APPENDIX E3: Avifauna Baseline and Impact Assessment

Proposed Parys PV Site– Avifaunal Baseline & Impact Assessment Free State Province

September 2022

CLIENT

Prepared by:

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Report Name	**Proposed Parys PV Site– Avifaunal Baseline & Impact Assessment**
Reference	**Altina PV site**
Submitted to	NEMAI CONSULTING
Report Writer (Fauna)	**Tyron Clark**
	Tyron Clark (Pr. Sci. Nat. 121338) has more than decade's worth of experience conducting biodiversity assessments in a number of African countries, affording him good experience in variety of development types, particularly avifaunal assessments. He attained his MSC in Zoological science from the University of the Witwatersrand. His research interests centre on biogeography and ecological niche modelling. Tyron has also completed courses in wetland delineation and management hosted by the University of the Free State.
Reviewer	**Andrew Husted**
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

White-browed Sparrow-Weaver (*Plocepasser mahali*)

DECLARATION

I, Tyron Clark, declare that:

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

Tyron Clark (Pr. Sci. Nat. 121338)

Terrestrial Ecologist

The Biodiversity Company

September 2022

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1 Introduction

The Biodiversity Company was appointed to undertake an avifaunal baseline and impact assessment for the proposed Parys solar photovoltaic (PV) system. The proposed project area is situated 6 km south-east of Parys in the Free State Province (Figure 1-2). The most significant habitat features from an avifaunal perspective is a small hill in the north-eastern corner of the project area and a large west-east trending valley-bottom wetland that bisects the project area. Based on its size, avifaunal sensitivity and potential to have three 132kv grid connection lines cross a High avifaunal sensitivity wetland this project warrants a Regime 2 assessment. This report portrays the results of the late summer survey but additional surveys are still required (preferably November/December 2022) in line with BirdLife South Africa's best practice for Regime 2 avifaunal studies (Jenkins et al. 2017).

The proposed solar farm consists of three solar areas distributed throughout the project area, connecting to the grid at the existing substation (-26.965219°; 27.500074°) in the project area via a series of three short (< 3km) 132 kv lines (Figure 1-3). This proposed layout has already been adjusted to take into account potential sensitivities. The solar panels will be bifacial and thus the complete clearing of vegetation beneath the PV panels is required. This study was conducted in line with relevant national legislation and best practice standards:

- The National Web-Based Environmental Screening Tool DEA website (2022);
- South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna Protocols for environmental impact assessments in South Africa;
- South African National Biodiversity Institute, Pretoria. Version 1.2020;
- Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998; and
- BirdLife South Africa (BLSA). 2017.Best Practice Guidelines. Birds and Solar Energy. Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa.

Figure 1-1 View across southern portion of project area

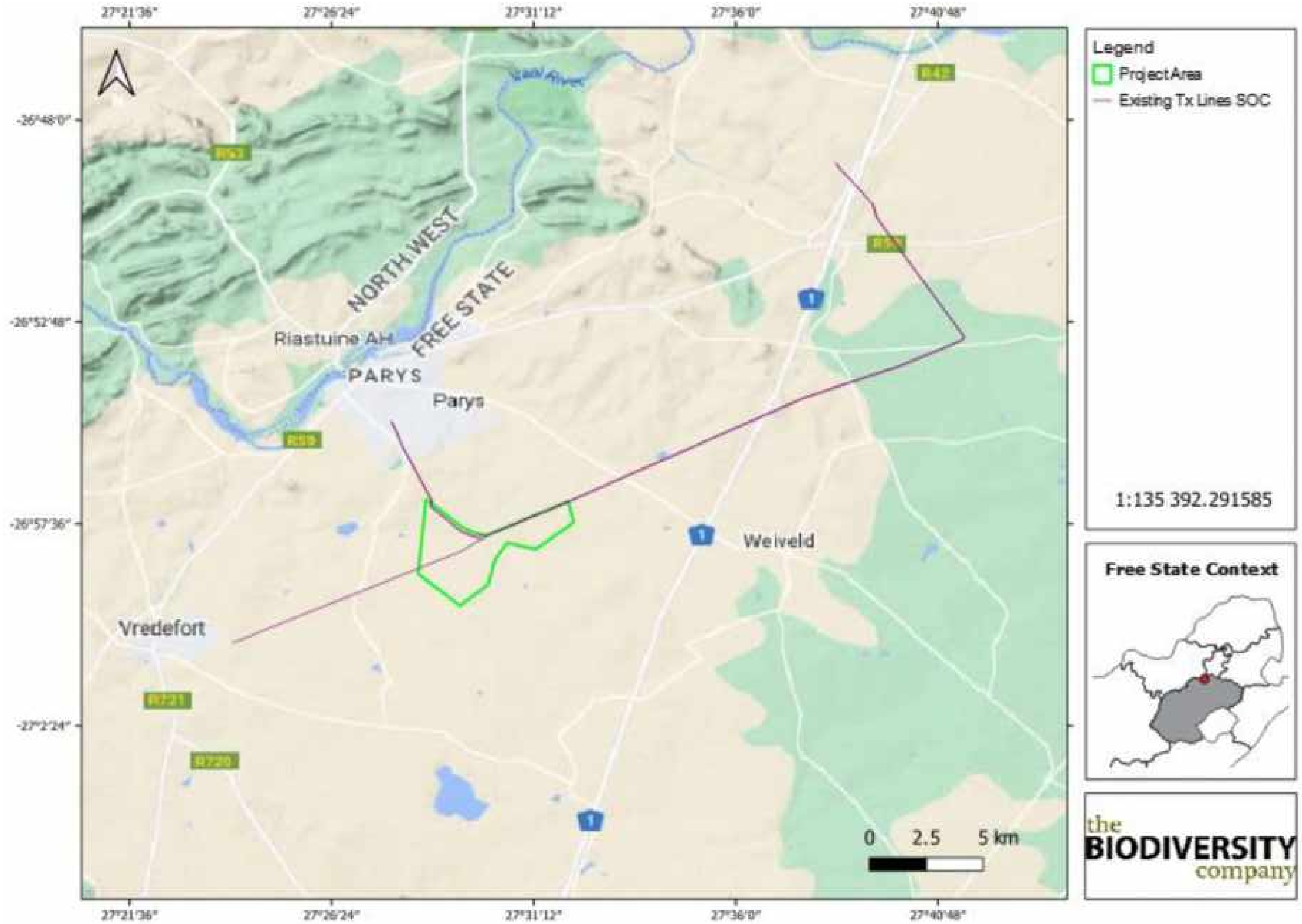

Figure 1-2 Location of the project area

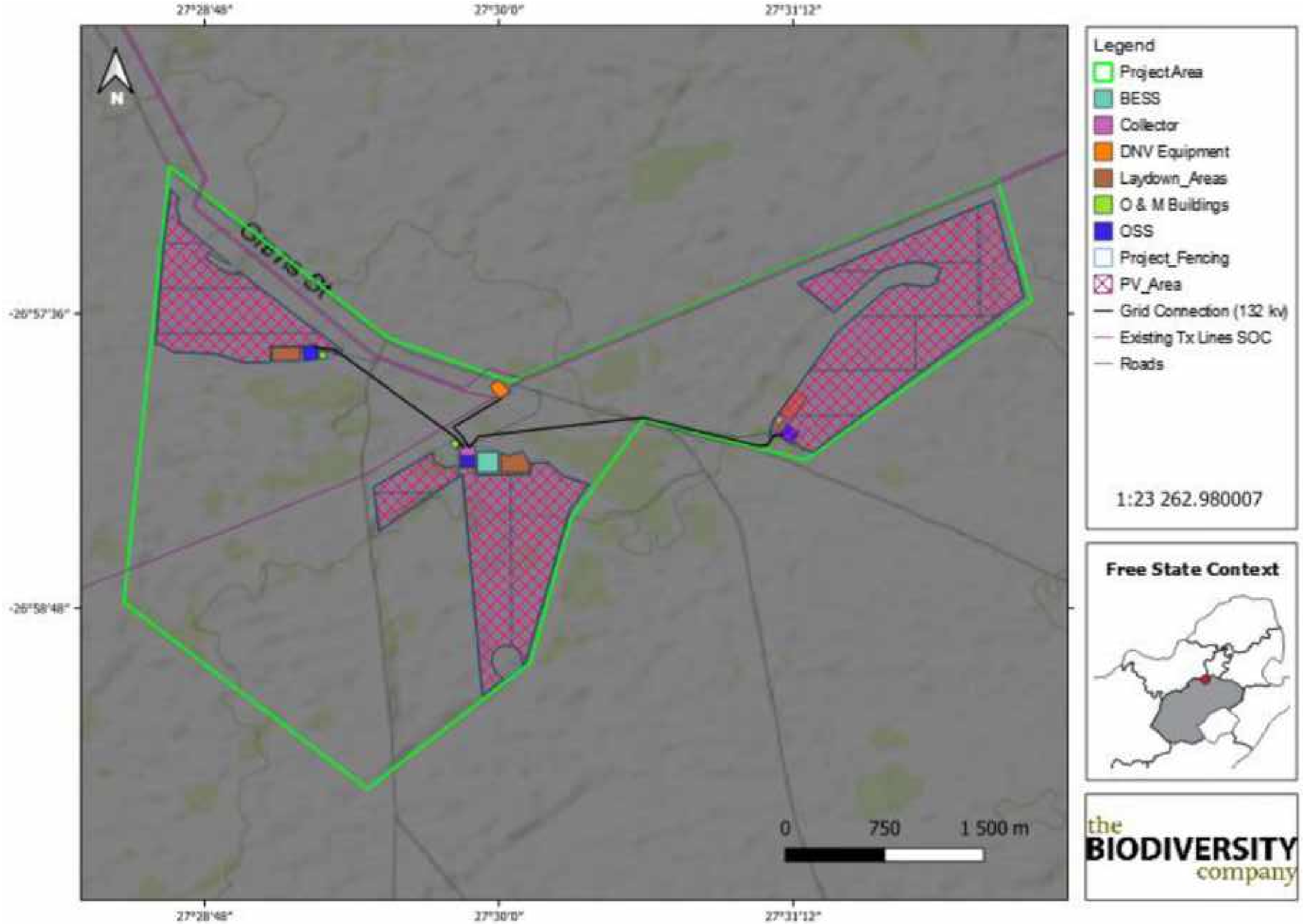

Figure 1-3 Proposed infrastructure layout

2 Terms of Reference

The Terms of Reference (ToR) included the following:

- Description of the baseline avifaunal community;
- Identification of present or potentially occurring SCC;
- Sensitivity assessment and map to identify sensitive areas in the project area;
- Impact assessment, mitigation measures to prevent or reduce the possible impacts.

