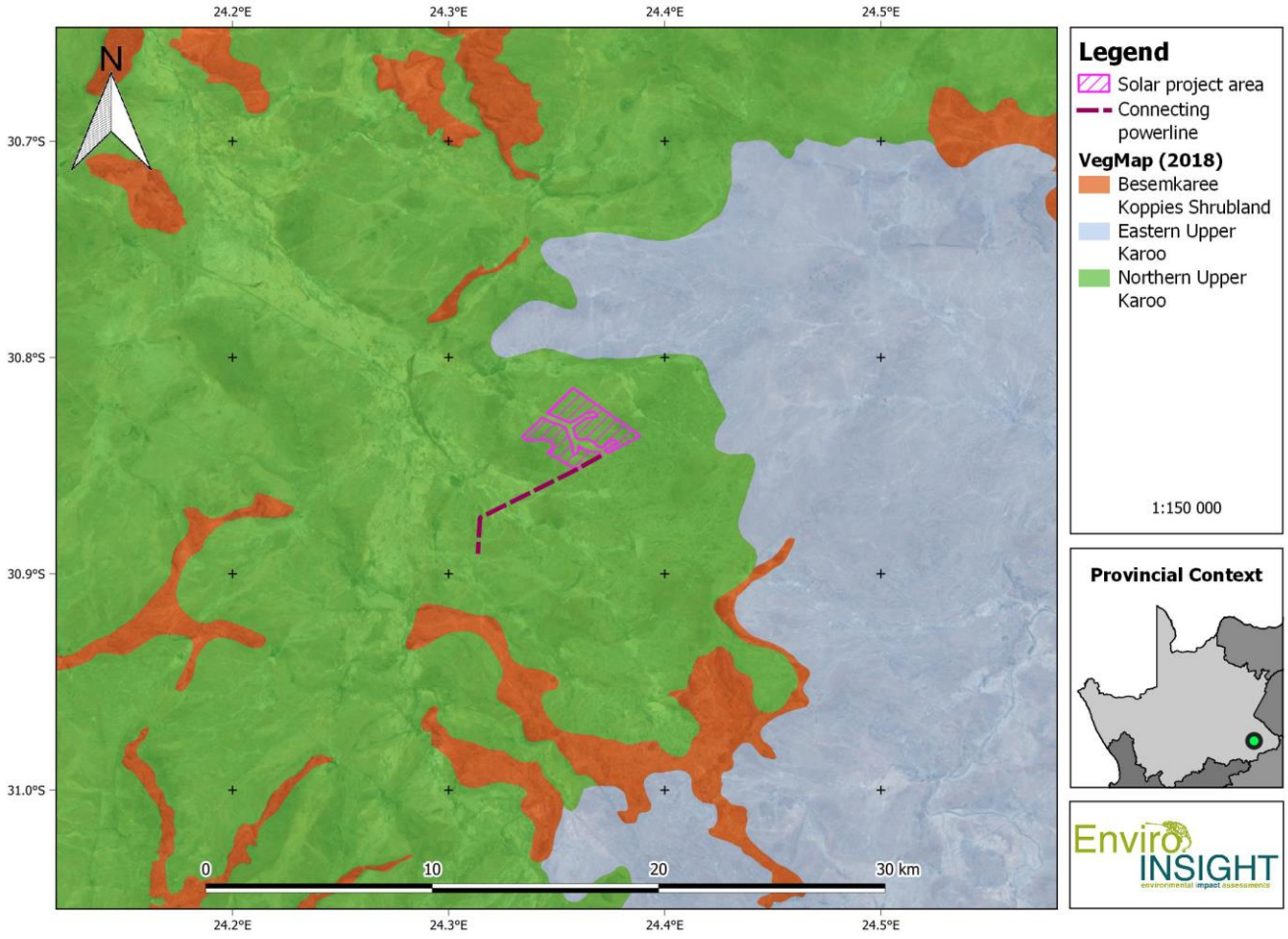

Figure 5: The proposed Soventix SEF in relation to regional vegetation types.

4.3 DESCRIPTION OF THE MAJOR BIRD HABITATS

4.3.1 Open Scrubland

The open scrubland supports a mix of drought-tolerant grass species such as *Aristida sp*., *Eragrostis sp*. and *Stipagrostis sp*. with dwarf shrubs known as the Northern Upper Karoo vegetation (*Mucina and Rutherford, 2006*). The vegetation type is the most dominant type for the proposed project. Due to the vegetation type being the most dominant type of habitat for the proposed study area, it is of medium sensitivity. This type of vegetation also supports most red listed avifauna species expected and observed within the study area such as medium to large terrestrial bird species (Blue Cranes, Secretary Bird, Ludwig's Bustard, Northern Black Korhaan and Karoo Korhaan) including raptor species (Tawny Eagle, Martial Eagle, Pale Chanting Goshawk and Black-chested Snake Eagle) which frequent the habitat for foraging and/ or breeding.

Figure 6: Open Scrublands.

4.3.2 Rocky ridges "koppies"

The rocky ridges found in and around the study area, differs in size and height. A pair of Verreaux's Eagle, with nest, was observed on one of the "koppies", which is also one of the highest in the PAOI, close to the southern point of the connecting powerline. There are some relatively lower ridges in the eastern and western parts of the proposed study area which support large populations of hyrax and rock rabbits which are primary food sources for Verreaux's Eagle specifically. Although, no nests were found within the "koppies" west and east of the study area, this vegetation type is of high sensitivity it supports great habitat for different fauna and flora species found within the study area. These areas also support scattered large thorn bushes which could be ideal nesting habitat for raptors species such as Secretarybird. Although, no nests where found, it is important to note the foraging potential for SCC.

Figure 7: Rocky ridges "koppies"

4.3.3 Waterbodies

All the waterbodies found within the study area are man-made and mostly fills up after heavy rains. The waterbodies situated within the study area are relatively small compared to the one larger waterbody situated about 1km northwest of the study area. The smaller dams observed within the study area, did not support any large and viable waterbird population. However, the larger wetland towards the northwest of the study area, included species such as Egyptian Goose, South African Shelduck, Cape Shoveler, Three-banded Plover and palaearctic migrants such as Little Stint. All the smaller dams were semi seasonal (near completely dry during the dry months), and all of the contained water due to the good rains during the summer. These waterbodies were observed during the dry seasons, so that the bird activity was compared to the other months.

Figure 8: Waterbodies.

The study area mostly consists of Open Scrubland and Grassland with some koppies ridges found in the southern and eastern parts of the proposed study area. The grassland and scrubland vegetation covers most of the study area and provides nesting habitat for bird species such as larks, pipits, cisticola's and korhaan and sensitive species such as Karoo Korhaan and Ludwig's Bustard, including hunting/foraging habitat for species such as Martial Eagle, Lanner Falcon, Secretary bird and Blue Crane. The ridge areas found within the study area consist of large thorn bushes which might provide possible nesting and foraging habitat for species such as chats and prinia's, including sensitivity species such as the Secretarybird.

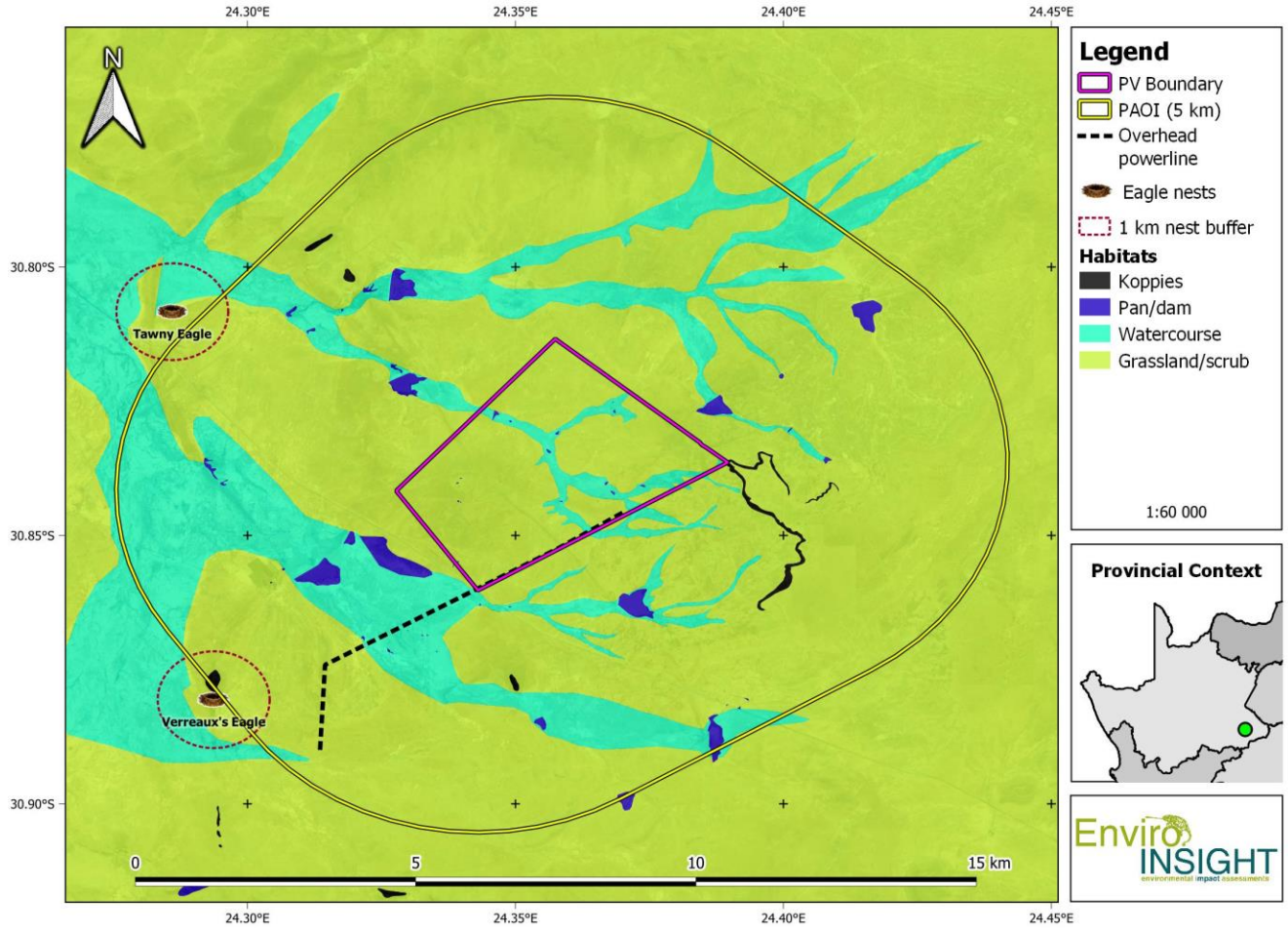

Figure 9: Habitat Delineation

The site visit in March 2022 took place during the rainy season, which means some small manmade dams found within the study area, were filled with water. However, these small dams did show very low signs in terms of waterbird activities. The larger dam found about 1.3km west outside of the project footprint, had the higher density of birds in terms of waterbodies, with species such as ducks, geese, stilts, stints, and plovers. The seasonal wetland area permeates the project footprint, where water eventually flows into the big dam after heavy rains. The wetland area was an important attractant in the dry season where it represented the most productive foraging habitat within the project footprint during that time, especially for sensitive species occurring on site such as Blue Cranes and Black Storks.

There is an existing powerline running along the border of the southern section of the study area. The powerline did not have any signs of priority bird species nests but could lead to possible nesting in the future for species such as Martial Eagle or Verreaux's Eagle. Verreaux's Eagle activity was unusually high in the dry season. The species abundance was at its highest during and after the rainy season, as food resources increase more birds will fly in, including water associated bird species which will mostly be found at the larger dam west of the study area.

4.4 EXISTING IMPACTS

The following existing impacts to avifauna were observed during the surveys:

- Burning regimes – Fires, controlled or otherwise may influence the habitat ecology including bird nesting habitat (ground dwelling species).
- Livestock grazing – The overall survey area is primarily comprised of sheep, goat and cattle grazing areas with some areas showing signs of overgrazing and trampling. Fenced habitats ultimately showed ecologically manipulated ecology which may be beneficial or detrimental to local avifaunal populations, species dependent.
- Existing pylons and powerlines – A large existing pylon servitude exists adjacent to the project footprint. Smaller powerlines are present with documented mortalities caused by collisions as shown in Figure 10.
- Linear infrastructure - The project area is fragmented by a multitude of linear structures which present restrictive and hazard barriers to avifauna. These include sand roads, tar roads and a large railway line.

Figure 10: Photographic evidence of Verreaux's Eagle mortality within the PAOI

4.5 CRITICAL BIODIVERSITY AREAS (CBA'S) OF THE NORTHERN CAPE

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection of important natural habitat and landscapes. Biodiversity priority areas are described as follows:

- Critical biodiversity areas (CBA's) are areas of the landscape that need to be maintained in a natural or near- natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses. For CBA's the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through the direct loss of a biodiversity feature (e.g. loss of a population or habitat). All FEPA prioritised wetlands and rivers have minimum category of CBA 1, while all FEPA prioritised wetland clusters have minimum category of CBA 2.
- Ecological support areas (ESA's) are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or delivery ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resources use in this specific ESA is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor results in a population going extinct elsewhere or a new plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity). All natural non-FEPA wetlands and larger rivers have minimum category of ESA.

A map of the study in relation to the 2016 Northern Cape CBA's is presented in Figure 11, indicating that the study area is located in an ESA.

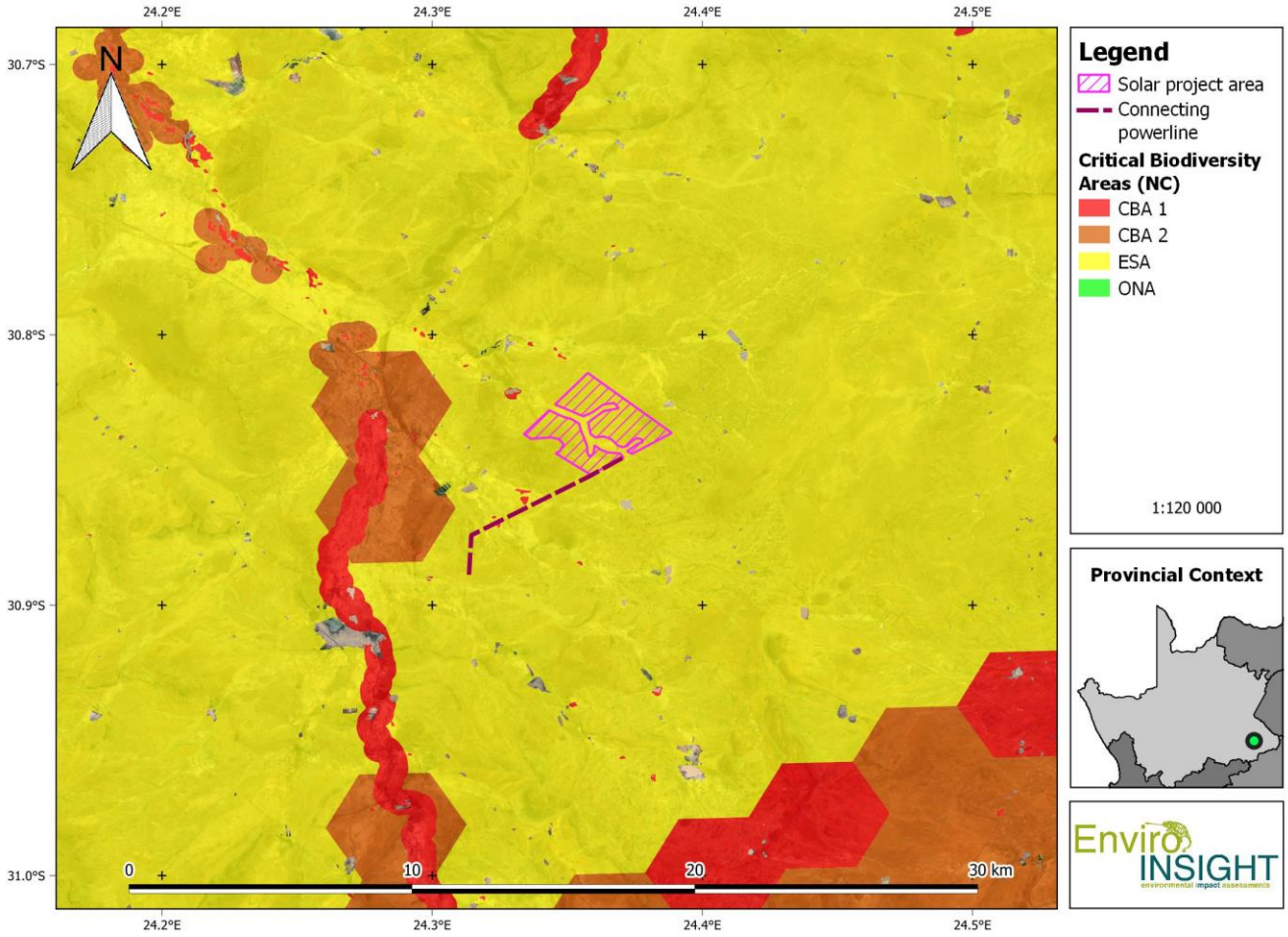

Figure 11: Project Footprint CBA's Map.

