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Kareekloof Energy PV and BESS

Avifauna Pre-Construction Monitoring

Environmental Impact Assessment Report

26 January 2024

for

Cape EAPrac

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Disclaimer by specialists

We,

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declare, that the work presented in this report is our own and has not been influenced in any way by the developer or the Environmental Assessment Practitioner (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)* for developing this specialist report.

EXECUTIVE SUMMARY

- A proponent proposes to develop the "Kareekloof Energy PV and BESS" near the town Potfontein in the Northern Cape Province, which comprises of one proposed photovoltaic solar energy facility (PVSEF) and Battery Energy Storage System (BESS), called the Kareekloof Energy PV and BESS;
- This Environmental Impact Assessment (EIA) Report is concerned exclusively with the Kareekloof PVSEF, with a 900 MW proposed capacity and a site boundary area of ~ 3512 ha;
- Additional infrastructure besides solar panels includes an O&M building, paved areas, Battery Energy Storage Systems, electrical substatios and access and internal roads with construction camp and laydown areas;
- The Screening Tool Report indicated a **Medium** Animal Theme Sensitivity due to the potential presence of two avifauna species of conservation concern (SCC), namely the Endangered Tawny Eagle (Aquila rapax) and the Endangered Ludwig's Bustard (Neotis ludwigii);
- Guidance for this avifauna study was provided by the "*Best-Practice Guidelines for assessing and monitoring the impact of solar energy facilities on birds in southern Africa"* (Jenkins *et al*., 2017), which classifies the Kareekloof PVSEF as a **Regime 2** facility.
- A comprehensive desktop study with a literature survey was undertaken to predict expected avifauna species likely to occur within and surrounding the Kareekloof PVSEF;
- Two avifauna surveys were conducted, in winter (31 July - 4 August 2023) and spring (6 - 8 October 2023) respectively consisting of walking and driving transects in and around the Kareekloof PVSEF project area;
- The Kareekloof PVSEF is situated within three regional vegetation types, namely the "Eastern Upper Karoo", "Northern Upper Karoo", and "Besemkaree Koppies Shrubland", all considered to be Least Concern. The project area is not within a REDZ but is situated entirely within the Central Power Corridor. The nearest protected area is the Rolfontein Provincial Nature Reserve situated ~ 40 km away towards the northeast, and the project area is situated entirely within the "Platberg-Karoo Conservancy" Important Bird Area (IBA);
- A total of 123 bird species are either expected to occur or have been observed in the area of the Kareekloof PVSEF, including nine species of conservation concern (SCC). The winter survey produced 69 bird species over 907 observations, while the spring visit produced 88 bird species over 793 observations. In total, 97 species were recorded over 1700 observations, while five SCCs were observed, namely Verreaux's Eagle, Tawny Eagle, Blue Crane, Secretarybird, and African Rock Pipit;
- Some existing impacts to avifauna were observed in the Kareekloof PVSEF during surveys, including low-intensity livestock and game farming, agricultural infrastructure such as reservoirs and fencing, the electricity infrastructure consisting of large pylons and powerlines through the area, a large dam situated close to the powerline, and tall alien trees;
- Five potential impacts to avifauna were identified from the proposed development namely Habitat Loss, Collision and Electrocution, Disturbance, Attraction to the Facility and Chemical Use. These have been described and potential mitigation measures have been proposed;

- Cumulative impacts to avifauna were assessed and described, with some cumulative impact expected on Bustards which are prone to colliding with powerlines (to be assessed in a separate environmental authorisation) despite implementation of mitigation measures. However, cumulative impacts from habitat loss are considered negligible;
- A Site Ecological Importance (SEI) classification process was developed for the Kareekloof PVSEF where Very High SEI are considered as No-Go areas and which were defined to include the drainage areas and dams + 100 m buffer and the rocky ridges + 30 m buffer – these do not interact meaningfully with the proposed Kareekloof PVSEF infrastructure;
- There are no major negative impacts to avifauna SCC expected from the proposed development, provided that the proposed mitigation measures described are applied;
- The specialists therefore recommend that the competent authority should grant environmental authorisation for this proposed PVSEF development (exclusive of any transmission lines which are to be evaluated separately), on condition that:
    - All mitigation measures stipulated in this EIA report are adhered to and captured in an Environmental Management Plan (EMP);
    - The EMP must include the necessity for post-construction avifauna monitoring as stipulated in Jenkins et al (2017).

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1 INTRODUCTION

1.1 PROJECT DESCRIPTION

The proposed "Kareekloof Energy PV and BESS" and associated infrastructure which includes the BESS, covers an area of ~1530 ha, has a proposed generation capacity of up to 900MW solar PV facility including a Battery Energy Storage System (BESS) . It is located ~14 km southeast of Potfontein in the Northern Cape Province (Figure 1-1) and is not situated within a Renewable Energy Development Zone (REDZ). Enviro-Insight was commissioned to perform the required pre-construction avifauna studies as part of the Environmental Authorisation (EA) application process. This document is included in the Environmental Impact Assessment (EIA) required as part of the process to obtain environmental authorisation (EA) for the proposed development.

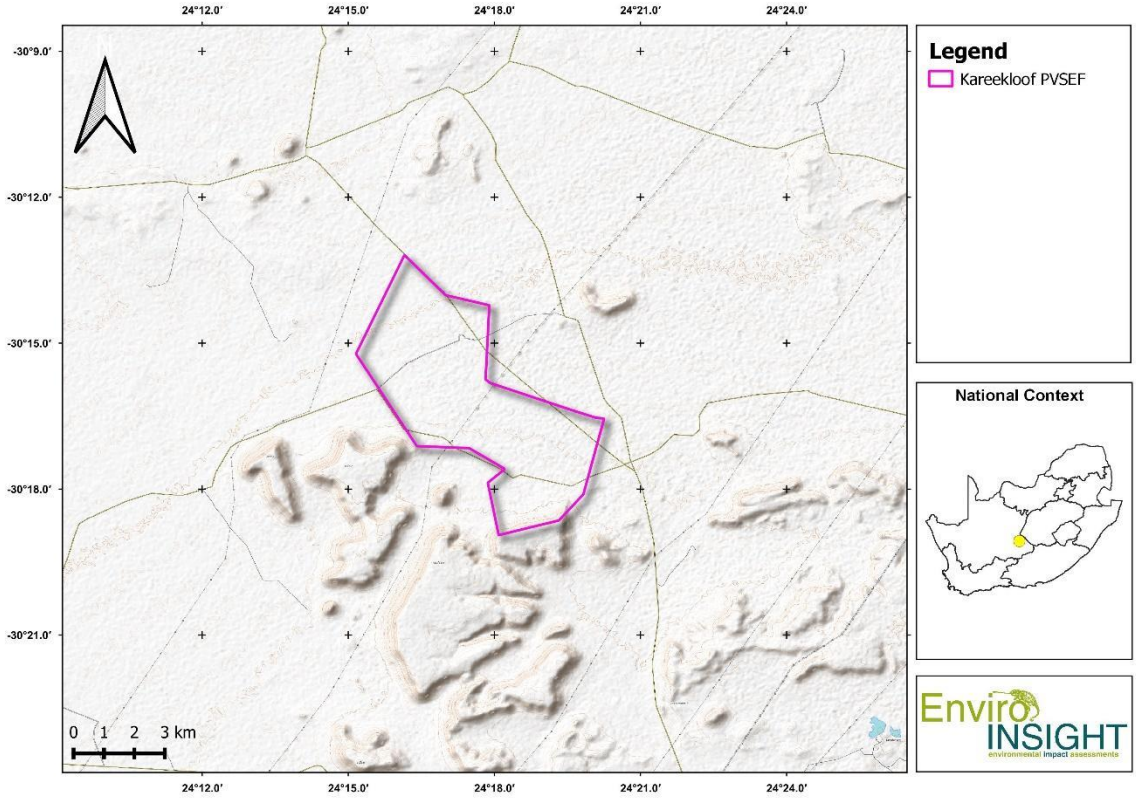


Figure 1-1. Location of the proposed Kareekloof PVSEF project area to be developed.

1.2 LEGAL CONTEXT & STUDY GUIDANCE

- This report addresses the avifauna species of the Sensitive Animal Species Theme of the Environmental Impact Assessment report (EIAr) required for the environmental authorisation process for a proposed development.

- The minimum report content requirements for environmental impacts on terrestrial animal and plant species in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)[1] are applicable;
- Guidance for the implementation of the above-mentioned protocol is followed according to SANBI (2020), hereafter referred to as "the animal species protocol guidelines"; and
- Guidance for avifauna studies in relation to developments of solar facilities is followed according to the "*Best-Practice Guidelines for assessing and monitoring the impact of solar energy facilities on birds in southern Africa"* (Jenkins *et al*., 2017).

1.3 SCREENING TOOL REPORT

The Screening Tool Report (STR) produced by the National Environmental Screening Tool[2] (generated on 10 August 2023) indicated a **Medium** Animal Theme Sensitivity for the Kareekloof PVSEF project area, due to the potential presence (medium sensitivity) of two avifauna species of conservation concern (SCC), namely the Endangered Tawny Eagle (*Aquila rapax*) and the Endangered Ludwig's Bustard (*Neotis ludwigii*) (Figure 1-2).

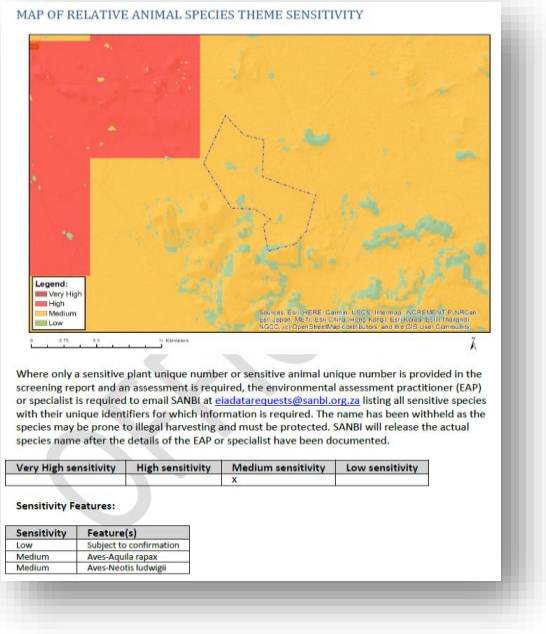


Figure 1-2. Animal Theme Sensitivities of the Kareekloof PVSEF project area indicated by the National Screening Tool.

[1] GOVERNMENT GAZETTE, No. 43855, 30 OCTOBER 2020. Available from: http://www.gpwonline.co.za/Gazettes/Gazettes/43855_30-10_NationalGovernment.pdf
[2] https://screening.environment.gov.za/screeningtool/

2 METHODS

2.1 GIS

Existing data layers were incorporated into a Geographic Information System (GIS) to establish how the study area interacts 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); and
- South African Protected Areas Database (SAPAD).

The existing national landcover classification was used to assist with the identification of habitat types of importance for avifauna during the initial surveys. Furthermore, a drainage and aquatic habitat map was obtained from the aquatic specialist. These were pre-emptively buffered by 100 m to include the more prominent marginal vegetation. Finally, a digital elevation model (DEM) was obtained for the area and a slope analysis was performed to delineate sensitive rocky habitats. Slopes of > 7° were considered steep enough in this region to constitute potentially sensitive rocky habitats and these were buffered by 30 m. All mapping was performed using open-source GIS software (QGIS[3] and SAGA[4]).

2.2 DESKTOP AND LITERATURE SURVEY

A desktop study and literature review was undertaken to evaluate all bird species which could potentially occur in the vicinity of the Kareekloof PVSEF project area (see Figure 2-1), predominantly using data from the second South African Bird Atlas Project (SABAP 2[5]; [SABAP2, 2020]) but cross-referencing with Hockey et al. (2005) and Sinclair & Ryan (2010). SABAP 2 data are collected as records per pentad (i.e., 5' X 5' or roughly 9 x 9 km). A list of species potentially occurring within and adjacent to the Kareekloof PVSEF project area was therefore developed from SABAP 2 data for the nine (9) pentads overlapping with the Kareekloof PVSEF project area (3010_2410, 3010_2415, 3010_2420, 3015_2410, 3015_2415, 3015_2420, 3020_2410, 3020_2415, 3020_2420; Figure 2-1). The expected species list is therefore based on an area much larger than the Kareekloof PVSEF project area. This approach was adopted to ensure that all species potentially occurring within the Kareekloof PVSEF project area, whether resident, nomadic, or migratory, were included.

Species were considered as sensitive to the proposed development based on their abundance, flight characteristics, ecological role, population trend and conservation status.