3 Key Legislative Requirements

The legislation, policies and guidelines listed below are applicable to the current project with regards to avifauna. The list below, although extensive, is not exhaustive and other legislation, policies and guidelines may apply in addition to those listed below (Table 3-1).

Table 3-1 A list of key legislative requirements relevant to these studies in the Free State

Region	Legislation
International	Convention on Biological Diversity (CBD, 1993)
	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973)
	The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
National	Constitution of the Republic of South Africa (Act No. 108 of 2006)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 42946 (January 2020)
	The National Environmental Management Act (NEMA) (Act No. 107 of 1998) Section 24 , No 43110 (March 2020)
	The National Environmental Management Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management Biodiversity Act (Act No. 10 of 2004)
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989) and associated EIA Regulations
	National Protected Areas Expansion Strategy (NPAES)
	Environmental Conservation Act (Act No. 73 of 1983)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Framework (NBF, 2009)
	National Spatial Biodiversity Assessment (NSBA)
	National Heritage Resources Act, 1999 (Act 25 of 1999)
	Alien and Invasive Species Regulations, 2014
	South Africa's National Biodiversity Strategy and Action Plan (NBSAP)
	Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)
	White Paper on Biodiversity
	South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.2020.
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998
	Free State Nature Conservation Ordinance 8 of 1969

4 Limitations

The following limitations should be noted for the assessment:

- Access was only arranged for survey work within the project area;
- To date only a single season (late summer) survey has been completed;

5 Methodologies

5.1 Desktop Assessment

The following resources were consulted during the desktop assessment and for the compilation of the expected species list:

- Hockey et al. (2005), Roberts Birds of Southern Africa (seventh end.). Primary source for species identification, geographic range and life history information.
- Sinclair and Ryan (2010), Birds of Africa. Secondary source for identification.
- South African Bird Atlas Project (SABAP 2). Full protocol atlassing data from relevant pentads used to construct expected species list. These included the two pentads covering the site (2700_2640 and 2700_2645) and one from the nearby town of Orkney (2655_2640).
- Taylor et al. (2015), Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Used for conservation status, nomenclature and taxonomical ordering.
- The National Web-Based Environmental Screening Tool DEA website (2022), specifically Animal, Avian and Terrestrial Biodiversity Themes.
- BirdLifeSa (2022) website for information on Important Bird and Biodiversity Areas.

5.2 Fieldwork

Fieldwork was conducted on two occasions on 21 March 2022 constituting a late summer survey. Sampling consisted of standardized point counts as well as incidental observations. Standardized point counts were conducted to gather data on the species composition and relative abundance of species within the various habitats within the project area. Each point count run over a 5 min period. The horizontal detection limit was set a 200 m. At each point the observer documented the date, start time and end time, habitat, numbers of each species, detection method (seen or heard), behaviour (perched or flying) and flight direction and general notes on habitat and nesting suitability for conservation important species. To supplement the species inventory with cryptic and illusive species that may not have been detected within the rigid point count protocol, incidental observations were included. A search of for signs of African Grass Owl breeding or presence was conducted along the main valley-bottom wetland.

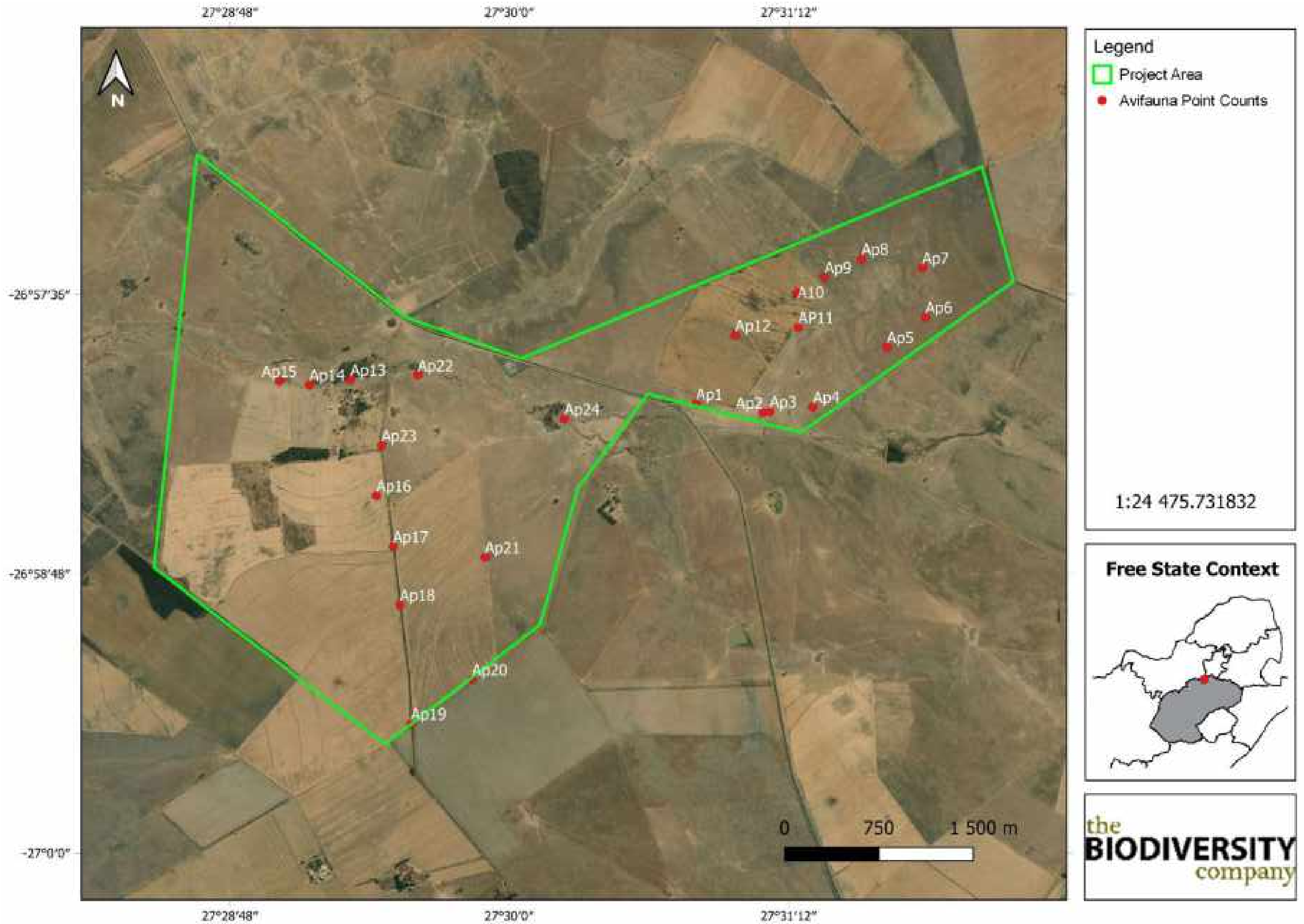

Figure 5-1 Avifaunal point count localities

5.3 Data analysis

Point count data was arranged into a matrix with point count samples in rows and species in columns. The table formed the basis of the various subsequent statistical analyses. This data was first used to generate a species accumulation curve to assess sampling adequacy. Random accumulation was assumed over 100 permutations. To distinguish similarities / differences in the species composition between the four identified avifaunal habitats the matrix was converted into a Bray-Curtis dissimilarity matrix and used to generate a two-axis non-metric multidimensional scaling (NMDS) ordination. Thirdly raw count data converted to relative abundance values and used to establish dominant species and calculate the diversity of each habitat. Shannon's Diversity Index H was the metric used to estimate diversity. All statistical analyses were performed in the R statistical environment.

5.4 Sensitivity Assessment

The habitat sensitivity is classed based on the following categories/scores (Table 5-1):

Table 5-1 Sensitivity criteria

Sensitivity	Criteria
Very High	• Habitat is occupied by a red-listed species. • Red-listed vegetation type exhibiting natural integrity. • Provides critical ecosystem services. • Protected by national or provincial legislation. • Low resilience to disturbance • Area overlaps with intact CBA • Overlap with NBA classified wetlands.
High	• Possesses a high diversity of protected species but does not possess red-listed species • Habitats that provide important ecosystem services but not necessarily possess high species richness. • Corridors and wetland buffer zones. • Natural habitats that are unique within the landscape • Natural habitats that possess a relatively high species richness in comparison to the rest of the landscape. • Area overlaps with intact CBA (small areas of disturbed habitat)
Moderate	• Natural areas that although listed as not threatened are regarded as Not Protected or Poorly Protected. • Degraded areas that provide some ecosystem services. • Area overlaps with intact Ecological Support Area (ESA) or Other Natural Area (ONA). • Such habitat is considered to have a strong chance of recovering if left undisturbed to restore through natural succession processes, even more so if successfully rehabilitated. • Species diversity is considered moderate.
Low	• Transformed areas. • Insignificant amounts of natural habitat or vegetation present. • Area does not overlap with any areas of ecological significance (also datasets). • Natural or degraded areas that are not red-listed vegetation types and Moderately Protected or Well Protected.

5.5 Impact Assessment

The assessment of impacts was based on the Department of Environmental Affairs and Tourism's (1998) Guideline Document: Environmental Impact Assessment Regulations. This assessment considered the impacts arising from the proposed activities of the project both before and after the implementation of appropriate mitigation measures for all phases of the project. The criteria used to arrive at an overall significance rating included extent, duration, magnitude (intensity), and probability. A description of this methodology is provided in the text box below.

