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Avifauna EIA Report for the proposed Lesaka 1 Solar Energy Facility near Loeriesfontein, Northern Cape Province, South Africa

July 2023

APPLICANT:

Lesaka 1 Solar Energy Facility (Pty) Ltd

EAP:

SiVEST Environmental

SPECIALIST:

Enviro-Insight CC

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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

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GLOSSARY and ACCRONYMS

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.
DT	Drive Transect
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.
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
SEF	Solar Energy Facility
WT	Walking Transect

INTRODUCTION AND PROJECT BACKGROUND

Enviro-Insight CC was commissioned by Enertrag South Africa (Pty) Ltd on behalf of Lesaka 1 Solar Energy Facility (Pty) Ltd to perform a Terrestrial Biodiversity Assessment for the proposed construction of the Lesaka 1 Solar Energy Facilities (SEF) located near Loeriesfontein in the Northern Cape Province, South Africa. Pluralism

The distinct Environmental Authorisation that is required for the respective Project Infrastructure is as follows:

- Lesaka 1 SEF (up to 240MW)

The proposed SEF is subject to full Environmental Impact Assessment (EIA) processes in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) as amended and EIA Regulations, 2014 (as amended). Accordingly, the EIA processes as contemplated in terms of the EIA Regulations (2014, as amended) are being undertaken in respect of the proposed SEF project. The competent authority for this EIA is the national Department of Forestry, Fisheries and the Environment (DFFE).

Enviro-Insight CC was appointed to undertake the requisite avifauna assessment associated with the proposed SEF. The aim of this report is to undertake a desktop analysis and compile an Environmental Impact Assessment report.

1.1 STUDY AREA

Lesaka 1 SEF is located approximately 35km north of the Loeriesfontein town within the Hantam Local Municipality, in the Namakwa District Municipality, in the Northern Cape Province. The Lesaka 1 SEF is located on Portion 0 of the Farm Kluitjes Kraal No. 264. The buildable area for the SEF will be approximately 600ha, pending environmental constraints and buffers, and final facility design.

There are two site access roads to the Project site. The first access road is via the R355, which is approximately 34km south from the proposed development area; and the second access road is on the north of the proposed development area, namely, the Grannaatboskolk road.

1.2 PROJECT DESCRIPTION

The project aims to supply suitable private off-taker initiatives (direct supply or wheeling agreements, as applicable), or be bid into the government coordinated Renewable Energy Independent Power Producer Procurement Programme (“REIPPPP”) or similar procurement program under the Integrated Resource Plan (“IRP”). The Lesaka 1 SEF Project will be administered under the respective Project Companies, and the Project will be required to be composed of the following:

<u>Lesaka 1 Solar Energy Facility (Pty) Ltd</u>

- Lesaka 1 SEF (up to 240MW)
- Battery Energy Storage System (“BESS”)
- On-site Independent Power Producer (“IPP”) Substation (up to 33/132kV)
- All associated grid infrastructure

<u>Location Alternatives</u>

- No other activity alternatives are being considered. Renewable Energy development in South Africa is highly desirable from a social, environmental and development.

Technology Alternatives

- No other activity alternatives are being considered. Renewable Energy development in South Africa is highly desirable from a social, environmental and development point of view.

SEF Layout Alternatives

- Design and layout alternatives is considered and assessed as part of the EIA. These include alternatives for the Substation locations and also for the construction / laydown area.

No-Go Alternative

- The 'no-go' alternative is the option of not undertaking the proposed SEF infrastructure project. Hence, if the 'no-go' option is implemented, there would be no development. This alternative would result in no environmental impacts from the proposed project on the site or the surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report.

1.3 OBJECTIVES

The final Environmental Impact Assessment Report (EIA) will feed into the final Environmental Authorisation (EA) and Environmental Management Plan Report (EMPR). The principal aim of the avifaunal assessment is 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 for the main EIA Report are 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 the Project with other proposed and/ or existing regional facilities (phases) into account.
- Identify actual and potential species of conservation concern/importance (protected – NEMBA, endemic, threatened or identified as Priority classified as per the recommendations from Jenkins *et. Al.* 2017)). 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. Alternatively, exact timed records of all species observed within the prescribed transects (Driving, Walking and Random) will suffice in order to model required densities.

- Demarcate appropriate ecological buffers around sensitive communities or receptors.
- Compile a search and rescue plan for relevant species to be adopted prior to construction (if required).
- 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 for the Project. Then, in addition to the development site, also take into consideration other similar or proposed 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.
- Draft the basic elements of a Monitoring Program.

1.4 AVIFAUNA SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS

To reiterate, the EIA Report will fulfil the following minimum 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 (Jenkins *et. Al.* 2017).
- 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 Plan of Study.
- Ensure that the avifauna assessment and reporting meet all the requirements of the relevant protocol.

1.5 STUDY LIMITATIONS AND ASSUMPTIONS

- It is assumed that all third-party information acquired is correct (e.g., GIS data and scope of work); and
- Owing to extremely dry, early spring conditions occurring during the reconnaissance site visit in July 2022, bird activity was at its lowest.
- **It is extremely important to note that the preconstruction experimental design was finalised before the final layouts were provided. Therefore, the data collected was for the entire Project Area (PA) which includes Lesaka 1 and 2. This provides a richer data set for a larger Project Area of Influence (PAOI) although it does ensure**

some replication between specific projects.

LEGISLATIVE FRAMEWORK

2.1 NATIONAL ENVIRONMENTAL SCREENING TOOL AND ENVIRONMENTAL THEME PROTOCOLS

2.1.1 Screening Report

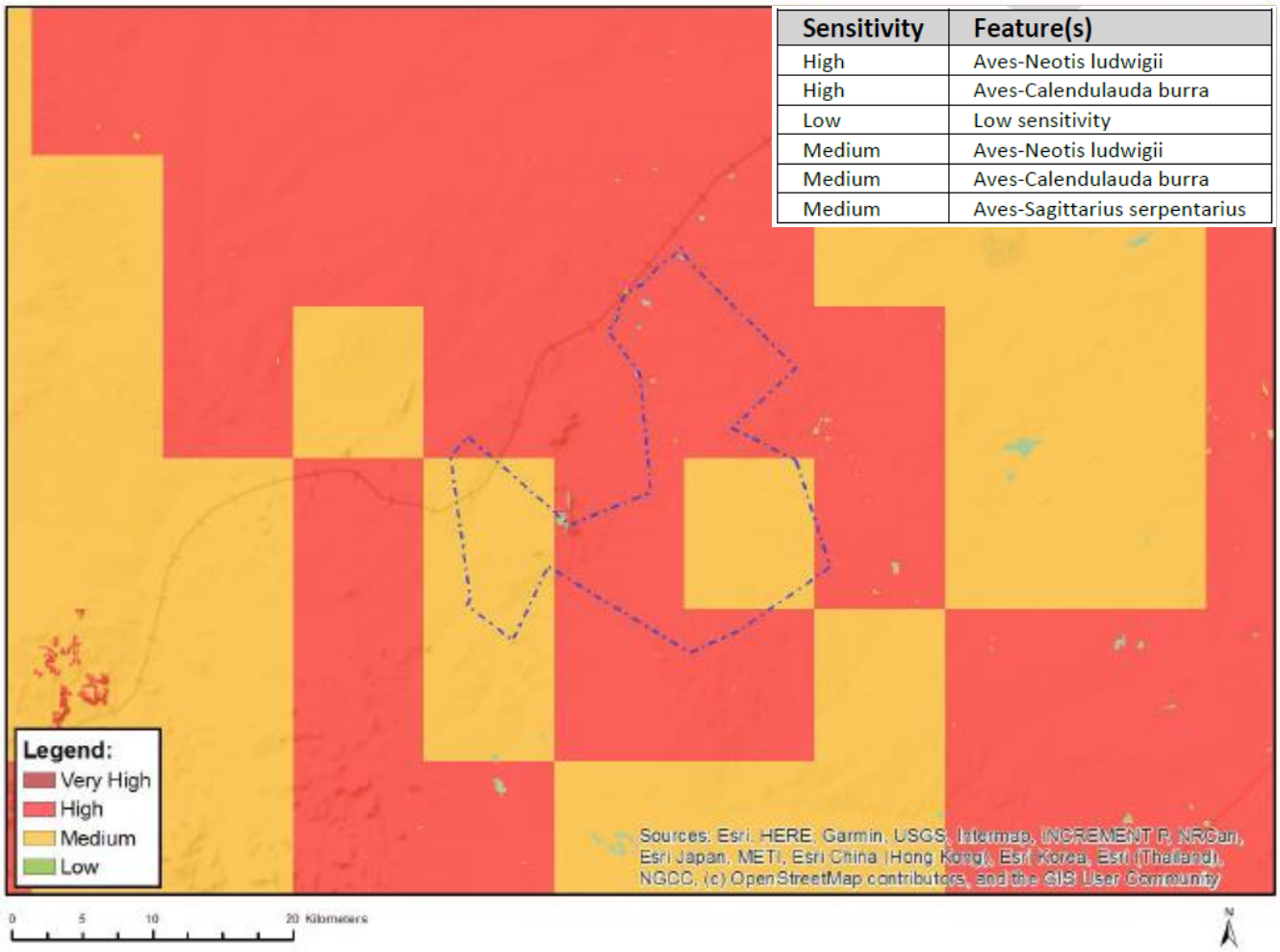
The Minister of Environment, Forestry and Fisheries, gave notice that the submission of a report generated from the national web-based environmental screening tool[1], as contemplated in Regulation 16(1)(b)(v) of the Environmental Impact Assessment Regulations, 2014, published under Government Notice 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 relative animal species theme is indicated as high sensitivity, due to confirmed presence of two Red List species classified as Endangered, *Neotis ludwigii and Calendulauda burra* (Figure 2-1). Accordingly, a full EIA assessment is required as per the relevant protocol.

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



Sensitivity	Feature(s)
High	Aves-Neotis ludwigii
High	Aves-Calendulauda burra
Low	Low sensitivity
Medium	Aves-Neotis ludwigii
Medium	Aves-Calendulauda burra
Medium	Aves-Sagittarius serpentarius

Figure 2-1: Screening tool map of relative animal species theme sensitivity for the proposed Lesaka 1 SEF.

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 Lesaka 1 SEF is not located in a REDZ which ensures that the study must fulfil a Scoping & EIA process.

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 (of which this report services the Tier 2 component):

Tier 1

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.

Tier 2

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.

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 Lesaka 1 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 (3030_1920, 3030_1925, 3030_1930, 3035_1920, 3035_1925, 3035_1930 3040,_1920, 3040_1925, 3040_1930 Figure 3-1: The proposed Lesaka 1 SEF in relation to the SABAP2 pentads.

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

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 (priority) 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:

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

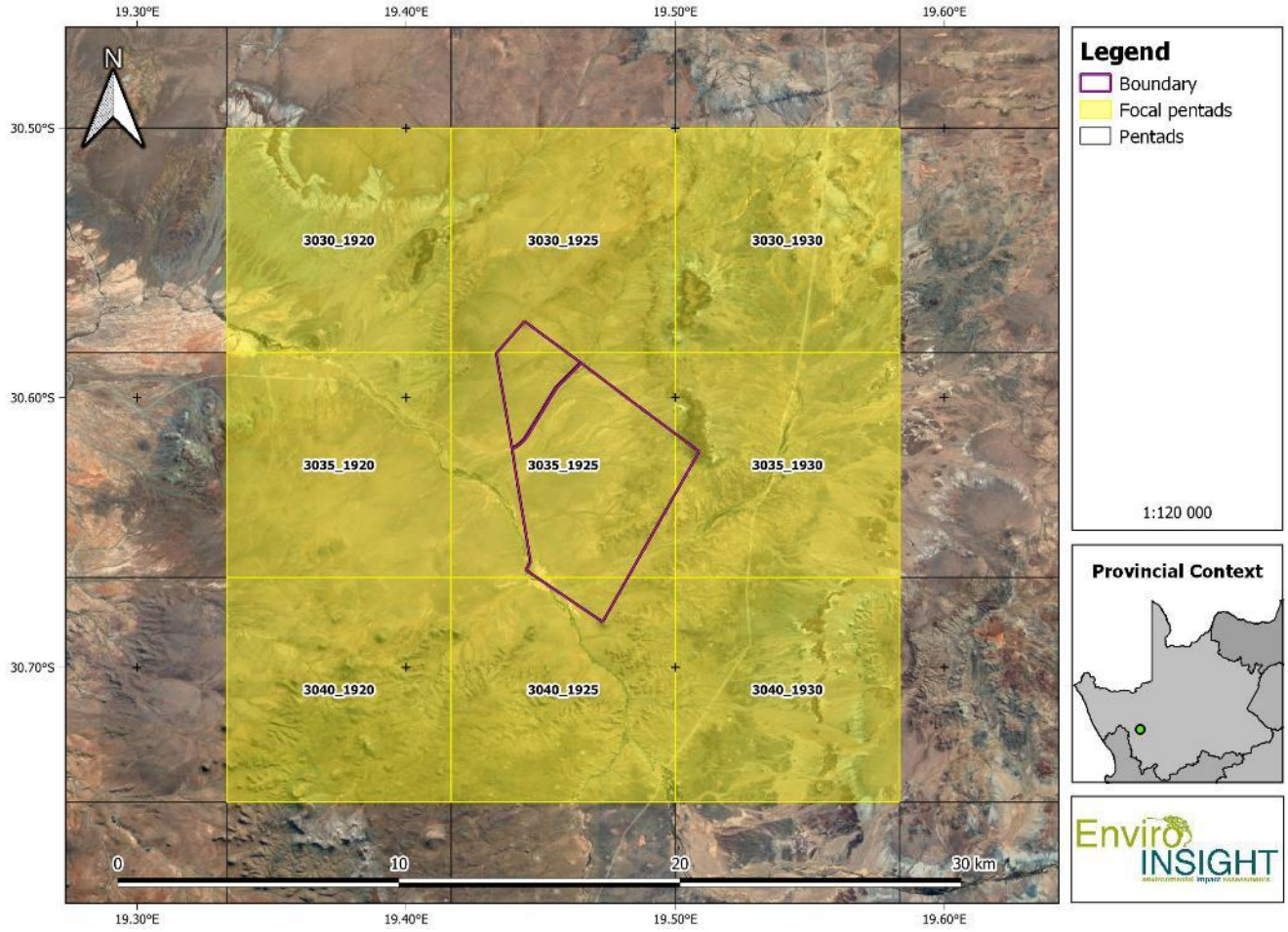


Figure 3-1: The proposed Lesaka 1 SEF in relation to the SABAP2 pentads.

3.3 PRECONSTRUCTION BIRD MONITORING SURVEY DESIGN

The proposed study area is classified as a Regime 2 based on the size of the study area, high avifaunal sensitivity and type of technology that will be used for the proposed project. The avifaunal sensitivity was also 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 Important Bird and Biodiversity Areas.