The following main literature sources were consulted for the 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 2023);
- del Hoyo *et al.* (1992) and Hockey *et al.* (2005) were consulted for general information on the life history attributes of relevant bird species;

[3] http://qgis.osgeo.org/en/site/
[4] https://saga-gis.sourceforge.io/
[5] http://sabap2.birdmap.africa/

- Distributional data was sourced from the Southern Africa Bird Atlas Project (SABAP 2 2023), Hockey *et al.* (2005), del Hoyo *et al.* (1992) and Sinclair & Ryan (2010);
- iNaturalist[6] records within ~15 km of the Kareekloof PVSEF were also consulted (no records of Tawny Eagle and Ludwig's Bustard found before surveys were conducted);
- Nomenclature and taxonomy followed the IOC World Bird Names unless otherwise specified (see www.worldbirdnames.org; Gill & Donsker 2012).

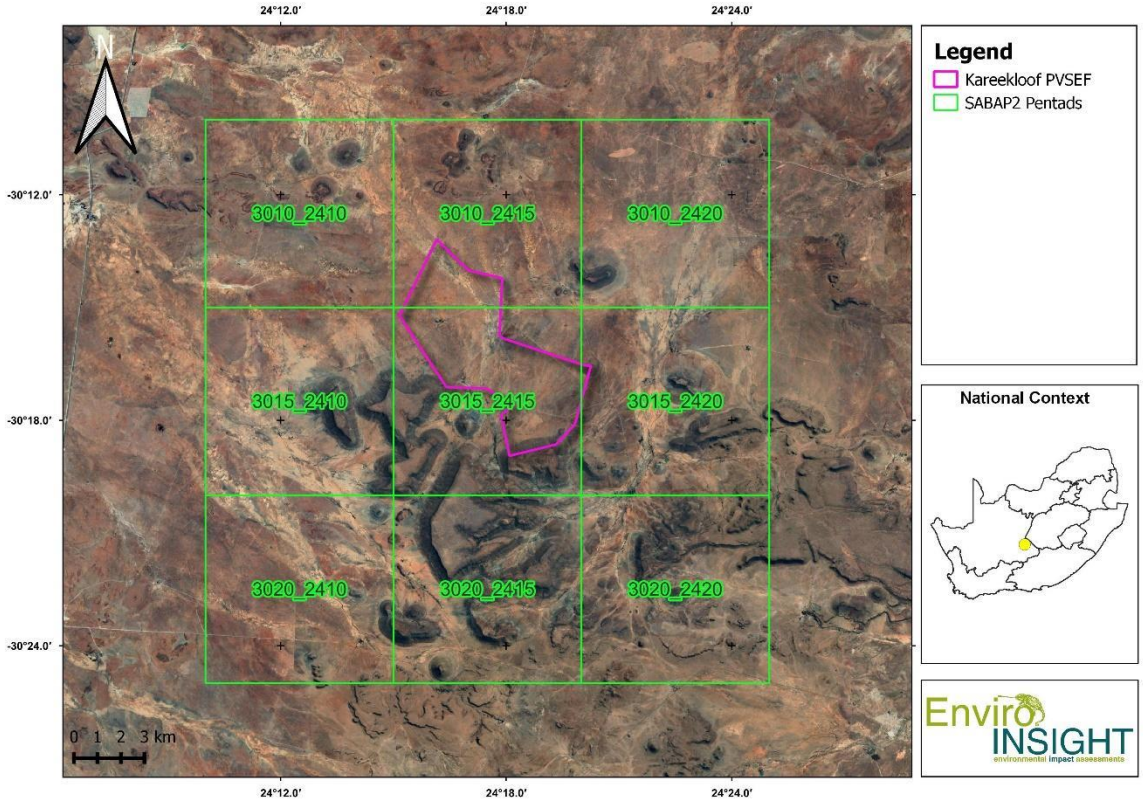


Figure 2-1. The proposed Kareekloof PVSEF project area in relation to the SABAP2 pentads.

2.3 Solar Energy Facilities (SEF) Survey Requirements

The Birds and Solar Energy Guidelines (Jenkins et al. 2017) provide clear requirements for Avifauna Impact Assessments of SEFs. SEFs are categorised into 3 regimes depending on the potential impact on Avifauna. The regime determines the level and intensity of surveys to be completed by the avifauna specialist.

The proposed Kareekloof PVSEF is regarded to be a **Regime 2** facility, because the facility has a potentially large footprint (>150 ha) and it is of Medium avifauna sensitivity (Figure 1-2).

A Regime 2 facility has the following requirements (Jenkins et al. 2017):

[6] https://www.inaturalist.org/home

1. Preliminary Assessment
    a. Literature review, habitats and desktop – provided in the scoping report and this EIA report;
2. Structured and detailed data collection
    a. Baseline data collection over 6-12 months, across as many seasons as possible – two seasonal surveys were performed in Winter and Spring respectively;
    b. Small bird abundance estimates – *provided in this EIA report*;
    c. Transect and vantage point abundances for large birds and raptors – *provided in this EIA report*;
    d. Flight behaviour of priority species – *provided in this EIA report*;
    e. Wetland bird counts and movements between wetlands using the CWAC initiative (Taylor et al. 1999) – *not possible for this site as no suitable CWAC sites exist within or around the Kareekloof PVSEF*;
    f. Existing power line collision mortalities – none observed in the Winter survey, but one observed in the Spring survey.
3. Impact Assessment (informed by 2)
    a. Map key habitats and flyways to be avoided – provided in this report;
    b. Inform SEF layout – provided in the scoping report and this EIA report;
    c. Assess impacts and mitigation strategies – expanded upon in this EIA report.

2.4 Walking & Driving Transects

Two site visits were conducted.

Winter: 31 July - 4 August 2023

Sampling was performed by means of combined walking and driving transects in and around the Kareekloof PVSEF project area. Driving was done at very low speeds, with frequent stoppages to observe birds and record data. Short walking transects were conducted from the vehicle wherever habitat allowed and bird productivity was high. The entire Kareekloof PVSEF project area and all the different habitats were surveyed in this manner. Although waterbodies were present on the Kareekloof PVSEF project area, none were appropriate for waterbirds counts (CWAC) as far fewer than 500 individual birds were present at a time. Suitable nesting structures and habitats were evaluated carefully for any possible nests of sensitive/priority bird species and recorded for mapping purposes.

Spring: 6 - 8 October 2023

A second survey was undertaken in Spring to comply with the requirements of a Regime 2 facility (Jenkins *et al*., 2017). As with the first season, sampling by means of walking and driving transects was performed in and around the project area. The same walking and driving transects were repeated to ensure consistency with the first survey, with efforts to cover all habitats. Efforts to monitor waterbodies on and around the site were made, but these sites still did not qualify as CWAC sites. Nest scoping continued in the second survey to assess if new priority species nests had been built after the first survey.

2.5 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 takes precedent for this assessment, but only in cases where the current global status is not of a higher risk. The first three categories i.e. Critically Endangered, Endangered and Vulnerable, are collectively referred to as 'threatened' species.

The extinction risk 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.

2.6 Impact Assessment

The following impact assessment methodology was followed for the EIA phase of the project. SANBI (2020) cautions that assessing impacts by assigning numerical rankings that are then mathematically combined is not the preferred manner to evaluate impacts, and may frequently lead to erroneous evaluations. Care must therefore be taken when interpreting such evaluations. The Mitigation Hierarchy Guideline for South Africa which offers appropriate guidance to determine impact significance is still in development and therefore cannot be implemented here. As such, the "traditional" method of evaluating impacts is followed in lieu of an accepted published alternative.

2.6.1 Definitions of terminology

ITEM	DEFINITION
EXTENT	
Local	Extending only as far as the boundaries of the activity, limited to the site and its immediate surroundings
Regional	Impact on the broader region
National	Will have an impact on a national scale or across international borders
DURATION	
Short-term	0-5 years

Medium-term	5-15 years
Long-term	>15 years, where the impact will cease after the operational life of the activity
Permanent	Where mitigation, either by natural process or human intervention, will not occur in such a way or in such a time span that the impact can be considered transient.
MAGNITUDE OR INTENSITY	
Low	Where the receiving natural, cultural or social function/environment is negligibly affected or where the impact is so low that remedial action is not required.
Medium	Where the affected environment is altered, but not severely and the impact can be mitigated successfully and natural, cultural or social functions and processes can continue, albeit in a modified way.
High	Where natural, cultural or social functions or processes are substantially altered to a very large degree. If a negative impact, then this could lead to unacceptable consequences for the cultural and/or social functions and/or irreplaceable loss of biodiversity to the extent that natural, cultural or social functions could temporarily or permanently cease.
PROBABILITY	
Improbable	Where the possibility of the impact materialising is very low, either because of design or historic experience
Probable	Where there is a distinct possibility that the impact will occur
Highly Probable	Where it is most likely that the impact will occur
Definite	Where the impact will undoubtedly occur, regardless of any prevention measures
SIGNIFICANCE	
Low	Where a potential impact will have a negligible effect on natural, cultural or social environments and the effect on the decision is negligible. This will not require special design considerations for the project
Medium	Where it would have, or there would be a moderate risk to natural, cultural or social environments and should influence the decision. The project will require modification or mitigation measures to be included in the design
High	Where it would have, or there would be a high risk of, a large effect on natural, cultural or social environments. These impacts should have a major influence on decision making.
Very High	Where it would have, or there would be a high risk of, an irreversible negative impact on biodiversity and irreplaceable loss of natural capital that could result in the project being environmentally unacceptable, even with mitigation. Alternatively, it could lead to a major positive effect. Impacts of this nature must be a central factor in decision making.
STATUS OF IMPACT	
Whether the impact is positive (a benefit), negative (a cost) or neutral (status quo maintained)	
DEGREE OF CONFIDENCE IN PREDICTIONS	

The degree of confidence in the predictions is based on the availability of information and specialist knowledge (e.g. low, medium or high)
MITIGATION
Mechanisms used to control, minimise and/or eliminate negative impacts on the environment and to enhance project benefits. Mitigation measures should be considered in terms of the following hierarchy: (1) avoidance, (2) minimisation, (3) restoration and (4) off-sets.

2.6.2 Scoring System for Impact Assessment Ratings

To comparatively rank the impacts, each impact has been assigned a score using the scoring system outlined in the table below. This scoring system allows for a comparative, accountable assessment of the indicative cumulative positive or negative impacts of each aspect assessed.

IMPACT PARAMETER	**SCORE**	
Extent (A)	Rating	
Local	1	
Regional	2	
National	3	
Duration (B)	Rating	
Short term	1	
Medium Term	2	
Long Term	3	
Permanent	4	
Probability (C)	Rating	
Improbable	1	
Probable	2	
Highly Probable	3	
Definite	4	
IMPACT PARAMETER	**NEGATIVE IMPACT SCORE**	**POSITIVE IMPACT SCORE**
Magnitude/Intensity (D)	Rating	Rating

Low	-1	1
Medium	-2	2
High	-3	3
SIGNIFICANCE RATING (F) = (A*B*D)*C	**Rating**	**Rating**
Low	0 to - 40	0 to 40
Medium	- 41 to - 80	41 to 80
High	- 81 to - 120	81 to 120
Very High	> - 120	> 120

2.7 Assumptions & Limitations

- It is assumed that all third-party information acquired is correct (e.g. GIS data and scope of work);
- Due to the timing of the seasonal surveys, summer migrants were not observed in either season of fieldwork. This may impact observational results by reducing the perceived likelihood of migratory priority species (such as Lesser Kestrels) being present or being impacted by the proposed project if observational data is solely used. To overcome this limitation, it is assumed in the impact assessment (based on iNaturalist and SABAP 2 records) that migratory birds will be present on the Kareekloof PVSEF site during summer months if the species is likely to occur in the available habitats.

3 Results

3.1 Regional Context

The Kareekloof PVSEF project area spans three regional vegetation types; all of which are considered to be of Least Concern (Figure 3-1; SANBI 2018), and all of which contain mostly natural habitats, with some low-intensity impacts from sheep farming. The Kareekloof PVSEF project area is not within a REDZ but is situated entirely within the Central Power Corridor. The nearest protected area is the Rolfontein Provincial Nature Reserve situated ~ 40 km away towards the northeast and the Kareekloof PVSEF project area is situated entirely within the “Platberg-Karoo Conservancy” Important Bird Area (IBA) (Figure 3-2). In 2014, this IBA's conservation state (condition) was indicated as "very unfavourable" due to "high" threat levels and "negligible" response or action taken (Birdlife International 2024). The IBA trigger species include globally threatened species (Blue Crane, Ludwig's Bustard, Kori Bustard, Sectarybird, Martial Eagle, Blue Korhaan, Black Harrier and Denham's Bustard), regionally threatened species (Black Stork, Lanner Falcon, Tawny Eagle, Karoo Korhaan and Verreaux's Eagle), congregatory species (Lesser Kestrel and Amur Falcon) and a number a biome-restricted species. During the summer, this IBA provides close to 10% of the global population of Lesser Kestrel roosting sites. Renewable energy developments have been identified as a new threat, however only moderate susceptibility has been predicted to the various impacts of solar-energy facilities. Concerns continue for the lack of effective mitigation methods to prevent power line collisions and the use of harmful pest control within the region to

target damage-causing predators and pests, such as black-backed jackals and brown locusts. The latter is of particular concern as non-target raptor species can be affected directly by the poisoning as scavengers or indirectly by feeding on poisoned locusts.