Status of Impact
The impacts are assessed as either having a:
negative effect (i.e., at a `cost' to the environment),
positive effect (i.e., a `benefit' to the environment), or
Neutral effect on the environment.
Extent of the Impact
(**1**) Site (site only),
(**2**) Local (site boundary and immediate surrounds),
(**3**) Regional (within the City of Johannesburg),
(**4**) National, or
(**5**) International.
Duration of the Impact
The length that the impact will last for is described as either:
(**1**) immediate (<1 year)
(**2**) short term (1-5 years),
(**3**) medium term (5-15 years),
(**4**) long term (ceases after the operational life span of the project),
(**5**) Permanent.
Magnitude of the Impact
The intensity or severity of the impacts is indicated as either:
(**0**) none,
(**2**) Minor,
(**4**) Low,
(**6**) Moderate (environmental functions altered but continue),
(**8**) High (environmental functions temporarily cease), or
(**10**) Very high / Unsure (environmental functions permanently cease).
Probability of Occurrence
The likelihood of the impact actually occurring is indicated as either:
(**0**) None (the impact will not occur),
(**1**) improbable (probability very low due to design or experience)
(**2**) low probability (unlikely to occur),
(**3**) medium probability (distinct probability that the impact will occur),
(**4**) high probability (most likely to occur), or
(5) Definite.
Significance of the Impact
Based on the information contained in the points above, the potential impacts are assigned a significance rating (**S**). This rating is formulated by adding the sum of the numbers assigned to extent (**E**), duration (**D**) and magnitude (**M**) and multiplying this sum by the probability (**P**) of the impact.
S=(E+D+M) P
The significance ratings are given below
(**<30**) low (i.e., where this impact would not have a direct influence on the decision to develop in the area),
(**30-60**) medium (i.e., where the impact could influence the decision to develop in the area unless it is effectively mitigated),
(**>60**) high (i.e., where the impact must have an influence on the decision process to develop in the area).

6 Desktop Assessment

6.1 Prevailing Land Use

The project area is comprised primarily of a relatively equal mix of commercially cultivated croplands and natural grassland. A large east-west flowing valley-bottom wetland crosses the project area. The grasslands (and some of the wetlands) are grazed by beef cattle. Overall, weedy annuals and invasive plant pressure is low. A few small scattered bushclumps occur (comprised mainly of *Populus* spp.). The national landcover map correctly classifies and delineates the extent of commercial annual croplands, grassland and alien bushclumps but underestimates the extent of wetland habitat (Figure 6-1).

6.2 Free State Biodiversity Conservation Plan

The Free State Biodiversity Conservation spatial layer was developed to illustrate the province's most Critical Biodiversity Areas. These areas need to be maintained to meet the province's biodiversity targets. The broad categories recognised are: Protected Areas (PA), Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Other Natural Areas (ONA), and Modified Areas.

CBAs represent areas of high biodiversity significance in the province. Typically, two types of CBA are distinguished namely CBA1 and CBA2 areas. CBA1 areas are considered crucial in defining and achieving biodiversity conservation targets in the province. CBA2 areas represent areas of high biodiversity significance but do not necessarily result in the target not being achieved if they are lost, i.e., they represent areas for which options exist (SANBI-BGIS, 2017).

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

ONAs consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI-BGIS, 2017).

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

According to this spatial dataset, part of the valley-bottom wetland and surrounding grasslands near the access gate is classified as CBA 2. Most non-cultivated areas are classified as Other Natural Areas or ONAs while all croplands are classified as (Figure 6-2)