Based on the site sensitivity, a Regime 2 assessment was followed. The duration, in terms of data collection, for this study was 1 reconnaissance and 2 peak season visits of 3 days. This complied 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 dry-season 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 July 2022, during sub-optimal conditions where the area receives the most rainfall but is extremely cold with low activity. During the site visits, sampling was done by means of walking and driving transects in and around the study area. Waterbodies in- and outside of the study area were identified and observed whilst powerlines and pylons were scanned for any possible nests from sensitive bird species. The second site visit was conducted in October 2022 (Spring). The final site visit was conducted during the December season. All site visits 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 determined after the first day of the first site visit (**Error! Not a valid bookmark self-reference.**). Additional methods that commenced during the data collection site visit included nesting sites and Coordinated Waterbird Counts, (CWAC) (where possible).

Table 3-1: Avifauna monitoring sampling period for the Lesaka 1 SEF.

Date	Season	Methodology applied*
July 2022 (dry season) – Preassessment and SSV	Winter	WT, DT, NE, WB establishment
October 2022 – Second survey	Spring	WT, DT, NE, WB
December 2022 – Third survey	Summer	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

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 facilities in order to maximize the comparative value of the data which is 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 end with a fixed sample point. These transects were 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 was used), who records 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 be 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 the October Spring season and was repeated in the Summer (December) season. Surveys commenced mostly after sunrise and are 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 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 are 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 travels slowly in a vehicle recording all species on both sides of the drive transect. The observer stops at regular intervals (every 300 m) to scan the environment with binoculars. The number, distance and locations of each driving transects were determined during the first site visit in July. The driving and walking transects are shown in Figure 3-2: The Driving and Walking Transects identified for the Project Area (PA)

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, were searched for 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 Incidental or Random 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 are 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).

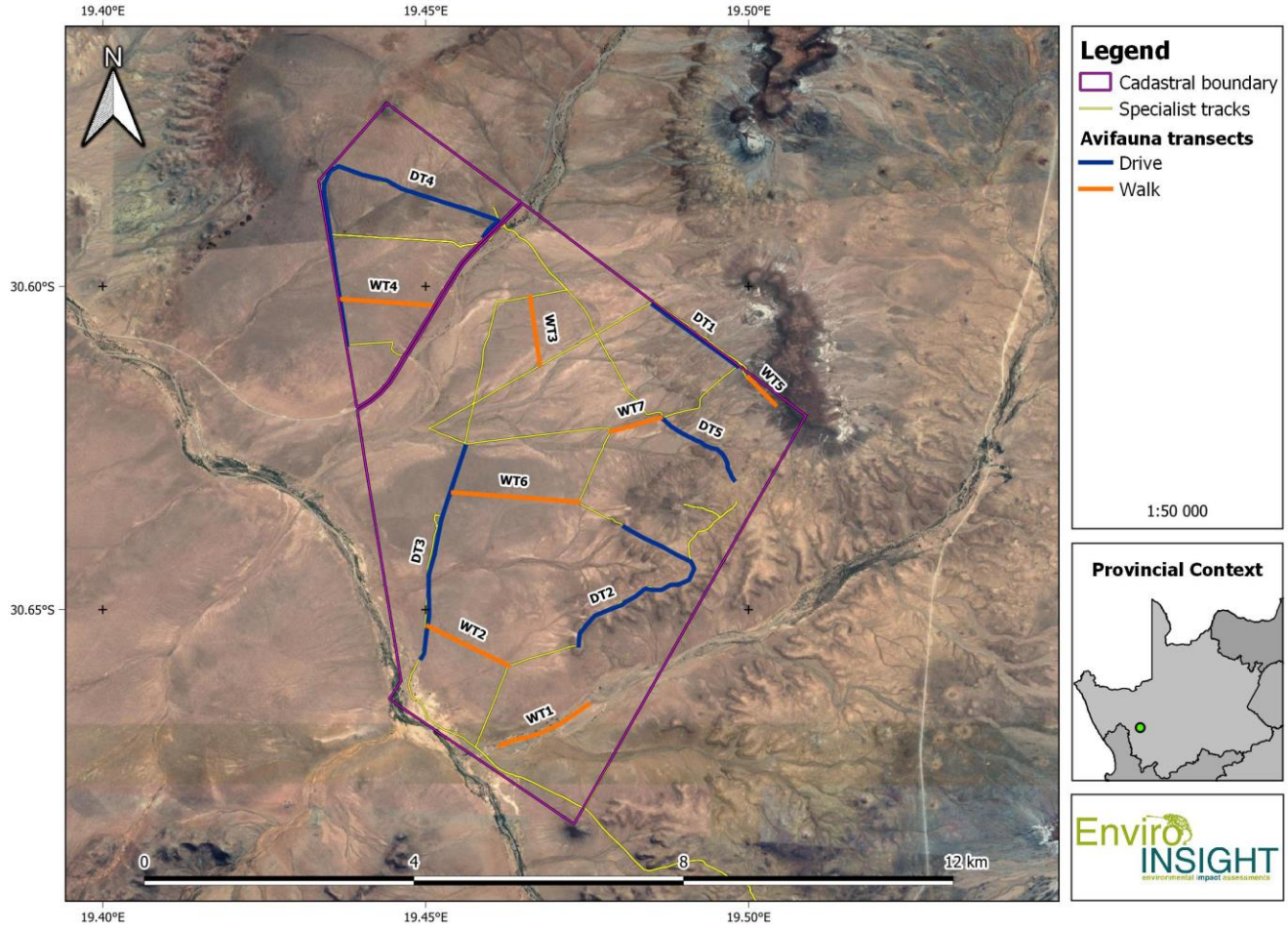


Figure 3-2: The Driving and Walking Transects identified for the Project Area (PA)

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).

Priority species: any species which is qualifies as high risk to impacts from solar facilities as suggested by Jenkins *et al. (2017).*

3.5 IMPACT ASSESSMENT

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact (e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence). Significance is calculated as shown in Table 1.

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

Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue/impact is also assessed according to the various project

stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue, the following criteria (including an allocated point system) is used.

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		

1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.**		

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

RESULTS

4.1 REGIONAL CONTEXT

The study area is located in the Hantam Karoo vegetation type (Mucina & Rutherford, 2006 – as amended), listed as Least Threatened (Figure 4-1; Table 4-1).

Table 4-1: Attributes of the Hantam Karoo vegetation type (Mucina & Rutherford, 2006, as amended).

Name of vegetation type	**Hantam Karoo**
Code as used in the Book - contains space	**SKt2**
Conservation Target (percent of area) from NSBA	**18%**
Protected (percent of area) from NSBA	**0.1%**
Remaining (percent of area) from NSBA	**98.6%**
Description of conservation status from NSBA	**Least threatened**
Description of the Protection Status from NSBA	**Hardly protected**
Area (sqkm) of the full extent of the Vegetation Type	**7463.56**
Name of the Biome	**Succulent Karoo Biome**
Name of Group	**Trans-Escarpment Succulent Karoo Bioregion**
Name of Bioregion	**Trans-Escarpment Succulent Karoo Bioregion**

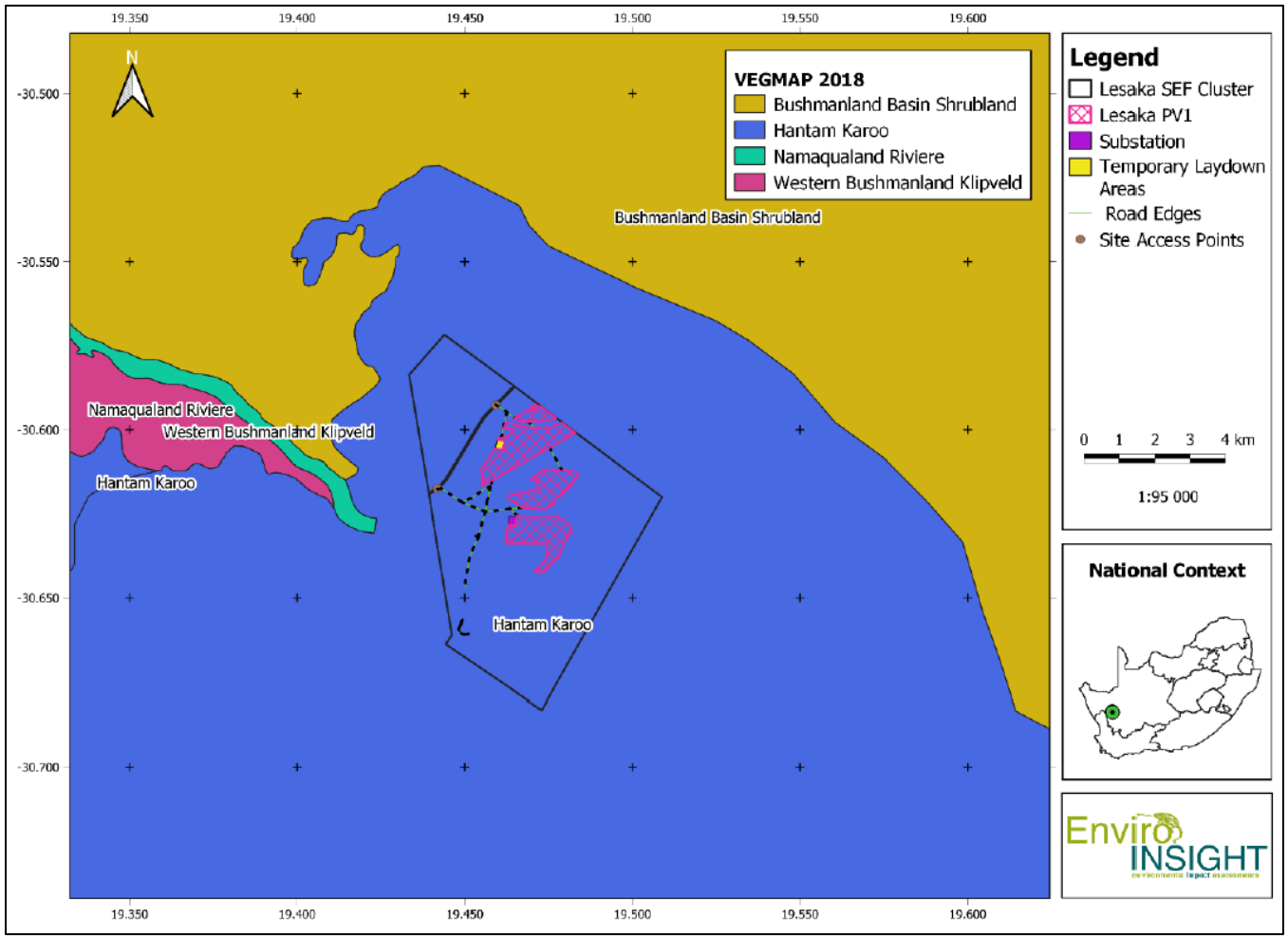


Figure 4-1: The proposed Lesaka 1 SEF in relation to regional vegetation types.

4.2 CRITICAL BIODIVERSITY AREAS (CBA)

The following CBA information has been extracted and mapped Verbatim from the Enviro-Insight Terrestrial Biodiversity survey conducted as part of the application process. The delineation and classification is highly relevant for ecological resilience, sensitivity and overall avifaunal potential.

The Northern Cape CBA Map (2016) identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of e landscape as a whole (Holness & Oosthuysen, 2016). Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated. Targets for terrestrial mecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes. CBAs 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 landuse 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 populations or habitat). All FEPA prioritized wetlands and rivers have a minimum category of CBA1, while all FEPA prioritised wetland clusters have a minimum category of CBA2.
- 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 in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas. For ESA's a change from the desired ecological state 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 a minimum category of ESA. According to the Northern Cape CBA Map (2016), the study area is mainly located in CBA2, with sections of CBA1, ESA and "Other Natural Areas" (Figure 5-3). CBA2 are mainly due to the FEPA catchment, FEPA rivers and 500m buffer and the vegetation type. The CBA1 are the NFEPA Rivers, Klein-Rooiberg and Rooiberg, both considered largely natural. The ESA towards the western section is the Krom River and associated wetlands, while the smaller scattered ESAs towards the eastern boundary are koppies which are large high value climate resilience areas.

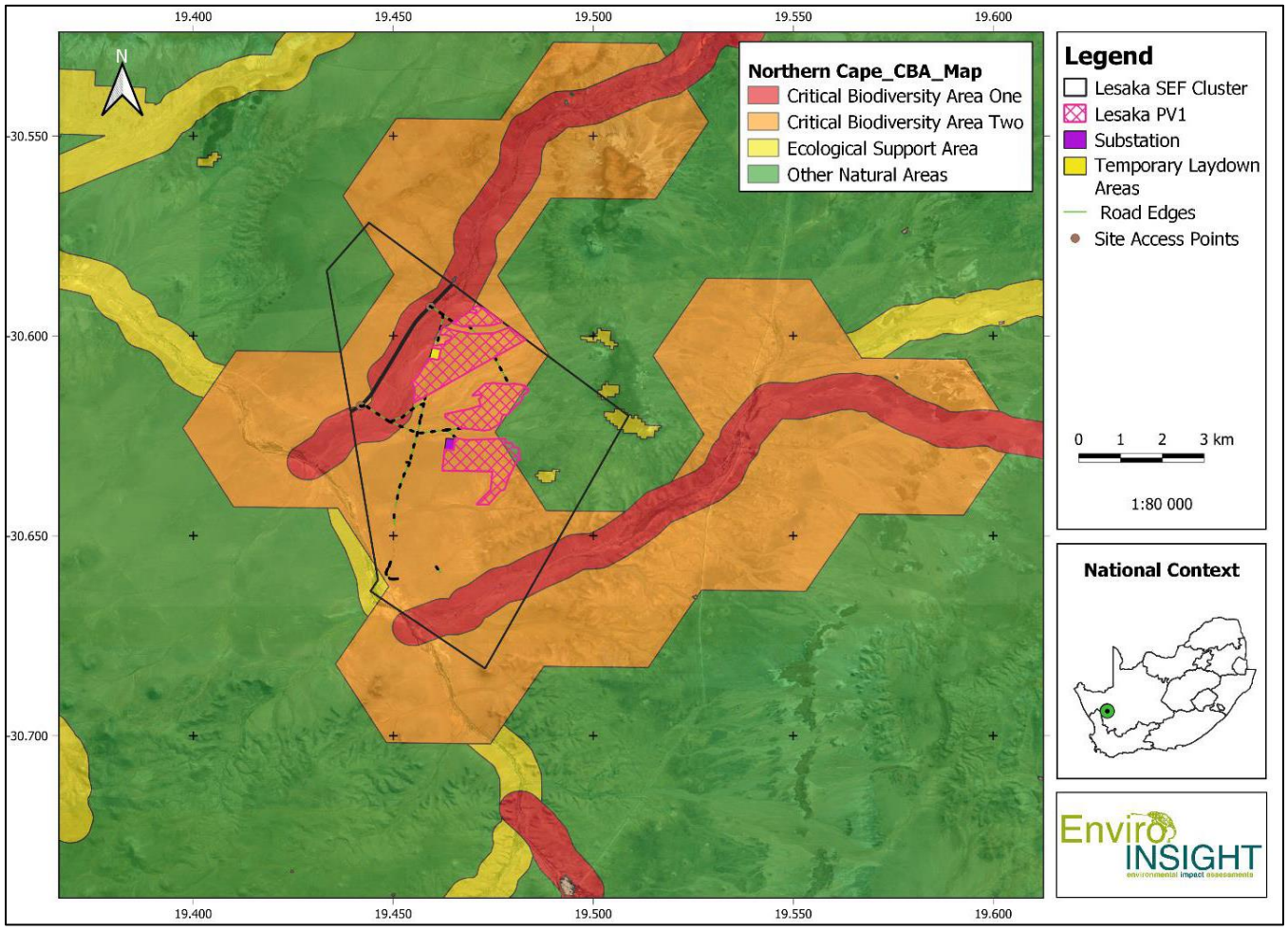


Figure 4-2: Lesaka 1 relative to the Northern Cape Critical Biodiversity Areas (2016)

4.3 DESCRIPTION OF THE MAJOR BIRD HABITATS

The overall habitat delineation as expressed below is more complex than the habitats described below. However, for the purposes of avifaunal monitoring, the monitoring can be confined to the below-described habitat types which will encompass all delineated habitats below.