4.6 PROTECTED AREAS AND IMPORTANT BIRD AND BIODIVERSITY AREAS

The proposed solar farm occurs in the Platberg-Karoo Conservancy (SA037) Important Bird and Biodiversity Area (IBA) (Figure 12). The Platberg-Karoo Conservancy IBA covers c. 1240 000 ha and is located in the Northern Cape Province with a protected status of "Unprotected". The folding process has forged several large peaks and plateaus in this area. The IBA encompasses a continuous chain of mountains and includes several State forests, mountain catchment areas and provincial nature reserves. A total of 289 bird species have been recorded in the IBA during SABAP2. With regards to the conservation, the IBA contributes greatly to the large terrestrial bird and raptor species. The priority species includes Blue Crane (*Anthropoides paradiseus)*, Ludwig's Bustard (*Neotis ludwigii)*, Kori Bustard (*Ardeotis kori)*, Blue Korhaan (*Eupodotis caerulescens)*, Black Stork (*Ciconia nigra)*, Secretarybird (*Sagittarius serpentarius)*, Martial Eagle (*Polemaetus bellicosus)*, Verreauxs' Eagle (*Aquila verreauxii)* and Tawny Eagle (*Aquila rapax).*

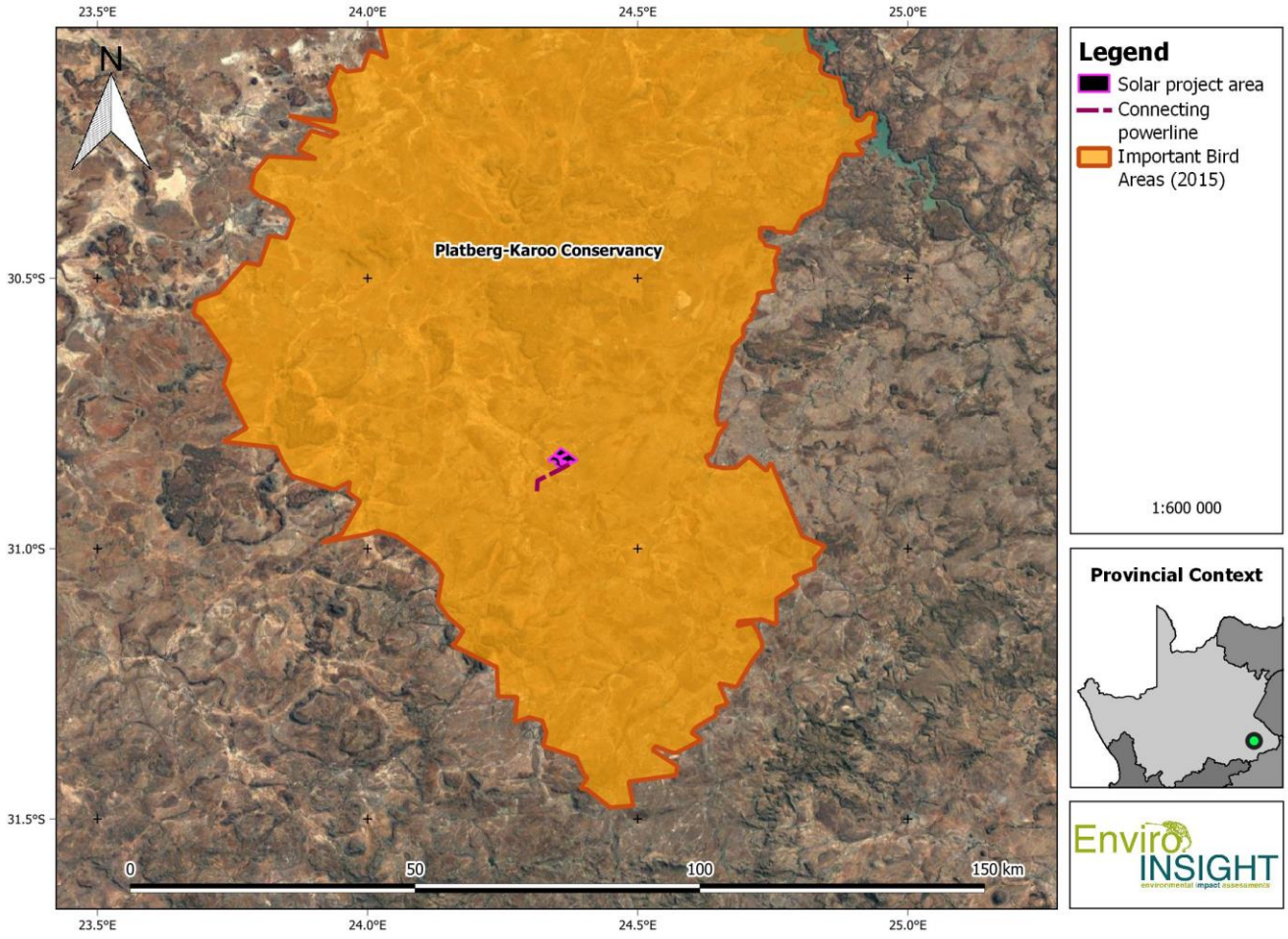

Figure 12: Important Bird Areas in the region

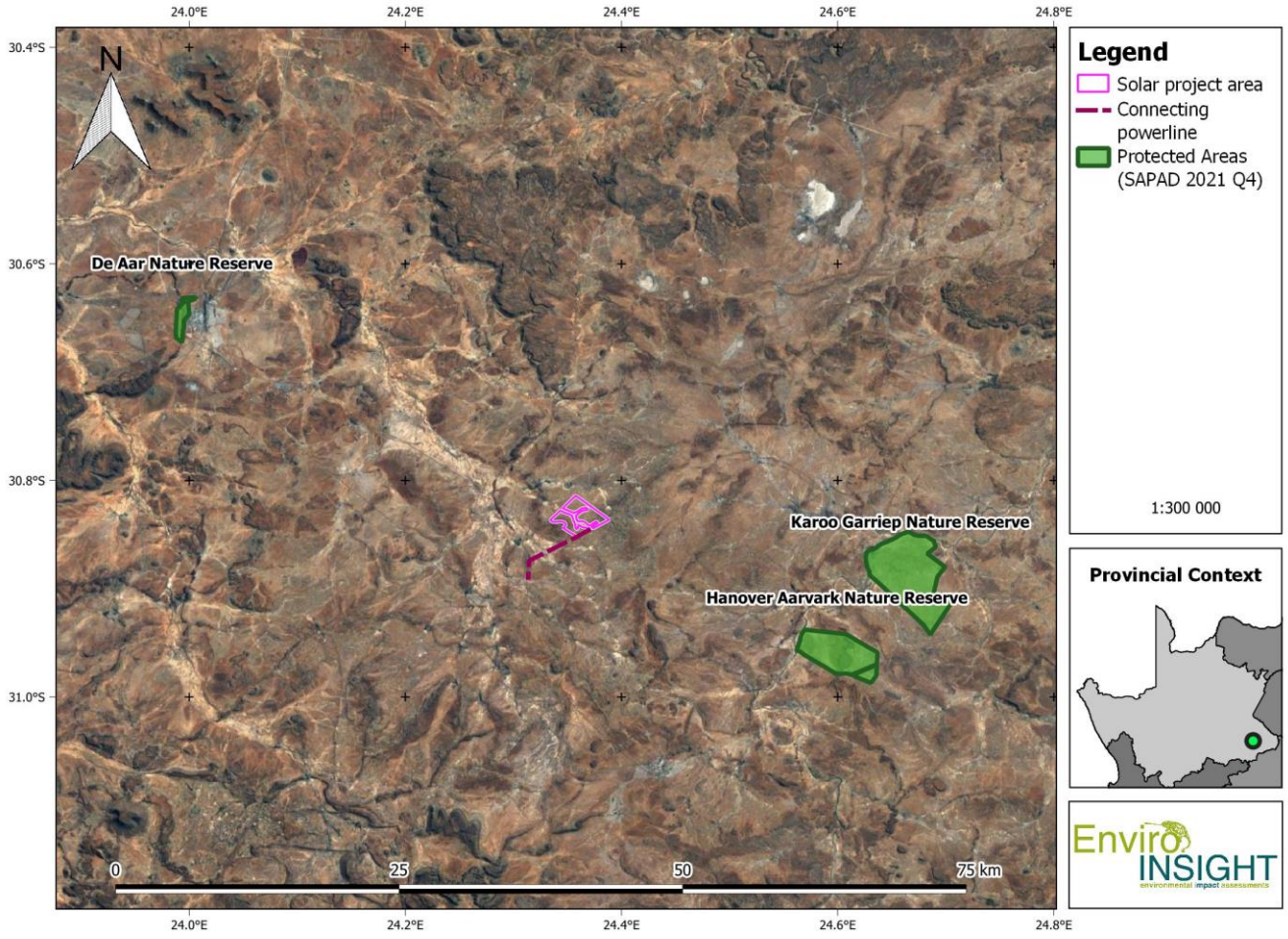

Figure 13: Protected Areas Map.

4.7 EXPECTED SENSITIVE AVIFAUNA SPECIES LIST

A list of expected priority species in the project area is provided in Table 3. A total of 17 priority species are expected to occur within and surrounding the study area, of which 13 species are listed as threatened and near threatened.

Thirteen (13) of the seventeen (17) expected avifauna sensitive species were confirmed within the PAOI with ten (10) being listed as SCC.

The priority species list in Table 3 includes the following data:

- Threatened and Near-Threatened species recorded as per the SABAP pentad data;
- Observed threatened species recorded during the monitoring phase done by Simon Tod Consulting (2017); and
- Priority species with a medium or higher probability of occurrence.

Consequently, every effort was taken to capture all aspects of priority species observed within the field survey to allow for careful evaluation of potential impacts and application of suitable mitigation measures to reduce these impacts where possible.

Table 4 represents a summary explanation of the Red-Listed species identified by SABAP 1 and SABAP 2 within the AOI and relates to the detailed discussion provided below. The table illustrates the long-term habitat suitability for the observed and high likelihood Red-Listed species. The remaining taxa are either (1) irregular to rare foraging visitors or (2) unlikely to be present on the study area due to the poor availability (surface cover) of suitable habitat on the study areas.

Table 3: Priority avifauna species list expected and observed in the study area.

Common name	Taxonomic name	Status (RG/GB)	Southern African Endemic	POC
Bustard, Ludwig's	*Neotis ludwigii*	EN, EN		Confirmed
Buzzard, Jackal	*Buteo rufofuscus*	LC	Yes	Confirmed
Crane, Blue	*Anthropoides paradiseus*	NT, VU	Yes	Confirmed
Eagle, Booted	*Hieraaetus pennatus*	LC		Low
Eagle, Martial	*Polemaetus bellicosus*	EN, EN		Confirmed
Eagle, Tawny	*Aquila rapax*	EN, VU		Confirmed
Eagle, Verreaux's	*Aquila verreauxii*	VU, LC		Confirmed
Falcon, Lanner	*Falco biarmicus*	VU, LC		Confirmed
Goshawk, Pale Chanting	*Melierax canorus*	LC	Yes	Confirmed
Kestrel, Greater	*Falco rupicoloides*	LC		Confirmed
Kestrel, Lesser	*Falco naumanni*	LC/ NT		Confirmed
Korhaan, Blue	*Eupodotis caerulescens*	LC, NT		Moderate
Korhaan, Karoo	Eupodotis vigorsii	NT, LC	Yes	Confirmed
Korhaan, Northern Black	*Afrotis afraoides*	LC	Yes	Confirmed
Kori Bustard	*Ardeotis kori*	NT		Confirmed
Secretarybird	*Sagittarius serpentarius*	VU/ EN		Confirmed
Stork. Black	*Ciconia nigra*	VU, LC		Low

* These species were observed and recorded to date by SABAP1 or SABAP2.

Table 4: Avifauna species of conservation concern previously recorded in the study area pentads

Species	Global Conservation Status (IUCN 2019)	National Conservation Status (Taylor et al. 2015)	Preferred Habitat	Potential likelihood of occurrence on study area
Anthropoides paradiseus (Blue Crane)	Vulnerable	Near threatened	Prefers open grasslands. Also forages in wetlands, pastures and agricultural land.	Confirmed: A common, high-density foraging (and possibly breeding) resident to most of the study areas. High densities expected with breeding pairs recorded in adjacent areas and potentially susceptible to development activities.
Aquila verreauxii (Verreaux's' Eagle)	-	Vulnerable	Mountainous areas or areas with prominent outcrops with a high prey base (e.g. hyrax)	Confirmed: frequent foraging and breeding resident throughout the study areas, susceptible to poisoning events. Impacts primarily secondary (food availability reduction).
Polemaetus bellicosus (Martial Eagle)	Endangered	Endangered	Open bushveld with adequate roosting and foraging potential.	Confirmed: A low density foraging visitor dependent on adequate food supply and roosts. Moderately vulnerable to the proposed development activities
Aquila rapax (Tawny Eagle)	Endangered	Endangered	Open bushveld with adequate roosting and foraging potential.	Confirmed: A low density to rare freeding and foraging resident dependent on adequate food supply and roosts. Moderately vulnerable to the proposed development activities (disturbance to nesting sites).
Falco biarmicus (Lanner Falcon)	Least Concern	Vulnerable	Varied, but prefers to breed in mountainous areas.	Confirmed: A fairly common foraging migrant recorded in the current study. Not vulnerable to the proposed activities.
Neotis ludwigii (Ludwig's Bustard)	Endangered	Endangered	Primary upland grassland, particularly on hilly terrain.	Confirmed in moderate densities throughout the study areas. Large bodied species, highly susceptible to development activities, especially collisions with secondary powerline infrastructure.
Ardeotis kori (Kori Bustard)	Near Threatened	Near Threatened	Generalist in arid habitat and open scrubland.	Confirmed in moderate densities throughout the study areas. Large bodied species, highly susceptible to development activities, especially

Species	Global Conservation Status (IUCN 2019)	National Conservation Status (Taylor et al. 2015)	Preferred Habitat	Potential likelihood of occurrence on study area
				collisions with secondary powerline infrastructure.
Sagittarius serpentarius (Secretarybird)	Vulnerable	Vulnerable	Prefers open grassland or lightly wooded habitat although forages extensively in open karroid savannah.	Confirmed: Regular low-density resident which is most likely of lower risk to the proposed development activities.
Eupodotis vigorsii (Karoo Korhaan)	Near threatened	Near threatened	Open scrubland.	Confirmed: Common resident occurring throughout the PAOI. Individually susceptible to development activities, especially increased traffic and fencing (collision) but as a species, low risk.
Red-footed falcon (Lesser Kestrel)	Near Threatened	Near Threatened	Prefers open grassland or lightly wooded habitat although forages extensively in open karroid savannah.	Confirmed: Regular migrant of fluctuating seasonal density which is most likely of lower risk to the proposed development activities due to most pressures occurring with breeding grounds and migration routes.

4.8 OBSERVED AVIFAUNA

84 bird species were observed within and around the Combined Project Area out of an expected total of 104 species, based on previous surveys, the SABAP Pentad analysis and habitat suitability, based Probability of Occurrences. This was derived from a total of 291 individual observations (Appendix 2). The observed avian species richness and abundance is considered low to moderate for an area of this size in the South African context although the proportion of observations related to SCC was considered high, as was the overall SCC diversity which is discussed below. Many of the birds observed are generally considered to be common, widespread and adaptable species which were observed within their expected habitats. Multiple nests of multiple raptor species were located within the project footprint with two SCC nests located within the PAOI which warrants detailed discussion below. The Combined Project Area was confirmed to support resident and / or breeding populations of SCC as per the results. Generally, small passerine flight activity was surprisingly low and flight paths mainly low, short and local with very few higher-flying commuting individuals observed. However, observations of medium to larger species, including large flocks of commuting waterfowl and cranes were observed, as were ground congregations of species such as Blue Cranes and Northern Black Korhaan. Abundances of powerline collision-prone species such as Ludwig's Bustard and Kori Bustard were moderate.

During the walked transects, the total number of individual birds (per species) were recorded regardless of if they are listed as priority or not. Notable Priority Species recorded during walked transects included Blue Cranes, Verreaux's Eagle, Ludwig's Bustards that were often flushed from foraging positions as well as numerous Northern Black Korhaans and Karoo Korhaans. The main focus of drive transects were the recording of large birds and raptors. Raptors and korhaans were the most frequently recorded priority species. Due to its abundance and conservation status, the Blue Crane and Ludwig's Bustard is a priority species of concern since it may be prone impacts at certain times (e.g., when commuting between roosting and feeding sites, following rainfall events, invertebrate outbreaks (locusts) or commuting after farming activities which increase food availability). Blue Cranes were observed throughout the study area but especially in association with drainage lines and artificial water points. Ludwig's Bustards were in frequent in their observations and were mostly observed close to koppies, drainage lines, adjacent to roadsides and in adjacent livestock fields. Larger raptors persisted throughout the survey area but were often congregated near perching habitat (pylons). These are discussed in more detail below.