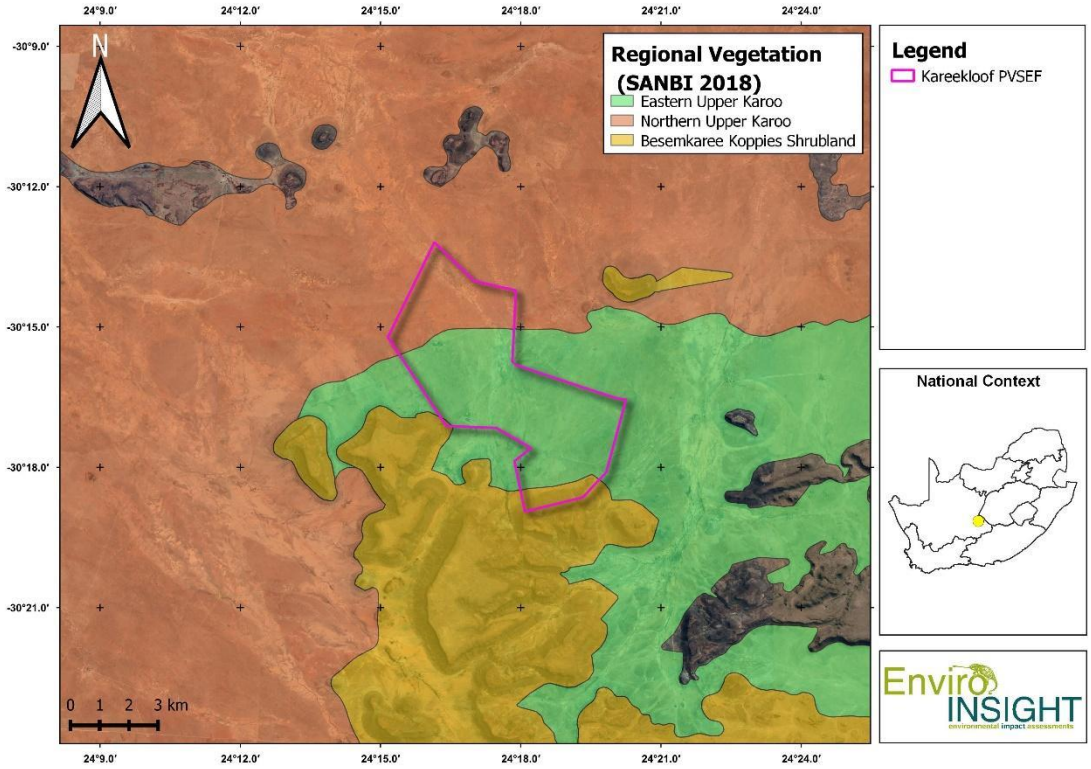


Figure 3-1.The Kareekloof PVSEF project area in relation to the regional vegetation types (SANBI 2018).

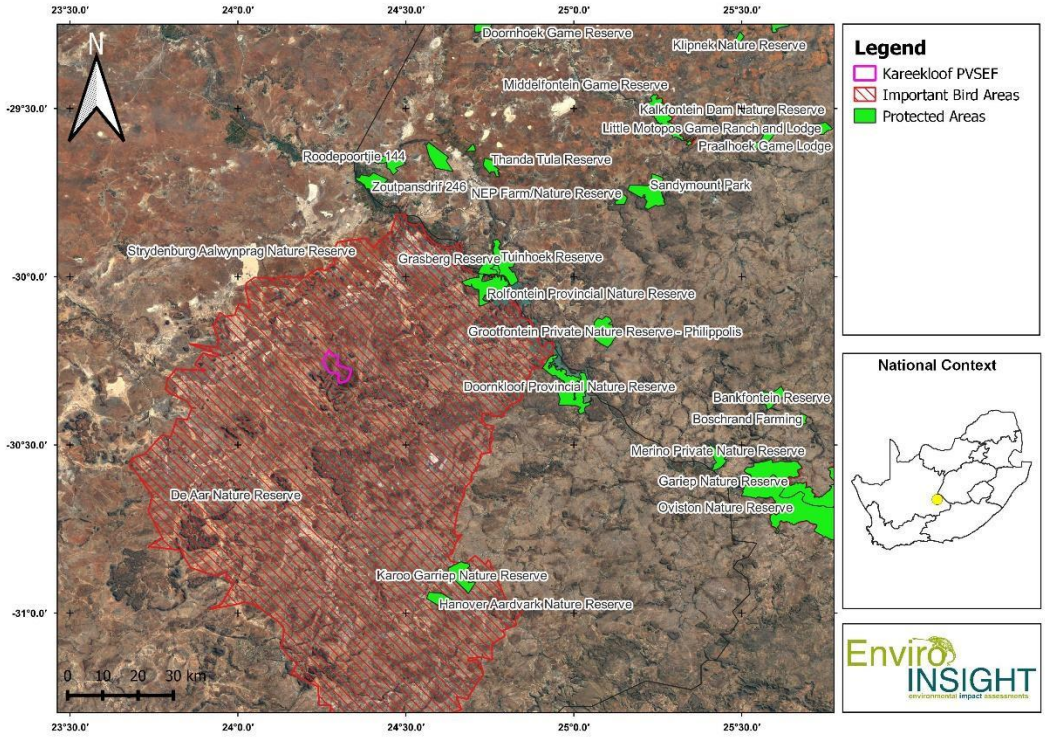


Figure 3-2.The Kareekloof PVSEF project area in relation to the nearest protected areas and IBAs.

3.2 HABITAT DESCRIPTION

The Kareekloof PVSEF project area is predominantly located on relatively flat land, with elevated rocky ridges characterising the southern areas outside of the proposed PVSEF (Figure 3-1). These flat areas of Northern and Eastern Upper Karoo vegetation types are characterised by two major habitat types - Nama Karoo Low Shrubland and Natural Grassland - according to the National Landcover Classification (NLC 2018[7]) (Figure 3-3). In addition, aquatic habitats are represented by a prominent drainage area bisecting the PVSEF with several scattered artificial dams (Figure 3-3). Furthermore, artificial habitat has been created by the Eskom power line running across the centre of the site.

[7] https://www.dffe.gov.za/projectsprogrammes/egis_landcover_datasets

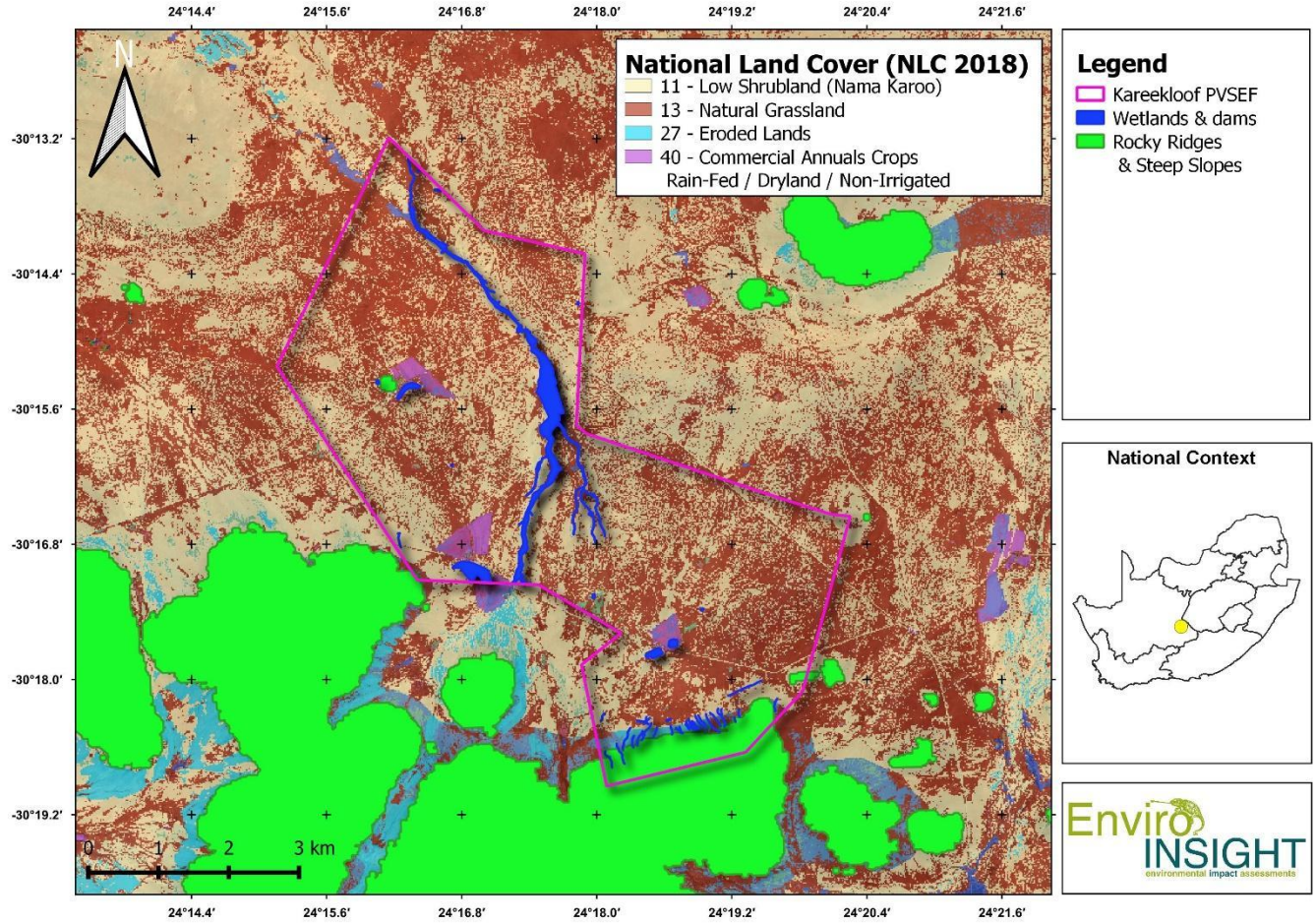


Figure 3-3.The major habitats of the Kareekloof PVSEF project area.

There are four specific avifauna habitats within the Kareekloof PVSEF project area, mostly consistent with the National Landcover data (Figure 3-3). These habitats are each briefly described below.

3.2.1 Grassland

This is the dominant habitat and is mostly present on softer, sandier soils. It is characterised by a dense grass sward with no or only few shrubs present (Figure 3-4). It extends up onto the foot-slopes of the rocky ridges. Given the very expansive occurrence of this habitat and its ability to support only few avifauna species of conservation (SCC) at low densities, it is not considered to be highly sensitive from an avifauna perspective.


Figure 3-4. Major habitat of the Kareekloof PVSEF: Grassland on soft sandy soils.

3.2.2 Scrubland

This habitat is present as patches amongst the grassland, typically characterised by the absence or near-absence of grasses and the presence of large, woody shrubs (Figure 3-5). However, it often forms a habitat mosaic with the grassland, particularly on the ecotone of the two habitats. Similar to the grassland habitat, scrubland has a very expansive occurrence in the region and does not support SCC at high densities and is therefore not considered to be highly sensitive from an avifauna perspective.


Figure 3-5. Major habitat of the Kareekloof PVSEF: Scrubland.

3.2.3 Rocky Ridges & Steep Slopes

This structurally defined habitat (Figure 3-6) is limited in the region and has the potential to support lekking sites for the Endangered Ludwig's Bustard and was confirmed to have a nesting pair of Vulnerable Verreaux's Eagles too. Due to the importance of lekking habitat for breeding success of Ludwig's Bustard, the presence of nesting Verreaux's Eagles, and the fact

that such habitat is limited in the landscape, it is considered to be sensitive from an avifauna perspective and has therefore been buffered from development by 30 m.


Figure 3-6. Major habitat of the Kareekloof PVSEF: Rocky ridges & steep slopes.

3.2.4 Drainage, Wetlands & Dams

This is a collection of aquatic habitats predominantly characterised by the ephemeral drainage lines and their marginal vegetation, but also the man-made impoundments (dams) in these drainage lines which retain surface water for longer (Figure 3-7). These habitats are very limited in this arid region, and due to the periodic presence of water, provide excellent foraging habitats for avifauna, particularly in the dry months. The dense marginal vegetation is also often suitable for breeding purposes. Since certain avifauna SCC may rely on these habitats for foraging purposes, and since the limited presence of surface water in the region may enhance the likelihood of waterbirds landing on the reflective surface of solar panels if placed nearby to these water sources, this habitat is considered to be sensitive from an avifauna perspective and has therefore been buffered from development by 100 m.