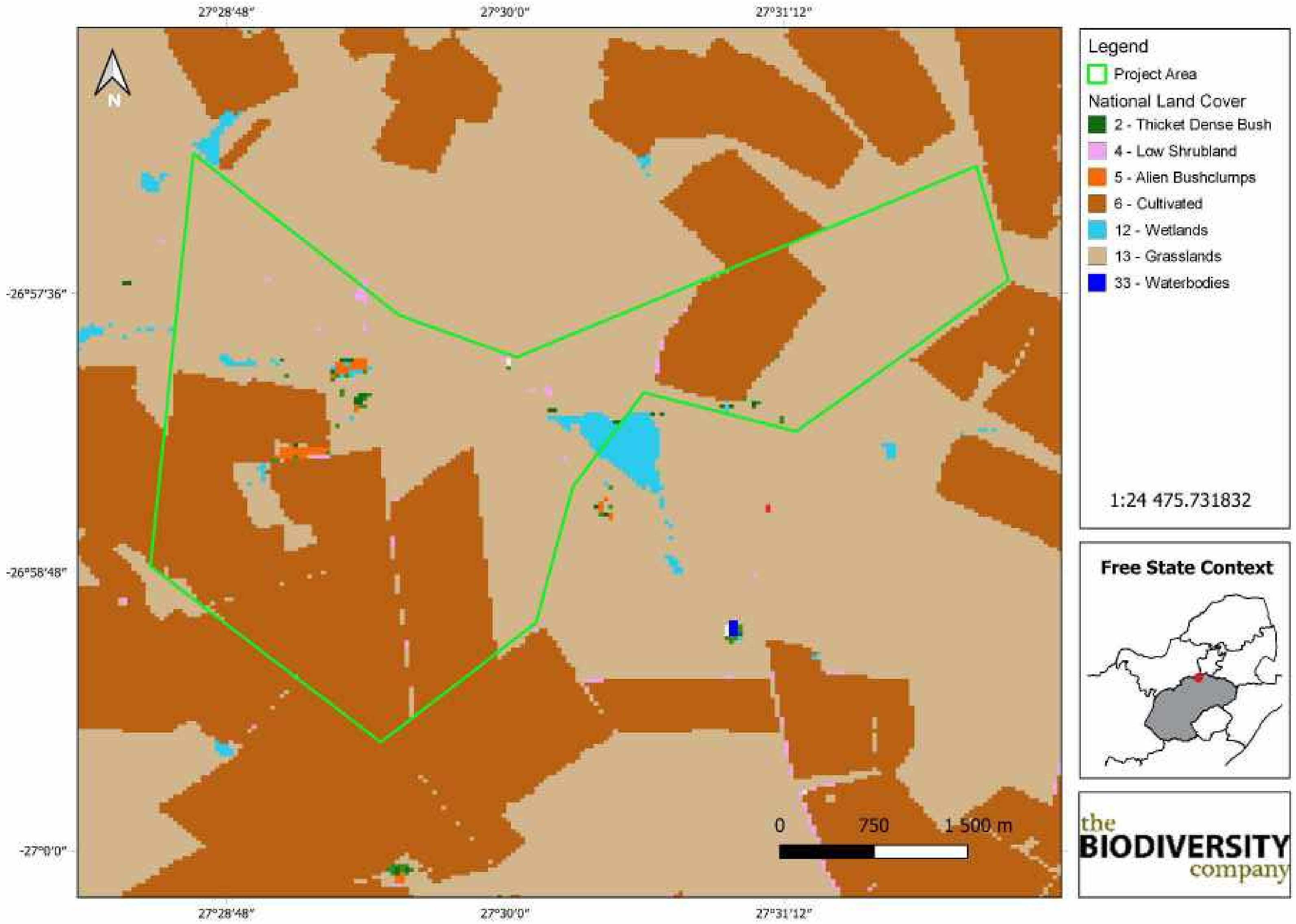

Figure 6-1 Landcover within the project area

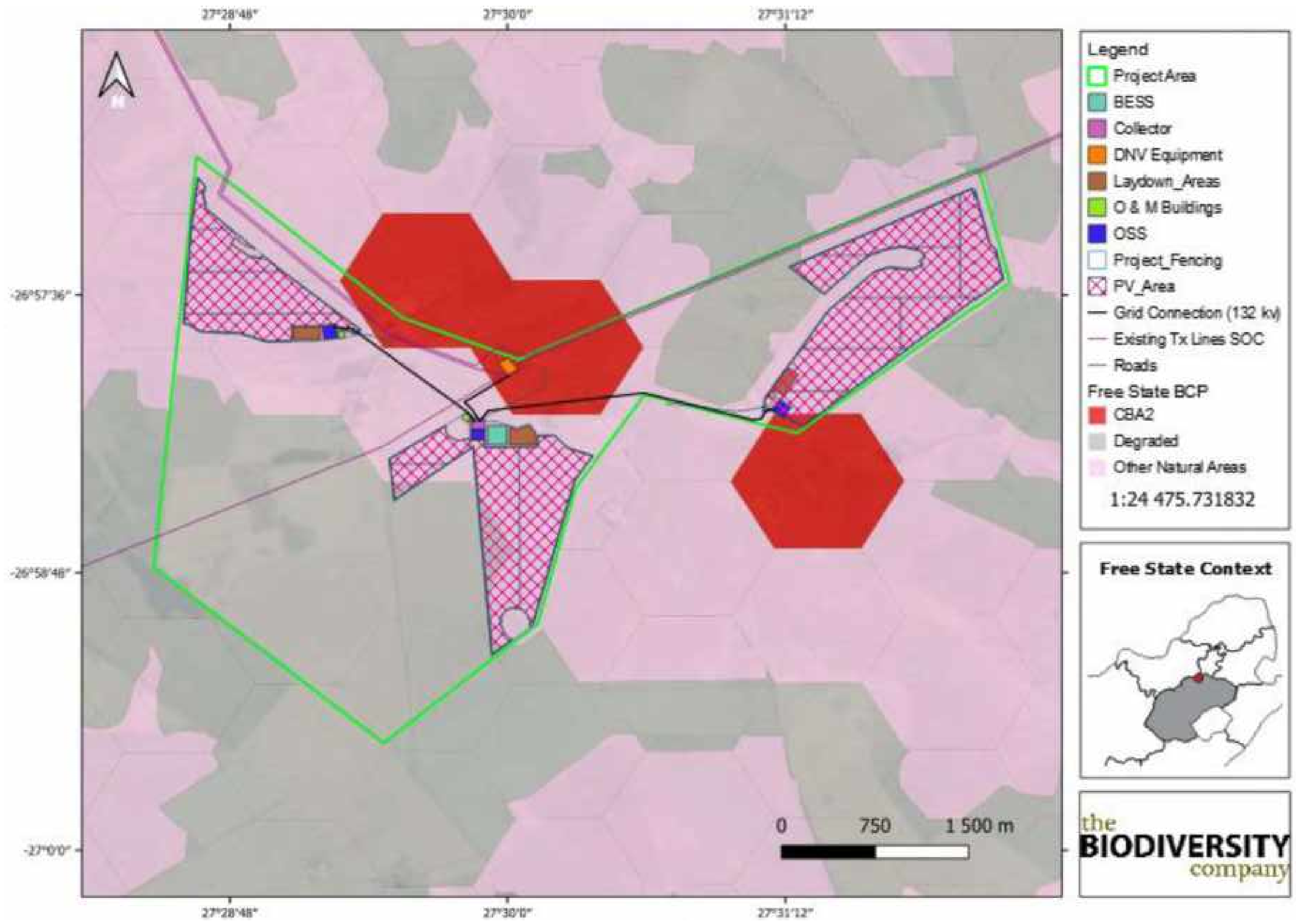

Figure 6-2 Free State Biodiversity Conservation Plan

6.2.1 Important Bird Areas

The project area is not situated within any national or global Important Bird and Biodiversity Area (IBA) as designated by Birdlife. The closest IBA (Figure 6-3) is the Suikerbosrand Nature Reserve (ZA039). The characteristic landscape feature in the reserve is the Suikerbos Ridge (1918 masl), a large igneous outcrop which is divided by numerous well-wooded streams and kloofs. The reserve also hosts extensive grasslands and palustrine wetlands.

The reserve is important for the conservation of African Grass Owl (*Tyto capensis*), Secretarybird (*Sagittarius serpentarius*), Melodius Lark (*Mirafra cheniana*) and African Marsh Harrier (*Circus ranivorus*) but also for the high diversity of species it supports which includes over 270 bird species (BirdlifeSA, 2022).

6.2.2 South African Bird Atlas Project 2

A total of 125 bird species have been recorded during SABAP2 surveys within the two pentads covering the project area (SABAP2, 2022). This inventory is considered to be an under representative, portrayal of the regional diversity. Consequently, this list was supplemented with additional species known to occur based on Hockey et al. (2005) and expert knowledge of avifauna from the region. This integrated inventory was used as the basis for the project's species probability list as presented in Appendix A-1.

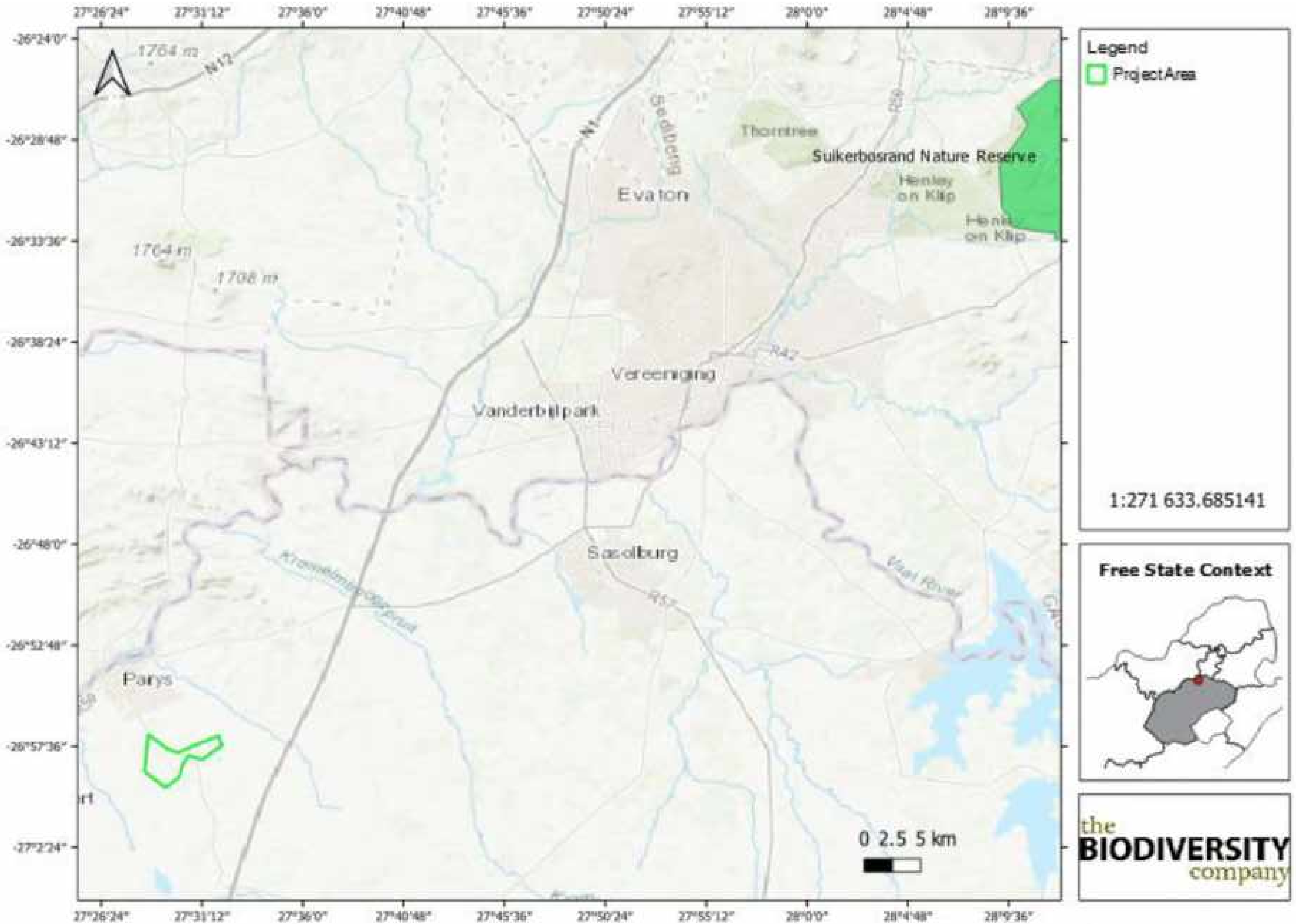

Figure 6-3 Project area in relation to Important Bird Areas

6.3 Results

6.3.1 Habitat Types

Three main avifaunal habitat types were identified within the project area namely Wetlands, Grasslands and Croplands. From an avifaunal perspective the Wetland habitat includes only the valley-bottom wetlands and excludes the seepage areas. Land under commercial annual crop production comprised the Croplands habitat. All remaining non-cultivated or built-up areas between these represent the Grasslands avifaunal habitat. This habitat includes both seepage and terrestrial grassland as the habitat structure of the temporary seep grasslands is similar and no meaningful distinction could be made in-field in terms of their respective species assemblages.

Figure 6-4 Examples of the main avifauna habitats identified within the project area; A) Wetlands, B) Croplands and C) Grasslands

6.3.2 Expected Site Diversity

Of the approximately 283 regionally occurring species, some 225 species are considered highly likely to occur on a regular basis. A further 47 species are likely to occur sporadically while the remaining species are only likely to occur very rarely or not at all. However, when considering seasonal variation in species assemblages and local movements the actual number of species likely to be encountered on any one day in the project area is likely to be < 120 species. This represents moderate diversity in the South African context.

6.3.3 Observed Site Diversity

During the site visit, a total of 58 bird species were recorded within the project area. However, conditions were cold and rainy which limited detection. Of these, 54 were recorded during the standardised point counts (n=24) while the remaining species were detected incidentally (while moving between point counts). Images of some of these species, as taken on site, are shown in Figure 6-7 **Examples of some of the avifauna photographe on site; A)** Tawny-flanked Prinia (Prinia subflava)**, B)** Green-winged Pytilia (Pytilia melba)**, C)** Red-billed Quelea (Quelea quelea) **and** Ant-eating Chat (Myrmecocichla formicivora)**, D)** Common Waxbill **(**Estrilda astrild**), E)** Western Cattle Egret (Bubulcus ibis)**, F)** Amur Falcon (Falco amurensis)**, G)** White-winged Widowbird (Euplectes albonotatus) **and White-browed** Sparrow-Weaver (Plocepasser mahali).

6.3.4 Sampling Adequacy

A species accumulation curve (Figure 6-5) generated for the point counts within the AOI suggests adequate sampling effort. The curve reached did not reach an asymptote (as defined by a straight-line tangent to the curve with a gradient of one). This means that after more than one bird was being observed for every subsequent sample thereafter suggesting that more sampling is required and that considerable scope for new species additions remains with increased sampling time and seasonality.

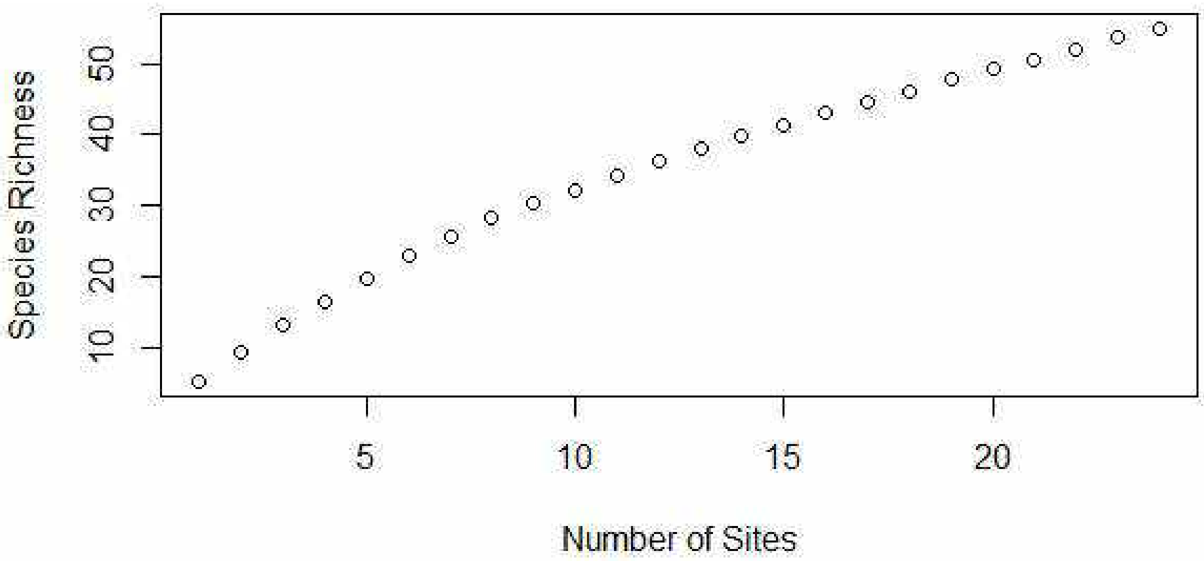

Figure 6-5 Species accumulation curve for the point counts within the project area

6.3.5 Habitat Diversity

A summary the diversity rankings as indicated by Shannon's H (an index of habitat diversity) for each of the main habitat types is presented in Table 6-1. From this table it is apparent that the highest avian diversity was observed in the Grassland habitat followed by Wetland and lastly Croplands. The Grassland and Wetland habitats are the most diverse habitat types due to their higher microhabitat diversity, structural complexity and resource diversity.