4.3.1 Open Sandy Grassland/ Hantam Karoo Shrubland

Photographs	Description
	**Classification:** Sandy Grassland/ Hantam Karoo Shrubland **Hydrology:** No major hydrological impacts are expected from the development. **Geomorphology:** Undulating sandy grassy habitat with fewer flat areas and variable basal layer. **Vegetation:** Vegetation varies depending on slope and depth of topsoil and is characterized by grassland dominated and interspersed by negligible succulent/ Nama scrub (in varying ratios) karroid vegetation **Avifaunal Characteristics:** The sandy grassland habitats show a reduced structural complexity and vegetation which provides for a more generic species diversity albeit often at high densities of individuals. The habitat contains features that provide suitable foraging habitat for Red Lark (*Calendulauda burra*), Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*) and medium raptors Specifically, the habitat is characterised by a much-reduced rocky substrate and a higher prevalence of grassed red sand infusions which provides highly localized portions of optimal habitat for Red Larks. .

4.3.2 Open Karoo Shale

Photographs	Description
	**Classification:** Open Karoo Shale and Shrubland **Hydrology:** No major hydrological impacts are expected from the development **Geomorphology:** Undulating semi-succulent karroid habitat with large extents of flat terrain. **Vegetation:** Vegetation varies depending on soil quality but is mostly comprised of karroid shrub interspersed with grassy patches **Avifaunal Characteristics:** This habitat is largely concentrated in the north-east section of the SEF There is a localised high population density of small mammals/ ground birds such as rodents, springhares, hares and korhaans within the PAOI as well as the regional linkage to the drainage line habitats. The absence of these animals in high densities reduces the ecological importance of this habitat for avifauna. The shrubland habitats do not provide structural complexity allowing for a higher species diversity and often showed lower densities of avifauna due to the lack of specific prey species that are found within. However, the habitat vegetation provides suitable foraging habitat for the Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*) and medium sized raptors and thus maintains a medium sensitivity. .

4.3.3 Isolated Rocky Ridge "Koppies"

Photographs	Description
	**Classification:** Koppies and Ridges **Hydrology:** No major hydrological impacts are expected from the development although some ridges are associated with non-perennial watercourses and facultative wetlands. **Geomorphology:** Undulating semi-succulent karroid habitat with large extents of connected and isolated ridges. The ridges are divided into quartz and dolerite based. **Vegetation:** Vegetation varies depending on soil quality but is mostly comprised of karroid shrub interspersed with grassy patches **Avifaunal Characteristics:** Isolated rocky ridges, or "koppies", are situated in the south-eastern and north-eastern areas of the SEF. The rocky ridge found in the project footprint are linked to isolated inselbergs and connected ridges and hills which differ in size and height and can (regionally) form extensive ridge systems. The localised high population densities of small mammals such as rodents, springhares and hares within the PAOI as well as the local linkage to the drainage line habitats, elevates the overall ecological importance of this habitat for avifauna. The rocky habitats provide structural complexity which often showed higher diversity and densities of avifauna due to the abundance of prey species that are found in this habitat. The habitat vegetation provides suitable foraging, roosting and breeding habitat for the Ludwig's Bustard (*Neotis ludwigii*), Karoo Korhaan, Kori and large, medium and small raptors.

4.3.4 Drainage lines

Photographs	Watercourses and Drainage Lines
	**Classification:** Ephemeral and endorheic drainage lines **Hydrology:** No major hydrological impacts are expected from the development. **Geomorphology:** Channels varying in width and depth from large multi-channeled sandy gullies to shallow narrow channels. **Vegetation:** Vegetation varies depending on channel width and depth, where larger deep-rooted trees line larger channels with lower shrub layers characterising smaller drainage line systems. **Avifaunal Characteristics:** Drainage lines border the south-western and southern extremes of the SEF and enter the south-eastern and central areas. Avifaunal assemblages differed depending on the classification of the drainage line system as well as the season. Most of the drainage line systems are seasonally ephemeral or dry. Thus, most of the bird associations are linked to the prevailing vegetation and soil types within the delineated drainage line habitats. In summary, drainage lines with taller shrub and tree layers showed a much higher diversity of passerine species as well as sand-associates and ground-dwelling birds such as coursers and thick-knees. Species of conservation concern such as Red Lark and coursers were observed in varying densities. The seasonal drainage lines and accompanying riparian trees are linear dispersal corridors for terrestrial bird species. Much higher species diversity (as well as a unique composition) was observed in this habitat and therefore, these systems are classified to be of high avifaunal importance. The drainage lines act as important flight corridors for passerines and raptors between foraging and roosting sites.

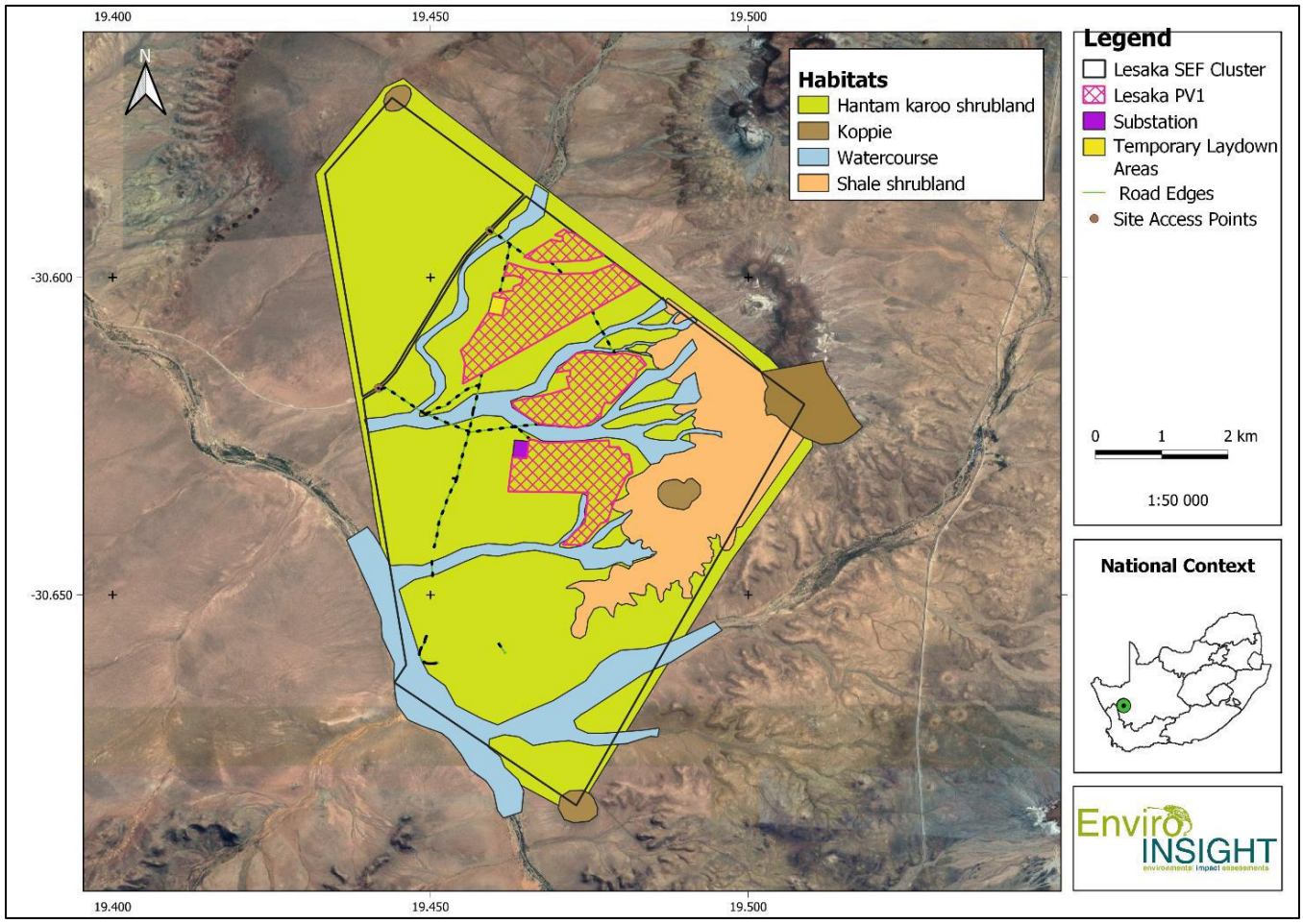


Figure 4-3: Delineated Habitat Types within the Lesaka 1 SEF cluster.

4.4 PROTECTED AREAS AND IMPORTANT BIRD (IBA) AND BIODIVERSITY AREAS

Figure 4-4 shows the identified IBAs in relation to the Lesaka 1 SEF. The Lesaka 1 SEF is not located in or directly adjacent to an Important Bird Area (IBA) or protected area. The closest IBA to the SEF is Bitterputs Conservation Area which is approximately 60 km north-west of the study area. The Bitterputs Conservation Area (SA036) is an arid landscape which consists of extensive sandy and gravel plains covered with sparse, perennial desert grassland. A few large salt pans are a unique habitat type in this IBA. The conservation area falls within the Bushmanland Bioregion and the Nama Karoo Biome. Three vegetation types are present: the Bushmanland Vloere (salt pans), Bushmanland Arid Grassland and Bushmanland Sandy Grassland. The ecosystem status for the entire area is Least Concern.

The Bitterputs Conservation Area is one of a few sites protecting both the globally threatened Red Lark (*Calendulauda burra)*, which inhabits the red sand dunes and sandy plains where there is mixed cover of grasses and dwarf shrubs, and the near-threatened Sclater's Lark (*Spizocorys sclateri).* This site also holds 16 of the 23 Namib-Karoo biome-restricted assemblage species and a host of other arid-zone birds. Other priority species, including globally threatened species, within this IBA include Ludwig's Bustard (*Neotis ludwigii),* Kori Bustard (*Ardeotis kori)*, Karoo Korhaan (*Eupodotis vigorsii)*, Secretarybird (*Sagittarius serpentarius)* and Lanner Falcon (*Falco biarmicus)*. Restricted-range and biome-restricted species are Stark's Lark (*Spizocorys starki)*, Karoo Long-billed Lark (*Certhilauda subcoronata)*, Black-eared Sparrow-Lark (*Eremopterix australis)*, Tractrac Chat (*Cercomela tractrac)*, Sickle-winged Chat (*C. sinuate)*, Karoo Chat (*C. schlegelii)*, Karoo Eremomela (*Eremomela gregalis)*, Cinnamon-breasted Warbler (*Euryptila subcinnamomea)* and Black-headed Canary (*Serinus alario)*.

The Bitterputs Conservation Area is one of three Bushmanland IBAs important for the conservation of endemic lark species. There has been a c. 75% loss of optimal habitat for the Red Lark over the past 100 years. The disappearance of this species from ranches where dune grassland has been replaced by ephemerals is probably linked to the reduction in grass awns for nesting, shelter and invertebrate and plant foods.

There is a serious threat from climate change, and it is predicted that temperatures will increase and rainfall decrease sharply in arid areas such as Bushmanland. Locally resident endemic larks, in particular, are at risk. Increased CO_2 can lead to the increase of C3 plants (shrubs) at the expense of C4 plants (mainly grasses), causing a shift in vegetation diversity and structure and making the habitat unsuitable for some species. It is expected that the Red Lark will not meet the challenge of global warming (BirdLife International, 2021).

Currently no part of this IBA is formally conserved and no conservation actions have been implemented. Bitterputs falls within the Central Astronomy Advantage Area, which has restrictions on activities that can take place in it. This could result in some protection for the IBA.

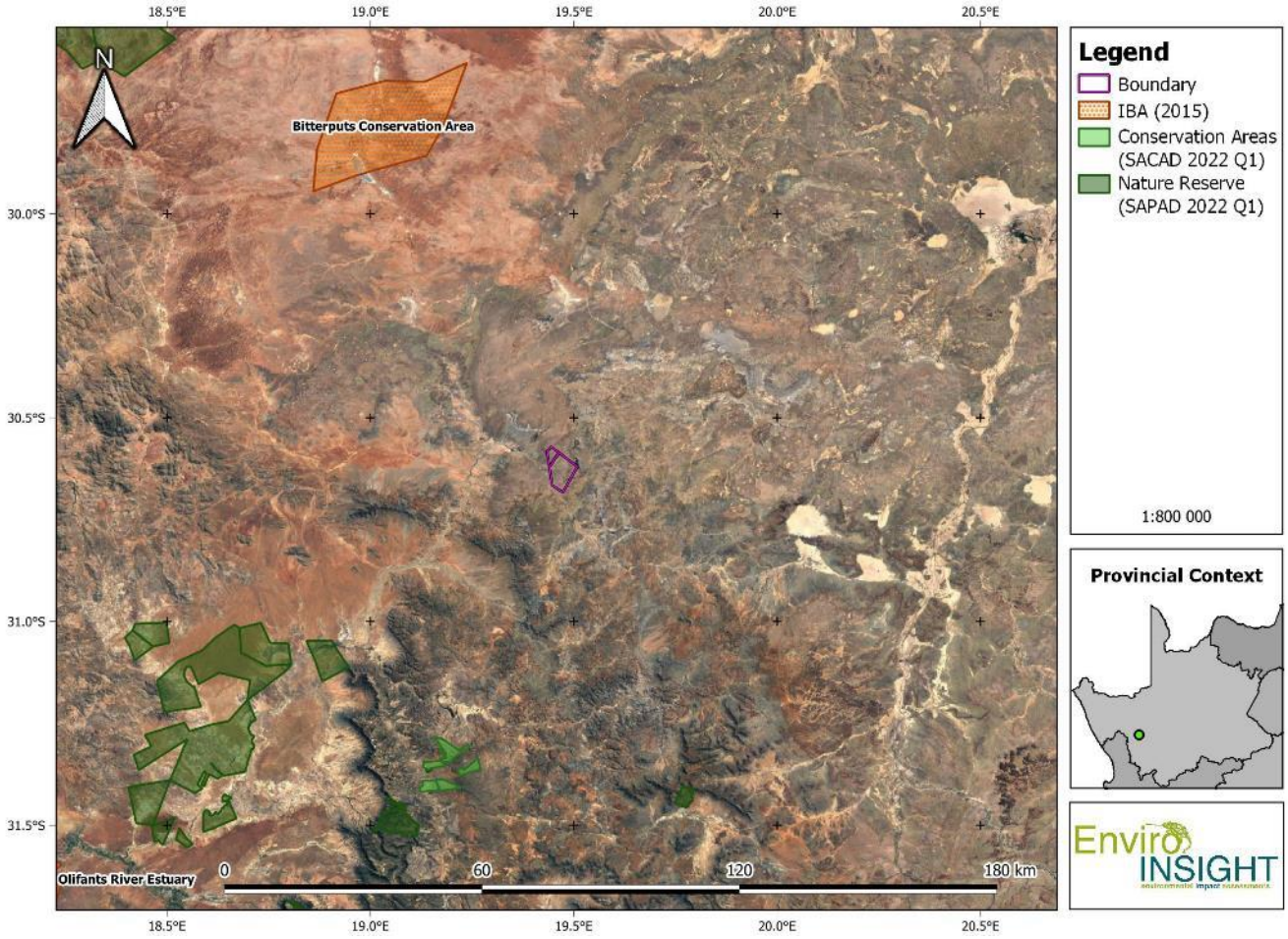


Figure 4-4: Important Bird Areas in the region in relation to the Lesaka 1 SEF

4.5 EXPECTED AND OBSERVED AVIFAUNA

4.5.1 Total species composition and abundance

A relatively moderate diversity of 93 bird species for the area have been recorded within the 16 SABAP pentads in which the study area is situated. A total of 58 (62.3%) bird species were recorded in the greater area (9 pentads), as shown in

s.