Figure 3-7. Major habitat of the Kareekloof PVSEF: Drainage, wetlands & dams.

3.2.5 Electricity Power Lines and Pylons

The Eskom powerline infrastructure laid across the centre of the Kareekloof PVSEF site in a north-easterly/south-westerly trajectory has created artificial habitat for some avian species (Figure 3-8). The infrastructure provides both perching and nesting opportunities for some raptor species and other large birds (crows and geese). Survey observations certainly noticed the use of these structures by large birds and may even attract species into the area. Since the powerline is aligned alongside the main drainage line, the area is already considered as sensitive.

Figure 3-8: Artificial habitat created by electricity power lines and pylons on the Kareekloof PVSEF site.

3.3 SURVEY COVERAGE

The flat, open landscape without any obstructions and the large-bodied target avifauna SCC meant that observations were possible for up to 1 km on either side of the road/transect with the aid of binoculars, cameras and spotting scopes. The survey coverage of the Kareekloof PVSEF project area was comprehensive and sufficient (Figure 3-9).

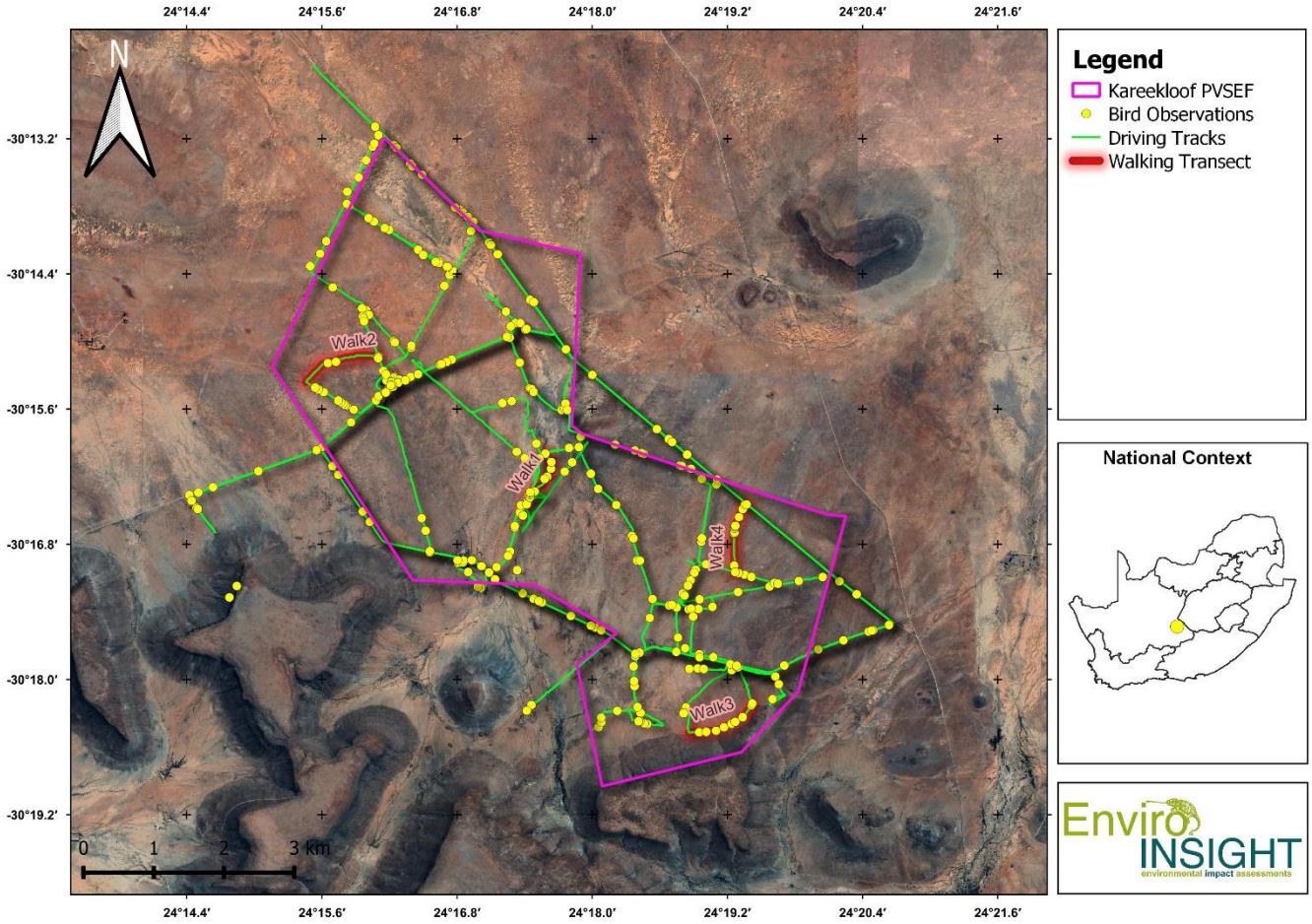


Figure 3-9: Avifauna survey coverage of the Kareekloof PVSEF project area during both seasonal the summer surveys.

3.4 Expected & Observed Avifauna

A total of 109 bird species have been recorded by the South African Bird Atlas Project (SABAP2) on the nine focal pentads relevant to the Kareekloof PVSEF project area (Table 6-1), all of which are expected to occur on the project area. Eight species of conservation concern (SCC; threatened and near-threatened) have been observed within at least one of the nine focal pentads for the Kareekloof PVSEF project area (

Table 3-1), two of which were observed during the winter survey (August 2023). During the spring survey (October 2023) five SCC species were observed. It is interesting to note that the Tawny Eagle which was observed during the spring survey and predicted by the Screening Tool (Figure 1-2), has not been recorded in the SABAP2 dataset for the nine focal pentads for the Kareekloof PVSEF project area (Table 6-1).

Table 3-1: Expected and observed avifauna species of conservation concern for the Kareekloof PVSEF Project Area.

Common Name	Scientific Name	Global Status (IUCN)	Regional Status (Taylor et al. 2015)	Winter (Aug '23)	Spring (Oct '23)
Ludwig's Bustard	*Neotis ludwigii*	EN	EN		
Martial Eagle	*Polemaetus bellicosus*	EN	EN		
Secretarybird	*Sagittarius serpentarius*	EN	VU	1	4
African Rock Pipit	*Anthus crenatus*	LC	NT		1
Verreaux's Eagle	*Aquila verreauxii*	LC	VU	5	2
Lanner Falcon	*Falco biarmicus*	LC	VU		
Blue Korhaan	*Eupodotis caerulescens*	NT	LC		
Blue Crane	*Grus paradisea*	VU	NT		2
Tawny Eagle	*Aquila rapax*	VU	EN		1

The total number of bird species observed within and around the Kareekloof PVSEF project area during the winter survey (31 July - 4 August 2023) was 69, comprising a total of 907 individuals. Of these, two species are considered to be of conservation concern, namely the Verreax's Eagle and Secretarybird. In general, the observed avian species richness is relatively low but expected for this region and abundances were moderate to high due to a productive summer season. For the spring survey (6 - 8 October), a total of 88 species, comprising 793 individuals were observed. Of these, five are SSCs, including Secretarybird, African Rock Pipit, Verreaux's Eagle, Blue Crane and Tawny Eagle. Observed species richness was higher in the spring season which is to be expected. Individual densities were however, considerably lower in spring than in winter despite the greater species richness. This was largely due to a winter eruption of the highly nomadic Grey-backed Sparrow-Lark and Lark-like Bunting that were dispersed widely and not present in high localized densities in spring. A combined total of 97 species were observed across both seasons, with 1700 observations (Table 6-1).

Encountered abundances of avifauna species groups are presented per hour of survey effort in Table 3-2, which demonstrates low encounter rates for raptors and waterbirds across both seasons. Small-bodied species were dominant across both seasons with mixed flocks or small congregations of small birds elevating the small bird encounter rate. The large-bodied species were dominated over both seasons by the presence of Pied Crows and Helmeted Guineafowl. None of the encounter rates shown in Table 3-2 are considered to represent a potential concern for the proposed development.

Table 3-2: Observed avifauna species groups for the Kareekloof PVSEF Project Area by survey effort (per hour), presented by survey day and season respectively. Values in brackets are totals.

Date	Distance (km)	Duration (h)	Small Bird (<30cm)	Large Bird (>30cm)	Raptor	Waterbird
Winter	240.9	27.2	27.6 (750)	5.8 (157)	1.1 (29)	0.7 (18)

01-Aug-23	73.8	7.2	28.1 (202)	5.1 (37)	1.1 (8)	0.1 (1)
02-Aug-23	50.0	7.4	23.3 (172)	4.9 (36)	1.1 (8)	2.2 (16)
03-Aug-23	60.0	5.9	20.9 (122)	5 (29)	1.5 (9)	0.2 (1)
04-Aug-23	57.1	6.7	37.8 (254)	8.2 (55)	0.6 (4)	0 (0)
Spring	167.0	18.5	35 (647)	7.9 (146)	1.7 (31)	1.6 (29)
06-Oct-23	47.4	3.5	18.8 (65)	6.7 (23)	2.6 (9)	1.2 (4)
07-Oct-23	61.8	7.6	37 (279)	6.4 (48)	0.9 (7)	1.5 (11)
08-Oct-23	57.8	7.5	39.9 (298)	10 (75)	2 (15)	1.9 (14)
Total	**407.9**	**45.6**	**30.6 (1397)**	**6.6 (303)**	**1.3 (60)**	**1 (47)**

3.5 Species of Conservation Concern (SCC)

Brief descriptions of each of the expected and observed threatened (CR, EN, VU) SCC (Table 1) are provided below in context with the proposed development.

3.5.1 Endangered species

- Ludwig's Bustard (*Neotis ludwigii*) is widely but patchily distributed across the arid interior of South Africa, extending into western Namibia (Shaw 2015). This species is particularly prone to fatalities caused by collisions with electricity transmission lines and is also susceptible to disturbance, as well as hunting and poisoning (Shaw 2015). This species was not recorded during the survey but is considered likely to be present periodically. Lekking sites for this species are typically elevated areas compared to the surrounding landscape and therefore all such areas, indicated by the delineated "Rocky Ridges & Steep Slopes" have been pre-emptively buffered from development.
- Martial Eagle (*Polemaetus bellicosus*) is infrequently recorded for the nine focal pentads. No observations of this species have been recorded for the region on iNaturalist. This species forages extremely widely and could occasionally fly over the study area but will not breed there "naturally" owing to the absence of suitable natural breeding habitat. However, it regularly breeds on large electricity pylons. It was not observed during the fieldwork surveys and is considered unlikely to be affected by the proposed development (excluding the associated overhead powerlines).
- Tawny Eagle (*Aquila rapax*) is one of the most threatened eagles in South Africa with a high sensitivity to land transformation. They are known to have been electrocuted by overhead power lines (Taylor *et al.* 2015). They forage extremely widely and require tall structures (trees or electricity pylons) for breeding. This species is expected to sporadically forage over the Kareekloof PVSEF project area, which was confirmed by observation during the spring survey.
- Secretarybird (*Sagittarius serpentarius*) is listed as Endangered globally and Vulnerable regionally (Taylor et al., 2015; BirdLife International 2020). Secretarybirds favour open habitats for terrestrial foraging and seek out flat-top trees for nesting. This species has an extremely wide distribution across Africa but occurs at very low densities. It is prone to collision with powerlines and fences (from being flushed), while habitat loss and alteration are also major regional threats. Since only one individual was observed on site during the winter survey, the species was initially thought to be an infrequent visitor to the area. However, the second (spring) survey observed three live individuals (two individuals

likely to be a breeding pair on one day, and another individual the next day) and one dead individual trapped in a roadside fence (likely caused by flushing from a passing vehicle) (Figure 3-10). This species is more likely to be a frequent visitor on site with the potential to breed in future.

Figure 3-10: A foraging Secretarybird observed on the Kareekloof PVSEF project area during the winter survey (left) and a carcass of a Secretarybird found caught in a roadside fence in the spring survey (right).

3.5.2 Vulnerable species

- Lanner Falcon (*Falco biarmicus*) occurs widely across South Africa in nearly all open habitat types. Major threats include habitat loss and collisions with powerlines. No individuals were recorded within the project area during the surveys. This species is adept at using man-made structures such as transmission pylons as perches, sites to hunt from, and nesting sites. It is considered to be an infrequent visitor to the Kareekloof PVSEF project area.
- Verreaux's Eagle (*Aquila verreauxii*) is quite widely distributed in South Africa, showing a preference for rocky ridges and mountains on which it breeds and hunts for Dassies and Rock Rabbits. The main threats facing this species in South Africa are direct persecution, drowning in farm dams, and collisions with, and electrocutions on, electricity transmission lines. Collisions with wind turbines is a growing threat. This species is breeding on the cliffs just outside the Kareekloof PVSEF project area and was regularly observed during the surveys (Figure 3-11).