Table 6-1 Comparison of the diversity between the main habitats

Habitat	Shannon's H

Wetlands	2.69
Grasslands	2.42
Croplands	2.39

6.3.6 Habitat Uniqueness

The non-metric multidimensional scaling (NMDS) ordination shown in Figure 6-6 provides a visual representation of the difference / similarity in the species composition between the three habitat types. From the ordination it can be observed that no one habitat stands out as being completely unique in terms of its avifaunal assemblage. However, the Grassland and Wetland species assemblages differed most from one-another while the croplands community is comprised of low diversity mix of generalist species found in both Grassland and Wetland habitats.

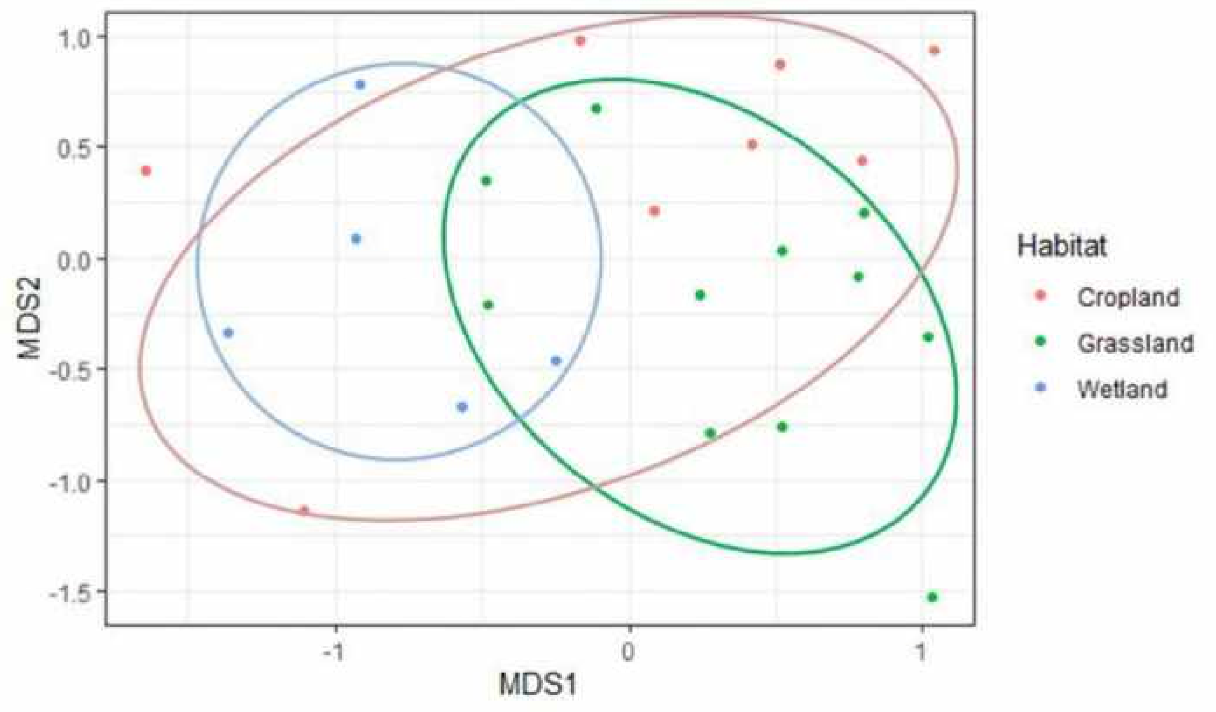

Figure 6-6 Non-metric multidimensional scaling ordination contrasting the avifaunal species assemblages within the project area

Figure 6-7 Examples of some of the avifauna photographe on site; A) Tawny-flanked Prinia (Prinia subflava), B) Green-winged Pytilia (Pytilia melba), C) Red-billed Quelea (Quelea quelea) and Ant-eating Chat (Myrmecocichla formicivora), D) Common Waxbill (Estrilda astrild), E) Western Cattle Egret (Bubulcus ibis), F) Amur Falcon (Falco amurensis), G) White-winged Widowbird (Euplectes albonotatus) and White-browed Sparrow-Weaver (Plocepasser mahali)

Table 6-2 provides a summary of the relative abundance and frequency of each species within each habitat. Based on the data Red-billed Quelea (*Quelea quelea*) are by far the most abundant species. Other particularly abundant species include Helmeted Guineafowl (*Numida meleagris*), Long-tailed Widowbird (*Euplectes progne*), Southern Red Bishop (*Euplectes orix*) and African Quail-finch (*Ortygospiza fuscocrissa*).

Table 6-2 Summary of the relative abundance (RA) and frequency (F) of avifauna in each habitat

Common Name	Scientific Name	Cropland		Grassland		Wetland		Total	
		F	RA	F	RA	F	RA	F	RA
Red-billed Quelea	*Quelea quelea*	1	0.0	1	8.3	2	16.5	4	24.8
Helmeted Guineafowl	*Numida meleagris*	0	0.0	0	0.0	2	10.5	2	10.5
Long-tailed Widowbird	*Euplectes progne*	0	0.0	3	5.0	1	0.6	4	5.5
Southern Red Bishop	*Euplectes orix*	0	0.0	1	5.5	0	0.0	1	5.5
African Quail-finch	*Ortygospiza fuscocrissa*	1	3.9	4	1.7	0	0.0	5	5.5
Common Waxbill	*Estrilda astrild*	0	0.0	0	0.0	1	2.8	1	2.8
Zitting Cisticola	*Cisticola juncidis*	3	0.0	4	2.5	0	0.0	7	2.5
Spike-heeled Lark	*Chersomanes albofasciata*	1	1.1	3	1.1	0	0.0	4	2.2
African Pipit	*Anthus cinnamomeus*	1	0.0	4	2.2	0	0.0	5	2.2
Western Cattle Egret	*Bubulcus ibis*	0	0.3	1	1.9	0	0.0	1	2.2
Cape Longclaw	*Macronyx capensis*	0	0.0	2	1.7	0	0.0	2	1.7
Barn Swallow	*Hirundo rustica*	0	0.0	1	1.7	0	0.0	1	1.7
Black-chested Prinia	*Prinia flavicans*	0	0.0	0	0.0	2	1.7	2	1.7
Black-shouldered Kite	*Elanus caeruleus*	1	1.7	0	0.0	0	0.0	1	1.7
Southern Masked Weaver	*Ploceus velatus*	1	0.3	1	0.3	1	1.1	3	1.7
Cape Wagtail	*Motacilla capensis*	0	0.8	1	0.6	0	0.0	1	1.4
Blacksmith Lapwing	*Vanellus armatus*	0	0.0	0	0.0	1	1.4	1	1.4
Northern Black Korhaan	*Afrotis afraoides*	0	0.0	4	1.1	1	0.3	5	1.4
Cape Robin-Chat	*Cossypha caffra*	0	0.6	0	0.0	1	0.8	1	1.4
Laughing Dove	*Streptopelia senegalensis*	0	0.0	1	0.3	2	1.1	3	1.4
White-browed Sparrow-Weaver	*Plocepasser mahali*	0	0.0	0	0.0	1	1.4	1	1.4
Amur Falcon	*Falco amurensis*	1	0.0	0	0.0	1	1.4	2	1.4
Speckled Mousebird	*Colius striatus*	0	0.0	0	0.0	1	1.4	1	1.4
Pink-billed Lark	*Spizocorys conirostris*	5	0.6	1	0.6	0	0.0	6	1.1
Cape Teal	*Anas capensis*	0	0.8	0	0.0	1	0.3	1	1.1
Spotted Thick-knee	*Burhinus capensis*	0	0.0	2	1.1	0	0.0	2	1.1
Levaillant's Cisticola	*Cisticola tinniens*	0	0.0	1	0.8	1	0.3	2	1.1
Cape Turtle Dove	*Streptopelia capicola*	1	0.3	0	0.0	1	0.8	2	1.1
Pied Starling	*Lamprotornis bicolor*	0	0.0	2	0.6	1	0.3	3	0.8
Red-billed Teal	*Anas erythrorhyncha*	0	0.0	0	0.0	1	0.8	1	0.8
White-winged Widowbird	*Euplectes albonotatus*	0	0.0	0	0.0	1	0.8	1	0.8
Pied Crow	*Corvus albus*	0	0.3	1	0.6	0	0.0	1	0.8
Crowned Lapwing	*Vanellus coronatus*	1	0.0	1	0.6	0	0.0	2	0.6
Yellow-crowned Bishop	*Euplectes afer*	0	0.3	0	0.0	1	0.3	1	0.6
African Snipe	*Gallinago nigripennis*	0	0.0	0	0.0	1	0.6	1	0.6
Swainson's Spurfowl	*Pternistis swainsonii*	0	0.0	1	0.3	1	0.3	2	0.6
African StoneChat	*Saxicola torquatus*	0	0.0	2	0.6	0	0.0	2	0.6
Greater Striped Swallow	*Cecropis cucullata*	0	0.0	0	0.0	1	0.6	1	0.6
Reed Cormorant	*Phalacrocorax africanus*	0	0.0	0	0.0	2	0.6	2	0.6
Jameson's Firefinch	*Lagonosticta rhodopareia*	0	0.3	0	0.0	1	0.3	1	0.6
Green-winged Pytilia	*Pytilia melba*	0	0.0	0	0.0	1	0.6	1	0.6