- **Focal Sites**

The drainage line system throughout the project study area contained a relatively high density (and higher diversity) of passerines, cranes and other potential SCC. The existing power lines were also surveyed, with notable high densities of raptor species including especially high Verreaux's Eagle activity separate from active nests.

- **Nest Survey**

Nest sites were searched for during the surveys which included windmills, trees, pylons, bridges and masts, representing most potential roost and nesting sites for raptors. Water bodies were potential roost and nesting sites for multiple species but the high degree of seasonality and highly arid conditions was prohibitive to being representative of optimal breeding habitat for water associates. The most significant breeding habitat recorded during the survey were the active Verreaux's Eagle and Tawny Eagle nests (Figure 14 and Figure 15) where breeding and foraging activity has been noted and strongly drive the recommended mitigation measures. During the site visits and at the Verreaux's Eagle nest, two active adults circling the nesting area. This is also the area where one Verreaux's Eagle mortality was found. The nesting site is at this stage the highest sensitivity found within proximately of the study area. The nest is found just over 6km from the proposed study area. However, the proposed connecting powerline as per the layout of the study area falls within 1.9km of the nest. The farmer in the area, mentioned that the nest has been there for several years. The Tawny Eagle was last observed in September 2022 incubating eggs on the nest. Ludwig's Bustard and Secretary Birds are considered a resident and to be breeding on site although no nests were located.

Figure 14: Active Verreaux's nest with eggs on the southwestern portion of the PAOI

Figure 15: Active Tawny Eagle nest on the north-western portion of the PAOI.

4.9 SITE ECOLOGICAL IMPORTANCE (SEI)

As described in the species protocol guidelines (SANBI 2020), Site Ecological Importance (SEI) is a "standardised metric for identifying site-based ecological importance for species, in relation to a proposed project with a specific footprint and suite of anticipated activities". SEI allows for rapid spatial inspection and evaluation of impacts of a proposed development within the context of on-site habitats and SCC, and also facilitates integration of inputs from different specialist studies. SEI depends on the careful spatial delineation of habitat types and an understanding of their utilisation by species of conservation concern. The evaluation of SEI is presented in Table 5Table 5 with the guidelines for interpreting SEI shown as Figure 16. The final expression of the SEI delineation for the Combined Project Area is shown in Figure 17. Two habitats with High SEI are present in the Combined Project Area. avoidance mitigation is recommended. However, minimisation and restoration mitigation will be required for the Medium SEI habitats.

Table 5: Evaluation of Site Ecological Importance (SEI) of avifauna habitats in the study area. BI = Biodiversity Importance.

Habitat	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
Open Scrubland	**Medium** – Multiple confirmed or highly likely populations of SCC albeit relatively generic and where SCC of IUCN Vulnerable or Endangered are dependent on the habitat.	**Medium** – Despite large area, this habitat has a sustained high level of current negative ecological impacts.	**Medium** – Habitat that can recover rapidly, because it is already in a transformed state.	**MEDIUM** (BI = Medium)
Rocky Ridges	**High** – Multiple confirmed or highly likely populations of SCC and where SCC of IUCN	**High** – Cumulatively small (>100 ha) intact area for any conservation status of SCC	**Medium** – Will recover slowly (~ more than 10 years) to restore >	**HIGH** (BI = High)

Habitat	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
	Vulnerable or Endangered are relatively dependent on the habitat for foraging and possibly breeding.	although ecosystem type is Least Concern. Habitat type crucial for SCC foraging, roosting and breeding (Ludwig's bustard) with currently only minimal current negative ecological impacts.	75% of the original species composition and functionality.	
Wetland and Drainage line Habitat	**High** – Multiple confirmed or highly likely populations of SCC and where SCC of IUCN Near Threatened, Vulnerable or Endangered are relatively dependent on the habitat for migration. foraging and possibly breeding.	**High** – Cumulatively large(>100 ha) intact area for any conservation status of SCC. Habitat type crucial for SCC foraging, roosting and breeding with currently only minimal current negative ecological impacts.	**Medium** – Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality.	**HIGH** (BI = High)
Waterbody Habitat	**Medium** – Multiple confirmed or highly likely populations of SCC and where SCC of IUCN Near Threatened, Vulnerable or Endangered are relatively dependent on the habitat for migration. foraging and possibly breeding. SCC. Limited potential to support SCC.	**Medium** – Largely disjunct and modified with fragmentation mitigated by connection to drainage line wetland habitat linkage, moderate level of current negative ecological impacts.	**Medium** – Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality.	**MEDIUM** (BI = Medium)

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.

Figure 16: Guidelines for interpreting SEI in the context of the proposed development activities, reproduced from SANBI (2020).

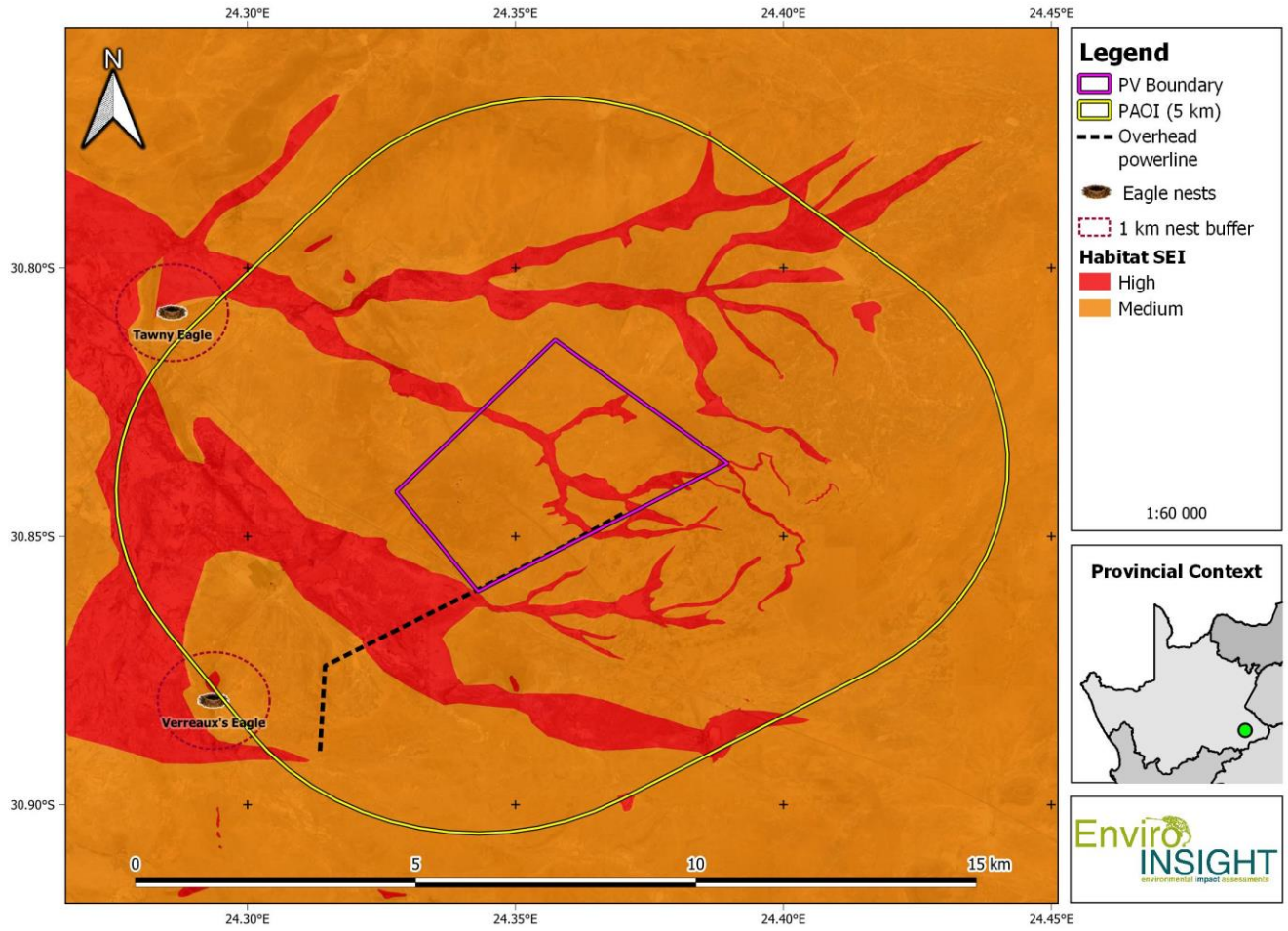

Figure 17: The Soventix Solar PV Combined Project Area Site Ecological Importance (SEI).

4.9.1 SEI Discussion

Avifaunal importance relates to species diversity, endemism and the presence of topographical features or primary habitat units with the intrinsic ability to sustain avifaunal assemblages, their food supply as well as SCC. It is clear that throughout the study area that most of the habitats are generic in their ability to support a high diversity of general avifaunal species, Red-Listed species and SCC. However, unique geographical or topographical features exist which would cause the areas targeted for development to be classified as a "No Go" area in regards to avifauna. Due to the high diversity and density of the above mentioned Red-Listed species recorded during the survey, (including regionally and globally listed Endangered and Vulnerable birds), the region as a whole is considered to be an area of very high avifaunal importance and activities should be managed in a holistic manner at a policy level, prioritising mitigation and monitoring of avifaunal species of conservation concern.

Habitats with high avifauna sensitivities include the seasonal drainage lines and water sources:

- The seasonal drainage lines and accompanying vegetation are linear dispersal corridors for terrestrial and wetland associated bird species. Much higher species diversity (as well as a unique composition) was observed in this habitat and therefore, these systems are earmarked with high avifaunal importance. The drainage lines act as important flight corridors for passerines and raptors between foraging and roosting sites. Secretary Birds will hunt for snakes within these habitats on a frequent basis.
- The surface water habitats (artificial dams) are vital in the landscape, primarily due to the very arid conditions prevailing within the region. Avifaunal species depend on an interconnected system of water features (artificial or otherwise) and, based on seasonality and prevailing climatic conditions, it is anticipated that these systems experience a frequent turnover of species over time (seasonally and long term). They often provide essential breeding habitat, foraging habitat and water resources for avifaunal species including large bodied species of conservation concern such as cranes, storks and bustards. When water is present, the impoundments and pan habitats provide ephemeral foraging habitat for regionally and national Vulnerable and Near-Threatened storks.
- The rocky ridges, specifically the steeper koppies act as prominent landmarks and foraging habitat for diurnal birds of prey. It also provides potential hunting habitat for all SCC eagles (especially Verreaux's) which hunts rock hyrax (common in these habitats) and rock rabbits as a staple of their dietary requirements. The localised high population densities of rock hyrax and rock rabbits within the study areas as well as the regional linkage to the koppie habitats, elevates the importance of this habitat for avifauna.

Areas with medium avifaunal sensitivities include the Open Scrub Habitat:

- The open karoo habitats (grassland areas) provide suitable foraging habitat for Blue Crane, Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*) and Secretary bird (*Sagittarius serpentarius*) but are higyl generic in the landscape and are not a specific attractant for SCC.

In summary, the following key findings include:

- A high richness of Red-Listed and species of conservation concern occur within the study areas;
- A total of six SCC were confirmed to be present in the study areas out of 17 possible species with nine being highly likely in total; and
- High frequency of observations for the Vulnerable Verreaux's Eagle, the Near Threatened Blue Crane and Karoo Korhaan as well as the Endangered Ludwig's Bustard.

5 IMPACT ASSESSMENT

5.1 BACKGROUND TO INTERACTIONS BETWEEN SOLAR ENERGY FACILITIES, POWER LINES AND BIRDS

The effects of a solar farm on birds are highly variable and depend on a wide range of factors including the design and specification of the development, the topography of the surrounding land, the habitats affected and the number and species of birds present.

Typical potential impacts include (but are not necessarily limited to):

- Habitat loss (including foraging and breeding) and fragmentation due to displacement (avoidance of disturbance). Habitat loss has the tendency to not only destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.
- Collision and electrocution with above-ground power transmission lines. In some cases, collision can be associated with polarised light pollution and waterbird species mistaking large PV panels areas as wetlands or other waterbodies, a case known as the "lake effect" (as per Jenkins *et al*. 2017). The mitigation of these impacts will be addressed in the final EIA report with operational phase monitoring to be designed in the EMPr.
- Disturbance due to noise such as, machinery movements and maintenance operations during the construction and operational phase of the proposed PV solar farm.
- The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as perches, nest and shade opportunities
- Chemical pollution: Chemicals being used to keep the PV panels clean from dust (suppressants) etc.

5.1.1 Construction Phase

Table 6: Habitat destruction during construction phase.

Nature: Habitat loss (including foraging and breeding) and fragmentation due to displacement (avoidance of disturbance) as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables) and associated dust effects. Habitat loss has the tendency to not only destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.		
	Without mitigation	**With mitigation**
Extent	2	1
Duration	4	3
Magnitude	8	3
Probability	5	4
Significance	**High (70)**	**Low (28)**
Status (positive or negative)	Negative	Negative

Reversibility	Medium	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation Measures

Impacts associated with the loss of bird foraging habitat due to construction activity cannot be mitigated in relation to the majority of the habitats but can be mitigated by avoiding avifaunal specific highly sensitive areas and their associated buffers, such as the local drainage lines, impoundments, smaller watercourses, pans and rocky koppies. The overall severity of the impact can be reduced to being insignificant if avoidance mitigation is applied related to the positioning of the panels and supporting infrastructure and minimisation mitigation is applied. Finally, construction should be restricted to the months of April, May, June and July (latest) to minimise dust effects and subsequent destruction of the avifaunal habitats.

5.1.1.1 Specific Mitigations for Wetland and Waterbody Crossings

The Site Development Plan (SDP) provided clearly shows intersection between infrastructure and designated High Sensitivity avifaunal features. Methods used for constructing linear infrastructure (such as buried powerlines, pipelines, raised powerlines, roads) across wetlands will vary, depending on the nature of wetland hydrology and soils. Thus, the following specific prescribed mitigations as well as guiding principles and "best practice" are described below.

1. Horizontal directional drilling is preferred for the crossing of wetlands,
2. If as is more typical, an open trench is dug, mitigations should be implemented to reduce impacts to wetland hydrology and soil structure.
3. All Pipelines corridors (affected areas) should be implemented to a maximum 10 metres wide through wetlands during construction.
4. During construction, laydown areas must be located in uplands a minimum of 35 metres from the wetland edge.
5. Construction equipment used while working in wetlands is limited to only those pieces that are essential and non-essential equipment is allowed to travel through wetlands only once during deployment and once during extraction.
6. During vegetation clearing, sediment barriers such as silt fences must be installed and maintained adjacent to wetlands.
7. The method of pipeline construction used in wetlands depends on the stability of the soils. Overall, topsoil is first removed and stored separately from the subsoil. Where wetland soils are saturated, segregating topsoil is not possible. Large timber mats placed ahead of the construction equipment can provide a stable working platform and protect wetland soils by spreading the weight of the construction equipment over a broad area.
8. Generally, the preferred method for crossing an actively flowing waterbody with a pipeline is horizontal directional drilling as compared to open-cut trenching. With this method, a hole is dug below the stream crossing and pulling a prefabricated section of pipe through the hole. The goal is for zero interruption to flow.
9. Open-cut crossings involve cutting a trench across the waterbody while water flows through the trenching area. Where the water is shallow enough, it may be diverted by flumes and pumps. A flume pipe may be placed to divert the water around the trenching area. Pumps in combination with dams may also be used to divert the water during open-cut trenching.

10. Where possible, pipelines can be installed using the push-pull technique-- stringing and welding the pipeline outside of the wetland and excavating and backfilling the trench using a backhoe supported by equipment mats or timber riprap. The prefabricated pipeline is installed in the wetland by pushing or pulling it across the trench. After the pipeline is floated into place, the floats are removed and the pipeline sinks into place. The trench is backfilled to the proper grade to maintain wetland hydrology and grades are restored to the original elevation.
11. If topsoil is segregated from subsoil, then subsoil is backfilled first.

5.1.1.2 Best Practice for Wetland Crossings

1. Avoidance. Avoid the construction of a crossing or staging area by either choosing an alternative route or by using aerial or overhead equipment;

2. Minimization. Limit the number of crossings and the number of equipment trips to as few as possible. Limit the number of equipment staging areas and spoil storage areas.

3. Use of Previously disturbed Areas. Use existing access roads, or staging areas.

4. Selection of Crossing Location. Consider criteria when locating crossing sites to minimize disturbance, such as shortest crossing point, avoiding unstable or steep banks, avoiding highly erodible soi8ls, avoid unstable portions of stream channels.