Figure 3-11: A soaring adult Verreaux's Eagle observed on the Kareekloof PVSEF project area during the winter survey (left) and a Verreaux's Eagle nest located just outside the study area photographed in the spring survey (right).

- Blue Crane (*Grus paradisea*) was downgraded from regionally Vulnerable to Near-Threatened (Taylor et al., 2015), but is still considered as globally Vulnerable (IUCN, 2023). The species was not observed in the Kareekloof PVSEF project area in the winter season, but a pair was observed foraging in the project area in spring. No suitable breeding habitat was observed, but the species is considered as a foraging visitor on site and the greater region.

3.5.3 Summary

Loss of foraging habitat and potential collisions and electrocutions with powerlines associated with the PVSEF represents the major threats from the proposed development to the avifauna SCC discussed above. No loss of breeding habitat to avifauna species of conservation concern is expected from the proposed development, but cannot be completely dismissed after the relatively short surveys performed. Figure 3-12 shows a collage of photographs for several bird species observed in the project area during the surveys.

Figure 3-12: Photographs taken of birds encountered during seasonal surveys. EN (Endangered); VU (Vulnerable); NT (Near-Threatened); NE (Near-Endemic).

3.6 EXISTING IMPACTS

Existing impacts to avifauna were observed in the Kareekloof PVSEF project area during the surveys. Land use is almost exclusively low intensity livestock and game farming, but other impacts are also present. Several current impacts to avifauna observed on site are listed below and illustrated in Figure 3-12.

- Livestock and game grazing – this reduces plant diversity and abundance and therefore habitat viability for foraging avifauna. However the low intensity of this practice is unlikely to have significantly altered the avifauna assemblage within the region. Death of game and livestock will attract scavenging species (e.g. Tawny Eagle) and could bring such species into direct contact with the project infrastructure (specifically powerlines) leading to fatalities.
- Livestock water facilities/waterholes – drinking facilities for livestock and small associated manmade structures are present throughout the site. Such facilities modify natural habitat through the presence of alien trees acting as an attractant for avifauna, as well as the trampling of vegetation by livestock removing foraging habitat for birds.
- Alien and invasive species – alien trees are present throughout the project area, but mostly near developed infrastructure such as buildings, waterholes and impoundments. While their presence may reduce natural foraging or roosting habitat for some avian species, it also provides roosting and nesting opportunities. Larger alien trees such as pines and eucalyptus tend to attract large birds such as raptors and crows.
- Electricity powerlines and pylons - as mentioned above, electricity powerlines and pylons are both opportunities and risks for avifauna. While the infrastructure provides roosting, nesting and perching habitat for birds, it also subjects avifauna to potential risks of collision and electrocution. As shown in Figure 3-13, a photo of a dead Jackal Buzzard was taken in the project area under a powerline that was likely killed by collision with the line. This poses a probable and continuous threat to avifauna in the project area.
- Impoundment situated close to the powerline - the large dam on site is an important attractant for water birds, as observed during both seasonal surveys. The location of the powerline within close proximity to the dam increases the risk of waterfowl collisions with powerlines, making both the powerline and dam greater impacts to birds on site.
- Farm fences - present throughout the site, livestock fences are a noteworthy impact to avifauna. While birds may use fences for perching, they also pose collision and entrapment risks. Fences running parallel to roads pose greater risks to avifauna, as birds may be flushed by passing vehicles and collide with fences.

Figure 3-13: Examples of current impacts to avifauna observed in the Kareekloof PVSEF project area.

3.7 SITE ECOLOGICAL IMPORTANCE (SEI)

As described in the species protocol guidelines (SANBI 2020), Site Ecological Importance (SEI) is a "standardised metric for identifying site-based ecological importance for species in relation to a proposed project with a specific footprint and suite of anticipated activities". SEI allows for rapid spatial inspection and evaluation of impacts of a proposed development within the

context of on-site habitats and SCC, and also facilitates integration of inputs from different specialist studies. SEI depends on the careful spatial delineation of habitat types and an understanding of their utilisation by SCCs.

SEI was evaluated for each of the avifauna habitats in the project area, and the detailed evaluation is presented below in Table 3-3 and mapped in Figure 3-14, with the proposed infrastructure overlayed on the SEI in Figure 3-15.

Table 3-3: Evaluation of Site Ecological Importance (SEI) of avifauna habitats in the project area of influence for the proposed Kareekloof PVSEF project. BI = Biodiversity Importance.

Habitat	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
Grassland and Scrubland	Medium – Confirmed foraging habitat of Endangered Secretarybird (Global EN [A2acde+3cde+4acde]; Regional: VU, [A4acd; C1]) and highly likely foraging habitat for the Endangered Ludwig's Bustard (A4cd). Due to the extensive geographical distribution of both species and their low densities of occurrence in the habitats present in the Project Area, the CI is downgraded to Low. This is considered appropriate given the buffering of optimal foraging and breeding habitats and the large number of protected areas in which both species occur.	Very High – Very large (> 100 ha) intact area for any conservation status of ecosystem type, high habitat connectivity serving as functional ecological corridors, minimal current negative ecological impacts.	Medium – Arid area habitats will typically recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality. Scarification of landscape due to vegetation clearing remains visible for decades.	MEDIUM (BI = High)
Drainage, Wetlands & Dams	High – Preferred foraging habitat of Endangered Secretarybird (Global EN [A2acde+3cde+4acde]; Regional: VU, [A4acd; C1]) and Endangered Ludwig's Bustard (A4cd). Presence of moisture leads to greater probability and persistence of prey items, which is why it is preferred.	Very High – Very large (> 100 ha) intact area for any conservation status of ecosystem type, high habitat connectivity serving as functional ecological corridors, minimal current negative ecological impacts.	Medium – Arid area habitats will typically recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality. Scarification of landscape due to vegetation clearing remains visible for decades.	VERY HIGH (BI = Very High)

Habitat	Conservation Importance (CI)	Functional Integrity (FI)	Receptor Resilience (RR)	Site Ecological Importance (SEI)
Rocky Ridges & Steep Slopes	Medium – Highly likely lekking habitat of the Endangered Ludwig's Bustard (A4cd). Due to the importance of lekking habitat for the conservation of this species, and the fact that such habitat is limited in the landscape, the CI is upgraded to High. This is considered appropriate given the downgrading of CI for Grassland and Scrubland foraging habitat of this species.	Very High – Very large (> 100 ha) intact area for any conservation status of ecosystem type, minimal current negative ecological impacts. Despite the isolated nature of rocky ridges, this habitat is well connected by natural areas in-between.	Very Low – Habitat that is unable to recover from major impacts – complete functionality cannot be restored if any excavations or physical alterations take place on the rocky ridges itself.	VERY HIGH (BI = High)

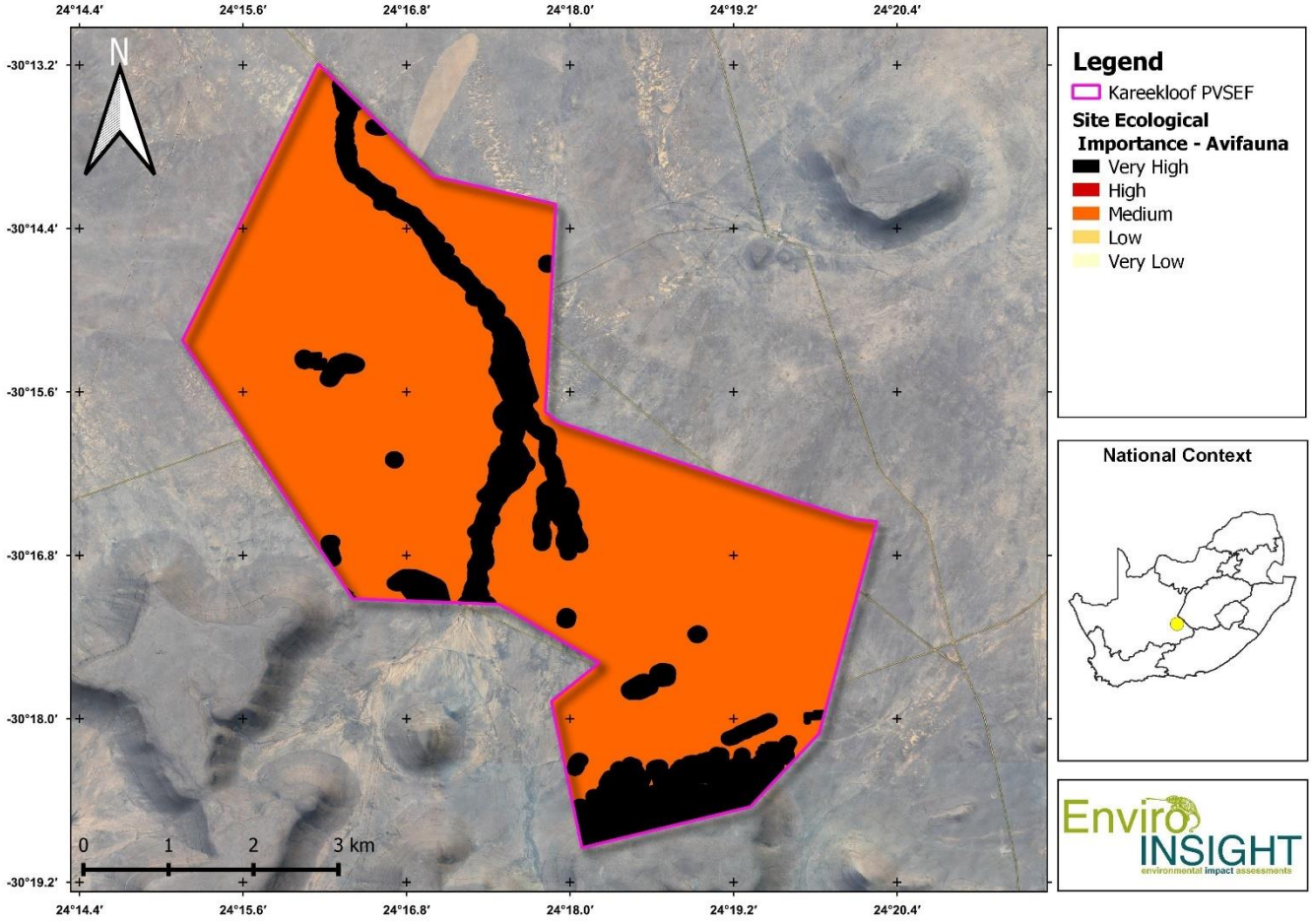


Figure 3-14: Site Ecological Importance (SEI) of avifauna habitats in the Kareekloof PVSEF project area.