4.5.1 Priority species list

A list of expected and observed priority species in the project area is provided in Table 4-2. A total of 20 priority species are expected to occur on and surrounding the study area, of which 14 have been recorded either within or adjacent to the project area footprint (PAOI). It is clear from Table 4-2 that numerous priority avifauna species occur within the PAOI and can be expected to interact with the proposed Lesaka 1 SEF. Indeed, Van Rooyen (2020) suggests that displacement effects of the renewable energy developments are more significant than direct mortality which can greatly affect habitat specific species such as Red Lark and Ludwig's Bustard. Consequently, all applicable data of priority species observed within the monitoring seasons of field surveys allowed for careful evaluation of potential impacts and application of suitable mitigation measures to reduce these impacts where possible.

Table 4-2: Priority avifauna species list (both expected and recorded) for the study area.

Common name	Scientific name	Global Status	Regional Status	South African Endemic	Current pre-construction monitoring
Bustard, Kori	*Ardeotis kori*	NT	NT		
Bustard, Ludwig's	*Neotis ludwigii*	EN	EN		X
Buzzard, Jackal	*Buteo rufofuscus*	LC	LC	X	
Courser, Burchell's	*Cursorius rufus*	LC	VU	X	X
Courser, Double-banded	*Rhinoptilus africanus*	LC	NT		X
Eagle, Booted	*Aquila pennatus*	LC	LC		X
Eagle, Martial (nest only)	*Polemaetus bellicosus*	EN	EN		X
Eagle, Verreaux's	*Aquila verreauxii*	LC	VU		
Eagle-owl, Cape	*Bubo capensis*	LC	LC		
Eagle-owl, Spotted	*Bubo africanus*	LC	LC		X
Falcon, Lanner	*Falco biarmicus*	LC	VU		X
Goshawk, Southern Pale Chanting	*Melierax canorus*	LC	LC	X	X

Common name	Scientific name	Global Status	Regional Status	South African Endemic	Current pre-construction monitoring
Kestrel, Greater	*Falco rupicoloides*	LC	LC		X
Kestrel, lesser	*Falco naumanni*	LC	LC		X
Kite, Black-winged	*Elanus caeruleus*	LC	LC		X
Korhaan, Karoo	*Eupodotis vigorsii*	LC	NT	X	X
Korhaan, Northern Black	*Afrotis afraoides*	LC	LC		
Lark, Red	*Calendulauda burra*	VU	VU		X
Lark, Sclater's	*Spizocorys sclateri*	NT	NT		
Secretarybird	*Sagittarius serpentarius*	EN	VU		
Snake- Eagle, Black-chested	*Circaetus pectoralis*	LC	LC		X

According to the literature, 15 Species of Conservation Concern (SCC) are known to occur in the region with six (6) species confirmed during the complete surveys, representing a moderate success rate. Of the expected SCC and according to Taylor *et al.* (2015), two of the species are Endangered, five of the species are Vulnerable and four are Near-Threatened. For the current study, it was deemed unnecessary that all SCC should be discussed in intensive detail unless deemed highly relevant to the proposed development. However, all SCC recorded (Table 4-7) and expected are described in brief below. Specifically excluded from initial discussions was Lappet-faced Vulture (rare vagrant). Selected relevant species that are possibly susceptible to the proposed development were discussed below in greater detail, which include specific (Guideline-based) recommendations for monitoring and mitigation.

Table 4-3: SCC avifauna species list (both expected and recorded) for the study area.

		Season			
English IOC Name	**Scientific Name**	**Spring**	**Summer**	**Winter**	**Total**
Double-banded Courser	*Rhinoptilus africanus*	1	6	3	10
Karoo Korhaan	*Eupodotis vigorsii*	1	14	17	32
Lanner Falcon	*Falco biarmicus*		3		3
Ludwig's Bustard	*Neotis ludwigii*	7	6	21	34
Martial Eagle	*Polemaetus bellicosus*		NEST SITES ONLY		
Red Lark	*Calendulauda burra*	8	14	10	32
Grand Total		**4**	**16**	**37**	**48**	**111**

4.5.1 Nest Survey

Nest sites were searched for during the surveys on all suitable sites which included windmills, trees, pylons, bridges and masts, representing the most potential roost and nesting sites for raptors. Water bodies and drainage lines showed potential for roost and nesting sites for multiple species, but the high degree of seasonality in the area may not guarantee successful breeding every year. During the survey and above average rainfall conditions was representative of optimal breeding habitat for water associated species. Highly significant breeding habitat was recorded during the survey and Ludwig's Bustard is considered a resident and likely to be breeding (mating) on site. Power line pylons were examined for raptor nesting sites to be discussed for Martial Eagles below. However, it is vital to understand that the abandoned large raptor (Martial Eagle) nests driving the site sensitivity analysis still hold significance given the potential for recolonisation as well the use of the nests by other priority species such as Lanner Falcons

4.5.1 Martial Eagle Nest Site

Utilising the interpretations stipulated above and in the absence of any mitigation measures, a buffer of 1 km is recommended as an exclusion area around the two Martial Eagle nests, which were confirmed after the completion of the pre-construction monitoring. There is currently no species-specific guideline for the Martial Eagle, and buffer areas around nest sites remains a scientifically contentious topic of discussion in the industry without rigorous scientific studies providing necessary guidance (for example, Murgatroyd, Bouten & Amar 2021). The only published recommended buffer to implement around raptor nests in South Africa is for the Verreauxs' Eagle (Ralston-Paton, 2017), which dictates that a precautionary buffer of 3 km is recommended and may be reduced or increased based on the results of rigorous avifaunal surveys. It must be stated that this is for Wind Energy Facilities and the current recommended buffering of 1km Figure 4-5 for the currently inactive martial eagle nests is considered adequate, subject to monitoring with the photographic examples of the two martial eagle nests shown as Figure 4-6 and Figure 4-7.

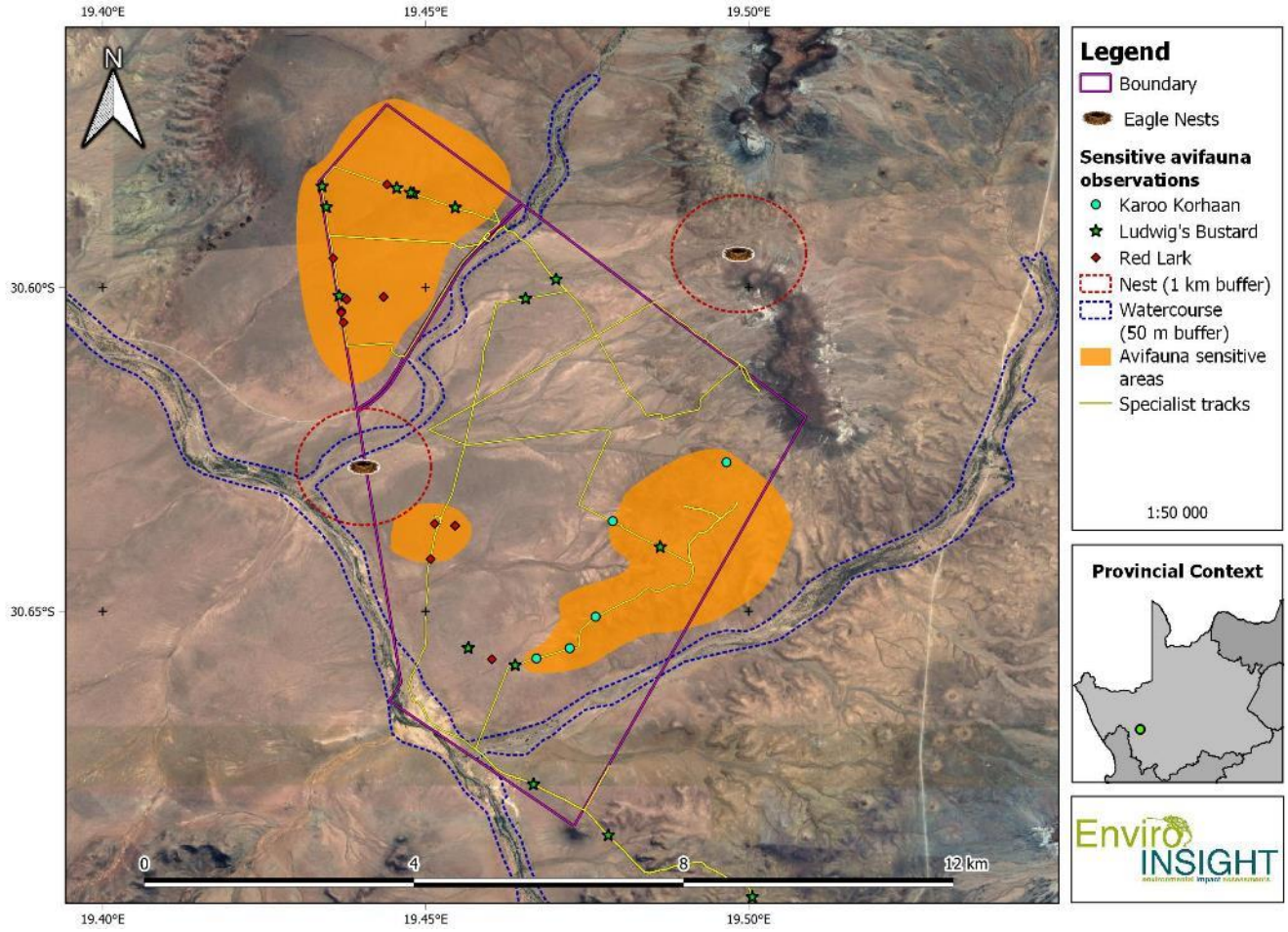


Figure 4-5: Site records and delineations of associated habitats within the Project Footprint.

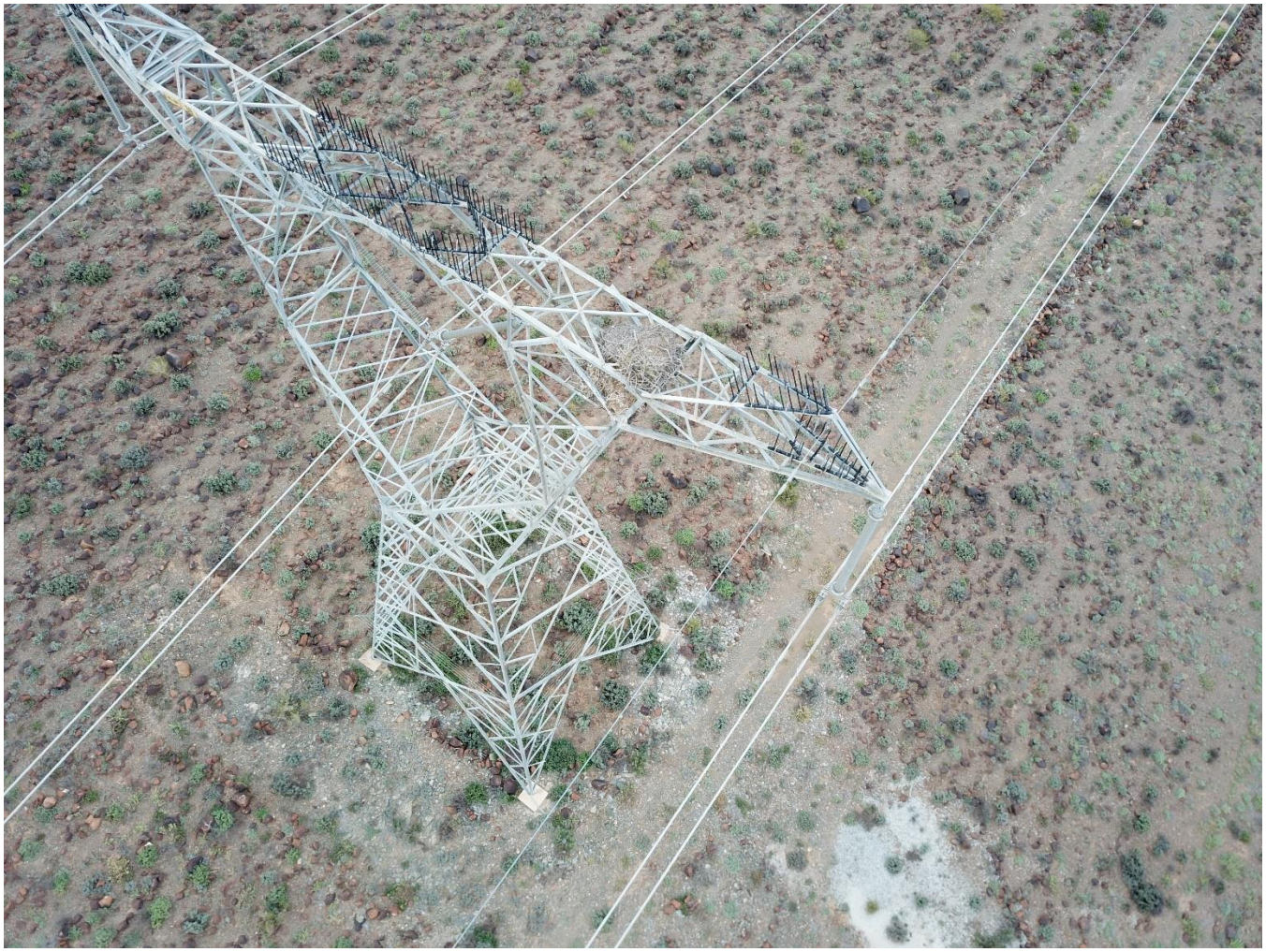


Figure 4-6: Martial Eagle Nest Lesaka East within the Project Footprint.

Figure 4-7: Martial Eagle Nest Lesaka West

4.6 PRECONSTRUCTION MONITORING MAIN RESULTS

4.6.1 Walked and Driven Transect Count

In total, more than 25 kilometres of transects took place for the Lesaka total PA over the three seasons which was considered to be excellent coverage. This was used to calculate the Index of Kilometric Abundance below. SEFs do not have the same collision risk calculation requirements as WEFs but overall, these figures were excellent for providing interpretative figures in order to calculate relative local abundances of avifauna as well as overall (general risks).