5. Scheduling. Schedule construction during the season least damaging to the stream or wetland system (i.e. dry season).

5.1.1.3 Powerline Crossing of Wetlands

Presented below are design objectives, considerations and examples of construction techniques of best practices. Variables of avifaunal sensitivity include such factors as wetland quality, topography, congregatory avian populations, prey populations, line configuration, adjacent wetlands, and historical bird use areas, all of which have been assessed as part of the pre-construction monitoring. The following mitigation measures are suggested;

- Avoid siting lines in areas where birds concentrate;
- In all raised powerline crossings, powerlines must install bird diverters to enhance visibility of lines;
- Where possible, construction should involve the burying of lines underground.
- In order to reduce avian mortalities related to bird collisions or nests, perch guards should be installed on all infrastructure (such as poles and platforms).

5.1.1.4 Wetland Road Design and Construction Practices

- All road construction should preferably take place in the dry season.
- A temporary road in a wetland needs to provide adequate crossroad drainage at all natural drainageways. Temporary drainage structures include culverts, bridges, and porous material.
- Prior to construction, areas of infrastructure placement must be graded flat so as not to cause vegetation root mat loss or restriction to sub surface flow. Topsoil storage must be enacted. Construction of roads must occur at natural ground level (not below) to minimize to restricting water flow.

- Limit or restrict the construction of fill roads. All fill roads must use a permeable fill material (such as gravel or crushed rock) for at least the first layer of fill in order to maintain the natural flow regimes of subsurface water.
- It is preferable to eliminate fill roads and utilise raised bridges and culverts with adequate sizing and spacing of water crossing structures, proper choice of the type of crossing structure, and installation of drainage structures at a depth adequate to pass subsurface flow.

5.1.1.5 Post Construction Rehabilitation

- A rehabilitation plan must be commissioned before construction commences.
- All topsoil harvesting must take place in the dry season (late dry season).
- Returning the wetlands to their original grade must take place as minor differences in the final surface elevation can produce significant impacts on the type of vegetation that re-establishes itself (alien invasive species).
- When topsoil is salvaged and returned, it is anticipated without reseeding that dense vegetative communities of native species can regenerate within two growing seasons.
- As emergent wetlands will recover more quickly than others, artificial seeding is not advised as it creates competition for reestablishment of native facultative and obligate wetland vegetation.

Table 7: Disturbance of bird roosts during the construction phase.

Nature: The destruction or disturbance of bird roosts during the construction phase		
	Without mitigation	**With mitigation**
Extent	2	2
Duration	2	2
Magnitude	8	4
Probability	5	3
Significance	**(42)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	No	Yes
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation Measures

Bird nesting sites and roosts varied from artificial structures such as pylons and windmills to some trees within the project footprint and infrastructure development will be associated with the destruction or disturbance of such roosts. This impact can cannot be mitigated within the open scrub habitat but can be mitigated by timing construction to May, June, July and August in order to avoid breeding periods of species within the sensitive drainage lines, wetlands and the general region. No construction vehicles or personnel may approach the Verreaux's/ Tawny Eagle nests within 1.5 km during the construction phase.

Table 8: Disturbance due to noise such as, machinery movements and maintenance operations during the construction and operational phase of the proposed PV solar farm

Nature: Disturbance (including of nesting SCC) due to noise such as, machinery movements and maintenance operations during the construction phase the proposed PV solar farm causing loss of offspring for a generation.		
	Without mitigation	**With mitigation**
Extent	3	3
Duration	4	3
Magnitude	8	2
Probability	5	2
Significance	**High (75)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	No	Yes
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation Measures

As with other impacts, this impact can be mitigated by timing construction to May, June, July and August in order to avoid breeding periods of species within the sensitive drainage lines, wetlands and the general region.

5.1.2 Operational Phase

Table 9: Bird mortalities during the operational phase.

Nature: Bird mortalities during the operational phase due to vehicle collisions, collisions with infrastructure and/or combustion.		
	Without mitigation	**With mitigation**
Extent	3	3
Duration	4	4
Magnitude	10	6
Probability	5	3
Significance	**High (85)**	**Medium (39)**
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	Yes	Potentially
Can impacts be mitigated?	Partially	

Mitigation Measures

Impacts due to bird mortalities during the operational phase are practically unavoidable for any large facility, but with the appropriate mitigation measures these impacts can be minimised. It is likely that most of the avifaunal populations will be largely displaced from the majority of the project infrastructure, although significant risks are associated with the likelihood of project vehicles flushing birds into fencing infrastructure as well as collisions of large bodied species with powerlines. Although the current overall bird activity qualifies the proposed solar development boundary as a high-density area, there are certain times of the year (and day) when it appears that large flocks of birds (such as cranes bustards and large birds of prey) are far more prevalent. All powerline infrastructure must be fitted with approved bird diverters in order to provide visibility for large-bodied birds. In all areas where service road intersects with semi natural or natural habitat, all fences must be set back at least (strictly) 75 metres from the edge of every service road in order to allow for vulnerable species such as cranes and korhaans to obtain adequate height after being flushed by vehicle traffic. Alternative 2 and where a 75 metre buffer is not possible, **new** fences must be set back no more than 2 metres (directly adjacent) from the edge of service roads. Through the essential elimination of habitat, this will limit any chance of vulnerable species foraging on verge side vegetation and causing subsequent fence collisions.

Table 10: Loss of Bird Foraging Habitat

Nature: Loss of Bird Foraging Habitat		
	Without mitigation	**With mitigation**
Extent	3	3
Duration	4	3
Magnitude	8	2
Probability	5	2
Significance	**High (75)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	No	Yes
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation Measures

Impacts associated with the loss of bird foraging habitat due to operations can be mitigated by avoiding avifaunal specific sensitive areas and their associated buffers, such as the local drainage lines, impoundments, smaller watercourses, pans and koppies. A green buffer should be maintained around all habitats with a SEI designated as High or above.

Table 11: Disruption of bird migratory pathways during the operational phase.

Nature: Disruption of bird migratory pathways during the operational phase		
	Without mitigation	**With mitigation**

Extent	3	3
Duration	4	3
Magnitude	8	2
Probability	5	2
Significance	**High (75)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	No	Yes
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation Measures

Migratory pathways of birds cannot be changed and the resulting impacts are unavoidable. However, severity of the impacts can be reduced with appropriate mitigation measures. Some significant discernible migratory flight pathways were able to be established which could be explained by large areas of generic habitats punctuated by some distinguishing geographic features in the landscape, such as large ridges. large impoundments, wetlands and drainage lines. The linear Drainage line habitats must be buffered by a minimum of 50 metres from the edge of the demarcated wetland.

Table 12: The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as lake effect, perches, nest and shade opportunities

Nature**:** The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as lake effect perches, nest and shade opportunities may cause both damage to the infrastructure through acidic defecation by certain species but also draw birds closer to infrastructure and cause significant direct mortality risks.		
	Without mitigation	**With mitigation**
Extent	3	3
Duration	4	3
Magnitude	8	2
Probability	5	2
Significance	**High (75)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	No	Yes
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation Measures

Essentially, all habitat attractants should be eliminated so that avifaunal populations will not embedded themselves within the infrastructure over time. This includes bird diverters, perch deterrents and the application of Non-polarising white tape can be used around and/or across panels to minimise reflection which can attract aquatic birds and insects (food) as panels mimic

reflective surfaces of waterbodies.

Table 13: Chemical pollution: Chemicals being used to keep the PV panels clean from dust (suppressants) etc.

***Nature*:** Chemical pollution: Chemicals being used to keep the PV panels clean from dust (suppressants) etc.		
	Without mitigation	**With mitigation**
Extent	3	3
Duration	4	3
Magnitude	8	2
Probability	5	2
Significance	**High (75)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	No	Yes
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation Measures

The application of strict chemical control protocols as per the EMPR.

5.1.3 Cumulative Impacts

There are a number of existing renewable energy projects (both solar and WEFs) that already have quantified negative impacts on the avifauna community in the region. Therefore, any impacts anticipated from the proposed solar facility will add to these existing impacts and require assessment under a Cumulative Impacts assessment. Results obtained during this preconstruction survey and from the subsequent impact analysis should be considered in conjunction with the impacts created by the proposed development. The current developments within the region raise the possibility of significant cumulative impacts, especially concerning collision risk, habitat loss and fragmentation and loss of suitable habitat for threatened species.

The following current impacts will be exacerbated through increased solar developments regionally;

- Habitat loss: The destruction of highly sensitive habitat (for example drainage line habitats for Blue Cranes) will potentially increase. Many SCC exist within a narrow ecological and distributional belt and loss of its ecologically specific habitat may be highly significant.
- Road-kills: Many birds are commonly killed on roads and flushed into fences associated with the facility (e.g. Karoo Korhaan).
- Regional saturation of solar facilities: This has implications for several priority species, both in terms of lake effect, collision mortality from additional powerline infrastructure (see below) for some species, especially Bustards and Raptors, and displacement due to transformation of habitats
- Powerlines: Numerous existing and new power lines are significant threats to large terrestrial priority species in the region as powerlines may kill significant numbers of all large terrestrial bird species.

Table 14: Cumulative impact of the project and other projects in the area.

Nature: Cumulative impact of the project and other projects in the area		
	Overall impact of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***
Extent	1	3
Duration	4	4
Magnitude	4	6
Probability	4	5
Significance	**Medium (36)**	**High (65)**
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Possibly

5.1.4 General Mitigation of Impacts

Due to the global demand for renewable energy, a strong research emphasis has been placed on describing and defining mitigation measures to negate or minimise the negative impacts associated with such facilities. In particular, much research is focused on bird impacts prevention/minimisation at solar facilities (see TBC 2021). New mitigation measures range from simple (e.g., buffering of habitats) to complex (retrofitting of panels to avoid Lake Effect Impacts). However, by far the best mitigation option remains the first step of the mitigation hierarchy which is “avoidance”. Consequently, all attempts will be made to avoid potential impacts arising from the proposed development through the application of necessary buffers for sensitive areas, where placement of panel infrastructure may not occur. Additional remaining impacts will be minimised through the application of known and previously tested mitigation measures.

Alternative additional mitigation measures may include change of the current land use to minimise attraction for priority species. Since development and construction go hand in hand with high ambient and stochastic noise levels (machinery) and habitat loss, it is possible for bird species and bird individuals to be displaced from the surrounding environment. It is essentially true for large species that require extensive home ranges, and those species that are inherently shy or unobtrusive by nature (e.g., raptors). Displacement will be the response of raptors to the disturbance activity, for example when a bird changes its behaviour or takes flight by aborting its activity prior to the disturbance or being unsuccessful in completing its current activity (Ruddock & Whitfield 2007). Reactions are likely to differ between species and between individuals of the same species (Rogers & Smith

1995; Rogers & Schwikert 2002). Reactions are also positively correlated to the magnitude and frequency of a particular disturbance event. For the proposed solar facilities as well as the cumulative impacts, it cannot be predicted to a 100% confidence to what degree these activities will affect the Priority Species, but it must be stated that many bird species will become accustomed, or have the ability to learn and adapt, to constant occurring disturbance events of low magnitude (e.g. vehicle noise) unless they are directly affected (e.g. their physical habitat is affected). Collision with powerlines is the most significant impact for the species in the region.

Set-back areas or buffer zones are allocated to sensitive or important habitat features to alleviate the effect of foraging and nesting/ roosting habitat in particular. The choice of an appropriate set-back distance is complex since different species and even different taxon groups demand different habitat types or home ranges to maintain a viable population in the long term.. Given that the study area has been confirmed as a foraging site and breeding site for Verreaux's and Tawny Eagles and indeed most other raptor species, the mitigation recommendations that are proposed in order to preserve the ecological function of the raptor habitats, minimising collisions and to maintain foraging corridors for large SCC raptor species in the form of a set-back area of natural vegetation are considered non-negotiable.

5.1.5 Summary of Proposed Mitigation Measures

It is deemed possible, through the application of appropriate mitigation measures, to restrict the impact of on the local and regional avifaunal population to a low level of significance. The following mitigation summary is provided:

Habitat destruction: Where possible, apply necessary buffers for roost sites and other sensitive bird habitat features, avoiding the construction of panels and access roads in these areas. Roads must utilise or upgrade existing farm roads as far as possible. All underground cables bisecting sensitive habitats must be placed below the subsurface flow of the ephemeral wetlands with the linear construction pits subjected to full rehabilitation in order to maintain normal subsurface slow. All roads and crossings must be engineered not to impede surface or subsurface flow in any way.

Bird mortality: Avoid placement of panels near sensitive bird breeding and roosting habitats. The application of adaptive mitigation measures (e.g., retrofitting non-polarising white tape can be used around and/or across panels to minimise reflection), according to post-construction monitoring results (counted collisions of threatened species) must be informed by environmental correlates of avifaunal activity and/or collisions (EMPr).In addition, the addition of grazing sheep to the footprint may attract raptor SCC who may scavenge on dead lambs/ adult sheep or prey upon livestock. Strict carcass retrieval must be incorporated into the EMP where carcasses are removed and correctly disposed of within the same day of death. This will require constant monitoring of all sheep herds in the footprint.

Bird collisions with panels and powerlines: Use of parabolic (curved) mirrors is preferred instead of flat heliostats to reduce the likelihood of skyward reflection to minimise potential bird collisions. However the use of flat panels does not represent a fatal flaw. All powerlines must be flapped with appropriate diverters and no elevated powerlines are to cross drainage line habitats.

Avoidance: It is recommended that limited development takes place in High sensitivity areas. Minimise impacts to natural and artificial wetlands and water bodies by implementing the appropriate buffer areas where no development may take place. This includes a 50 m proposed no-go buffer proposed around small artificial water points as they serve as focal points for bird activity

and 50 metres around drainage lines/ wetlands. All large impoundments require a 1000 metre buffer from any infrastructure activity although this may be reduced to approximately 800 metres if no new powerline infrastructure impacts the 1000 metre threshold. All Verreaux's and Tawny Eagle nests must be buffered by at least 1 km with a preferable "non-disturbance" exclusion of 1.5 km during breeding season (refer to Figure 20). As some avoidance is not possible, the strict preconstruction prescriptive mitigation measures for infrastructure engineering described above must be applied.

General Mitigation Measures

- Formal post construction monitoring must be applied once the development have been activated, as per the most recent edition of the best practice guidelines (Jenkins et al. 2017). The exact scope and nature of the post-construction monitoring will be informed on an ongoing basis by the result of the monitoring through a process of an establishment of available new technology and adaptive management. The purpose of this would be to establish if and to what extent displacement of priority species has occurred through the altering of breeding and foraging behaviour post-construction, and to search for and identify carcasses near panels and newly erected powerlines (mortality).
- High value target species such as Tawny Eagle, Verreaux's Eagle, Secretary Bird, Bustards and Martial Eagles can be tracked using periodic ECO monitoring regimes to monitor movement patterns and breeding success. These programs should be implemented during and post construction.
- Post-construction monitoring should be undertaken as per the EMPr. The exact scope, nature and frequency of the post-construction monitoring will be informed on an ongoing basis by the results of the monitoring through a process of adaptive management.

5.1.6 Species Specific Risk Analysis and Recommended Mitigations

According to SABAP2 and Taylor *et al.* (2015), and as mentioned above, seventeen (17) SCC are known to occur in the region with ten (10) species confirmed during the respective surveys, representing a very high success rate given the short study period. Of the confirmed species and according to Taylor *et al.* (2015), three of the species are Endangered, four of the species are Vulnerable species and three are Near-Threatened. Given that even long-term studies conducted over multiple periods, these species warrant increased contextual discussion in regard to predicted impacts and mitigation measures.

However, the areas showing large associations with ridges and/ drainage lines are characterised by some significantly unique (in the landscape) habitat attributes and are thus likely to provide refuge and foraging habitat for large terrestrial bird species (e.g. cranes, bustards, secretary bird and storks) and/ or wetland associates/ foraging migratory raptors, therefore, elevating the sensitivity. Regarding the current study, it was deemed unnecessary that all species should be discussed in detail. Species such as Lanner Falcon and migratory raptors incur pressures outside of the borders of South Africa and do not warrant intensive discussion. Therefore, the selected relevant species that are possibly susceptible to the proposed development have been discussed in detail below. Photographic evidence of Red-Listed species observed during the current study are provided below.

Figure 18: A photo showing perching breeding pair of Verreaux's Eagle within the PAOI.

Figure 19: Large congregations of Blue Cranes following drainage line habitats within the project footprint

Ultimately, it is suggested that the morphological and behavioural; characteristics of a given bird species traits of birds, especially those related to size, wing beat, manoeuvrability, flight pattern and hunting/ foraging behaviour, are known to influence the relative collision risk with structures such as power lines and solar panels. Larger bird species often need to use thermal and updrafts to gain altitude, particularly for long distance flights. Thermal updrafts (thermals) and orographic lift (slope updraft) will affect the relative risk per species. The relatively flat nature of the survey area dictates that the overall topography related risks are low, However, some higher risk species have been identified and described below.