Common Name	Scientific Name	Cropland		Grassland		Wetland		Total	
		F	RA	F	RA	F	RA	F	RA
Orange-breasted Waxbill	*Amandava subflava*	1	0.6	0	0.0	0	0.0	1	0.6
Hadeda Ibis	*Bostrychia hagedash*	0	0.0	1	0.3	0	0.0	1	0.3
Neddicky	*Cisticola fulvicapilla*	0	0.0	1	0.3	0	0.0	1	0.3
Three-banded Plover	*Charadrius tricollaris*	0	0.0	0	0.0	1	0.3	1	0.3
Cape Sparrow	*Passer melanurus*	0	0.0	1	0.3	0	0.0	1	0.3
Crested Barbet	*Trachyphonus vaillantii*	0	0.0	0	0.0	1	0.3	1	0.3
Black-throated Canary	*Crithagra atrogularis*	0	0.0	0	0.0	1	0.3	1	0.3
Acacia Pied Barbet	*Tricholaema leucomelas*	0	0.0	0	0.0	1	0.3	1	0.3
Southern Fiscal	*Lanius collaris*	1	0.3	0	0.0	0	0.0	1	0.3
Pin-tailed Whydah	*Vidua macroura*	1	0.3	0	0.0	0	0.0	1	0.3
Black-headed Heron	*Ardea melanocephala*	1	0.3	0	0.0	0	0.0	1	0.3
South African Cliff Swallow	*Petrochelidon spilodera*	1	0.0	0	0.0	0	0.0	1	0.0
Ant-eating Chat	*Myrmecocichla formicivora*	1	0.0	0	0.0	0	0.0	1	0.0

6.3.7 Species of Conservation Concern

6.3.7.1 Red-listed Species

A total of 24 species of conservation concern (SCC) are, known to occur in the region (Table 6-3). Of these, four have been recorded during SABAP2 surveys within the three pentads relevant to the project area namely Secretarybird (*Sagittarius serpentarius*), Caspian Tern (*Sterna caspia*), Yellow-billed Stork (*Mycteria ibis*) and Blue Korhaan (*Eupodotis caerulescens*) (SABAP2, 2022). In the Free State all birds are protected except for generalist species; Mousebirds, Bulbuls, Red-winged Starling, Pied Starling, Common Myna, Cape and House Sparrow, Crows, weavers, Queleas, Widowbirds, Bishops, Speckled Pigeon, Cape Turtle Dove, Ostrich, Laughing Dove, Reed Cormorant, and White-breasted Cormorant (Nature Conservation Ordinance 8 of 1969). The provincially protected species are listed in the full list provided in Appendix A. The National Environmental Screening tool flags the pans and dams in the immediate vicinity as being of importance for Yellow-billed Stork and Caspian Tern.

During the brief site visit, one SCC was detected within the project area namely Blue Korhaan. However and additional 11 SCC are considered highly likely to occur within the project area based on habitat availability and suitability. These include African Marsh Harrier (*Circus ranivorus*), Yellow-billed Stork (*Mycteria ibis*), African Grass Owl (*Tyto capensis*), Caspian Tern (*Sterna caspia*), Blue Crane (*Anthropoides paradiseus*), Melodious Lark (*Mirafra cheniana*), Greater Flamingo (*Phoenicopterus roseus*), Lesser Flamingo (*Phoeniconaias minor*), Abdim's Stork (*Ciconia abdimii*), Black-winged Pratincole (*Glareola nordmanni*) and Maccoa Duck (*Oxyura maccoa*). Of these, potentially suitable breeding habitat exists for Caspian Tern, African Grass Owl and Melodious Lark. Some of the more significant present or potentially occurring SCC are discussed in greater detail below.

Blue Korhaan (*Eupodotis caerulescens*) – Near-Threatened

A flock of four birds were flushed from the grasslands in the north-eastern corner of the project area (-26.963601°; 27.522626°). The grasslands in the project area provide suitable breeding and foraging habitat for this uncommon South African / Lesotho endemic. Threats to this species centre on grassland habitat loss primarily from crop cultivation and expanding settlements. Large-bodied terrestrial birds such as this represent prime candidates for collisions with electrical transmission infrastructure.

Caspian Tern (*Sterna caspia*) – Vulnerable

This uncommon species is known to occur in pans and dams in the region. Its residency and breeding status at waterbodies in or immediately surrounding the project area remains uncertain. However, the waterbodies within the project area are almost certainly too small and unsuitably structured to be used as breeding sites for this colonial nesting species. Nevertheless, they could still be used as foraging sites. The total South African population is estimated at <400 pairs (Hockey et al. 2007).

Yellow-billed Stork (*Mycteria ibis*) - Endangered

This species is typically nomadic in the region, occurring at larger dams and pans in response to seasonal inundation. The species is thus likely to occur sporadically in the project area and is most likely to visit during summer following good rains. The species is, however unlikely to breed in the project area. The species is primarily threatened by degradation and loss of wetland habitat.

Melodious Lark (*Mirafra cheniana*) – Near-Threatened

This South African Endemic is likely to occur and potentially breed within less disturbed grassland areas in the project area, particularly in areas dominated by *Themeda triandra*. The species is primarily threatened by habitat loss from crop cultivation.

African Marsh Harrier (*Circus ranivorus*) – Endangered

This species is likely to forage along the valley-bottom wetland but breeding is unlikely based on a lack of sufficiently dense reedbeds. Although the species has an extremely large distributional range in sub-equatorial Africa, South African populations are declining due to the degradation of wetland habitats, loss of habitat through over-grazing and human disturbance and possibly, poisoning owing to over-use of pesticides (IUCN, 2017). The valley-bottom wetland is considered important for this species (from a foraging perspective).

African Grass Owl (*Tyto capensis*) – Vulnerable

Moderately suitable breeding and ideal foraging habitat occur in the valley-bottom wetland that bisects the project area, particularly in the west. The species has, however, not been recorded in the pentad during SABAP2 surveys. Although no signs of the species were detected during the survey it is possible that this cryptic and illusive species was overlooked. However, cattle grazing pressure is high which does decrease breeding site suitability. This is an uncommon and illusive resident. In the region, nests are most frequently associated with large, dense stands of *Imperata cylindrica* particularly in areas where the grass has grown tall and dense enough for the ends to start “knitting together”. These ground-dwelling owls construct a network of tunnels in grass referred to as runs. The species is a habitat specialist and wetlands appear to be important for hunting and breeding although they do hunt beyond wetland areas. African Grass Owl is primarily threatened by widespread loss of grassland and wetland habitat. Additional threats include anthropogenically altered burn regimes, livestock (trampling of runs and nest) as well as roadkill’s.

Table 6-3 List of present and potentially occurring SCC avifauna

Common Name	Scientific Name	Status			FS	LO	Atlas
		Global	Regional	NEMBA			
White-backed Vulture	*Gyps africanus*	CR	CR	EN	PG	4	
Cape Vulture	*Gyps coprotheres*	EN	EN	EN	PG	3	
African Marsh Harrier	*Circus ranivorus*	LC	EN		PG	2	
Yellow-billed Stork	*Mycteria ibis*	LC	EN		PG	2	x
Black Harrier	*Circus maurus*	VU	EN		PG	3	
Martial Eagle	*Polemaetus bellicosus*	VU	EN	EN	PG	3	
African Grass Owl	*Tyto capensis*	LC	VU		PG	2	
Caspian Tern	*Sterna caspia*	LC	VU		PG	2	x
Lanner Falcon	*Falco biarmicus*	LC	VU		PG	3	
Great White Pelican	*Pelecanus onocrotalus*	LC	VU		PG	3	
Pink-backed Pelican	*Pelecanus rufescens*	LC	VU		PG	3	
Black Stork	*Ciconia nigra*	LC	VU		PG	4	
Secretarybird	*Sagittarius serpentarius*	VU	VU		PG	3	x
Blue Crane	*Anthropoides paradiseus*	VU	NT	PS	OG	2	
Melodious Lark	*Mirafra cheniana*	NT	LC		PG	2	
Greater Flamingo	*Phoenicopterus roseus*	LC	NT		PG	2	
Abdim's Stork	*Ciconia abdimii*	LC	NT		PG	2	
Marabou Stork	*Leptoptilos crumeniferus*	LC	NT		PG	4	
Maccoa Duck	*Oxyura maccoa*	NT	NT		PG	2	
Chestnut-banded Plover	*Charadrius pallidus*	NT	NT		PG	3	
Black-winged Pratincole	*Glareola nordmanni*	NT	NT		PG	2	
Pallid Harrier	*Circus macrourus*	NT	NT		PG	3	
Red-footed Falcon	*Falco vespertinus*	NT	NT		PG	3	
Lesser Flamingo	*Phoeniconaias minor*	NT	NT		PG	2	
Blue Korhaan	Eupodotis caerulescens	NT	LC		PG	1	x

Key: Status: CR = Critically Endangered; DD = Data Deficient; EN = Endangered; LC = Least Concern; NA = Not Assessed; NT = Near Threatened; OG = Ordinary Game; PG = Protected Game; PS = Protected Species; VU = Vulnerable. Likelihood of Occurrence (LO): 1 = Present; 2 = High; 3 = Moderate. Sources: Taylor et al. (2015); BirdLife South Africa (2016); SABAP 2 (2022)

6.3.7.2 Species Congregations and Flyways

The project area was not found to support any globally significant congregations of water birds or other birdlife. The floodplain wetland was, however, found to support significant flocks of Red-billed Quelea (*Quelea quelea*), Yellow-crowned Bishop (*Euplectes afer*) and Southern Red Bishop (*Euplectes orix*) as well as numerous waterbirds. These breeding congregations should be considered important on a regional scale. The project area is not situated in any globally recognised avifaunal flyway.