Table 4-4: SCC avifauna species list (both expected and recorded) for the study area.

Name	Length (m)
DT 1	1633,695
DT 2	3674,721
DT 3	3712,698
DT 4	6086,125
DT 5	1614,871
WT 1	1508,567
WT 2	1367,36
WT 3	1160,899
WT 4	1397,424
WT 5	613,495
WT 6	1871,901
WT 7	772,142
Total	**25413,898**

During the walked transects, the total number of individual birds (per species) were recorded regardless of their priority status. Notable Priority Species recorded during walked transects included Ludwig's Bustards, Red Larks, Double-banded Coursers, Black-chested Snake Eagle and various raptor species. The main focus of drive transects were the recording of large birds and raptors. For the walked transects, a total of 689 individual bird contacts were recorded. For the driven transects, a total of 501 individual bird contacts were recorded. The summary data for priority species observations made from these transects are provided in Table 4-5 . Detailed data for priority species observations made from these transects are provided in Table 4-6Table 4-5.

4.6.2 Combined Species Summary

Using the prescribed methodology, A total of 1158 bird contacts were made within the greater PA (divided into 48 species) of which non-priority species were recorded on 1036 occasions (divided into 38 species) and priority species were recorded on 122 (10.5%) occasions divided into 10 species. The overwhelming majority of the contacts were not classified as Priority or SCC

and were considered to be common associates within the habitats delineated in the greater PA. These species are highly fecund and endure (without population declines) normal natural anthropogenic impacts such as drought, livestock agriculture, human settlements, roads, railway lines and powerlines. The establishment of SEF infrastructure is unlikely to affect significantly or fatally impact the population dynamics of these species. Of the122 Priority species Contacts, 91.9 % (111) were SCC which requires in depth discussion. The SCC observed and expected are discussed in detail in Table 4-7.

The combined priority and non-priority (1158 contacts over 25.41 km) calculated Index of Kilometric Abundance (IKA = birds/km) IKA is 45.57 birds/km which is relatively low and reflects the highly arid environment and low overall bird densities in the PA. However, these data (as is reflected by the arid ecology of the area) can be highly misleading as some areas of the PA exhibit very high densities of all avifauna and some Priority Species and SCC (such as drainage lines, water points and Red Larks near sandy dunes). Species density and diversity of avifaunal assemblages occupying the (temporarily) forage rich habitats of the PAOI can be affected through seasonal ecological changes caused by events such as drought or high rainfall events. It must again be stressed that although the IKA is not considered high, when applied to Priority Species (4.8 IKA) but surprisingly high for SCC (4.01 IKA) which made up a significant proposition of all the priority species observed during the study. The fact that Ludwig's Bustard and Red Larks were recorded extremely frequently is of particular concern. Although these SCC are high profile and sensitive to WEF developments, they are less susceptible to SEF developments. In addition, the frequency of occurrence suggested these populations are permanent breeding residents. **As a result, the risks and mitigations are considered to be significant** and are discussed in t eh impact Assessment below.

Somewhat unsurprisingly from an ecological point of view, the winter survey yielded a lower density count than the summer survey and this may be explained by the prevailing level of disturbance within the PA which sees a higher concentration of anthropogenic passerines around water points and agricultural feed points during the hottest months. Photographic evidence of SCC observed during the current study is provided in Figure 4-8 and Figure 4-9 .

Table 4-5: Per season priority species recorded during Drive Transects (DT) and Walked Transects (WT).

			Drive Transects					Walk Transects							Incidentals	
Season	**English IOC Name**	**Scientific Name**	**DT1**	**DT2**	**DT3**	**DT4**	**DT5**	**WT1**	**WT2**	**WT3**	**WT4**	**WT5**	**WT6**	**WT7**	**Random**	**Grand Total**
Spring	Booted Eagle	*Hieraaetus pennatus*													1	1
	Double-banded Courser	*Rhinoptilus africanus*													1	1
	Karoo Korhaan	*Eupodotis vigorsii*													1	1
	Ludwig's Bustard	*Neotis ludwigii*				3									4	7
	Pale Chanting Goshawk	*Melierax canorus*													1	1
	Pied Crow	*Corvus albus*							1							1
	Red Lark	*Calendulauda burra*				2			1		3		1		1	8
	Spring Total		**7**	**0**	**0**	**0**	**5**	**0**	**0**	**2**	**0**	**3**	**0**	**1**	**0**	**9**	**20**
Summer	Black-chested Snake Eagle	*Circaetus pectoralis*				1	1									2
	Double-banded Courser	*Rhinoptilus africanus*					2		2		2					6
	Karoo Korhaan	*Eupodotis vigorsii*			9				2						3	14
	Lanner Falcon	*Falco biarmicus*		1						1				1		3
	Ludwig's Bustard	*Neotis ludwigii*								3					3	6
	Pale Chanting Goshawk	*Melierax canorus*									1					1
	Pied Crow	*Corvus albus*				3	1			1	2					7
	Red Lark	*Calendulauda burra*		2	2		2			2	4				2	14
	Summer Total		**8**	**3**	**11**	**4**	**6**	**0**	**2**	**2**	**7**	**9**	**0**	**0**	**1**	**8**	**53**
Winter	Double-banded Courser	*Rhinoptilus africanus*								1					2	3
	Greater Kestrel	*Falco rupicoloides*													1	1
	Karoo Korhaan	*Eupodotis vigorsii*			3			3							11	17
	Ludwig's Bustard	*Neotis ludwigii*			2		1			1					17	21
	Pale Chanting Goshawk	*Melierax canorus*													1	1

	Pied Crow	*Corvus albus*														3	3
	Red Lark	*Calendulauda burra*					3				2	2				3	10
	Rock Kestrel	*Falco rupicolus*														1	1
	Winter Total		**8**	**0**	**5**	**0**	**4**	**3**	**0**	**0**	**4**	**2**	**0**	**0**	**0**	**39**	**57**
Grand Total			**10**	**3**	**16**	**4**	**15**	**3**	**2**	**4**	**11**	**14**	**0**	**1**	**1**	**56**	**130**

Table 4-6: Per season priority species recorded per season

		Season			
English IOC Name	**Scientific Name**	**Spring**	**Summer**	**Winter**	**Total**
Black-chested Snake Eagle	*Circaetus pectoralis*		2		2
Booted Eagle	*Hieraaetus pennatus*	1			1
Greater Kestrel	*Falco rupicoloides*			1	1
Karoo Korhaan	*Eupodotis vigorsii*	1	14	17	33
Lanner Falcon	*Falco biarmicus*		3		3
Ludwig's Bustard	*Neotis ludwigii*	7	6	21	35
Pale Chanting Goshawk	*Melierax canorus*	1	1	1	3
Pied Crow	*Corvus albus*	1	7	3	11
Red Lark	*Calendulauda burra*	8	14	10	32
Rock Kestrel	*Falco rupicolus*			1	1
Grand Total		**10**	**19**	**47**	**54**	**122**

Figure 4-8: Ludwig's Bustard flying over the proposed Lesaka 1 SEF Cluster.

Figure 4-9: Red Lark observed within the Lesaka 1 SEF

Table 4-7: Summary of avifauna species of conservation concern of known distribution, previously recorded in or adjacent to the study area pentads.

Species	Global Conservation Status[4]	National Conservation Status[5]	Preferred Habitat	Potential likelihood of occurrence on study area and potential risk posed from the SEF
Ardeotis kori (Kori Bustard)	Near Threatened	Near Threatened	Primary upland grassland, desert savanna and karoo with foraging and roosting particularly on rocky/ hilly terrain.	Unconfirmed: Low densities throughout the region and PAOI but surprisingly low densities within the study area. The species is likely to be a breeding resident within or adjacent to the study area. A large bodied species, it is highly susceptible to SEF development activities especially in relation to powerline collisions.
Spizocorys sclateri (Sclater's lark)	Near Threatened	Near Threatened	Dry shrubland, karroid drainage lines and karoo shrubveld	Unconfirmed: High densities throughout the region but uncommon in the study area. The species is likely to be a breeding resident within or adjacent to the study area. A localised low flying passerine, it is not highly susceptible to SEF development activities but is threatened by habitat loss
Calendulauda burra (Red lark)	Vulnerable	Vulnerable	Red dune open shrubland/ grassy duneveld	**Confirmed**: Moderate densities throughout the region but locally common in the project footprint. The species is likely to be a breeding resident within or adjacent to the study area. A localised low flying passerine, it is not susceptible to SEF development activities but is more threatened by habitat loss.
Aquila verreauxii (Verreaux's' Eagle)	-	Vulnerable	Mountainous areas or areas with prominent outcrops with a high prey base (e.g. hyrax)	**Regionally confirmed**, absent from study area: Frequent foraging resident throughout the PAOI but far less frequent within the study areas due to the large distances to the mountainous preferred habitats and a general lack of localised abundant prey. Localised areas exhibiting high abundance of hyraxes and rock rabbits should be considered highly sensitive to the species. The species is susceptible to poisoning events and SEF facilities with a low risk from proposed activities.
Polemaetus bellicosus (Martial Eagle)	Endangered	Endangered	Open bushveld, desert savanna and karoo with adequate roosting and foraging potential.	**Confirmed** (nest only): A rare breeding resident and foraging visitor dependent on adequate food supply and roosts. At least one nest has been confirmed adjacent to the proposed SEF footprint but no sightings in terms of foraging activity was recorded on the development footprint area. Typically, the

[4] IUCN 2021
[5] Taylor et al. 2015

Species	Global Conservation Status[4]	National Conservation Status[5]	Preferred Habitat	Potential likelihood of occurrence on study area and potential risk posed from the SEF
				species would exhibit a Low to Moderate risk to the proposed development activities.
Rhinoptilus africanus (Double-banded Courser)	Least Concern	Near Threatened	Flat, stony or gravelly, semi-desert terrains with firm, sandy soil and tufty grass or thorn scrub	**Confirmed**. A fairly common breeding resident recorded in the current study. Not highly vulnerable to the proposed activities due to ground dwelling habitats. .
Falco biarmicus (Lanner Falcon)	-	Vulnerable	Varied, but prefers to breed in mountainous areas.	**Confirmed**: A fairly common foraging migrant recorded in the current study and expected periodically to occur. Not highly vulnerable to the proposed activities.
Neotis ludwigii (Ludwig's Bustard)	Endangered	Endangered	Primary upland grassland, desert savanna and karoo with foraging and roosting particularly on rocky/ hilly terrain.	**Confirmed:** High densities throughout the study areas. The species is likely to be a breeding resident within or adjacent to the study area. A large bodied species, it is moderately susceptible to SEF development activities but is more likely to be affected by associated infrastructure (powerlines).
Sagittarius serpentarius (Secretarybird)	Vulnerable	Vulnerable	Prefers open grassland or lightly wooded habitat although forages extensively in open karroid savannah.	Unlikely: Irregular low-density resident which is most likely of lower risk to the proposed development activities given ground foraging habitats. In addition, persistent long term regional drought may have significantly decimated local prey sources (especially snakes) thus further reducing the likelihood of persisting local populations of significant densities.
Eupodotis vigorsii (Karoo Korhaan)	Near threatened	Near threatened	Karroid habitats, large saline pans and shallow impoundments.	**Confirmed**: Common resident occurring near areas with drainage lines (including ephemeral) and open areas. Individually susceptible to SEF development activities but as a species is considered low risk.
Falco naumanni (Lesser Kestrel)	Near Threatened	Near Threatened	Widespread species prefers open grassland or lightly wooded habitat although forages extensively in open karroid savannah. Roosts collectively in locations with tall trees.	**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.

Species	Global Conservation Status[4]	National Conservation Status[5]	Preferred Habitat	Potential likelihood of occurrence on study area and potential risk posed from the SEF

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 (to be assessed in separate application). In some cases, collision can be associated with combustion (streamers) from 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 are addressed in this final EIA report with operational phase monitoring 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.

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 must 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 must be minimised through the application of known and previously tested mitigation measures.

Potential 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 avifauna-specific highly sensitive areas and their associated buffers;
- Impact can be mitigated by timing construction in order to avoid breeding periods of species;
- 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;
- 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;

- All powerline infrastructure must be fitted with approved bird diverters in order to provide visibility for large-bodied birds while all fences must be set back from 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;
- 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;
- All habitat attractants should be eliminated so that avifaunal populations will not embed 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;
- The application of strict chemical control protocols which are not detrimental to avifauna.

Table 5-1: Impacts Associated with the SEF

Lesaka 1 SEF																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				

Habitat destruction	Significant habitat loss (including foraging and breeding) and fragmentation due to displacement (avoidance of disturbance) because 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.	3	4	4	4	4	3	66	-	Very High	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, high value sandy dunes, 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, and for all panel infrastructure, **commencement** of construction should be, if possible, limited to the months of December, January, February, March, April, May, September, October, November (latest) to minimise dust effects and subsequent destruction of the avifaunal habitats, especially during foraging and breeding season. **For detailed wetland specific mitigation measures, refer to Section 5.3 below.**	2	2	2	2	4	2	24	-	Med

Disturbance of bird roosts and breeding sites	The destruction or disturbance of bird roosts during the construction phase	3	4	3	4	2	3	48	-	High	As with other impacts, this impact can be mitigated by preferably 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. If construction takes place outside of May, June, July and August, all noise generated by machinery and maintenance operations must be kept to a minimum.	2	3	2	2	2	2	22	-	Low
Disturbance due to noise such as, machinery movements and maintenance operations	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.	3	3	1	2	3	3	36	-	Medium	As with other impacts, this impact can be mitigated by preferably 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. If construction takes place outside of May, June, July and August, all noise generated by machinery and maintenance operations must be kept to a minimum.	3	2	1	2	3	2	22	-	Low
Operational Phase																				

Disturbance due to noise such as, machinery movements and maintenance operations	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.	3	3	1	2	1	2	20	-	Low	No Mitigation Required	3	3	1	2	1	2	20	-	Low
Bird mortalities	Bird mortalities during the operational phase due to vehicle collisions, collisions with infrastructure and/or combustion.	3	3	3	3	4	4	64	-	Very High	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	2	2	2	2	4	3	36	-	Med

											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 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 that are constructed (if any) 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 coursers, cranes and korhaans to obtain adequate height after being flushed by vehicle traffic. An Alternative mitigation measure 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. Finally, reflective diverters should be attached to new fencing alongside regular maintenance									

											roads every 50 metres.									
Loss of Bird Foraging Habitat	Loss of Bird Foraging Habitat	3	3	3	3	3	3	45	-	High	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, sandy dunes, pans and koppies. A green buffer should be maintained around all habitats designated as High Sensitivity or above.	3	2	2	2	2	2	22	-	Low
Disruption of bird migratory pathways	Disruption of bird migratory pathways during the operational phase	3	3	2	2	4	2	28	-	Medium	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	3	2	2	2	2	2	22	-	Low

											lines. The linear Drainage line habitats must be buffered by a minimum of 50 metres from the edge of the demarcated wetland.									
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	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	3	3	3	3	3	3	45	-	High	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. An ECO can advise on the mitigations during operations.	3	2	2	2	3	2	24	-	Med

	infrastructure and cause significant direct mortality risks.																			
Chemical pollution spills	Chemicals being used to keep the PV panels clean from dust (suppressants) etc.	3	3	2	2	4	3	42	-	High	Application of strict chemical control procedures as per the EMPr. Zero spills should be targeted and full clean up kits available in the event of any chemical spill. Soil testing subject to EMPr.	1	2	2	2	3	2	20	-	Low
Decommissioning Phase																				
Disruption of bird migratory pathways	Disruption of bird migratory pathways during the decommissioning phase	3	3	2	2	4	2	28	-	Medium	Decommissioning of panels must not commence during the peak wet season months on November, December and January.	3	2	2	2	2	2	22		Low
Habitat destruction post decommissioning	Destruction of habitats and scarring	3	3	2	2	4	3	42	-	High	• A rehabilitation plan must be commissioned before construction commences. • All topsoil harvesting must take place in the dry season (late dry season).	3	2	2	2	3	2	24	-	Med

											• 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 5-2: Cumulative Impact Assessment

Cumulative: There are a number of existing renewable energy projects (currently only solar Energy Facilities (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.																				
Construction and Operational Phases																				
Habitat loss	Regional Saturation of SEF facilities causing habitat loss	3	4	3	3	4	4	68	-	Very High	Not able to be mitigated quantitatively. Mitigation measures are similar to SEF facility. 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.									