5.1.6.1 Kori Bustard (*Ardeotis kori*) and Ludwig's Bustard (*Neotis ludwigii*)

Ludwig's Bustards are globally and regionally listed as Endangered (BirdLife International 2012b and Taylor,*et. al.* 2015) which is cause for a significant evaluation of the species in relation to the proposed development. Actual counts were carried out although monitoring data suggest that a permanent (albeit seasonal) population including breeding pairs persist for prolonged periods within the study area. Multiple and frequent sightings were recorded.

The fact that sub-adults and juveniles were encountered in the study area provides strong anecdotal evidence of residential breeding behaviour which may have significance ramifications for the Cumulative Impact Assessment. This species is almost certainly resident and at risk to the creation of large, panel infrastructure in combination with non-marked powerlines may cause collision of birds which could significantly reduce local and regional populations. In addition, large-scale increases in fencing combined with a high volume of large maintenance trucks may cause drastic declines in bustard numbers due to flushing displacements, collisions and entanglements. The presence of this species must form a significant focal point of the mitigation measures.

On a final note concerning monitoring of the species (and possible mitigations), it is vital to highlight that fact that as an Endangered species, Ludwig's bustard demands higher degrees of auditing and monitoring attention than other Red-Listed birds (a fact supported by multiple publications including Visser *et. al.* 2018 and Scott *et. al.* 2012). It is also vital to highlight that presence or absence over time for a nomadic species is difficult to predict and spatial/ temporal population reductions may or may not be development-induced. For example, the cessation of predator poisoning activities within the study area may in fact cause a localised increase in jackal populations, thereby reducing the population of Bustards through good practice. Although it is highly feasible that the development may be directly responsible for local population reductions, comprehensive and continuous data collection is required to monitor the situation on site and apply appropriate mitigation measures and far more significant weighting and value should be applied to the Cumulative Impact Assessment.

Kori Bustards are globally and regionally listed as Near-Threatened (Taylor *et. al.*, 2015). This large terrestrial bird exhibits a preference for lightly wooded savanna as well as arid open systems, which are very abundant within the study areas. The species is resident and at risk to the creation of large, non-marked powerlines which may cause collision of birds. In addition, large-scale increases in fencing (entanglement) combined with a high volume of large construction and/or maintenance trucks/ vehicles may cause localised drastic declines in bustard numbers.

5.1.6.2 Black Stork (*Ciconia nigra*)

The IUCN Vulnerable Black Stork (*Ciconia nigra*) is not expected to occur within the study areas in significant densities. Due to lack of standing water and sub-optimal time of year, this species was not sighted during the current survey. The species is an uncommon albeit regular migrant and is seasonally associated with water bodies and pans throughout the region.

5.1.6.3 Tawny Eagle (*Aquilia rapax*), Verreaux's Eagle (*Aquila verreauxii*) and Martial Eagle (*Polemaetus bellicosus*)

All nesting raptors should be protected within the study area. Seen frequently, Verreaux's eagle is most likely classified as a regular foraging visitor on the study areas and a breeding resident in areas adjacent to the project footprint. The IUCN Vulnerable Verreaux's Eagles and IUCN Endangered Martial Eagle and Tawny Eagle provide a typical scenario where the foraging population (and breeding pairs) of resident raptor SCC can be significantly impacted.

Local populations are under constant pressure from development due to modifications and alterations of their preferred foraging habitat and dispersal networks. It must be stated that Martial Eagle rely on more ecologically "generic" habitats and are not bound by the ridge systems that define the presence and foraging of Verreaux's Eagle. Therefore, the impacts of the development of Martial Eagle will be less severe, especially because nests were not located within the project area of influence. Verreaux's and Tawny Eagle will be the focus forthwith.

Generally, Verreaux's eagles occupy a home range size of approximately 20-35 km^2 (Van der Lecq 2012) or 35 - 65 km^2 in the Magaliesberg (Allan 1988; Anderson 2002) in areas where their preferred prey, the Rock Hyrax (*Procavia capensis*) is abundant (Gargett & Mundy 1990; Simmons 2005). Within the Soventix Footprint area, not only were rock hyrax and Smith's red rock rabbit observed in high densities, but Verreaux's eagles were frequently observed actively foraging. A highly unusual observation saw four individual eagles interacting directly above the project footprint, possible the result of two local breeding pairs meeting in a territorial dispute and not within the context of competition for foraging. Overall, in areas of high disturbance, the species can increase their home range to an area of 150 - 200 km^2 which does not appear to be the case within in the PAO given the seemingly high abundance of Verreaux's Eagle. Any future observed expansion of the home range of the local population can probably explained by the lack of sufficient densities of prey as a result of habitat loss within the landscape, thus representing a key indicator for future monitoring.

Tawny Eagles are less predictable in their ecology and habits due to the fact that they are a low-density species although very widespread and with very generalist habitat requirements. The breeding pair adjacent to the project footprint will almost certainly represent long term residents. The primary impacts relate to loss of foraging habitat and potential collision with new powerline infrastructure which requires detailed discussion.

The overall findings data reveal a number of risks in regard to the current study. Increased stress to obtain food in the area will almost certainly modify the eagles' behaviour within the national population. Breeding adults become more aggressive towards each other leading to increased post-hatchling mortalities (Anon 2012). This is especially relevant in regards to the loss of habitat for the cumulative effects due to much reduced available prey as well as the increased disturbance levels.

It is an undisputed fact that the fitness of Verreaux's eagle (e.g. breeding success) is closely tied with the availability of its preferred prey. The proposed future development can likely threaten the long-term viability of suitable prey populations, the

Verreaux's Eagle can be expected to suffer equivalent population declines (Allan 1988). Tawny Eagles forage more widely although may be affected in similar ways as per Verreaux's Eagle.

Impacts

Disturbance applies to the disruption of a foraging, breeding or roosting bird caused by human-induced activities. Since development and construction go hand in hand with high ambient levels and habitat loss, it is possible for bird species and bird individuals to be displaced from the surrounding environment. It is essentially true for large species that require extensive home ranges, and those species that are inherently shy or unobtrusive by nature (e.g. raptors).

Displacement will be the response of eagles to the disturbance activity, for example when a bird changes its behaviour or takes flight by aborting its activity prior to the disturbance, or being unsuccessful in completing its current activity (Ruddock & Whitfield 2007). Reactions are likely to differ between species and between individuals of the same species (Rogers & Smith 1995; Rogers & Schwikert 2002). Reactions are also positively correlated to the magnitude and frequency of a particular disturbance event. For the proposed solar farm application as well as future applications, it is currently unknown to what degree these activities will affect the Verreaux's Eagles and their prey (due to absence of approvals, long-term studies and detailed list of activities), but reactions can be estimated to be similar due to the surrounding development activities. It must be stated that many bird species will become accustomed, or have the ability to learn and adapt, to constant occurring disturbance events of low magnitude (e.g. vehicle noise), unless they are not directly affected (e.g. their physical habitat is left intact). However, reduced poisoning of large SCC raptors (that may or may not hunt or scavenge livestock) may in fact have a positive effect on the population, albeit non-significant for the overall population.

Reaction to disturbance events causes behavioural disruption which is likely to result in an increased energy expenditure (e.g. if a disturbed bird takes flight) and physical stress. In the case of breeding birds, disturbances could lead to the loss of eggs or nestlings, thereby affecting the breeding success of the population (Stillman *et al*. 2007). In addition, sustained disturbances could eventually result in less time for individuals to invest in breeding activities due to high energy demands compromising their survival. Displacement and disturbances are further aggravated by an increased loss of suitable foraging, breeding and roosting habitat.

Nest Specific Mitigations

Utilising the interpretations stipulated above and in the absence of any mitigation measures, a preliminary buffer of 1 km (Figure 20) is recommended as an exclusion zone of ALL project activities, in addition to stipulated mitigation measures (see species specific mitigation measures below).

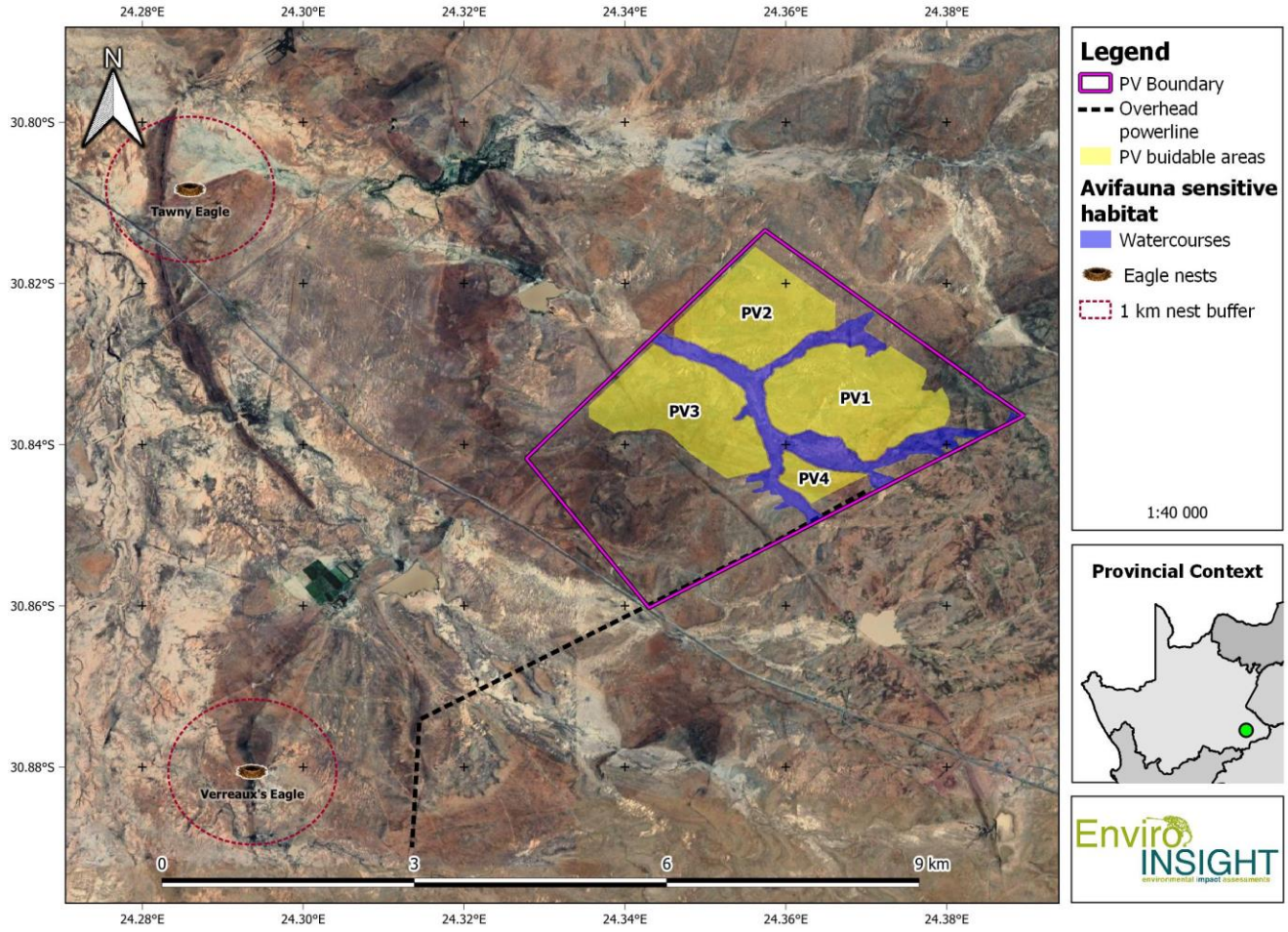

Figure 20: Regional sensitivity map and precautionary 1km operational phase buffers to SCC nests.

6 MONITORING REQUIREMENTS

Post-construction monitoring as per the relevant guidelines at the time must be implemented.

The following outlines a general monitoring plan (EMPr) structure.

	Title: SCC community monitoring
Stressor	Project Activities, Micro Climatic Changes
Receptor(s)	Avifauna SCC diversity and densities in each habitat type
Variables	Presence/absence of bird species of conservation concern, including observed breeding behaviour, proportion of SCC species present per sample site, species richness and densities.
Sampling Method	• Drive Transects (species lists) – all species seen to be recorded along set transects to be driven during dawn till pre 10 am; and • Walked Transects (species lists) – all species heard and seen to be recorded along set transects to be walked at dawn chorus
Sampling Frequency	• Annual wet and dry season surveys; and • Continuous observations by ECO.
Sampling Site(s)	As provided in EMPr with focus on drainage lines, koppies, nesting sites and 500 m buffer around the project footprint.
Change and Action Thresholds	Loss/decrease in any SCC parameter, unnatural decline (cannot be explained by stochastic weather changes) in species densities and/or richness. Similarly, positive changes (e,g, unusual presence in high densities of nomadic species such as Ludwig's Bustard or establishment of SCC breeding population such as Blue Cranes, Large SCC Raptors and Secretary Bird) in species densities and/or richness that indicate disturbance. Rapid surveys of greater surrounding area should be conducted to attempt to determine cause of change detected.
Data Analysis	All variables acquired should be statistically and graphically compared to the available data and the original targeted baseline data. Photographs should be taken of as many SCC observed in the field.
Reporting requirements	Annual reporting presenting data analysis results and mapping indicating locations of change. Specific reporting on negative change detection not directly attributable to Project activities (Solar Facility Operation) and their cause. All reporting to be accompanied by GIS shapefiles and any original photographs.

	TITLE: Mortality monitoring
Stressor(s)	Avifauna-Panel and powerline collisions (incidents)
Receptor(s)	Avifauna community composition, density and distribution
Variables	Species, geographical location and date of every avifaunal mortality
Sampling Method	• For powerlines: Weekly surveys before dawn (prior to scavenger activity) by driving slowly along the servitudes and documenting each collision kill location and species (a georeferenced photograph as evidence is required). • For panel location sites: weekly inspection on foot of cleared areas for birds killed during the operation process. Location and species must be recorded (a georeferenced photograph as evidence is also required).
Sampling Frequency	Weekly for powerlines, weekly for panels
Sampling Site(s)	Along the entire powerline network on the PAOI. All operational panels.
Collision Action Thresholds	Collision frequency and intensity (#kills per species per unit time) will need to be assessed per species by specialist. However, any non-specific collision concentrations (> 10 kills per month clustering in a stretch of powerline or a specific turbine) must initiate investigation and corrective measures (including retrofitting of mitigation measures).
Data Analysis	Geospatial analysis of density and dispersion of avifaunal mortalities highlighting the core areas of mortalities so that corrective measures can be implemented. Time-series and trend analysis to accompany evaluation to inform on temporal fluctuations (e.g. seasonality) and steer adaptive management. Cumulative species-specific summary statistics to be calculated.
Reporting requirements	• Bi-annual reporting of faunal avifaunal mortalities associated with collision data highlighting locations where corrective measures are to be taken (if necessary).

7 FINAL SITE SENSITIVITY

Each demarcated sensitive feature was evaluated for the degree of sensitivity based on the complete data set and presented as Figure 21 and Figure 22. There is an important presence and high densities of a number of SCC in the study area, recorded regularly and widespread through the proposed project footprint. In addition, there are several raptors utilising the PAOI, some of them priority species and/or of conservation concern, such as the Verreaux's Eagle, Lanner Falcon, Tawny Eagle, Pale-chanting Goshawk and Black-winged Kite. Areas of drainage lines and vegetated koppies which are vital to maintaining populations of habitat obligate sensitive species are deemed to have a high sensitivity Furthermore, natural drainage line vegetation represents an important habitat to maintain natural geohydrological processes of the PAOI which in turn directly relate to avifaunal SCC habitat and migratory corridors. Given the fact that some associated infrastructure will be impinging on the drainage line habitat, specific mitigations must be implemented along with a general 50 m buffer from the edge of the delineated drainage lines around these areas should be considered high sensitivity where unmitigated panels and associated infrastructure should be excluded. The engineering prescriptions for any infrastructure impacting the delineated wetland habitats

have been described in detail and must be implemented into the Construction Phare EMPr.