6.3.8 Collision Prone Species

The proposed solar PV may pose a collision risk to avifauna. However, the current body of scientific research on this topic is scant. Since the effects of PV solar farms on birds were investigated several monitoring studies have reported evidence of bird mortalities within and immediately surrounding PV farms. Several causes for these mortalities have been put forward but perhaps the widely cited are collisions. Collisions are thought to arise when birds (particularly waterbirds) mistake the panels for waterbodies, known as the "lake effect" (Lovich and Ennen 2011), or when migrating or dispersing birds become disorientated by the polarised light reflected by the panels. Mixed views have been presented on the significance of collisions as an impact, with a definitive answer precluded by a lack of long-term data. Currently the consensus is that collisions due to the lake effect is unlikely and that other impacts associated with the construction and operation of solar facilities (e.g., habitat loss, collision with fences, electrocution on transmission lines, increased predation pressure as birds attempt to forage beneath solar panels and struggle to escape) may be of greater overall consequence to avifauna (Birdlife, 2012). Nevertheless, given the paucity of empirical research on this topic, the precautionary principle is adopted here, and the potential for collision and (to a lesser intensity electrocution) considered possible.

For the purposes of this project a subset of collision prone species have been identified. These species are listed in Table 6-4 along with their likelihood of occurrence (LO), conservation status and mean SABAP2 reporting rate (%). The reporting rate provides a rough indication of the residency and commonness of these species, one of several factors which may increase their susceptibility to collision. Species are ranked in this table from highest to lowest reporting rate. Based on this data six species emerge with a high probability of collision having been seen on more 50% of the time during SABAP surveys. These include Northern Black Korhaan (*Afrotis afraoides*), Hadeda Ibis (*Bostrychia hagedash*), Helmeted Guineafowl (*Numida meleagris*), Egyptian Goose (*Alopochen aegyptiaca*), Western Cattle Egret (*Bubulcus ibis*), Swainson's Spurfowl (*Pternistis swainsonii*), Black-winged Kite (*Elanus caeruleus*) and Yellow-billed Duck (*Anas undulata*).

Species considered particularly prone and likely to collision based on in-field count data, and flight patterns include Blue Korhaan (*Eupodotis caerulescens*), Red-billed Quelea (*Quelea quelea*), Helmeted Guineafowl (*Numida meleagris*), Long-tailed Widowbird (*Euplectes progne*), Southern Red Bishop (*Euplectes orix*), Common Waxbill (*Estrilda astrild*), Black-shouldered Kite (*Elanus caeruleus*), Northern Black Korhaan (*Afrotis afraoides*), Amur Falcon (*Falco amurensis*), Cape Teal (*Anas capensis*) and White-winged Widowbird (*Euplectes albonotatus*).

Table 6-4 List of collision and electrocution prone species sorted by reporting rate

Common Name	Scientific Name	LO	Status	Mean SABAP RR (%)
Northern Black Korhaan	*Afrotis afraoides*	1		88.15
Hadeda Ibis	*Bostrychia hagedash*	1		76.6
Helmeted Guineafowl	*Numida meleagris*	1		76.3
Egyptian Goose	*Alopochen aegyptiaca*	2		72.3
Western Cattle Egret	*Bubulcus ibis*	1		70.45
Swainson's Spurfowl	*Pternistis swainsonii*	1		68.3
Black-winged Kite	*Elanus caeruleus*	1		54.9
Yellow-billed Duck	*Anas undulata*	1		50.9

Black-headed Heron	*Ardea melanocephala*	1		48.9
African Sacred Ibis	*Threskiornis aethiopicus*	2		45.1
Reed Cormorant	*Phalacrocorax africanus*	1		39.1
Spur-winged Goose	*Plectropterus gambensis*	2		34.9
Glossy Ibis	*Plegadis falcinellus*	2		33.4
Amur Falcon	*Falco amurensis*	1		21.55
African Spoonbill	*Platalea alba*	2		21.55
Grey Heron	*Ardea cinerea*	2		17.7
African Wattled Lapwing	*Vanellus senegallus*	2		15.4
South African Shelduck	*Tadorna cana*	1		13.7
White-faced Whistling Duck	*Dendrocygna viduata*	2		11.7
Red-billed Teal	*Anas erythrorhyncha*	1		11.55
Greater Kestrel	*Falco rupicoloides*	2		7.7
Blue Korhaan	*Eupodotis caerulescens*	1	NT,LC	5.85
Common (Steppe) Buzzard	*Buteo buteo*	2		3.85
Lanner Falcon	*Falco biarmicus*	3	VU, LC	3.85
Secretarybird	*Sagittarius serpentarius*	3	VU, VU	3.85
Yellow-billed Stork	*Mycteria ibis*	2	EN, LC	3.85
African Darter	*Anhinga rufa*	2		0
White-breasted Cormorant	*Phalacrocorax lucidus*	2		0
Cape Shoveler	*Anas smithii*	2		0
Little Egret	*Egretta garzetta*	2		0
African Fish Eagle	*Haliaeetus vocifer*	2		0
White-backed Duck	*Thalassornis leuconotus*	2		0
Maccoa Duck	*Oxyura maccoa*	2	NT, VU	0
African Black Duck	*Anas sparsa*	2		0
Southern Pochard	*Netta erythrophthalma*	2		0
Purple Heron	*Ardea purpurea*	2		0
Squacco Heron	*Ardeola ralloides*	2		0
Spotted Eagle-Owl	*Bubo africanus*	2		0
Gabar Goshawk	*Melierax gabar*	2		0
Hamerkop	*Scopus umbretta*	2		0
Black-crowned Night Heron	*Nycticorax nycticorax*	2		0
Cape Teal	*Anas capensis*	1		0
Black Heron	*Egretta ardesiaca*	2		0
Goliath Heron	*Ardea goliath*	2		0
Fulvous Whistling Duck	*Dendrocygna bicolor*	3		0
Great Egret	*Egretta alba*	3		0
Greater Flamingo	*Phoenicopterus roseus*	2	NT, LC	0
Lesser Flamingo	*Phoeniconaias minor*	2	NT, NT	0
Hottentot Teal	*Anas hottentota*	2		0
Yellow-billed (Intermediate) Egret	*Egretta intermedia*	2		0
Black Stork	*Ciconia nigra*	4	VU, LC	0
African Marsh Harrier	*Circus ranivorus*	2	EN, LC	0
Western Barn Owl	*Tyto alba*	2		0
Marsh Owl	*Asio capensis*	2		0
Little Bittern	*Ixobrychus minutus*	2		0
Abdim's Stork	*Ciconia abdimii*	2	NT, LC	0
Caspian Tern	*Sterna caspia*	2	LC,VU	0

7 Sensitivity Assessment

7.1 Desktop-based Sensitivity: National Environmental Screening Tool

The national environmental screening tool is a web-based application hosted by the Department of Environmental Affairs that allows developers to screen their prospective site for environmental sensitives. Importantly, this tool now serves as the first step in the environmental authorisation process as laid out in the gazetted assessment protocols for each environmental theme. Guidance towards achieving these protocols for terrestrial biodiversity is provided in the Species Environmental Assessment Guideline (SANBI, 2020) which, in turn, relies on the results of the screening tool to inform the level of assessment required. The screening tool provides an avifaunal sensitivity theme.

There are three sensitivity layers produced by the screening tool that are of relevance for avifauna namely (1) Animal Species Theme and (2) Avian Theme and (3) Terrestrial Biodiversity Theme. The Animal Species Theme highlights the valley-bottom wetland as being of Medium sensitivity on account of its suitability to support Spotted-necked Otter (*Hydrictus maculicollis*) while the rest is classified as Low sensitivity. Importantly, however, the screening tool also flags small pans and dams in the nearby vicinity of the project area as being of High Sensitivity for both Yellow-billed Stork and Caspian Tern. The Avifauna Theme shows that the project is situated within 20 km radius of a known vulture restaurant situated near Parys which the screening tool classifieds as being of High sensitivity. Lastly the terrestrial Biodiversity Theme highlights the entire project area as being of Very High sensitivity on account of it occurring within a Vulnerable Ecosystem.

7.2 Site-based Sensitivity Assessment

Areas of avifaunal sensitivity within the project area is presented in Figure 7-1. Overall, the large valley-bottom wetland was designated High sensitivity, while all remaining non-cultivated grassland was afforded a Medium sensitivity (Figure 7-1). The valley-bottom wetland is assigned a High importance and sensitivity on account of its capacity to support water associated SCC as well as significant abundances of waterfowl and seedeaters. This wetland supports potential breeding habitat for African Grass Owl (*Tyto capensis*) and is likely to be utilised from a foraging perspective in the summer months by African Marsh Harrier, Yellow-billed Stork (sporadic), Caspian Tern (sporadic) and potentially Maccoa Duck. This wetland also supported by far the highest species richness and abundance of avifauna within the entire project area as well as the highest abundances of collision prone species. It also represents a potentially busy corridor for bird movements. This habitat has been excluded from the PV development footprint but three 132 Kv grid connection lines are planned to be spanned over this wetland which poses a noteworthy collision risk. The solar PV areas and associated infrastructure (e.g. BESS, collectors, OSS) do, however occur in the Medium sensitivity grassland. These areas have been assigned a Medium Sensitivity on account of the largely natural condition of the grassland and its capacity to support most of the regionally occurring grassland SCC. Noteworthy species in this regard include Blue Korhaan (observed) and Melodious Lark (potentially occurring), both of which are Near-Threatened and likely to breed in this habitat. These grasslands also provide important foraging habitat for Amur Falcon and Black-winged Pratincole.