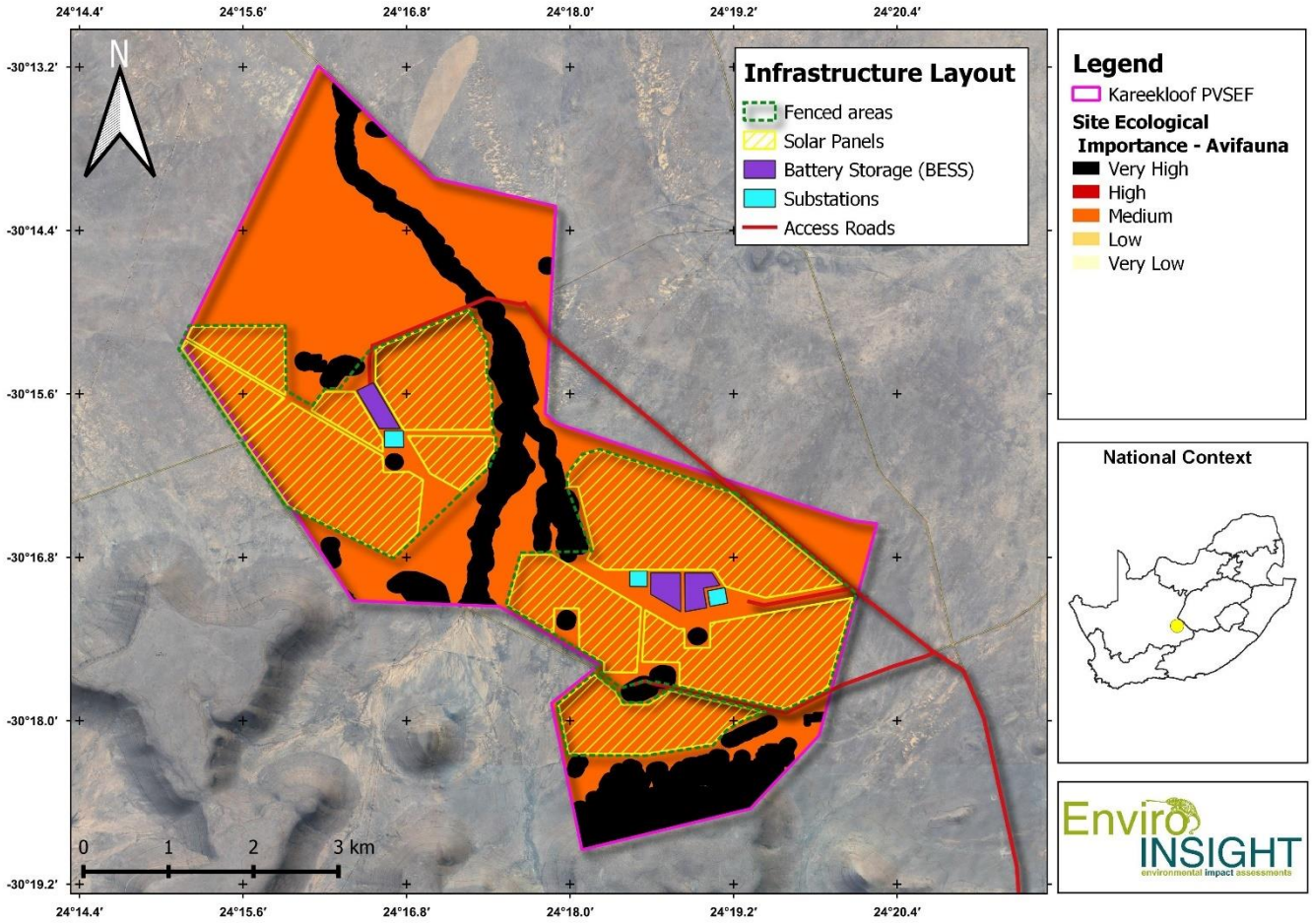


Figure 3-15: Proposed Infrastructure layout in relation to the Site Ecological Importance (SEI) of avifauna habitats in the Kareekloof PVSEF project area.

3.8 Anticipated Impact Description and Assessment

The main anticipated environmental impacts on avifauna from the proposed Kareekloof PVSEF are:

- the removal or alteration of large expanses of habitat specifically utilised by avifauna species of conservation concern;
- collisions with solar panels from the effects of polarized light and/or the "lake effect" [8];
- collisions/electrocutions with auxiliary infrastructure, specifically electrical transmission lines and security or farm fences (vehicle induced flushing);

[8] There is no research to unambiguously support or refute this hypothesized effect. However, ample evidence exists to suggest that it is likely to be an impact at PVSEFs (e.g. based on identified collision deaths of water-associated birds from an American review study by Kosciuch et al. 2020). Monitoring of bird carcasses at PVSEFs is in its infancy in South Africa and as such, there is no certainty of the causal mechanism behind waterbird deaths at these facilities. Consequently, the precautionary approach must be taken until ample evidence refutes the "lake effect" hypothesis and BLSA updates the Birds & Solar Guidelines to exclude it.

- disturbance due to noise such as, machinery movements and maintenance operations during the construction and operational phase of the proposed PVSEF;
- attraction of certain bird species due to the development of PVSEF with associated infrastructure such as perches, nest and shade opportunities; and
- chemicals used to keep the PV panels clean from dust (suppressants) may cause poisoning and/or exacerbate habitat loss.

Each of the potential impacts is carefully described below along with proposed mitigation measures to limit these impacts.

3.8.1 Habitat Loss

IMPACT NATURE	Direct loss of avifaunal habitat	STATUS	NEGATIVE
Impact Description	Clearing of natural vegetation for the construction and establishment of the solar PV and associated infrastructure will result in the loss, degradation and fragmentation of foraging and breeding habitat for avifauna. Optimal foraging habitat in and around drainage areas have been excluded from the development area by a buffer of 100 m. Loss of breeding and/or mating display habitat for SCC or the loss of habitat for important bird congregations may also occur but is unlikely given the buffering applied. While it is possible that a lekking site of Ludwig's Bustard may have been overlooked, it is highly unlikely due to the flat nature of the terrain, as they seek elevated areas from which to be visible from great distances and these areas have been excluded from the development area. Although no nests were located during the two site surveys, there is still the potential for nesting Secretarybirds due to the presence of scrubland along drainage lines on site (suitable for nesting) and ample grassland (suitable for foraging). Since Secretarybirds were recorded on site during both surveys, this suggests that the area is attractive and frequented by the species who may be locally impacted by habitat loss. Furthermore, the Kareekloof PVSEF project area does not support any globally, nationally or regionally important congregations of waterfowl and / or migratory species.		
Impact Source(s)	Site clearing and preparation.		
Receptor(s)	Ludwig's Bustard, Blue Korhaan, Blue Crane, Secretarybird, and Pink-billed Lark.		
PARAMETER	WITHOUT MITIGATION SCORE	WITH MITIGATION SCORE	
EXTENT (A)	2	1	
DURATION (B)	4	3	
PROBABILITY (C)	4	3	
INTENSITY OR MAGNITUDE (D)	-2	-1	
SIGNIFICANCE RATING (F) = A*B*D*C	MEDIUM (-64)	LOW (-9)	
CUMULATIVE IMPACTS	If the PVSEF and WEF facilities in the region take the necessary precautions to buffer the sensitive habitats for the receptor species and to prevent collisions of the receptor species with turbines and/or overhead		

	powerlines (such as high rotor sweep heights, bird flight diverters on powerlines etc.), the receptor species should persist within the region at ecologically viable population densities, limiting the potential for cumulative impacts to occur. The buffered sensitive habitats in the proposed Kareekloof PVSEF project area are expected to provide ample remaining habitat for the receptor species to persist, especially given the proposed arrangement of infrastructure that avoids Very High SEI habitats. Therefore, the cumulative impacts to the receptor species are unlikely to be significant.
CONFIDENCE	High
MITIGATION MEASURES	• Limit the areas cleared for construction purposes (e.g. laydown areas). • Do not implement a bare earth policy for construction of solar panels, rather mow the vegetation. • Use the finalized SEI spatial layers to appropriately position all surface infrastructure so as to minimise loss of high sensitivity avifaunal habitat – this has already been achieved see Figure 3-15. • Demarcate such areas on the ground during construction and sign post them as "Environmentally sensitive areas - keep out!". • Ensure that all non-solar panel infrastructure occurs in Low SEI portions of the project area. • Rehabilitate all areas disturbed immediately after construction. • Prioritise existing roads for access routes. • Develop and implement an Alien and Invasive Plant Control Plan.

3.8.2 Collision and Electrocution

IMPACT NATURE	Direct mortality through collision and electrocution	STATUS	NEGATIVE
Impact Description	Mortality from collision and electrocution is a potential impact to avifauna from solar PV farms. This risk is likely to be highest in situations where PV panels and electrical transmission infrastructure are placed closer to areas of higher habitat complexity and resource availability where bird abundances are higher (e.g. wetlands/rivers and rocky ridges). In addition, vehicle induced collisions (direct collisions with vehicles or vehicle-induced flushes into fence infrastructure) can pose significant direct mortality risk, especially to large ground dwelling species. Several SCC are likely/known to occur in the region of the proposed development which have a wingspan large enough (>1.5 m) to bridge gaps between live and earthed components or between phases of powerlines. In addition, electrocution of birds within the substations/switching or BESS areas is also possible. This impact can be reduced through appropriate planning of the infrastructure layout based on the SEI evaluation. The position of infrastructure and alignment of the electrical transmission lines have been confirmed but are being evaluated as a separate environmental authoristation process.		
Impact Source(s)	Solar PV and electrical transmission infrastructure		
Receptor(s)	All birds, but particularly water birds, raptors and other large-bodied species with low power to weight ratios and in-flight manoeuvrability. The major receptors are Ludwig's Bustard, Martial Eagle, Tawny Eagle, Secretarybird and Blue Crane, all known to be present within the region.		
PARAMETER	**WITHOUT MITIGATION SCORE**	**WITH MITIGATION SCORE**	
EXTENT (A)	2	1	

DURATION (B)	3	3
PROBABILITY (C)	3	2
INTENSITY OR MAGNITUDE (D)	-3	-2
SIGNIFICANCE RATING (F) = A*B*D*C	**MEDIUM (-54)**	**LOW (-12)**
CUMULATIVE IMPACTS	Without appropriate mitigation, the cumulative impacts on the receptors most at risk (bustards) from collisions with powerlines will be marked. Even with typical mitigation such as bird flight diverters, collisions are not unavoidable and there is likely to be an appreciable cumulative impact on bustard species in the region.	
CONFIDENCE	Low (without layout depicting grid connection routes and infrastructure)	
MITIGATION MEASURES	• Avoid placing any infrastructure near aquatic habitats by adhering at a minimum to a 100 m buffer around these habitats. • It is recommended that wherever possible, existing electrical transmission infrastructure is utilised or underground cabling is implemented. Where the creation of new transmission lines is necessary attempts should be made to minimise the route length to the closest existing substation and that the route be aligned with existing powerlines as far as possible. Additionally, the route should avoid or minimise wetland/riverine crossings. • Install Eskom-approved bird flight diverters (flappers or coils) on new transmission lines (particularly the earth wire). This can help to increase the visibility of transmission lines, especially the thinner earth line with which most collisions tend to be associated. If the transmission lines are long or if budget is constraining then prioritise portions of the transmission lines that pass near to or cross wetlands/riverine habitats or through Very High SEI habitat. • Design of overhead electrical lines must take into account potential for electrocution by large species and pre-emptively avoid the likelihood of this by increasing distances between spans to avoid faecal “streamers” or large open wings creating a short. • All power cables within the project area should be fully insulated and preferably buried in demarcated corridors. • White strips or simply the exposed (lustrous) aluminium frames along the edges of the solar panels appear to help to increase visibility and deter birds and are recommended as far as practically feasible. • Installation of bird deterrent devices on and around solar panels and on transmission line poles, pylons and / or monopoles as well as security/boundary fences, will be required to limit collision risk. • The BESS must be covered in non-reflective surfaces and protected against thermal discharge and the (low) risk of veld fires as a result. • In all areas where service roads intersect with semi natural or natural habitat (which is everywhere), 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 bustards, storks, cranes and korhaans to obtain adequate height after being flushed by vehicle traffic. Alternatively, the fences must be placed completely adjacent to the roads with a maximum of 3 metres buffer and marked with fence flappers in order to reduce flush related collisions.	

3.8.3 Disturbance

IMPACT NATURE	Sensory disturbance	STATUS	NEGATIVE
Impact Description	Sensory disturbances to avifauna are inevitable but are unlikely to negatively impact upon nesting SCC and is mainly likely to be restricted to the construction phase. Although dust, noise and human activity during construction is unavoidable, much can be done to reduce the effect of these sensory disturbance impacts on avifauna. During operation, the residual impacts associated with sensory disturbance should be negligible.		
Impact Source(s)	Machinery, influx of people, noise, dust, light.		
Receptor(s)	All avifauna, particularly large terrestrial birds and raptors		
PARAMETER	**WITHOUT MITIGATION SCORE**	**WITH MITIGATION SCORE**	
EXTENT (A)	1	1	
DURATION (B)	1	1	
PROBABILITY (C)	3	2	
INTENSITY OR MAGNITUDE (D)	-2	-1	
SIGNIFICANCE RATING (F) = A*B*D*C	**LOW (-6)**	**LOW (-3)**	
CUMULATIVE IMPACTS	Disturbances to birds from the construction of renewable energy facilities in the region is likely to be short lived and very occasional and therefore unlikely to represent a significant cumulative impact.		
CONFIDENCE	High		
MITIGATION MEASURES	• Adopt temporal avoidance strategies. Attempt, as far as possible to conduct the majority of the high intensity earthmoving and building activities during winter (June to September) to minimize disturbance of avifauna during sensitive life stages such as lekking, courting, nesting and fledging. • Minimise light pollution and fit external lighting with downward facing hoods. • Demarcate natural areas beyond the surface infrastructure footprint (buffered areas) and restrict access of personnel into these areas through education and signposting. • Train staff and contractors on the importance of birds and other biodiversity and the sensitive areas for these species which should be avoided. • Introduce and enforce a speed limit (40 km/h).		