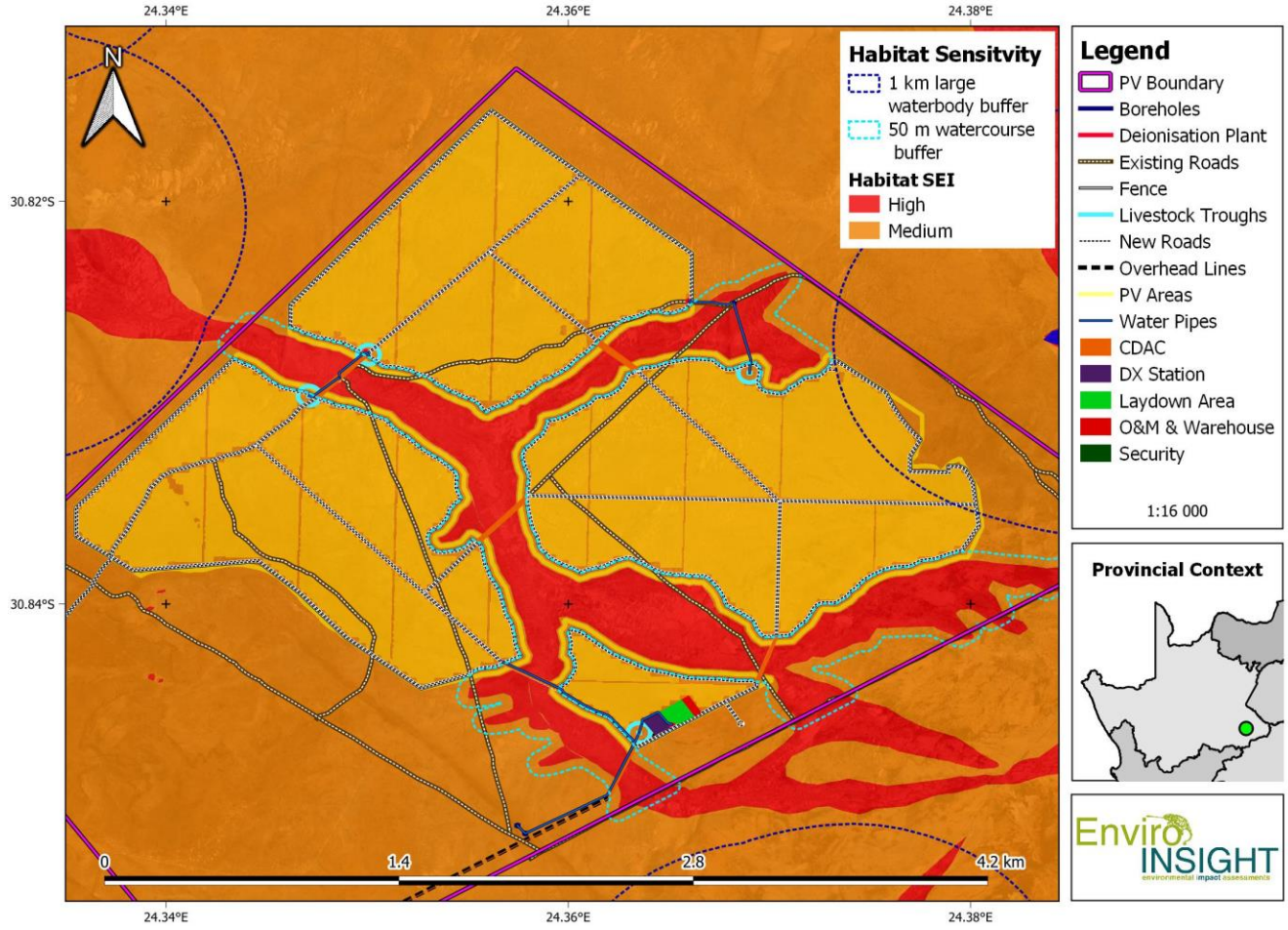

Figure 21: Avifauna sensitivity map for the project footprint

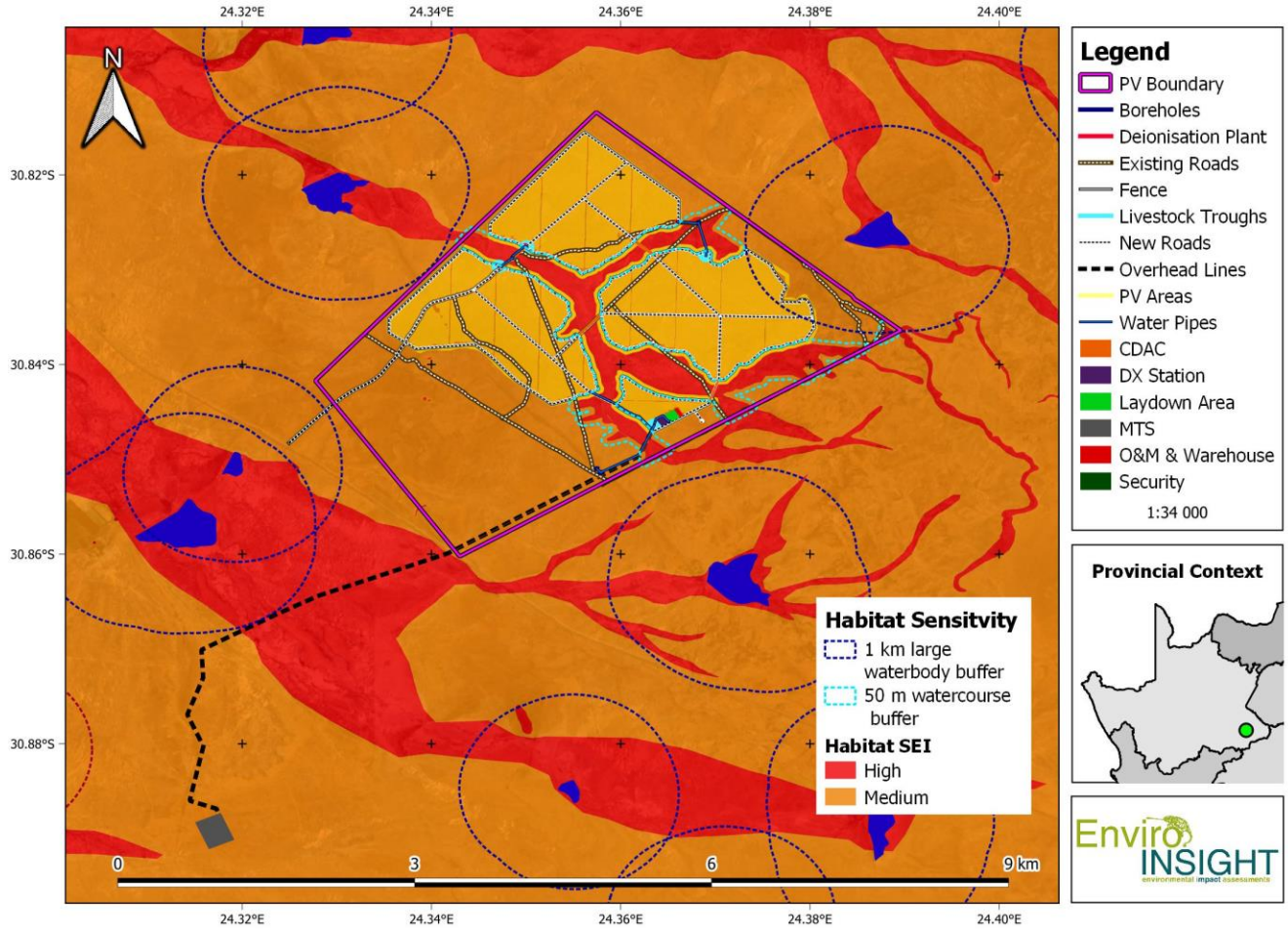

Figure 22: PAOI sensitivity map.

8 CONCLUSION AND PROFESSIONAL OPINION

The study area is situated within the Nama Karoo Biome and the Northern Upper Karoo vegetation type, nearly meeting the Grassland Biome to the east of the study area. The study area supports several large terrestrial bird species such as Blue Cranes, Ludwig's and Kori Bustards and Korhaans and multiple large Raptor Species. The CBAs of the Northern Cape (2016) designated that majority of the site falls within an ecological support area (ESA). Avoidance mitigation could be applied wherever possible to project infrastructure design and limit the amount of habitat impacted.

The study area is classified as a Regime 2 assessment (Jenkins *et al.* 2017) and the study followed the appropriate sampling method, which consists of 2-3 surveys of 3-5 days each over a 6-month period. Samling methods included walking and driving transects, bird species abundance at waterbodies and monitoring of new and previously observed nests on existing and constructed pylons.

A total of sixteen (16) priority species has the possibility of occurring within and around the study area, including Blue Crane, Jackal Buzzard, Martial Eagle, Booted Eagle, Verreaux's Eagle, and Ludwig's Bustard. Special attention was placed on these species, especially on the Verreaux's and Tawny Eagle nest sites that has been identified during the site visit within the PAOI

Unmitigated, the proposed solar project has the potential to be of medium to high sensitivity from an avifaunal point of view although the most significant impacts are undoubtably Cumulative in Nature, rather than *in* situ for the specific survey as much of the PAOI is surrounded with existing and/ or proposed renewable energy developments, both wind and solar, which could have the possibility of cumulative impacts at the proposed site. The surrounding wind and solar developments include Mulilo WEF and De Aar Solar Power. However, the study area is also surrounded by natural and undeveloped areas, which has the likelihood of low sensitivity, especially being large areas which are not unique in the landscape. Some of the priority bird species are habitat bound to the area for nesting and/or foraging purposes and mitigation measures focused on the some of the most significant sensitive habitat specific impacts for the proposed solar project. Possible primary impacts of the proposed study area on avifauna includes:

1. Potential habitat loss through the establishment of solar panel infrastructure.
2. The inclusion of sheep, some of which may die of natural causes or act as a prey source as part of a Agrivoltaic system might attract more avifauna species (especially raptor SCC) to the area.
3. Collision with solar panel infrastructure is possible albeit less likely than secondary collision risk.
4. Secondary collision risks are represented by supporting powerline infrastructure which are connected to solar panel infrastructure. Several species such as IUCN Endangered Ludwig's Bustard and Secretary Birds are highly susceptible to collision impacts with supporting powerline infrastructure.

Sensitive bird species found within the study area include Blue Crane, Ludwig's Bustard, Martial Eagle, Karoo Korhaan, and Lanner Falcon. Other species that were observed outside of the study area but will also have a high occurrence probability within the study area are Secretarybird and Kori Bustard. No nests of sensitive species were observed or identified within the study area. Multiple (up to four at a time) Verreaux's Eagle nest was recorded outside inside PV area, and two active adults circling the nesting area outside of the project footprint. One Verreaux's Eagle mortality was also found.

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The addition of the proposed Soventix development does indicate some significant impacts to the receiving environment via the risk to Priority Species (such as Blue Crane, Tawny and Verreaux's Eagle and Ludwig's Bustard) as well as the Cumulative Impacts need to be considered and provision made within the EMPr for this development.

Although previous impact assessments and monitoring programs for existing local solar developments indicated that not all impacts can be mitigated to acceptable levels, the overall low significance post-mitigation should be interpreted that the project risks are within acceptable levels. It must however be related that this report must be considered in context with the greater EIA process. In addition, while striving to maintain the highest standards of mitigation and monitoring as well as the consideration of the Cumulative Impact Assessment. The EMPr must be implemented in a manner that will adhere to the recommendations.

Overall, the author sees no reason why an Environmental Authorisation (EA) should not be granted on the following conditions;

- All recommended buffering be strictly adhered to where possible.
- All recommended mitigation measures be applied preconstruction, post construction and operations.
- The Prescribed engineering mitigation measures must be supported by a pre-construction and Construction Phase rehabilitation plan to be commissioned prior to commencement of construction activities.
- An EMPr for the Construction Phase must be created and be subsequently updated every three years (during Operation) in order to revaluate the effectiveness of the mitigations. All mortalities must be recorded.

9 REFERENCES

Del Hoyo, J., Elliott, A. AND Sargatal, J. 1992. Handbook of the birds of the world. 1992 – 2011 editions, Lynx Editions, Barcelona.

Gill, F. & Donsker, D. (Eds). 2019. IOC World Bird List (v9.2). doi: 10.14344/IOC.ML.9.2.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V., & Brown, C.J. (eds). (1997) *The Atlas of Southern African Birds*. BirdLife South Africa, Johannesburg.

Hockey P., Dean, W., Ryan, P., Maree S. & Brickman, B. (2005). *Roberts - Birds of Southern Africa* 7th ed. Trustees of the John Voelcker Bird Book Fun/ Africa Geographic Books. 1296 p.

IUCN. (2021) The IUCN Red List of Threatened Species. http://www.iucnredlist.org.

Jenkins, A.R., Ralston-Paton, S. and Smit-Robinson, H.A. (2017). Birds & Solar Energy. Best Practice Guidelines: Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa.

Malan, G. (2009) *Raptor Survey and Monitoring – a Field Guide for African Birds of Prey*. Briza Publications, Pretoria, South Africa.

Marnewick, M., Retief, E., Theron, N., Wright, D., & Anderson, T. (2015). Important Bird and Biodiversity Areas of South Africa. BirdLife South Africa. Johannesburg.

Mucina, L. & Rutherford, M.C. (eds). (2006, as amended). *The Vegetation of South Africa, Lesotho and Swaziland*. South African National Biodiversity Institute, Pretoria.

SABAP2 (South African Bird Atlas Project). Visited February 2022. http://vmus.adu.org.za/

South African National Biodiversity Institute. (2018) Beta Vegetation Map of South Africa, Lesotho and Swaziland (File Geodatabase) [File geodatabase] 2018. Available from the Biodiversity GIS website (http://bgis.sanbi.org/SpatialDataset/Detail/670).

Taylor, M.R., Peacock, F. & Wanless, R.M. (eds). (2015). *The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Johannesburg, South Africa.

10 APPENDIX

10.1 APPENDIX 1: EXPECTED & OBSERVED AVIFAUNA SPECIES LIST

Avifauna recorded by SABAP1 and SABAP2 for the sixteen pentads, which includes the study area and surrounding area, is situated (see Figure 3).

Table 15: Avifauna species expected (medium probability and higher) in the study area.

Common Name	Scientific Name	Latest FP	Status (RG/GB)	SABAP Pentad	Todd, S	ADU	Observed on Site	POC
Acacia Pied Barbet	*Tricholaema leucomelas*	2020/11/14	LC				Yes	Medium
African Black Swift	*Apus barbatus*	2022/03/04					Yes	Medium
African Pipit	*Anthus cinnamomeus*	2020/12/09		X	X		Yes	High
African Red-eyed Bulbul	*Pycnonotus nigricans*	2021/05/04		X			Yes	High
African Sacred Ibis	*Threskiornis aethiopicus*	2017/11/05			X	X	Yes	Medium
African Stonechat	*Saxicola torquatus*	2021/05/22		X			Yes	High
Amur Falcon	*Falco amurensis*	2022/02/03		X		X	Yes	Medium
Ant-eating Chat	*Myrmecocichla formicivora*	2022/02/03		X		X	Yes	High
Pied Avocet	*Recurvirostra avosetta*	2017/11/05		X		X	Yes	Medium
Barn Swallow	*Hirundo rustica*	2022/02/03		X			Yes	High
Black-chested Snake Eagle	*Circaetus pectoralis*	2022/03/03					Yes	Medium
Black-headed Heron	*Ardea melanocephala*	2020/10/12		X			Yes	Medium
Blacksmith Lapwing	*Vanellus armatus*	2021/01/15		X	X	X	Yes	High

Black-throated Canary	*Crithagra atrogularis*	2017/03/01		X				Medium
Black-winged Stilt	*Himantopus himantopus*	2017/11/05		X	X	X	Yes	Medium
Blue Crane	*Grus paradisea*	2022/02/03	NT, VU	X	X	X	Yes	High
Blue Korhaan	*Eupodotis caerulescens*	2017/11/05	LC, NT	X	X			Medium
Bokmakierie	*Telophorus zeylonus*	2022/02/03		X			Yes	High
Booted Eagle	*Hieraaetus pennatus*	2017/03/01		X				Medium
Brown-throated Martin	*Riparia paludicola*	2017/10/19		X			Yes	Medium
Cape Robin-Chat	*Cossypha caffra*	2020/12/09		X			Yes	Medium
Cape Shoveler	*Spatula smithii*	2017/10/12		X	X	X	Yes	Medium
Cape Sparrow	*Passer melanurus*	2022/02/03		X			Yes	High
Cape Turtle Dove	*Streptopelia capicola*	2022/02/03		X		X	Yes	Medium
Cape Wagtail	*Motacilla capensis*	2020/12/09		X			Yes	High
Capped Wheatear	*Oenanthe pileata*	2021/05/22		X			Yes	Medium
Chat Flycatcher	*Melaenornis infuscatus*	2020/11/13		X			Yes	Medium
Chestnut-vented Warbler	*Curruca subcoerulea*	2017/10/07		X				Medium
Cloud Cisticola	*Cisticola textrix*	2017/10/07		X			Yes	Medium
Common Greenshank	*Tringa nebularia*	2017/11/05		X				Medium
Common Quail	*Coturnix coturnix*						Yes	
Desert Cisticola	*Cisticola aridulus*	2017/03/01		X	X	X	Yes	Medium