Collison mortality (vehicle)	Increased roadkill due to higher traffic volumes	3	3	3	3	4	3	48		High	Strict enforcement of speed limits in the PAOI as well saturation of fence infrastructure with reflective diverters and maintaining fence set aside distances (75/ 5 metres).	3	2	1	1	2	2	18		Low
Collison mortality (infrastructure)	Increased mortalities due to collisions with SEF infrastructure, especially powerlines and fences	3	4	3	3	4	4	64		Very High	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. All powerline infrastructure must be fitted with approved bird diverters in order to provide visibility for large-bodied birds. Positive Cumulative Mitigation will be the **retrofitting of existing powerline infrastructure (in consultation with Eskom)** which currently does not have diverter infrastructure in place.	3	2	3	3	2	3	33		Med
Decommissioning Phase																				
Cumulative: Powerlines are ubiquitous throughout the South African rural landscape and ever-increasing connectivity combined with current developments within the region raise the possibility of significant cumulative impacts, especially concerning collision risk.																				
Collison mortality (powerlines)	Increased collision related mortalities due to increased	3	4	3	3	3	4	64		Very High	Saturation of powerline infrastructure with approved bird diverters	3	2	2	2	3	4	48		High

	powerlines																			

5.1.1.1 Post Construction Rehabilitation

- A rehabilitation plan must be commissioned before construction commences, especially for sandy dunes, drainage lines and wetlands.
- 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.

5.2 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 potential effect of foraging and nesting/ roosting habitat in particular and these are built in to the sensitivity mapping. 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 not been confirmed as a foraging site and breeding site for Secretary Birds and Vultures but is a foraging site for other raptor species, the mitigation recommendations that are proposed in order to preserve the basic existing High sensitivity 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.

5.3 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.

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 5 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.

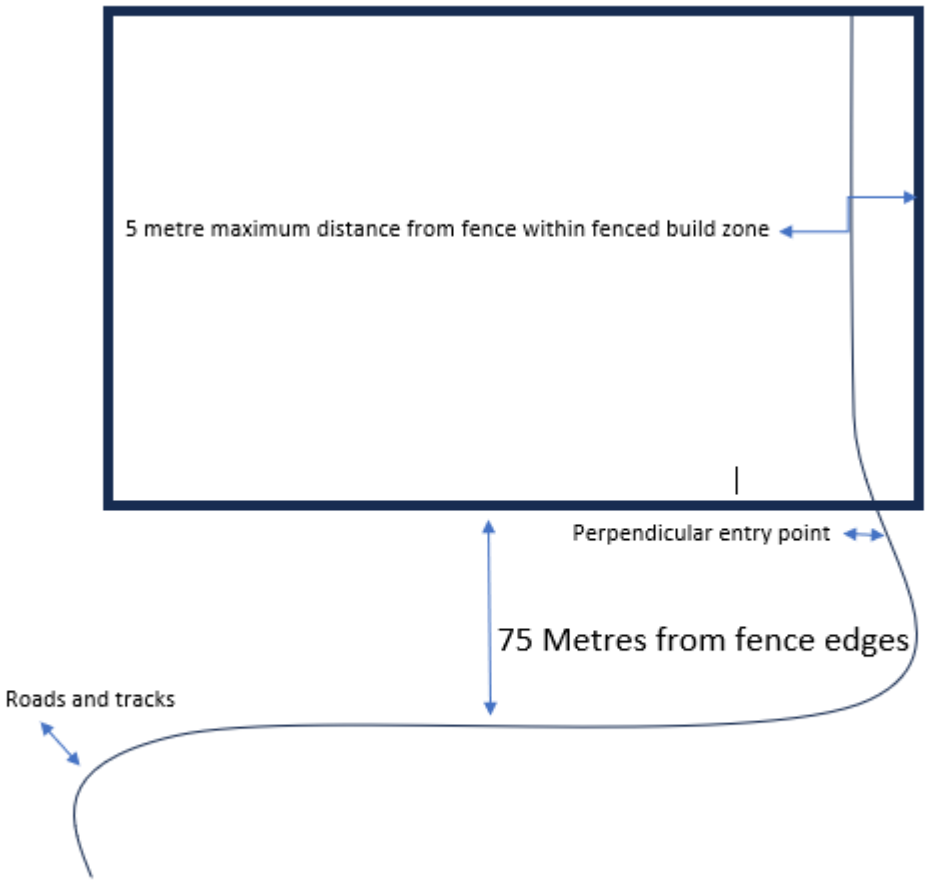


Figure 5-1: Diagrammatic representation of road alignment with fencing infrastructure

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.

Habitat Destruction: 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 buffer from any infrastructure activity. The buffering is displayed on the sensitivity mapping although significant infrastructure is far more than the required minimum buffering.

Impacts on foraging and breeding habitats: Impacts associated with the loss of bird foraging and breeding 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.
Disruption of breeding and foraging behaviour: As with other impacts, this impact can be mitigated by preferably 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. If construction takes place outside of May, June, July and August, all noise generated by machinery and maintenance operations must be kept to a minimum.

5.4 SPECIFIC MITIGATIONS FOR WETLAND AND WATERBODY CROSSINGS

The Site Development Plan (SDP) provided clearly shows potential interaction between infrastructure and designated High Sensitivity avifaunal features. Methods used for constructing linear infrastructure (such as buried powerlines, pipelines, raised powerlines, roads) across wetlands or drainage lines 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. An ECO should be appointed in order to consult with the engineers regarding the technical requirements of the following mitigations. Changes may be allowed as per the ECOs discretion.
2. Horizontal directional drilling is preferred for the crossing of wetlands,
3. If as is more typical, an open trench is dug, mitigations should be implemented to reduce impacts to wetland hydrology and soil structure.
4. All pipeline corridors (affected areas) should be implemented to a maximum 10 metres wide through wetlands during construction.
5. During construction, laydown areas must be located in uplands a minimum of 35 metres from the wetland edge.
6. 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.
7. During vegetation clearing, sediment barriers such as silt fences must be installed and maintained adjacent to wetlands.
8. 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.
9. 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.
10. 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.

11. 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.
12. If topsoil is segregated from subsoil, then subsoil is backfilled first.

5.4.1.1 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 soils, 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).

5.4.1.2 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).

5.4.1.3 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.

5.5 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).
- Post-construction monitoring should be undertaken as per the EMPr and Section 6 of this report. 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.

5.6 CUMULATIVE IMPACT ASSESSMENT DISCUSSION

The cumulative effects of regional solar farm developments on birds are highly variable and depend on a wide range of factors including the density, designs and layouts of the infrastructure. This was evaluated within the framework of this final EIA report. The map of regional WEF and SEFs in relation to the Lesaka 1 SEF is shown as Figure 5-2 with the surface area calculations shown as Table 5-3.

Table 5-3: Cumulative Impact Calculations for the Lesaka Clusters

Type	Area (m)	Area (ha)	Percentage of 30 km buffer
Lesaka	49042925.00	4904.29	1.30
Solar	376929991.00	37693.00	9.98
Wind	722999747.00	72299.97	19.15
PV+Lesaka	425972916.00	42597.29	11.28
ALL+Lesaka	1148972663.00	114897.27	30.43
30km buffer	3776404086.00	377640.41	100.00

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 sandy dune habitats for Red Lark) 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 and Ludwig's Bustard).
- 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.

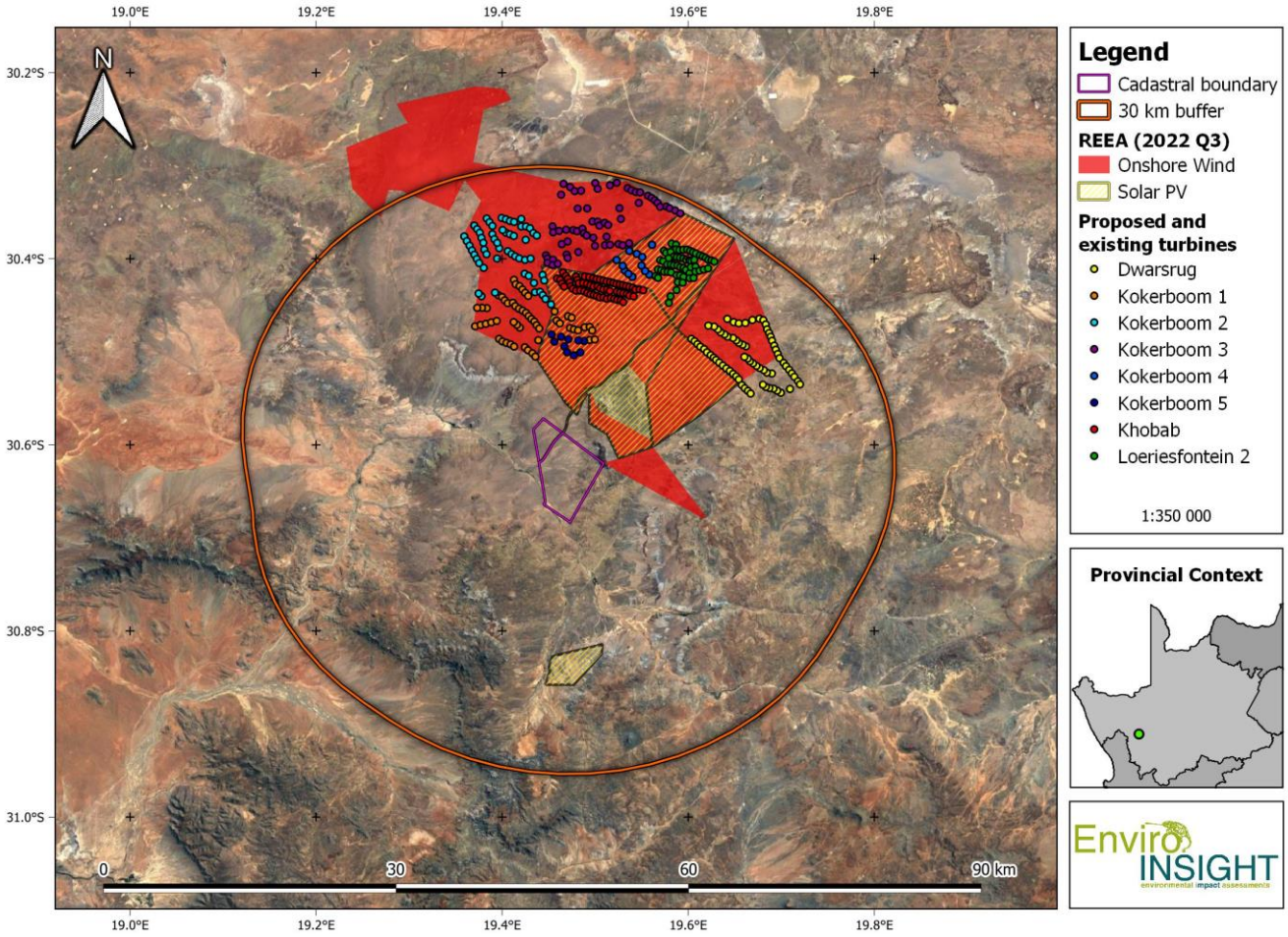


Figure 5-2: The map of regional WEFs and SEFs in relation to the Lesaka 1 SEF

5.7 SPECIES SPECIFIC RISK ANALYSIS AND RECOMMENDED MITIGATIONS

According to SABAP2 and Taylor *et al.* (2015), and as mentioned above, 22 (twenty-two) Priority Species /SCC are known to occur in the region with 10 (ten) 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), two of the species are Endangered, two of the species are Vulnerable species and two are Near-Threatened. Given that even long-term studies conducted over multiple periods, some of 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 priority and large terrestrial bird species (e.g., Red Larks, Ludwig's Bustards) 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.

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 variable nature of the survey area dictates that the overall topography related risks are moderate to high, However, some higher risk species have been identified and described below.

5.7.1.1 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 and preconstruction 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.

5.7.1.2 Martial Eagle (*Polemaetus bellicosus*) and other large raptors

All nesting raptors should be protected within the study area. The IUCN Endangered Martial 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 other species such as Verreaux's Eagle. The impacts of the development of Martial Eagle may be more severe, especially because nests were located within the project area of influence. Martial 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 primary impacts relate to loss of foraging habitat and potential collision with new powerline infrastructure which requires detailed discussion.

The overall findings data reveal no resident population (currently) but there are still a number of risks in regard to the current study, especially due to the significant recolonisation being observed by the species regionally. 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 large eagles (e.g. breeding success) is closely tied with the availability of its preferred prey and disturbance levels. The proposed future development will likely not threaten the long-term viability of suitable prey populations required to sustain both species although the cumulative increase in SEFs within the region does pose a threat to the local populations via collision mortality.

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 Martial 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 local "vermin" such as caracal and jackals (that may or may not hunt or scavenge livestock) may in fact have a positive effect on the raptor 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.

5.7.1.3 Red Lark (Calendulauda burra)

This species is highly range range-restricted (Figure 5-3**Error! Reference source not found.**) and is listed as IUCN Vulnerable (Taylor *et al*., 2015). The species was observed frequently during the assessment period albeit within a highly restricted habitat preference. Significant populations (breeding and foraging) within he PAOI have been confirmed. Even though the species exhibits a specific breeding behaviour (display flights of up to 20 metres as described in Hockey *et. al.)* it has been deemed to have a relatively low risk of collision for SEFs and thus is not considered a fatal flaw to the project. The species prefers the open sandy habitats in particular open sandy karroid dunes and grassland, particularly on dune crests and dune side slopes. The species is considered as a regular breeding resident in the region. Avoidance based mitigation is the primary mitigation measure and must be based upon the aforementioned delineated sensitivity. Where possible, additional small-scale micro sighting is required.