3.8.4 Attraction to the Facility

IMPACT NATURE	Attraction of birds	STATUS	NEGATIVE

Impact Description	Certain (mainly commensal species) are often attracted by the establishment of the PVSEF and associated infrastructure as it presents additional resources in the form of perches, nesting habitat, shade and often food availability (increased rodents and weedy annual plants). This artificial increase in the abundance of some species has the effect of augmentation of the natural abundance and species composition of birds but more importantly places these opportunistic species and their predators at risk of collision and electrocution.	
Impact Source(s)	PVSEF and associated infrastructure.	
Receptor(s)	Commensal and opportunistic species but also their predators, including Martial Eagle, Tawny Eagle and Lanner Falcon.	
PARAMETER	**WITHOUT MITIGATION SCORE**	**WITH MITIGATION SCORE**
EXTENT (A)	2	2
DURATION (B)	3	3
PROBABILITY (C)	3	2
INTENSITY OR MAGNITUDE (D)	-2	-1
SIGNIFICANCE RATING (F) = A*B*D*C	**MEDIUM (-36)**	**LOW (-12)**
CUMULATIVE IMPACTS	Expected to be low.	
CONFIDENCE	Medium	
MITIGATION MEASURES	• Install bird deterrent devices around panels and on transmission line poles, pylons and / or monopoles to limit perching and minimise collision and electrocution risk. • In the event of increased rodent activity, non-harmful pest control measures should be applied to control population numbers and limit the attractiveness of the project area for foraging. • Add flappers/streamers to solar panels wherever possible to break up the continuous nature of their reflection in an attempt to minimise the “lake effect”.	

3.8.5 Chemical Use

IMPACT NATURE	Ecotoxicity	Ecotoxicity	Ecotoxicity
Impact Description	The surfactants, dust suppressants and other chemicals that may be used to keep the PV panels clean may cause poisoning and or exacerbate habitat loss. Battery acids or electrolytes may leak causing environmental damage or toxicity that can enter the avian food chain		
Impact Source(s)	Chemicals		
Receptor(s)	All avifauna		

PARAMETER	WITHOUT MITIGATION SCORE	WITH MITIGATION SCORE
EXTENT (A)	2	1
DURATION (B)	3	3
PROBABILITY (C)	2	1
INTENSITY OR MAGNITUDE (D)	-2	-1
SIGNIFICANCE RATING (F) = A*B*D*C	LOW (-24)	LOW (-3)
CUMULATIVE IMPACTS	The regular use of cleaning detergents by a large number of PVSEFs in a region has the potential to adversely affect water quality of watercourses. The extent, regularity and intensity of this impact on a regional level in such an arid environment is difficult to assess and impacts of this nature from solar developments on avifauna are poorly studied. However, given the limited number of PVSEFs and the very limited occurrence of wetlands and drainage areas throughout the region as a whole, this is unlikely to be a major concern.	
CONFIDENCE	Medium	
MITIGATION MEASURES	• Avoid or minimise the use of chemical surfactants; • Avoid or minimise the use chemical dust suppressants on site (preferentially use natural or biodegradable options); and • Ensure that none of the cleaning water enters nearby watercourses through runoff; • Do not clean before an imminent rainstorm. • Refer to the BESS Risk Assessment for mitigation of environmental impacts	

3.9 Anticipated Cumulative Impacts

Cumulative impacts are notoriously difficult to assess accurately. However, the evaluation of cumulative impacts from PVSEFs and to a certain degree WEFs can largely be considered as a spatial analysis, because the most obvious impact to avifauna from these developments in arid areas, when evaluated in isolation of the associated overhead powerline infrastructure, is the loss of habitat, which includes flyways (for WEFs).

There are 7 known PVSEFs and seven known WEFs within a 30 km radius of the proposed Kareekloof PVSEF project area (REEA Q1 2023[9]) (Figure 3-16). Assuming that the total areas represented by all of these renewable energy developments shown in Figure 3-16 will be transformed, Table 3-4 shows that the maximum transformed area from renewable energy development boundaries within a 30 km radius of the proposed development cluster currently amounts to only 7.17% of the total land area. The proposed Kareekloof PVSEF itself only represents 1.01% of the 30 km radius area, indicating an insignificant

[9] Renewable Energy EIA Application Database Quarter 1 2023 - https://egis.environment.gov.za/data_egis/data_download/current

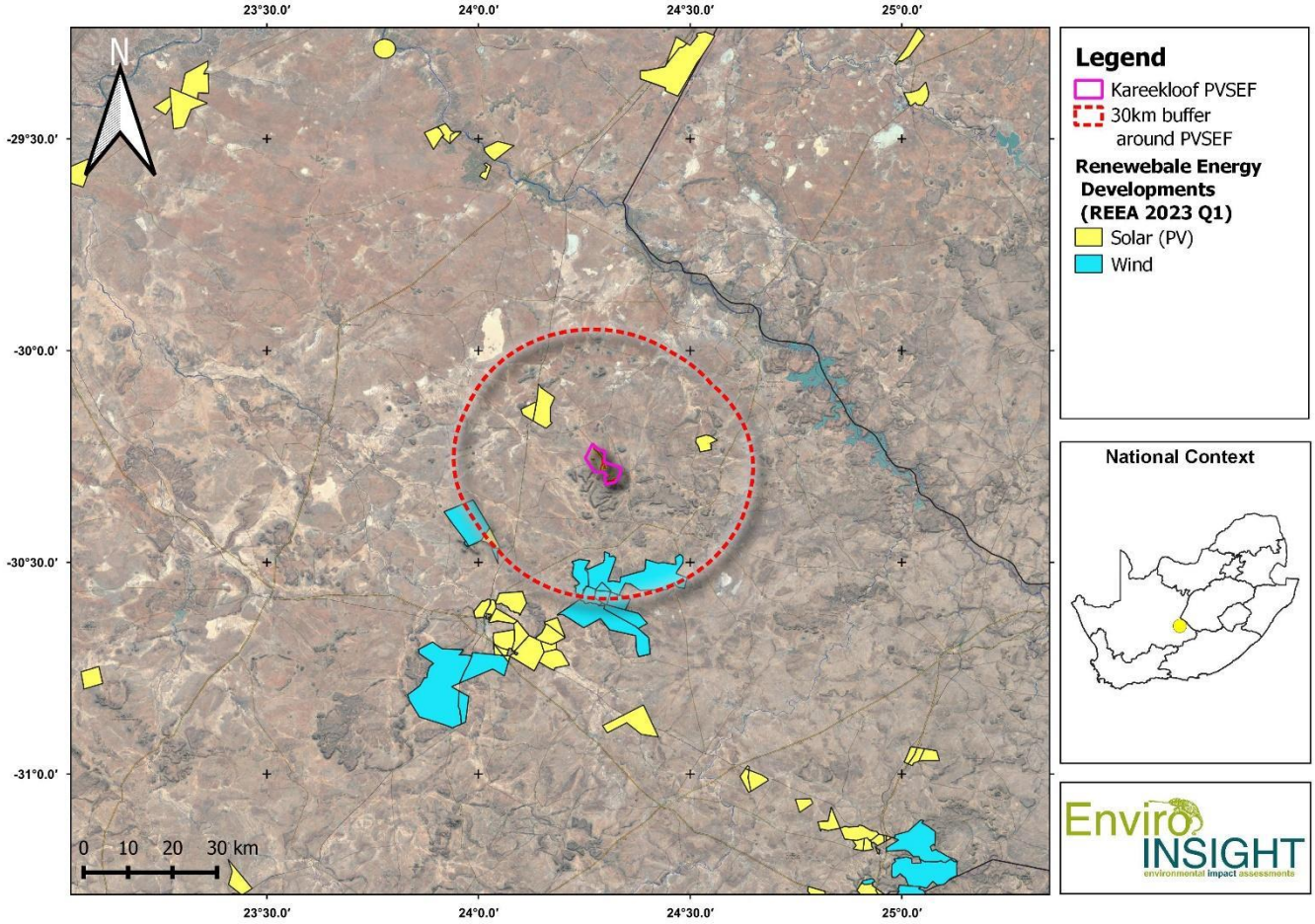
proportion of transformation in the regional context that can be expected from this development alone. It is important to note that not all of these areas will be transformed by the proposed developments and mitigation recommendations made above and implemented by the existing developments will ensure that the most sensitive habitats remain undisturbed in the region (see Figure 3-15).

As mentioned above, even with the best mitigation measures applied there are still cumulative negative impacts expected to bustard species, especially Ludwig's Bustard, in the region due to their propensity for collision with overhead powerlines (OHPLs) which cannot be completely mitigated with current measures such as bird flight diverters. Some cumulative impact to these species is therefore expected in the region from the renewable energy developments but it is not possible to accurately calculate the magnitude of this impact at this stage. More research is required to assess these impacts appropriately and develop mitigation solutions that are more effective than those currently available. The Endangered Wildlife Trust is currently attempting to develop new bird flight diverters to reduce Ludwig's Bustard fatalities.

The major component of cumulative impacts expected from renewable energy developments in the region is therefore from collisions with wind turbines and OHPLs, not habitat loss. Given the small additional land area that will be taken up by the proposed Kareekloof PVSEF, (Figure 3-15), it is highly unlikely to be significant in the regional context. The cumulative impact of habitat loss is therefore considered negligible.

Table 3-4: Cumulative impact from renewable energy developments in the region.

Elements	Area (ha)	Proportion of total area
Total area of 30 km buffer surrounding (and including) the proposed Kareekloof PVSEF.	369908.7	100.00%
Total area of known renewable energy developments within a 30 km buffer surrounding the proposed Kareekloof PVSEF.	26510.3	7.17%
Total area of known WIND energy developments within a 30 km buffer surrounding the proposed Kareekloof PVSEF.	18288.0	4.94%
Total area of known PV energy developments within a 30 km buffer surrounding the proposed Kareekloof PVSEF.	8222.3	2.22%
Total area of the proposed Kareekloof PVSEF.	3720.8	1.01%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Legend
Kareekloof PVSEF
30km buffer around PVSEF
Renewebale Energy Developments (REEA 2023 Q1)
Solar (PV)
Wind
National Context
Enviro INSIGHT
environmental impact assessments

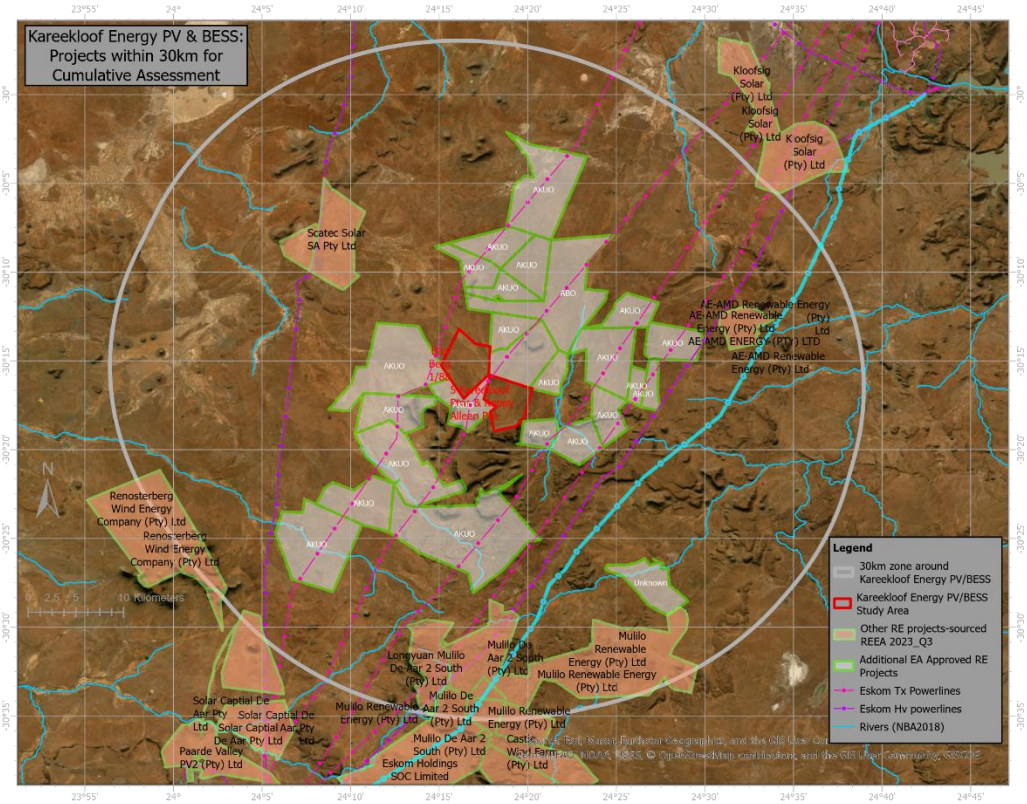

Figure 3-16: Location of known regional renewable energy projects (Quarter 1, 2023[10]) in relation to the Kareekloof PVSEF.