Eastern Clapper Lark	*Mirafra fasciolata*	2022/02/03		X	X		Yes	High
Egyptian Goose	*Alopochen aegyptiaca*	2022/02/03		X		X	Yes	High
European Bee-eater	*Merops apiaster*	2020/12/09		X				Medium
Familiar Chat	*Oenanthe familiaris*	2020/12/09		X			Yes	High
Fiscal Flycatcher	*Melaenornis silens*	2022/02/03		X				Medium
Greater Kestrel	*Falco rupicoloides*	2021/05/22		X		X	Yes	Medium
Greater Striped Swallow	*Cecropis cucullata*	2022/02/03		X			Yes	High
Grey Heron	*Ardea cinerea*	2021/01/15		X			Yes	Medium
Grey-backed Cisticola	*Cisticola subruficapilla*	2020/12/09		X			Yes	Medium
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	2021/11/03		X			Yes	Medium
Hadada Ibis	*Bostrychia hagedash*	2021/08/13		X		X	Yes	Medium
Helmeted Guineafowl	*Numida meleagris*	2022/02/03				X	Yes	Medium
House Sparrow	*Passer domesticus*	2020/02/07					Yes	Medium
Jackal Buzzard	*Buteo rufofuscus*	2021/10/10				X	Yes	Medium
Karoo Korhaan	*Eupodotis vigorsii*	2022/02/03	NT, LC	X			Yes	Medium
Karoo Long-billed Lark	*Certhilauda subcoronata*	2019/07/29			X			Medium
Karoo Prinia	*Prinia maculosa*	2020/11/13		X			Yes	Medium
Karoo Scrub Robin	*Cercotrichas coryphoeus*	2021/05/22		X	X		Yes	High
Karoo Thrush	*Turdus smithi*	2020/11/14		X				Medium
Kittlitz's Plover	*Charadrius pecuarius*	2017/10/19		X		X	Yes	Medium

Kori Bustard	*Ardeotis kori*	2022/03/06					Yes	Medium
Large-billed Lark	*Galerida magnirostris*	2022/02/03		X	X	X	Yes	High
Lark-like Bunting	*Emberiza impetuani*	2021/11/03		X		X	Yes	High
Laughing Dove	*Spilopelia senegalensis*	2021/05/04		X			Yes	High
Lesser Kestrel	*Falco naumanni*	2022/02/03		X	X		Yes	Medium
Little Stint	*Calidris minuta*	2017/10/19		X	X	X	Yes	Medium
Little Swift	*Apus affinis*	2021/11/03		X			Yes	Medium
Ludwig's Bustard	*Neotis ludwigii*	2022/02/03	EN, EN	X	X		Yes	Medium
Martial Eagle	*Polemaetus bellicosus*	2019/07/29	EN, EN	X			Yes	Medium
Mountain Wheatear	*Myrmecocichla monticola*	2020/12/09		X	X		Yes	High
Namaqua Sandgrouse	*Pterocles namaqua*	2020/10/12		X	X	X		Medium
Neddicky	*Cisticola fulvicapilla*	2022/03/07					Yes	Medium
Northern Black Korhaan	*Afrotis afraoides*	2021/10/10		X	X		Yes	Medium
Pale Chanting Goshawk	*Melierax canorus*	2021/10/10		X	X		Yes	Medium
Pied Avocet	*Recuvirostra avosetta*						Yes	
Pied Crow	*Corvus albus*	2022/02/03		X		X	Yes	High
Pied Starling	*Lamprotornis bicolor*	2021/05/22		X			Yes	High
Pink-billed Lark	*Spizocorys conirostris*							
Red-billed Quelea	*Quelea quelea*	2021/05/04		X				Medium
Red-capped Lark	*Calandrella cinerea*	2017/10/19		X				Medium
Red-eyed Dove	*Streptopelia semitorquata*	2017/10/07		X			Yes	High

Red-headed Finch	*Amadina erythrocephala*	2022/02/03		X			Yes	Medium
Red-knobbed Coot	*Fulica cristata*	2015/11/09		X				Medium
Rock Kestrel	*Falco rupicolus*	2019/05/31		X				Medium
Rock Martin	*Ptyonoprogne fuligula*	2021/08/13		X				Medium
Rufous-eared Warbler	*Malcorus pectoralis*	2021/05/22		X	X	X	Yes	High
Sabota Lark	*Calendulauda sabota*	2017/08/07		X	X		Yes	High
Secretarybird	*Sagittarius serpentarius*	2022/02/03	VU, EN		X		Yes	Medium
Sickle-winged Chat	*Emarginata sinuata*	2021/05/22		X			Yes	High
South African Cliff Swallow	*Petrochelidon spilodera*	2017/10/19		X		X		Medium
South African Shelduck	*Tadorna cana*	2020/05/26		X	X	X	Yes	High
Southern Fiscal	*Lanius collaris*	2022/02/03		X			Yes	High
Southern Grey-headed Sparrow	*Passer diffusus*	2017/08/05		X			Yes	Medium
Southern Masked Weaver	*Ploceus velatus*	2022/02/03		X			Yes	High
Southern Red Bishop	*Euplectes orix*	2021/05/22		X		X		Medium
Speckled Pigeon	*Columba guinea*	2022/02/03		X			Yes	Medium
Spike-heeled Lark	*Chersomanes albofasciata*	2021/05/22		X	X		Yes	High
Spotted Thick-knee	*Burhinus capensis*	2022/02/03		X			Yes	Medium
Spur-winged Goose	*Plectropterus gambensis*	2022/02/03		X		X	Yes	Medium
Tawny Eagle	*Aquila rapax*	2021/05/22	EN, VU	X	X		Yes	Medium

Three-banded Plover	*Charadrius tricollaris*	2022/02/03		X			Yes	Medium
Verreaux's Eagle	*Aquila verreauxii*	2022/02/03	VU, LC	X	X		Yes	Medium
Western Cattle Egret	*Bubulcus ibis*	2017/03/01		X				Medium
White-backed Mousebird	*Colius colius*	2021/05/19		X			Yes	Medium
White-rumped Swift	*Apus caffer*	2020/12/09		X			Yes	Medium
White-throated Canary	*Crithagra albogularis*	2020/12/09		X				Medium
White-throated Swallow	*Hirundo albigularis*	2017/10/19		X			Yes	Medium
Yellow-crowned Bishop	*Euplectus afer*	2022/03/03					Yes	Medium
Yellow Canary	*Crithagra flaviventris*	2021/05/22		X			Yes	Medium
Yellow-bellied Eremomela	*Eremomela icteropygialis*	2017/08/05		X			Yes	Medium
Yellow-billed Duck	*Anas undulata*	2020/05/26		X			Yes	Medium
Zitting Cisticola	*Cisticola juncidis*	2012/11/10					Yes	Medium

10.2 APPENDIX 2: AVIFAUNAL DATA CATALOG

Species secondary name	Species tertiary name	Date	Time	Count	Transect	Season 1	Season 2
Blue Crane	*Grus paradisea*	2022/03/03	06:59:23	17	Random	Autumn	March2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/03/03	08:54:36	2	Random	Autumn	March2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/03/03	08:55:25	2	Random	Autumn	March2022
Greater Kestrel	*Falco rupicoloides*	2022/03/03	08:55:50	1	Random	Autumn	March2022
Barn Swallow	*Hirundo rustica*	2022/03/03	09:00:54	1	Random	Autumn	March2022
Desert Cisticola	*Cisticola aridulus*	2022/03/03	09:07:38	1	Random	Autumn	March2022
Martial Eagle	*Polemaetus bellicosus*	2022/03/03	09:13:41	1	Random	Autumn	March2022
Greater Kestrel	*Falco rupicoloides*	2022/03/03	09:19:22	2	Random	Autumn	March2022
Martial Eagle	*Polemaetus bellicosus*	2022/03/03	09:20:17	1	Random	Autumn	March2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/03/03	09:25:50	1	Random	Autumn	March2022
African Pipit	*Anthus cinnamomeus*	2022/03/03	09:29:09	1	Random	Autumn	March2022
Lesser Kestrel	*Falco naumanni*	2022/03/03	09:33:12	1	Random	Autumn	March2022
Northern Black Korhaan	*Afrotis afraoides*	2022/03/03	09:49:45	1	Random	Autumn	March2022
Ludwig's Bustard	*Neotis ludwigii*	2022/03/03	10:06:22	1	Random	Autumn	March2022
Cape Sparrow	*Passer melanurus*	2022/03/03	10:15:53	1	Random	Autumn	March2022
Pied Crow	*Corvus albus*	2022/03/03	10:32:03	1	Random	Autumn	March2022
Black-chested Snake Eagle	*Circaetus pectoralis*	2022/03/03	10:40:32	2	Random	Autumn	March2022
Large-billed Lark	*Galerida magnirostris*	2022/03/03	10:45:17	1	Random	Autumn	March2022
Sickle-winged Chat	*Emarginata sinuata*	2022/03/03	11:24:21	1	Random	Autumn	March2022
Yellow-crowned Bishop	*Euplectes afer*	2022/03/03	11:49:42	1	Random	Autumn	March2022
Lesser Kestrel	*Falco naumanni*	2022/03/03	12:32:05	3	Random	Autumn	March2022
Secretarybird	*Sagittarius serpentarius*	2022/03/03	13:18:55	1	Random	Autumn	March2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/03/04	07:20:12	1	Random	Autumn	March2022
Pale Chanting Goshawk	*Melierax canorus*	2022/03/04	07:32:41	1	Random	Autumn	March2022
Cloud Cisticola	*Cisticola textrix*	2022/03/04	08:03:28	1	Random	Autumn	March2022
Barn Swallow	*Hirundo rustica*	2022/03/04	08:05:32	12	Random	Autumn	March2022
Sabota Lark	*Calendulauda sabota*	2022/03/04	08:12:13	1	Random	Autumn	March2022
Desert Cisticola	*Cisticola aridulus*	2022/03/04	08:24:38	1	Random	Autumn	March2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/03/04	08:24:46	1	Random	Autumn	March2022
Karoo Korhaan	*Eupodotis vigorsii*	2022/03/04	08:31:21	1	Random	Autumn	March2022
African Pipit	*Anthus cinnamomeus*	2022/03/04	09:10:50	2	Random	Autumn	March2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/03/04	09:12:44	2	Random	Autumn	March2022
Lesser Kestrel	*Falco naumanni*	2022/03/04	09:18:20	3	Random	Autumn	March2022
Lanner Falcon	*Falco biarmicus*	2022/03/04	09:50:43	1	Random	Autumn	March2022
Little Swift	*Apus affinis*	2022/03/04	09:58:32	2	Random	Autumn	March2022

Karoo Scrub Robin	*Cercotrichas coryphoeus*	2022/03/04	10:00:23	2	Random	Autumn	March2022
Northern Black Korhaan	*Afrotis afraoides*	2022/03/04	10:01:10	1	Random	Autumn	March2022
Desert Cisticola	*Cisticola aridulus*	2022/03/04	10:07:07	1	Random	Autumn	March2022
White-rumped Swift	*Apus caffer*	2022/03/04	10:31:24	1	Random	Autumn	March2022
Pale Chanting Goshawk	*Melierax canorus*	2022/03/04	10:36:49	1	Random	Autumn	March2022
African Pipit	*Anthus cinnamomeus*	2022/03/04	10:37:38	1	Random	Autumn	March2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/03/04	10:38:07	1	Random	Autumn	March2022
African Black Swift	*Apus barbatus*	2022/03/04	11:16:51	4	Random	Autumn	March2022
Northern Black Korhaan	*Afrotis afraoides*	2022/03/04	11:22:51	1	Random	Autumn	March2022
Cloud Cisticola	*Cisticola textrix*	2022/03/04	11:24:50	1	Random	Autumn	March2022
Blue Crane	*Grus paradisea*	2022/03/04	11:25:01	2	Random	Autumn	March2022
Ludwig's Bustard	*Neotis ludwigii*	2022/03/04	11:33:19	1	Random	Autumn	March2022
Blacksmith Lapwing	*Vanellus armatus*	2022/03/05	10:40:05	1	CWAC	Autumn	March2022
Yellow-billed Duck	*Anas undulata*	2022/03/05	10:40:44	1	CWAC	Autumn	March2022
South African Shelduck	*Tadorna cana*	2022/03/05	10:40:51	4	CWAC	Autumn	March2022
Egyptian Goose	*Alopochen aegyptiaca*	2022/03/05	10:41:01	8	CWAC	Autumn	March2022
Pied Avocet	*Recurvirostra avosetta*	2022/03/05	10:41:09	3	CWAC	Autumn	March2022
Cape Shoveler	*Anas smithii*	2022/03/05	10:41:29	12	CWAC	Autumn	March2022
Kittlitz's Plover	*Charadrius pecuarius*	2022/03/05	10:43:01	25	CWAC	Autumn	March2022
Cape Wagtail	*Motacilla capensis*	2022/03/05	10:47:14	1	CWAC	Autumn	March2022
African Sacred Ibis	*Threskiornis aethiopicus*	2022/03/05	10:47:49	1	CWAC	Autumn	March2022
Little Stint	*Calidris minuta*	2022/03/05	10:53:01	50	CWAC	Autumn	March2022
Three-banded Plover	*Charadrius tricollaris*	2022/03/05	11:07:52	1	CWAC	Autumn	March2022
Red-eyed Dove	*Streptopelia semitorquata*	2022/03/05	07:25:55	1	Random	Autumn	March2022
Large-billed Lark	*Galerida magnirostris*	2022/03/05	07:42:08	1	Random	Autumn	March2022
Desert Cisticola	*Cisticola aridulus*	2022/03/05	07:42:16	1	Random	Autumn	March2022
Cloud Cisticola	*Cisticola textrix*	2022/03/05	07:45:26	1	Random	Autumn	March2022
Greater Striped Swallow	*Cecropis cucullata*	2022/03/05	07:47:08	4	Random	Autumn	March2022
Karoo Korhaan	*Eupodotis vigorsii*	2022/03/05	07:59:14	1	Random	Autumn	March2022
Secretarybird	*Sagittarius serpentarius*	2022/03/06	07:15:54	1	Random	Autumn	March2022
Grey Heron	*Ardea cinerea*	2022/03/06	08:07:46	2	Random	Autumn	March2022
Ludwig's Bustard	*Neotis ludwigii*	2022/03/06	08:30:47	1	Random	Autumn	March2022
Speckled Pigeon	*Columba guinea*	2022/03/06	09:58:02	3	Random	Autumn	March2022
Red-backed Shrike	*Lanius collurio*	2022/03/06	10:40:44	1	Random	Autumn	March2022
Spotted Thick-knee	*Burhinus capensis*	2022/03/06	12:06:25	1	Random	Autumn	March2022
Common Quail	*Coturnix coturnix*	2022/03/06	12:29:41	1	Random	Autumn	March2022
Kori Bustard	*Ardeotis kori*	2022/03/06	14:12:26	1	Random	Autumn	March2022
Verreaux's Eagle	*Aquila verreauxii*	2022/03/06	18:42:03	2	Random	Autumn	March2022
Bokmakierie	*Telophorus zeylonus*	2022/03/07	08:23:24	3	Random	Autumn	March2022
Lark-like Bunting	*Emberiza impetuani*	2022/03/07	08:27:10	2	Random	Autumn	March2022

Blue Crane	*Grus paradisea*	2022/03/07	08:44:37	18	Random	Autumn	March2022
Blue Crane	*Grus paradisea*	2022/03/07	09:01:53	1	Random	Autumn	March2022
Mountain Wheatear	*Myrmecocichla monticola*	2022/03/07	09:02:46	2	Random	Autumn	March2022
Neddicky	*Cisticola fulvicapilla*	2022/03/07	09:15:06	1	Random	Autumn	March2022
Jackal Buzzard	*Buteo rufofuscus*	2022/03/07	09:26:40	1	Random	Autumn	March2022
Ludwig's Bustard	*Neotis ludwigii*	2022/03/07	09:51:06	1	Random	Autumn	March2022
Blue Crane	*Grus paradisea*	2022/06/28	07:27:28	70	Random	Winter	June 2022
Blue Crane	*Grus paradisea*	2022/06/28	07:44:02	1	Random	Winter	June 2022
Verreaux's Eagle	*Aquila verreauxii*	2022/06/28	07:58	1	Random	Winter	June 2022
Desert Cisticola	*Cisticola aridulus*	2022/06/28	08:30:30	2	Random	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/28	08:43	1	Random	Winter	June 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/06/28	08:43	1	Random	Winter	June 2022
Large-billed Lark	*Galerida magnirostris*	2022/06/28	08:46	1	Random	Winter	June 2022
Greater Kestrel	*Falco rupicoloides*	2022/06/28	08:48	1	Random	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/28	08:52:11	1	DT1	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/28	08:53:51	1	DT1	Winter	June 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/06/28	08:54:15	2	DT1	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/28	08:55:15	1	DT1	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/28	08:58:06	2	DT1	Winter	June 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/06/28	08:58:22	1	DT1	Winter	June 2022
Sabota Lark	*Calendulauda sabota*	2022/06/28	08:58:37	1	DT1	Winter	June 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/06/28	09:01:03	1	DT1	Winter	June 2022
Zitting Cisticola	*Cisticola juncidis*	2022/06/28	09:01:09	2	DT1	Winter	June 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/06/28	09:03:29	1	DT1	Winter	June 2022
Common Quail	*Coturnix coturnix*	2022/06/28	09:05:24	1	DT1	Winter	June 2022
Karoo Scrub Robin	*Cercotrichas coryphoeus*	2022/06/28	09:14	2	WT1	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/28	09:23	2	WT1	Winter	June 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/06/28	09:23	1	WT1	Winter	June 2022
Pied Crow	*Corvus albus*	2022/06/28	09:45:34	1	Random	Winter	June 2022
Blacksmith Lapwing	*Vanellus armatus*	2022/06/28	09:46:12	1	Random	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/28	09:52	1	WT2	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/28	10:02	5	WT2	Winter	June 2022
Ring-necked Dove	*Streptopelia capicola*	2022/06/28	10:03	1	WT2	Winter	June 2022
Cloud Cisticola	*Cisticola textrix*	2022/06/28	10:06	2	WT2	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/28	10:12	1	WT2	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/28	10:12	4	WT2	Winter	June 2022
Desert Cisticola	*Cisticola aridulus*	2022/06/28	10:17	1	WT2	Winter	June 2022
Pink-billed Lark	*Spizocorys conirostris*	2022/06/28	10:20	1	WT2	Winter	June 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/06/28	10:24	1	Random	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/28	10:27	1	Random	Winter	June 2022