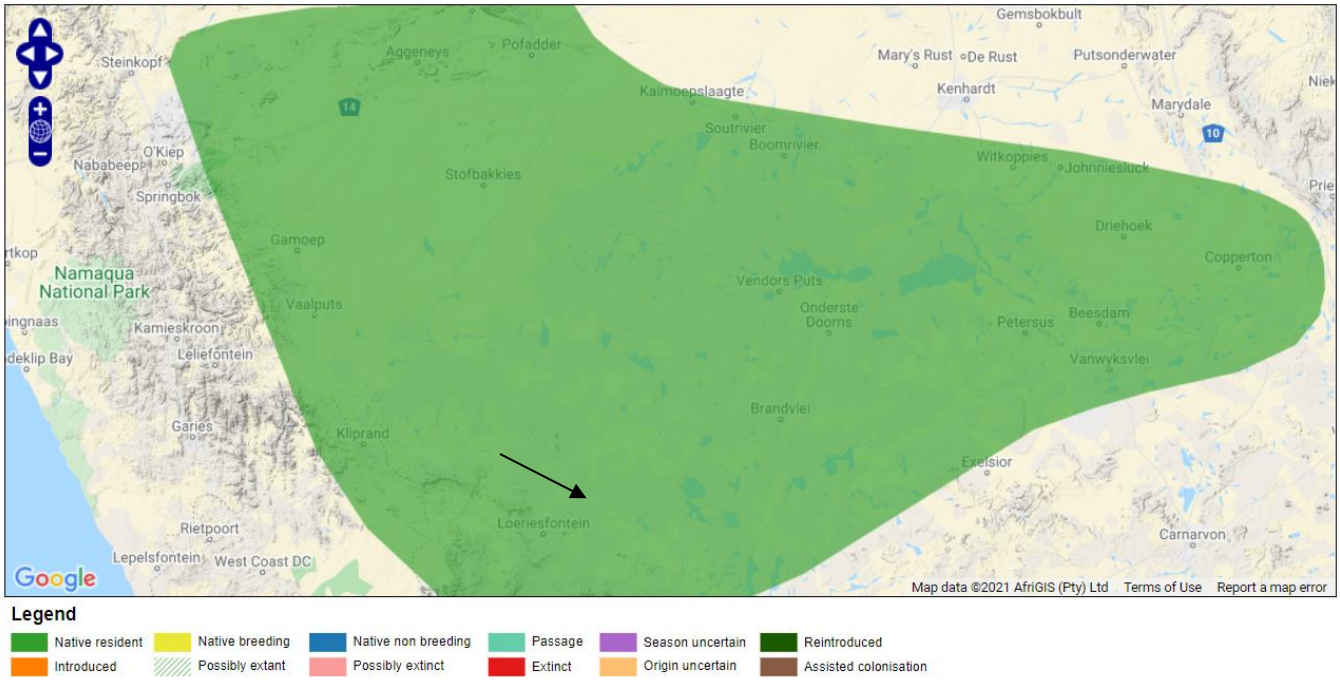


Figure 5-3: Red lark (Calendulauda burra) distribution map (BirdLife International, 2021[b]).

6 MONITORING REQUIREMENTS

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

	Title: SCC community monitoring
Stressor	Project Activities, 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	• Vantage Point counts – 2 x Three hour counts (morning and evening) to be conducted at each monitoring plot • 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.
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 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 and their cause. All reporting to be accompanied by GIS shapefiles and any original photographs.

	TITLE: Collision monitoring
Stressor(s)	Avifauna-powerline and infrastructure 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).
Sampling Frequency	Weekly for powerlines
Sampling Site(s)	Along the entire powerline network on the PAOI.
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) must initiate investigation and corrective measures (additional mitigation infrastructure).
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).

Table 6-1: EMP Table Summary for Lesaka 1

Lesaka 1 SEF					
Impact/Aspect	**Mitigation/Management Actions**	**Responsibility**	**Methodology**	**Mitigation/Management Objectives and Outcomes**	**Frequency**
Design					
Construction					
Disturbance of bird roosts	• As with other impacts, this impact can be mitigated by timing of any panel construction to not commence in November, December and January in order to avoid breeding periods of species within the sensitive drainage lines, wetlands and the general region.	• Client Appointed ECO.	• 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. • All variables acquired should be statistically and graphically compared to the available data and the original targeted baseline data. Photographs	• 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 Bustards or establishment of SCC breeding populations (not yet sighted), 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	• Twice weekly during construction.

			should be taken of as many SCC observed in the field. • Quarterly 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.	determine cause of change detected.	
Disturbance due to noise such as, machinery movements and maintenance operations	As with "Disturbance of bird roosts"	As with "Disturbance of bird roosts"	As with "Disturbance of bird roosts"	As with "Disturbance of bird roosts"	As with "Disturbance of bird roosts"
Operation					
	• Impacts due to bird mortalities during the	• Company Appointed	• For panel location sites: weekly	• Collision frequency and intensity (# kills per	• Weekly for panels between

Bird mortalities	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	ECO, trained by SACNASP registered Zoologist.	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). • Monthly 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.	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) must initiate investigation and corrective measures (including retrofitting of mitigation measures).	November and March.

	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 bustards, raptors and korhaans to obtain adequate height after being flushed by vehicle traffic. An Alternative mitigation measure and where a 75-metre buffer is not possible, new fences must be set back no more than 5 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.				
• ***Disruption of bird migratory pathways*** • ***The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as lake effect, perches,***	• 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	• Company Appointed ECO, trained by a SACNASP registered Zoologist.	• For panel location sites: Monthly inspection using Drive and Walking Transects. • CWAC counts	• Species inventories and passage rate data collection.	• Monthly SCC and species inventories during November, December, January and February

nest and shade opportunities. • ***Disturbance due to noise such as, machinery movements and maintenance operations.***	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 in accordance with the EIA sensitivity mapping. • 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.				
Chemical pollution	• The application of strict chemical control protocols as per the EMPr.	• Company appointed ECO.	• For panel location sites: weekly inspection on foot • Yearly soil analysis sent to accredited lab	• Spill Records • Yearly chemical analysis results matched to prescribed thresholds	• Weekly spill detection for panels

7 SENSITIVITY ANALYSIS

The study area mostly consists of Open Grassland and Karoo Shale habitats with some drainage line and koppies found in parts of the proposed project footprint. The Sandy Grassland and Koppie vegetation provides potential nesting habitat for bird species such as Ludwig's Bustard, Raptors, Red Larks, Cisticola's and Karoo Korhaan, and possibly includes hunting/foraging habitat for species such as Lanner Falcon, Secretarybird and other larger raptors.

One site visit in July 2022 took place during the winter season, which means the habitat conditions were at their least optimal. When conditions are sub-optimal, avifaunal assemblages will carry out small scale migrations to more ecologically productive habitats (such as permanent water courses) and return after the commencement of the warmer months. The Spring and Summer surveys yielded more significant results due to the warmer temperatures and post rain ecological productivity.

The associated powerlines within the study area footprint showed significant signs of priority bird species nests and could lead to possible recolonisation in the future for species such as Martial Eagle. Accordingly, final sensitivities have been shown in Figure 7-1. The figure indicates that the entire north-western area, as well as smaller pockets to the south and east, are "high sensitivity" areas, while the nest buffers towards the south-west and beyond the north-east border are "no-go" areas. The drainage line running across the site has also been marked as a "no-go".

Nest Specific Mitigations

Utilising the interpretations stipulated above and in the absence of any mitigation measures, a buffer of 1 km (Figure 7-1) is recommended as an exclusion zone of ALL project activities, in addition to stipulated mitigation measures (see species specific mitigation measures above). This applies to the two (seemingly) abandoned Martial Eagle nests within the PA and PAOI.

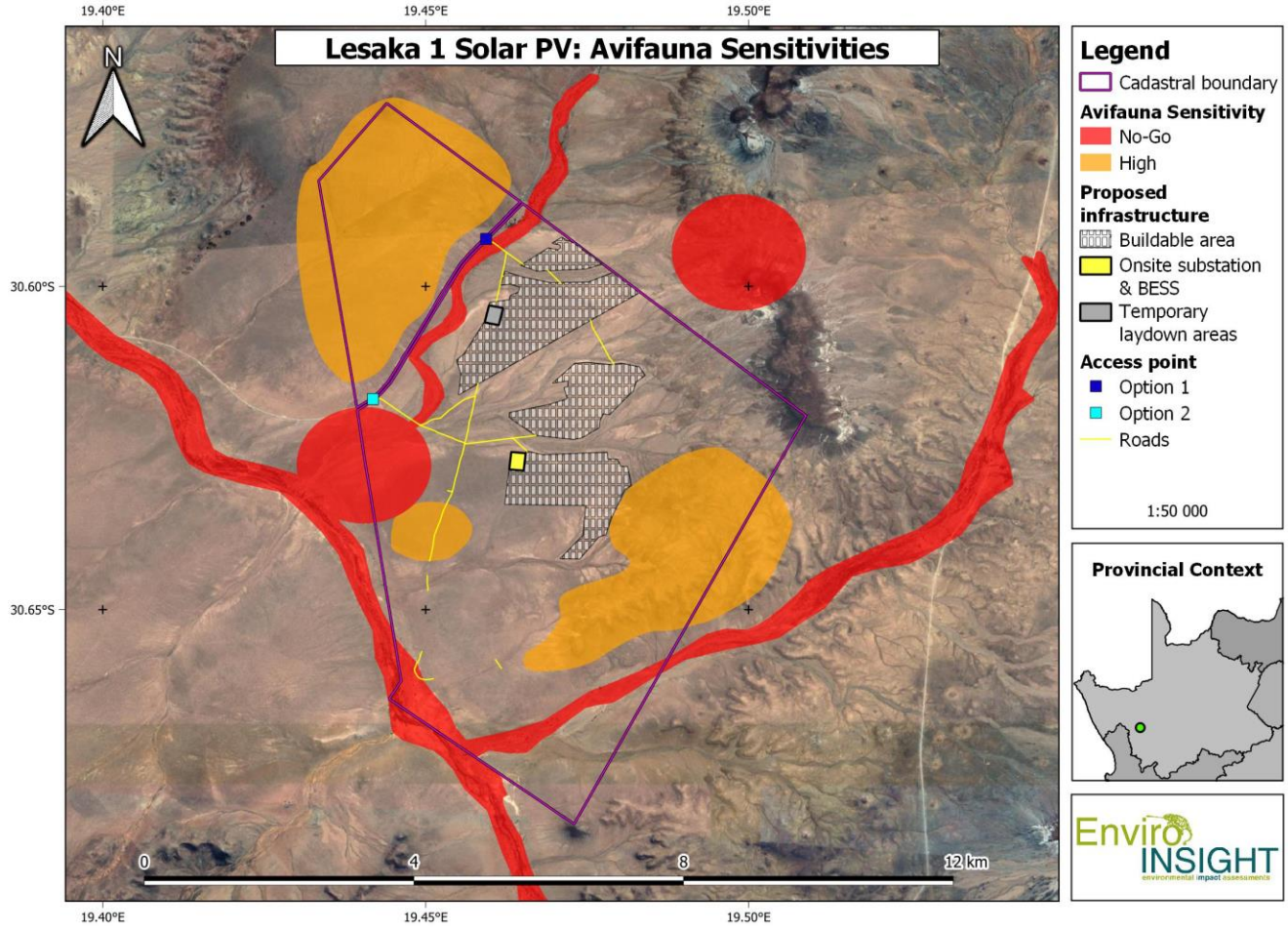


Figure 7-1: Final avifauna sensitivity map for the Lesaka 1 SEF.

8. CONCLUSIONS

The study area is situated within the Hantam Karoo vegetation type. The study area is not anticipated to support breeding populations of several large terrestrial bird species such as bustards and large raptor species in sufficiently large densities or within breeding habitat that may be considered a fatal flaw. However, given the size of the area, the proximity to a very large areas of suitable habitat, the high-density presence of Red Lark, Ludwig's Bustard and Karoo Korhaan is deemed to be a significant concern. The CBAs of the Northern Cape designated that majority of the site falls within a CBA 1, CBA 2 and an ESA1. 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). The study area is not within a REDZ and requires a full S&EIA and the methods will follow the appropriate sampling method, which consisted of 3 surveys of 3 days each (minimum) over a 6-month period.

Sampling methods used 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 twenty-two (22) priority species has the possibility of occurring within and around the study area with 122 records and 10 species being recorded.

Some of the priority bird species are not habitat-bound to the area for nesting and/or foraging purposes and is therefore important to focus on the some of the most significant cumulative impacts for the proposed solar project. Possible primary impacts of the proposed study area on avifauna included:

1. Potential habitat loss through the establishment of solar panel infrastructure.
2. The inclusion of livestock agriculture that might attract more SCC avifauna (e.g. vultures) species to the area.
3. Collision with solar panel infrastructure is possible albeit less likely than secondary collision risk with powerlines.
4. Secondary collision risks are represented by supporting powerline infrastructure which are connected to solar panel infrastructure.

Species Specific Mitigations apply to Ludwig's Bustard, Martial Eagle (nests) and Red Lark.

The study area is surrounded with existing renewable energy developments, both wind and solar developments, although a number are proposed which could manifest as significant cumulative impacts at the proposed site. Consequently, every effort is taken to finalise within an EIA Framework, 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.

Overall and with these factors taken into consideration, the specialist deems that the project may proceed.

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10. APPENDICES

APPENDIX 1: EXPECTED AVIFAUNA SPECIES LIST

Avifauna recorded by SABAP1 and SABAP2 for the nine pentads.