4 CONCLUSIONS AND PROFESSIONAL OPINION

There are no major negative impacts to avifauna SCC expected from the proposed development, provided that the proposed mitigation measures described above are applied. The Kareekloof PVSEF and associated project activities are likely to represent a low risk to avifauna (after application of mitigation). Indeed, the infrastructure design has considered the Site Ecological Importance delineation carefully and successfully avoided all Very High SEI habitats (Figure 3-15). The specialists therefore recommends that the Competent Authority should grant environmental authorisation for this proposed PVSEF development (exclusive of any transmission lines which are to be evaluated separately), on condition that:

- All mitigation measures stipulated in this EIA report above are adhered to and captured in an Environmental Management Plan (EMP);
- The EMP must include the necessity for post-construction avifauna monitoring as stipulated in Jenkins et al. (2017).

[10] https://egis.environment.gov.za/data_egis/data_download/current

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6 APPENDIX

6.1 EXPECTED & OBSERVED AVIFAUNA SPECIES

Table 6-1 : Observed avifauna species for the nine focal SABAP2 pentads of the Kareekloof PVSEF [see Figure 2-1]. Species of conservation concern are highlighted at the top of the table.

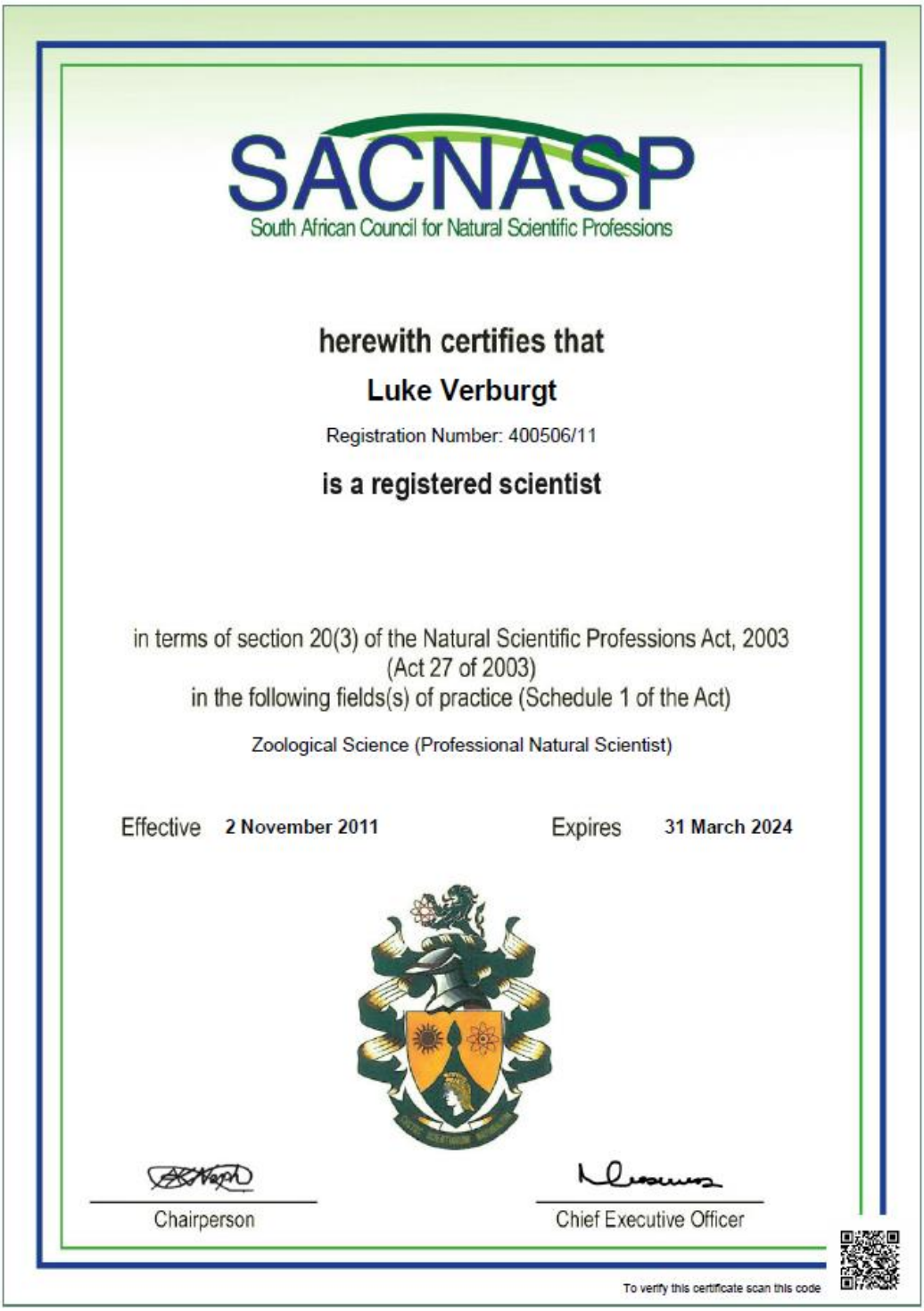
Common Name	Scientific Name	Global Status (IUCN)	Regional Status (Taylor et al. 2015)	Winter (Aug '23)	Spring (Oct '23)
Ludwig's Bustard	*Neotis ludwigii*	EN	EN		
Martial Eagle	*Polemaetus bellicosus*	EN	EN		
Secretarybird	*Sagittarius serpentarius*	EN	VU	1	4
African Rock Pipit	*Anthus crenatus*	LC	NT		1
Verreaux's Eagle	*Aquila verreauxii*	LC	VU	5	2
Lanner Falcon	*Falco biarmicus*	LC	VU		
Blue Korhaan	*Eupodotis caerulescens*	NT	LC		
Blue Crane	*Grus paradisea*	VU	NT		2
Tawny Eagle	*Aquila rapax*	VU	EN		1
Northern Black Korhaan	*Afrotis afraoides*			10	12
Egyptian Goose	*Alopochen aegyptiaca*			3	10
Red-headed Finch	*Amadina erythrocephala*				14
African Pipit	*Anthus cinnamomeus*			1	1
Nicholson's Pipit	*Anthus nicholsoni*				
Buffy Pipit	*Anthus vaalensis*				
Little Swift	*Apus affinis*				5
Common Swift	*Apus apus*				
White-rumped Swift	*Apus caffer*				4
Black-headed Heron	*Ardea melanocephala*				
Pririt Batis	*Batis pririt*				2
Hadada Ibis	*Bostrychia hagedash*				9
Black-faced Waxbill	*Brunhilda erythronotos*				1
Spotted Eagle-Owl	*Bubo africanus*				4
Common Buzzard	*Buteo buteo*				
Jackal Buzzard	*Buteo rufofuscus*			5	4
Red-capped Lark	*Calandrella cinerea*				
Fawn-colored Lark	*Calendulauda africanoides*				2
Sabota Lark	*Calendulauda sabota*			4	22
Greater Striped Swallow	*Cecropis cucullata*				14
Red-breasted Swallow	*Cecropis semirufa*				
Karoo Scrub Robin	*Cercotrichas coryphoeus*			14	13
Kalahari Scrub Robin	*Cercotrichas paena*			5	11
Karoo Long-billed Lark	*Certhilauda subcoronata*				
Three-banded Plover	*Charadrius tricollaris*			1	1
Spike-heeled Lark	*Chersomanes albofasciata*			18	26

Common Name	Scientific Name	Global Status (IUCN)	Regional Status (Taylor et al. 2015)	Winter (Aug '23)	Spring (Oct '23)
White Stork	*Ciconia ciconia*				
Dusky Sunbird	*Cinnyris fuscus*			5	8
Desert Cisticola	*Cisticola aridulus*			12	31
Neddicky	*Cisticola fulvicapilla*			5	6
Grey-backed Cisticola	*Cisticola subruficapilla*			10	11
Cloud Cisticola	*Cisticola textrix*				
White-backed Mousebird	*Colius colius*				4
Speckled Pigeon	*Columba guinea*				3
White-necked Raven	*Corvus albicollis*				
Pied Crow	*Corvus albus*			74	39
Cape Robin-Chat	*Cossypha caffra*			1	2
Wattled Starling	*Creatophora cinerea*			5	1
White-throated Canary	*Crithagra albogularis*			14	9
Black-throated Canary	*Crithagra atrogularis*				
Yellow Canary	*Crithagra flaviventris*			15	12
Layard's Warbler	*Curruca layardi*			3	2
Chestnut-vented Warbler	*Curruca subcoerulea*				11
African Palm Swift	*Cypsiurus parvus*				
Sickle-winged Chat	*Emarginata sinuata*			2	3
Cape Bunting	*Emberiza capensis*			6	3
Lark-like Bunting	*Emberiza impetuani*			282	44
Cinnamon-breasted Bunting	*Emberiza tahapisi*				2
Yellow-bellied Eremomela	*Eremomela icteropygialis*			1	6
Grey-backed Sparrow-Lark	*Eremopterix verticalis*			107	22
Southern Red Bishop	*Euplectes orix*				
Cinnamon-breasted Warbler	*Euryptila subcinnamomea*				
Greater Kestrel	*Falco rupicoloides*			1	6
Rock Kestrel	*Falco rupicolus*			1	
Large-billed Lark	*Galerida magnirostris*			4	4
Booted Eagle	*Hieraaetus pennatus*				
White-throated Swallow	*Hirundo albigularis*				4
Barn Swallow	*Hirundo rustica*				
Pied Starling	*Lamprotornis bicolor*			6	2
Cape Starling	*Lamprotornis nitens*				16
Southern Fiscal	*Lanius collaris*			11	2
Red-backed Shrike	*Lanius collurio*				
Lesser Grey Shrike	*Lanius minor*				
Rufous-eared Warbler	*Malcorus pectoralis*			28	22
Chat Flycatcher	*Melaenornis infuscatus*			11	9
Fiscal Flycatcher	*Melaenornis silens*			3	13
Pale Chanting Goshawk	*Melierax canorus*			15	9

Common Name	Scientific Name	Global Status (IUCN)	Regional Status (Taylor et al. 2015)	Winter (Aug '23)	Spring (Oct '23)
European Bee-eater	*Merops apiaster*				1
Gabar Goshawk	*Micronisus gabar*				
Eastern Clapper Lark	*Mirafra fasciolata*			3	35
Short-toed Rock Thrush	*Monticola brevipes*			1	4
Cape Wagtail	*Motacilla capensis*			4	6
Spotted Flycatcher	*Muscicapa striata*				
Ant-eating Chat	*Myrmecocichla formicivora*			42	31
Mountain Wheatear	*Myrmecocichla monticola*			2	3
Malachite Sunbird	*Nectarinia famosa*				2
Helmeted Guineafowl	*Numida meleagris*			24	20
Namaqua Dove	*Oena capensis*				10
Familiar Chat	*Oenanthe familiaris*			3	7
Capped Wheatear	*Oenanthe pileata*				
Pale-winged Starling	*Onychognathus nabouroup*				2
Southern Grey-headed Sparrow	*Passer diffusus*				6
House Sparrow	*Passer domesticus*				7
Cape Sparrow	*Passer melanurus*			16	6
South African Cliff Swallow	*Petrochelidon spilodera*				
Willow Warbler	*Phylloscopus trochilus*				
White-browed Sparrow-Weaver	*Plocepasser mahali*			11	6
Southern Masked Weaver	*Ploceus velatus*				5
African Harrier-Hawk	*Polyboroides typus*				1
Black-chested Prinia	*Prinia flavicans*			4	32
Rock Martin	*Ptyonoprogne fuligula*			3	7
African Red-eyed Bulbul	*Pycnonotus nigricans*			7	22
Red-billed Quelea	*Quelea quelea*			10	
Grey-winged Francolin	*Scleroptila afra*				
Laughing Dove	*Spilopelia senegalensis*				5
Pink-billed Lark	*Spizocorys conirostris*				
Scaly-feathered Weaver	*Sporopipes squamifrons*			8	8
Fairy Flycatcher	*Stenostira scita*				4
Cape Turtle Dove	*Streptopelia capicola*			6	10
Common Ostrich	*Struthio camelus*				
Long-billed Crombec	*Sylvietta rufescens*				2
Alpine Swift	*Tachymarptis melba*				
South African Shelduck	*Tadorna cana*				18
Bokmakierie	*Telophorus zeylonus*			6	1
Crested Barbet	*Trachyphonus vaillantii*				2
Acacia Pied Barbet	*Tricholaema leucomelas*			10	14
Karoo Thrush	*Turdus smithi*			1	3
Violet-eared Waxbill	*Uraeginthus granatinus*				5

Common Name	Scientific Name	Global Status (IUCN)	Regional Status (Taylor et al. 2015)	Winter (Aug '23)	Spring (Oct '23)
Red-faced Mousebird	*Urocolius indicus*			20	28
Blacksmith Lapwing	*Vanellus armatus*				
Crowned Lapwing	*Vanellus coronatus*				
Pin-tailed Whydah	*Vidua macroura*				4
Orange River White-eye	*Zosterops pallidus*				2
Cape White-eye	*Zosterops virens*				

6.2 SACNASP REGISTRATION OF SPECIALIST



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