Pied Crow	*Corvus albus*	2022/06/28	10:27	1	Random	Winter	June 2022
Large-billed Lark	*Galerida magnirostris*	2022/06/28	10:31	2	Random	Winter	June 2022
Greater Kestrel	*Falco rupicoloides*	2022/06/28	10:33	1	Random	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/28	10:38	1	Random	Winter	June 2022
Blue Crane	*Grus paradisea*	2022/06/28	10:52:13	5	Random	Winter	June 2022
South African Shelduck	*Tadorna cana*	2022/06/28	10:57	6	CWAC	Winter	June 2022
Pied Avocet	*Recurvirostra avosetta*	2022/06/28	10:57	2	CWAC	Winter	June 2022
Egyptian Goose	*Alopochen aegyptiaca*	2022/06/28	10:57	6	CWAC	Winter	June 2022
Cape Shoveler	*Anas smithii*	2022/06/28	10:57	3	CWAC	Winter	June 2022
Blacksmith Lapwing	*Vanellus armatus*	2022/06/28	10:58	5	CWAC	Winter	June 2022
Black-winged Stilt	*Himantopus himantopus*	2022/06/28	11:00	2	CWAC	Winter	June 2022
Blue Crane	*Grus paradisea*	2022/06/28	11:02	19	CWAC	Winter	June 2022
Familiar Chat	*Oenanthe familiaris*	2022/06/28	11:35:17	1	Random	Winter	June 2022
Jackal Buzzard	*Buteo rufofuscus*	2022/06/28	11:44:18	1	Random	Winter	June 2022
Pale Chanting Goshawk	*Melierax canorus*	2022/06/29	08:00:52	1	Random	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/29	08:28:53	1	DT2	Winter	June 2022
Desert Cisticola	*Cisticola aridulus*	2022/06/29	08:29:05	1	DT2	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/29	08:30:00	1	DT2	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/29	08:34:19	4	DT2	Winter	June 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/06/29	08:35:50	1	DT2	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/29	08:36:17	1	DT2	Winter	June 2022
Greater Kestrel	*Falco rupicoloides*	2022/06/29	08:36:56	1	DT2	Winter	June 2022
Cloud Cisticola	*Cisticola textrix*	2022/06/29	09:01	1	WT3	Winter	June 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/06/29	09:01	1	WT3	Winter	June 2022
Pied Crow	*Corvus albus*	2022/06/29	09:03	1	WT3	Winter	June 2022
Hadada Ibis	*Bostrychia hagedash*	2022/06/29	09:09	1	WT3	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/29	09:11	4	WT3	Winter	June 2022
Large-billed Lark	*Galerida magnirostris*	2022/06/29	09:13	2	WT3	Winter	June 2022
Blue Crane	*Grus paradisea*	2022/06/29	09:15	1	WT3	Winter	June 2022
Cloud Cisticola	*Cisticola textrix*	2022/06/29	09:16	1	WT3	Winter	June 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/06/29	09:19	1	WT3	Winter	June 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/06/29	09:19	1	WT3	Winter	June 2022
African Pipit	*Anthus cinnamomeus*	2022/06/29	09:22:20	1	Random	Winter	June 2022
Cape Wagtail	*Motacilla capensis*	2022/06/29	09:41	1	Random	Winter	June 2022
Large-billed Lark	*Galerida magnirostris*	2022/06/29	09:53	2	Random	Winter	June 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/06/29	09:53	1	Random	Winter	June 2022
Karoo Scrub Robin	*Cercotrichas coryphoeus*	2022/06/29	10:36	1	WT4	Winter	June 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/06/29	10:36	3	WT4	Winter	June 2022
Large-billed Lark	*Galerida magnirostris*	2022/06/29	10:36	2	WT4	Winter	June 2022
Pied Crow	*Corvus albus*	2022/06/29	10:42	1	WT4	Winter	June 2022

Ant-eating Chat	*Myrmecocichla formicivora*	2022/06/29	10:59:08	1	DT3	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/29	11:05:32	1	DT3	Winter	June 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/06/29	11:06:30	1	DT3	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/29	11:06:58	1	DT3	Winter	June 2022
Karoo Korhaan	*Eupodotis vigorsii*	2022/06/29	12:09:49	4	Random	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/30	08:42:58	1	Random	Winter	June 2022
Spur-winged Goose	*Plectropterus gambensis*	2022/06/30	08:46:42	1	Random	Winter	June 2022
Pied Crow	*Corvus albus*	2022/06/30	08:50:16	2	Random	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/30	08:52:43	4	Random	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/30	08:56:03	1	DT4	Winter	June 2022
Pied Crow	*Corvus albus*	2022/06/30	08:56:53	1	DT4	Winter	June 2022
South African Shelduck	*Tadorna cana*	2022/06/30	09:02:59	2	DT4	Winter	June 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/06/30	09:04:33	3	DT4	Winter	June 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/06/30	09:04:45	3	DT4	Winter	June 2022
Cloud Cisticola	*Cisticola textrix*	2022/06/30	09:04:55	1	DT4	Winter	June 2022
Cloud Cisticola	*Cisticola textrix*	2022/06/30	09:09:44	2	DT4	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/30	09:11:18	5	DT4	Winter	June 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/06/30	09:11:28	1	DT4	Winter	June 2022
Ludwig's Bustard	*Neotis ludwigii*	2022/06/30	09:11:33	1	DT4	Winter	June 2022
Large-billed Lark	*Galerida magnirostris*	2022/06/30	09:33:14	1	Random	Winter	June 2022
Cape Turtle Dove	*Streptopelia capicola*	2022/06/30	09:35:44	1	Random	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/30	10:00:37	1	Random	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/06/30	10:04	1	Random	Winter	June 2022
Large-billed Lark	*Galerida magnirostris*	2022/06/30	10:06	1	Random	Winter	June 2022
Common Quail	*Coturnix coturnix*	2022/06/30	10:07:22	2	Random	Winter	June 2022
Large-billed Lark	*Galerida magnirostris*	2022/06/30	10:07:29	1	Random	Winter	June 2022
Sickle-winged Chat	*Emarginata sinuata*	2022/06/30	10:09:50	3	Random	Winter	June 2022
Cape Wagtail	*Motacilla capensis*	2022/06/30	10:11	1	Random	Winter	June 2022
Karoo Korhaan	*Eupodotis vigorsii*	2022/06/30	10:37:42	2	Random	Winter	June 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/06/30	10:40:02	1	Random	Winter	June 2022
Karoo Korhaan	*Eupodotis vigorsii*	2022/06/30	10:41	2	Random	Winter	June 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/06/30	10:41	1	Random	Winter	June 2022
Blue Crane	*Grus paradisea*	2022/06/30	10:47	73	Random	Winter	June 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/11	09:17:13	1	DT1	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	09:18:34	2	DT1	Spring	September 2022
Greater Kestrel	*Falco rupicoloides*	2022/09/11	09:19:22	2	DT1	Spring	September 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/11	09:19:49	1	DT1	Spring	September 2022
Pied Crow	*Corvus albus*	2022/09/11	09:20:04	4	DT1	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	09:22:01	2	DT1	Spring	September 2022
Desert Cisticola	*Cisticola aridulus*	2022/09/11	09:22:59	1	DT1	Spring	September 2022

Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/11	09:25:26	1	DT1	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	09:26:33	1	DT1	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	09:27:36	2	DT1	Spring	September 2022
Cloud Cisticola	*Cisticola textrix*	2022/09/11	09:27:44	1	DT1	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/11	09:28:12	2	DT1	Spring	September 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/09/11	09:29:17	1	DT1	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	09:30:22	1	DT1	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	09:30;58	2	DT1	Spring	September 2022
Sabota Lark	*Calendulauda sabota*	2022/09/11	09:31:01	1	DT1	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	09:31:18	1	DT1	Spring	September 2022
Pied Crow	*Corvus albus*	2022/09/11	09:31:56	1	DT1	Spring	September 2022
Zitting Cisticola	*Cisticola juncidis*	2022/09/11	09:32:19	2	DT1	Spring	September 2022
Black-winged Kite	*Elanus caeruleus*	2022/09/11	09:32:43	1	DT1	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/11	09:41:33	1	DT2	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	09:42:32	2	DT2	Spring	September 2022
Blue Crane	*Grus paradisea*	2022/09/11	09:43:09	5	DT2	Spring	September 2022
Desert Cisticola	*Cisticola aridulus*	2022/09/11	09:44:12	1	DT2	Spring	September 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/09/11	09:45:18	1	DT2	Spring	September 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/09/11	09:45:56	1	DT2	Spring	September 2022
Sabota Lark	*Calendulauda sabota*	2022/09/11	09:46:43	1	DT2	Spring	September 2022
Desert Cisticola	*Cisticola aridulus*	2022/09/11	09:47:26	1	DT2	Spring	September 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/11	09:48:22	4	DT2	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/11	09:48:51	3	DT2	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/11	09:49:40	1	DT2	Spring	September 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/09/11	09:50:31	1	DT2	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/11	09:51:27	1	DT2	Spring	September 2022
Cape Turtle Dove	*Streptopelia capicola*	2022/09/11	09:52:28	8	DT2	Spring	September 2022
Crowned Lapwing	*Vanellus coronatus*	2022/09/11	09:52:54	6	DT2	Spring	September 2022
Speckled Pigeon	*Columba guinea*	2022/09/11	09:53:09	4	DT2	Spring	September 2022
Blue Crane	*Grus paradisea*	2022/09/11	09:53:53	3	DT2	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	10:03:08	2	DT3	Spring	September 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/09/11	10:04:32	1	DT3	Spring	September 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/09/11	10:05:30	2	DT3	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/11	10:06:08	1	DT3	Spring	September 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/09/11	10:06:32	1	DT3	Spring	September 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/09/11	10:06:59	1	DT3	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/11	10:07:58	3	DT3	Spring	September 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/11	10:38:27	1	DT4	Spring	September 2022
Pied Crow	*Corvus albus*	2022/09/11	10:39:31	2	DT4	Spring	September 2022
Blue Crane	*Grus paradisea*	2022/09/11	10:40:12	21	DT4	Spring	September 2022

Crowned Lapwing	*Vanellus coronatus*	2022/09/11	10:41:05	7	DT4	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/11	10:42:29	2	DT4	Spring	September 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/11	10:43:50	2	DT4	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/11	10:45:43	1	DT4	Spring	September 2022
Blue Crane	*Grus paradisea*	2022/09/11	10:47:22	8	DT4	Spring	September 2022
Pale Chanting Goshawk	*Melierax canorus*	2022/09/12	06:16:34	1	WT1	Spring	September 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/12	06:19:54	2	WT1	Spring	September 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/09/12	06:22:05	1	WT1	Spring	September 2022
Ant-eating Chat	*Myrmecocichla formicivora*	2022/09/12	06:23:15	1	WT1	Spring	September 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/09/12	06:25:56	1	WT1	Spring	September 2022
Zitting Cisticola	*Cisticola juncidis*	2022/09/12	06:26:41	1	WT1	Spring	September 2022
Karoo Scrub Robin	*Cercotrichas coryphoeus*	2022/09/12	06:28:23	2	WT1	Spring	September 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/09/12	06:31:41	1	WT1	Spring	September 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/12	06:34:11	2	WT1	Spring	September 2022
Verreaux's Eagle	*Aquila verreauxii*	2022/09/12	06:34:54	1	WT1	Spring	September 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/09/12	06:35:01	1	WT1	Spring	September 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/09/12	07:19:28	1	WT2	Spring	September 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/12	07:20:43	2	WT2	Spring	September 2022
Ring-necked Dove	*Streptopelia capicola*	2022/09/12	07:21:41	3	WT2	Spring	September 2022
Cloud Cisticola	*Cisticola textrix*	2022/09/12	07:25:17	1	WT2	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/12	07:28:47	4	WT2	Spring	September 2022
Spike-heeled Lark	*Chersomanes albofasciata*	2022/09/12	07:29:21	1	WT2	Spring	September 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/09/12	07:33:56	2	WT2	Spring	September 2022
Desert Cisticola	*Cisticola aridulus*	2022/09/12	07:37:34	1	WT2	Spring	September 2022
Blue Crane	*Grus paradisea*	2022/09/12	07:40:45	6	WT2	Spring	September 2022
Cloud Cisticola	*Cisticola textrix*	2022/09/12	09:19:18	1	WT3	Spring	September 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/09/12	09:20:19	1	WT3	Spring	September 2022
Pied Crow	*Corvus albus*	2022/09/12	09:21:43	1	WT3	Spring	September 2022
Hadada Ibis	*Bostrychia hagedash*	2022/09/12	09:24:22	1	WT3	Spring	September 2022
Cloud Cisticola	*Cisticola textrix*	2022/09/12	09:27:59	1	WT3	Spring	September 2022
Pied Crow	*Corvus albus*	2022/09/12	09:28:10	1	WT3	Spring	September 2022
Eastern Clapper Lark	*Mirafra fasciolata*	2022/09/12	09:30:11	2	WT3	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/12	09:30:48	2	WT3	Spring	September 2022
Desert Cisticola	*Cisticola aridulus*	2022/09/12	09:31:18	2	WT3	Spring	September 2022
Large-billed Lark	*Galerida magnirostris*	2022/09/12	09:32:28	2	WT3	Spring	September 2022
Cloud Cisticola	*Cisticola textrix*	2022/09/12	09:32:49	1	WT3	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/12	09:37:51	2	WT3	Spring	September 2022
Common Quail	*Coturnix coturnix*	2022/09/12	08:24:18	2	WT4	Spring	September 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/09/12	08:24:45	3	WT4	Spring	September 2022
Blue Crane	*Grus paradisea*	2022/09/12	08:26:32	5	WT4	Spring	September 2022

Large-billed Lark	*Galerida magnirostris*	2022/09/12	08:28:32	2	WT4	Spring	September 2022
Rufous-eared Warbler	*Malcorus pectoralis*	2022/09/12	08:30:55	3	WT4	Spring	September 2022
Northern Black Korhaan	*Afrotis afraoides*	2022/09/12	08:32:12	1	WT4	Spring	September 2022
Crowned Lapwing	*Vanellus coronatus*	2022/09/12	08:34:09	15	WT4	Spring	September 2022
Hadada Ibis	*Bostrychia hagedash*	2022/09/12	08:35:17	1	WT4	Spring	September 2022
Blacksmith Lapwing	*Vanellus armatus*	2022/09/12	11:31:04	1	CWAC	Spring	September 2022
Crowned Lapwing	*Vanellus coronatus*	2022/09/12	11:31:55	15	CWAC	Spring	September 2022
Egyptian Goose	*Alopochen aegyptiaca*	2022/09/12	11:32:25	4	CWAC	Spring	September 2022
Cape Shoveler	*Anas smithii*	2022/09/12	11:32:42	8	CWAC	Spring	September 2022
African Sacred Ibis	*Threskiornis aethiopicus*	2022/09/12	11:32:04	2	CWAC	Spring	September 2022
Kittlitz's Plover	*Charadrius pecuarius*	2022/09/12	11:35:45	12	CWAC	Spring	September 2022
Three-banded Plover	*Charadrius tricollaris*	2022/09/12	11:37:32	20	CWAC	Spring	September 2022
Yellow-billed Duck	*Anas undulata*	2022/09/12	11:38:31	4	CWAC	Spring	September 2022
African Sacred Ibis	*Threskiornis aethiopicus*	2022/09/12	11:39:43	3	CWAC	Spring	September 2022
Yellow-billed Duck	*Anas undulata*	2022/09/12	11:41:07	1	CWAC	Spring	September 2022
South African Shelduck	*Tadorna cana*	2022/09/12	11:43:28	1	CWAC	Spring	September 2022
Egyptian Goose	*Alopochen aegyptiaca*	2022/09/12	11:45:54	4	CWAC	Spring	September 2022
Pied Avocet	*Recurvirostra avosetta*	2022/09/12	11:46:11	4	CWAC	Spring	September 2022
South African Shelduck	*Tadorna cana*	2022/09/12	11:47:04	2	CWAC	Spring	September 2022
Cape Shoveler	*Anas smithii*	2022/09/12	11:50:23	8	CWAC	Spring	September 2022