	Common group	Common species	Genus	Species
1		Bokmakierie	*Telophorus*	*zeylonus*
2	Avocet	Pied	*Recurvirostra*	*avosetta*
3	Barbet	Acacia Pied	*Tricholaema*	*leucomelas*
4	Bee-eater	European	*Merops*	*apiaster*
5	Bishop	Southern Red	*Euplectes*	*orix*
6	Bulbul	African Red-eyed	*Pycnonotus*	*nigricans*
7	Bunting	Cape	*Emberiza*	*capensis*
8	Bunting	Lark-like	*Emberiza*	*impetuani*
9	Bustard	Kori	*Ardeotis*	*kori*
10	Bustard	Ludwig's	*Neotis*	*ludwigii*
11	Buzzard	Common	*Buteo*	*buteo*
12	Buzzard	Jackal	*Buteo*	*rufofuscus*
13	Canary	Black-headed	*Serinus*	*alario*
14	Canary	Black-throated	*Crithagra*	*atrogularis*
15	Canary	White-throated	*Crithagra*	*albogularis*
16	Canary	Yellow	*Crithagra*	*flaviventris*
17	Chat	Ant-eating	*Myrmecocichla*	*formicivora*
18	Chat	Familiar	*Oenanthe*	*familiaris*
19	Chat	Karoo	*Emarginata*	*schlegelii*
20	Chat	Sickle-winged	*Emarginata*	*sinuata*
21	Chat	Tractrac	*Emarginata*	*tractrac*
22	Cisticola	Grey-backed	*Cisticola*	*subruficapilla*
23	Courser	Double-banded	*Rhinoptilus*	*africanus*
24	Crow	Cape	*Corvus*	*capensis*
25	Crow	Pied	*Corvus*	*albus*
26	Dove	Cape Turtle	*Streptopelia*	*capicola*
27	Dove	Laughing	*Spilopelia*	*senegalensis*
28	Dove	Namaqua	*Oena*	*capensis*
29	Eagle	Black-chested Snake	*Circaetus*	*pectoralis*
30	Eagle	Martial	*Polemaetus*	*bellicosus*
31	Eagle-Owl	Spotted	*Bubo*	*africanus*

32	Eremomela	Karoo	*Eremomela*	*gregalis*
33	Eremomela	Yellow-bellied	*Eremomela*	*icteropygialis*
34	Falcon	Lanner	*Falco*	*biarmicus*
35	Fiscal	Southern	*Lanius*	*collaris*
36	Flycatcher	Chat	*Melaenornis*	*infuscatus*
37	Flycatcher	Fiscal	*Melaenornis*	*silens*
38	Goose	Egyptian	*Alopochen*	*aegyptiaca*
39	Goshawk	Pale Chanting	*Melierax*	*canorus*
40	Heron	Black-headed	*Ardea*	*melanocephala*
41	Hoopoe	African	*Upupa*	*africana*
42	Kestrel	Greater	*Falco*	*rupicoloides*
43	Kestrel	Rock	*Falco*	*rupicolus*
44	Kite	Yellow-billed	*Milvus*	*aegyptius*
45	Korhaan	Karoo	*Eupodotis*	*vigorsii*
46	Lapwing	Blacksmith	*Vanellus*	*armatus*
47	Lapwing	Crowned	*Vanellus*	*coronatus*
48	Lark	Karoo Long-billed	*Certhilauda*	*subcoronata*
49	Lark	Large-billed	*Galerida*	*magnirostris*
50	Lark	Red	*Calendulauda*	*burra*
51	Lark	Red-capped	*Calandrella*	*cinerea*
52	Lark	Sclater's	*Spizocorys*	*sclateri*
53	Lark	Spike-heeled	*Chersomanes*	*albofasciata*
54	Martin	Rock	*Ptyonoprogne*	*fuligula*
55	Mousebird	Red-faced	*Urocolius*	*indicus*
56	Mousebird	White-backed	*Colius*	*colius*
57	Pigeon	Speckled	*Columba*	*guinea*
58	Pipit	African	*Anthus*	*cinnamomeus*
59	Plover	Kittlitz's	*Charadrius*	*pecuarius*
60	Plover	Three-banded	*Charadrius*	*tricollaris*
61	Prinia	Karoo	*Prinia*	*maculosa*
62	Sandgrouse	Namaqua	*Pterocles*	*namaqua*
63	Scrub Robin	Karoo	*Cercotrichas*	*coryphoeus*
64	Shelduck	South African	*Tadorna*	*cana*
65	Sparrow	Cape	*Passer*	*melanurus*
66	Sparrow	House	*Passer*	*domesticus*
67	Sparrow-Lark	Black-eared	*Eremopterix*	*australis*
68	Sparrow-Lark	Grey-backed	*Eremopterix*	*verticalis*
69	Starling	Pale-winged	*Onychognathus*	*nabouroup*

70	Starling	Pied	*Lamprotornis*	*bicolor*
71	Stilt	Black-winged	*Himantopus*	*himantopus*
72	Sunbird	Dusky	*Cinnyris*	*fuscus*
73	Sunbird	Malachite	*Nectarinia*	*famosa*
74	Swallow	Barn	*Hirundo*	*rustica*
75	Swallow	Greater Striped	*Cecropis*	*cucullata*
76	Swift	Little	*Apus*	*affinis*
77	Swift	White-rumped	*Apus*	*caffer*
78	Teal	Cape	*Anas*	*capensis*
79	Thick-knee	Spotted	*Burhinus*	*capensis*
80	Thrush	Karoo	*Turdus*	*smithi*
81	Tit	Cape Penduline	*Anthoscopus*	*minutus*
82	Tit	Grey	*Melaniparus*	*afer*
83	Wagtail	Cape	*Motacilla*	*capensis*
84	Warbler	African Reed	*Acrocephalus*	*baeticatus*
85	Warbler	Chestnut-vented	*Curruca*	*subcoerulea*
86	Warbler	Layard's	*Curruca*	*layardi*
87	Warbler	Namaqua	*Phragmacia*	*substriata*
88	Warbler	Rufous-eared	*Malcorus*	*pectoralis*
89	Waxbill	Common	*Estrilda*	*astrild*
90	Weaver	Cape	*Ploceus*	*capensis*
91	Weaver	Southern Masked	*Ploceus*	*velatus*
92	Wheatear	Capped	*Oenanthe*	*pileata*
93	Wheatear	Mountain	*Myrmecocichla*	*monticola*

APPENDIX 2: TOTAL NUMBER OF NON-PRIORITY SPECIES OBSERVED PER SEASON

		Season			
English IOC Name	Scientific Name	Spring	Summer	Winter	Total
Acacia Pied Barbet	*Tricholaema leucomelas*	1	6	2	9
African Red-eyed Bulbul	*Pycnonotus nigricans*	1	6	2	9
Ant-eating Chat	*Myrmecocichla formicivora*	4	13	11	28
Black-chested Prinia	*Prinia flavicans*	1	8		9
Black-eared Sparrow-Lark	*Eremopterix australis*	70	35	1	106
Black-headed Canary	*Serinus alario*	2			2
Bokmakierie	*Telophorus zeylonus*	3		3	6
Cape Bunting	*Emberiza capensis*			6	6
Cape Penduline Tit	*Anthoscopus minutus*	1		1	2
Cape Sparrow	*Passer melanurus*	6		6	12
Cape Turtle Dove	*Streptopelia capicola*			3	3
Chat Flycatcher	*Melaenornis infuscatus*			5	5
Common Quail	*Coturnix coturnix*	15	4		19
Common Swift	*Apus apus*		54		54
Double-banded Courser	*Rhinoptilus africanus*	1	6	3	10
Dusky Sunbird	*Cinnyris fuscus*	4	4	2	10
European Bee-eater	*Merops apiaster*	1			1
Grey Tit	*Melaniparus afer*	1			1
Grey-backed Cisticola	*Cisticola subruficapilla*		8		8
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	59	35	8	102
Karoo Chat	*Emarginata schlegelii*	3		12	15
Karoo Eremomela	*Eremomela gregalis*		6	2	8
Karoo Lark	*Calendulauda albescens*		5		5

Karoo Long-billed Lark	*Certhilauda subcoronata*		2	7	9	18
Karoo Prinia	*Prinia maculosa*		5	27	2	34
Karoo Scrub Robin	*Cercotrichas coryphoeus*		4		2	6
Large-billed Lark	*Galerida magnirostris*		1		5	6
Lark-like Bunting	*Emberiza impetuani*		220	12	4	236
Laughing Dove	*Spilopelia senegalensis*		1			1
Layard's Tit-Babbler	*Curruca layardi*				2	2
Malachite Sunbird	*Nectarinia famosa*				1	1
Mountain Wheatear	*Myrmecocichla monticola*			3	3	6
Namaqua Dove	*Oena capensis*		4	19		23
Namaqua Sandgrouse	*Pterocles namaqua*		21	20	4	45
Pearl-breasted Swallow	*Hirundo dimidiata*		7			7
Pririt Batis	*Batis pririt*				1	1
Red-faced Mousebird	*Urocolius indicus*				7	7
Ring-necked Dove	*Streptopelia capicola*		3	12		15
Rock Martin	*Ptyonoprogne fuligula*		1		1	2
Rufous-eared Warbler	*Malcorus pectoralis*		1		15	16
Sickle-winged Chat	*Emarginata sinuata*		2	7		9
Southern Fiscal	*Lanius collaris*		2	1		3
Spike-heeled Lark	*Chersomanes albofasciata*		24	19	48	91
Tractrac Chat	*Emarginata tractrac*			10	1	11
White-throated Canary	*Crithagra albogularis*		4		7	11
White-throated Swallow	*Hirundo albigularis*		1			1
Yellow Canary	*Crithagra flaviventris*		5	8	37	50
Yellow-fronted Canary	*Crithagra mozambica*			4		4
Grand Total		**48**	**481**	**339**	**216**	**1036**

APPENDIX 3: OBSERVED AVIFAUNA SPECIES LIST

Season	English IOC Name	Scientific Name	Grand Total
Spring	Acacia Pied Barbet	*Tricholaema leucomelas*	1
	African Red-eyed Bulbul	*Pycnonotus nigricans*	1
	Ant-eating Chat	*Myrmecocichla formicivora*	4
	Black-chested Prinia	*Prinia flavicans*	1
	Black-eared Sparrow-Lark	*Eremopterix australis*	70
	Black-headed Canary	*Serinus alario*	2
	Bokmakierie	*Telophorus zeylonus*	3
	Booted Eagle	*Hieraaetus pennatus*	1
	Cape Penduline Tit	*Anthoscopus minutus*	1
	Cape Sparrow	*Passer melanurus*	6
	Common Quail	*Coturnix coturnix*	15
	Double-banded Courser	*Rhinoptilus africanus*	1
	Dusky Sunbird	*Cinnyris fuscus*	4
	European Bee-eater	*Merops apiaster*	1
	Grey Tit	*Melaniparus afer*	1
	Grey-backed Sparrow-Lark	*Eremopterix verticalis*	59
	Karoo Chat	*Emarginata schlegelii*	3
	Karoo Korhaan	*Eupodotis vigorsii*	1
	Karoo Long-billed Lark	*Certhilauda subcoronata*	2
	Karoo Prinia	*Prinia maculosa*	5
	Karoo Scrub Robin	*Cercotrichas coryphoeus*	4
	Large-billed Lark	*Galerida magnirostris*	1

	Lark-like Bunting	*Emberiza impetuani*		220
	Laughing Dove	*Spilopelia senegalensis*		1
	Ludwig's Bustard	*Neotis ludwigii*		7
	Namaqua Dove	*Oena capensis*		4
	Namaqua Sandgrouse	*Pterocles namaqua*		21
	Pale Chanting Goshawk	*Melierax canorus*		1
	Pearl-breasted Swallow	*Hirundo dimidiata*		7
	Pied Crow	*Corvus albus*		1
	Red Lark	*Calendulauda burra*		8
	Ring-necked Dove	*Streptopelia capicola*		3
	Rock Martin	*Ptyonoprogne fuligula*		1
	Rufous-eared Warbler	*Malcorus pectoralis*		1
	Sickle-winged Chat	*Emarginata sinuata*		2
	Southern Fiscal	*Lanius collaris*		2
	Spike-heeled Lark	*Chersomanes albofasciata*		24
	White-throated Canary	*Crithagra albogularis*		4
	White-throated Swallow	*Hirundo albigularis*		1
	Yellow Canary	*Crithagra flaviventris*		5
	Spring Total		**40**	**500**
Summer	Acacia Pied Barbet	*Tricholaema leucomelas*		6
	African Red-eyed Bulbul	*Pycnonotus nigricans*		6
	Ant-eating Chat	*Myrmecocichla formicivora*		13
	Black-chested Prinia	*Prinia flavicans*		8
	Black-chested Snake Eagle	*Circaetus pectoralis*		2
	Black-eared Sparrow-Lark	*Eremopterix australis*		35
	Common Quail	*Coturnix coturnix*		4
	Common Swift	*Apus apus*		54

Double-banded Courser	*Rhinoptilus africanus*		6
Dusky Sunbird	*Cinnyris fuscus*		4
Grey-backed Cisticola	*Cisticola subruficapilla*		8
Grey-backed Sparrow-Lark	*Eremopterix verticalis*		35
Karoo Eremomela	*Eremomela gregalis*		6
Karoo Korhaan	*Eupodotis vigorsii*		14
Karoo Lark	*Calendulauda albescens*		5
Karoo Long-billed Lark	*Certhilauda subcoronata*		7
Karoo Prinia	*Prinia maculosa*		27
Lanner Falcon	*Falco biarmicus*		3
Lark-like Bunting	*Emberiza impetuani*		12
Ludwig's Bustard	*Neotis ludwigii*		6
Mountain Wheatear	*Myrmecocichla monticola*		3
Namaqua Dove	*Oena capensis*		19
Namaqua Sandgrouse	*Pterocles namaqua*		20
Pale Chanting Goshawk	*Melierax canorus*		1
Pied Crow	*Corvus albus*		7
Red Lark	*Calendulauda burra*		14
Red-eyed Dove	*Streptopelia semitorquata*		2
Ring-necked Dove	*Streptopelia capicola*		12
Sickle-winged Chat	*Emarginata sinuata*		7
Southern Fiscal	*Lanius collaris*		1
Spike-heeled Lark	*Chersomanes albofasciata*		19
Tractrac Chat	*Emarginata tractrac*		10
Yellow Canary	*Crithagra flaviventris*		8
Yellow-fronted Canary	*Crithagra mozambica*		4
Summer Total		**34**	**388**

	Acacia Pied Barbet	*Tricholaema leucomelas*	2
	African Red-eyed Bulbul	*Pycnonotus nigricans*	2
	Ant-eating Chat	*Myrmecocichla formicivora*	11
	Black-eared Sparrow-Lark	*Eremopterix australis*	1
	Bokmakierie	*Telophorus zeylonus*	3
	Cape Bunting	*Emberiza capensis*	6
	Cape Penduline Tit	*Anthoscopus minutus*	1
	Cape Sparrow	*Passer melanurus*	6
	Cape Turtle Dove	*Streptopelia capicola*	3
	Chat Flycatcher	*Melaenornis infuscatus*	5
	Double-banded Courser	*Rhinoptilus africanus*	3
	Dusky Sunbird	*Cinnyris fuscus*	2
	Greater Kestrel	*Falco rupicoloides*	1
Winter	Grey-backed Sparrow-Lark	*Eremopterix verticalis*	8
	Karoo Chat	*Emarginata schlegelii*	12
	Karoo Eremomela	*Eremomela gregalis*	2
	Karoo Korhaan	*Eupodotis vigorsii*	17
	Karoo Long-billed Lark	*Certhilauda subcoronata*	9
	Karoo Prinia	*Prinia maculosa*	2
	Karoo Scrub Robin	*Cercotrichas coryphoeus*	2
	Large-billed Lark	*Galerida magnirostris*	5
	Lark-like Bunting	*Emberiza impetuani*	4
	Layard's Tit-Babbler	*Curruca layardi*	2
	Ludwig's Bustard	*Neotis ludwigii*	21
	Malachite Sunbird	*Nectarinia famosa*	1
	Mountain Wheatear	*Myrmecocichla monticola*	3
	Namaqua Sandgrouse	*Pterocles namaqua*	4

	Pale Chanting Goshawk	*Melierax canorus*		1
	Pied Crow	*Corvus albus*		3
	Pririt Batis	*Batis pririt*		1
	Red Lark	*Calendulauda burra*		10
	Red-faced Mousebird	*Urocolius indicus*		7
	Rock Kestrel	*Falco rupicolus*		1
	Rock Martin	*Ptyonoprogne fuligula*		1
	Rufous-eared Warbler	*Malcorus pectoralis*		15
	Spike-heeled Lark	*Chersomanes albofasciata*		48
	Tractrac Chat	*Emarginata tractrac*		1
	White-throated Canary	*Crithagra albogularis*		7
	Yellow Canary	*Crithagra flaviventris*		37
	Winter Total		**39**	**270**
Grand Total			**59**	**1158**

APPENDIX 4: SACNASP CERTIFICATE

SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Samuel David Laurence

Registration Number: 400450/13

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)
Zoological Science (Professional Natural Scientist)

Effective **20 November 2013** Expires **31 March 2023**

Chairperson

Chief Executive Officer