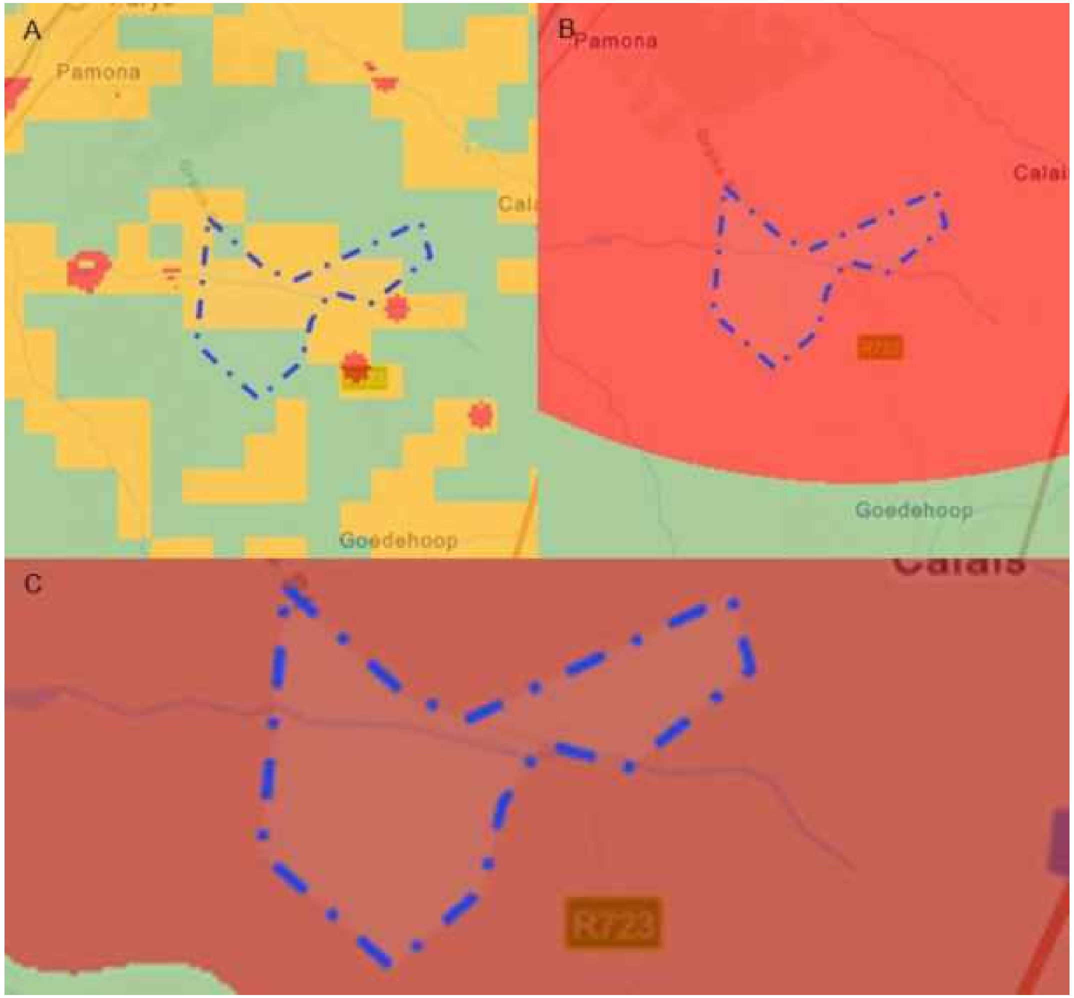

Figure 7-1 *National Environmental Screening Tool; A) Animal Species Theme sensitivity map based on DFFE data (red = High; orange-yellow = Medium; green = Low). Note the medium sensitivity area in the project area is for Spotted-necked Otter. The red patches surrounding the project area indicates optimal wetland habitat for Caspian Tern and Yellow-billed Stork, B) Avian Theme sensitivity map showing 20 k High sensitivity radial buffer on Vulture restaurant and C) Terrestrial Biodiversity Theme sensitivity map showing Very High sensitivity Threatened ecosystem*

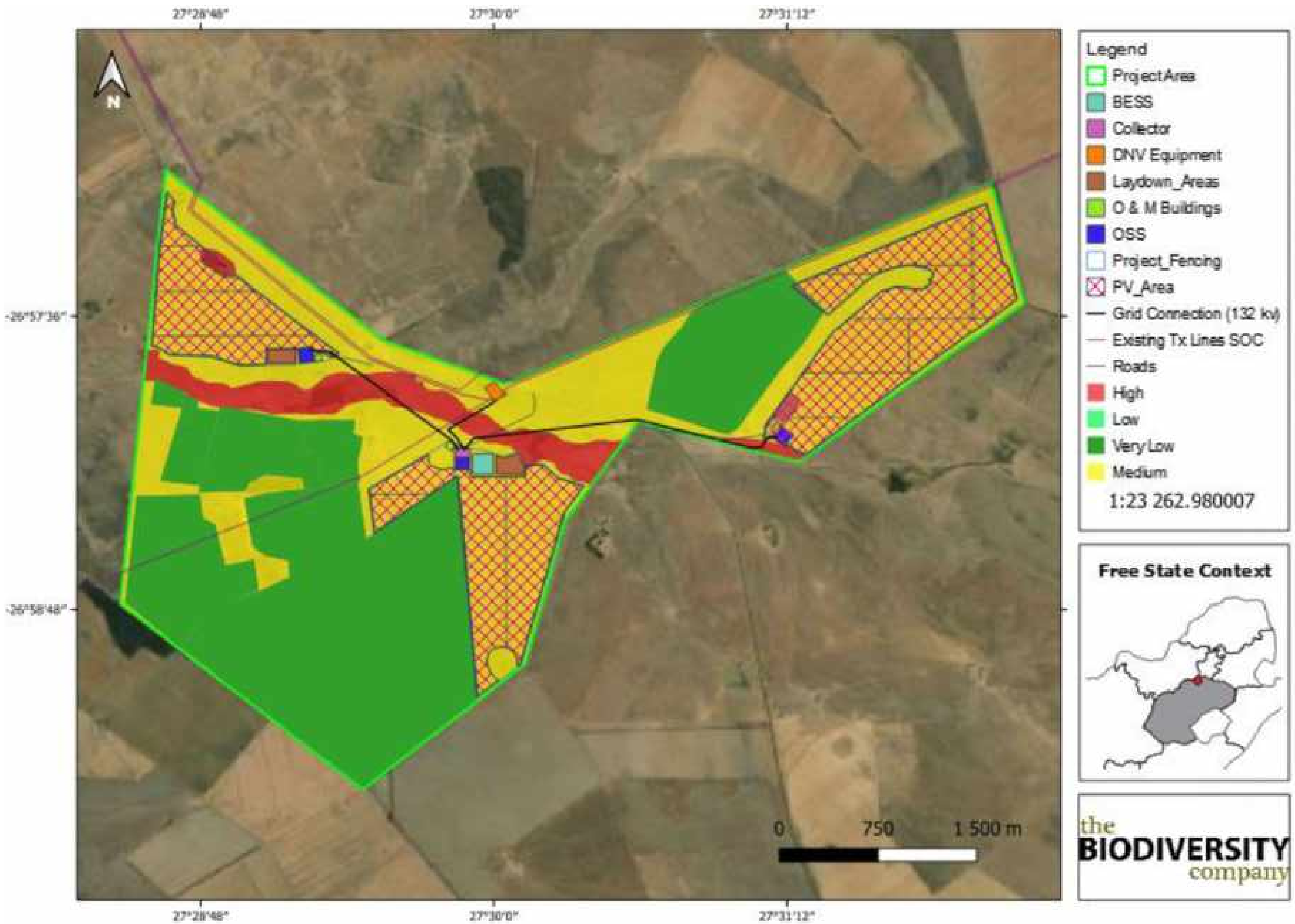

Figure 7-2 *Site-based avifaunal sensitivity map showing overlaid preferred infrastructure layout Alternative 2*

8 Impact Assessment

8.1 Existing Impacts

The following existing impacts were observed:

- Extensive commercial crop cultivation
- Historical agricultural land-use;
- Intense past cattle grazing practices;
- Extensive and intense sandmining in certain areas along the eastern bank of the floodplain;
- Roads and associated vehicle traffic; and
- Fences posing restrictive and entrapment risks.

Figure 8-1 Existing impacts; A) alien bushclumps, B) cattle farming, fences and powerlines, C) dams, D) farm infrastructure

8.2 Anticipated Impacts

The anticipated impacts during the construction, operation and decommissioning phases of the proposed activity are presented in the tables to follow along with the prescribed mitigation.

8.2.1 Loss, degradation and fragmentation of sensitive avifaunal habitat

Development of the PV plant within the project area and its associated infrastructure will result in the loss of a significant area of grassland habitat. This grassland habitat, although relatively homogenous, remains in a largely natural state and provides suitable breeding habitat for several SCC (e.g. Blue Korhaan and possibly Melodious Lark) and foraging habitat for most of the regionally occurring grassland SCC. As such its has been designated a Medium sensitivity rating and its loss due to PV construction is likely to be of local to regional significance with a Medium severity. Mitigation is limited in this regard and the impact would be inevitable, with little potential for the site to still be utilised by these species (due to complete clearing associated with bifacial design of the solar arrays). It should be noted that the infrastructure layout has been adjusted to avoid the High sensitivity valley-bottom wetland, the loss or degradation of which would have represented a High residual impact rating (as it would impact upon potentially suitable habitat for a number of water-associated SCC and affect large congregations of roosting waterfowl and seed-eaters). In light of the above, the loss of grassland habitat is afforded a residual impact rating of Medium overall significance.

Mitigation:

- Continue to use the sensitivity spatial layers provided by TBC to appropriately position all surface infrastructure so as to avoid placing solar panels and associated infrastructure within the areas demarcated as being of High avifaunal sensitivity.
- Demarcate these areas on the ground during construction and sign post them as environmentally sensitive areas keep out.
- Rehabilitate all areas that may have been redundantly disturbed immediately after construction.
- Develop and implement an Alien and Invasive Plant Control Plan.
- Continue to avoid all areas of High avifaunal sensitivity, this must be enforced through on-ground demarcation and education of staff and contractors through inductions and signage.

Table 8-1 Loss, degradation and fragmentation of sensitive avifaunal habitat

Criteria	Without mitigation	With mitigation
Extent	High (4)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

8.2.2 Collision, electrocution and entrapment with PV infrastructure

Based on the current infrastructure layout three short (<3 km) 132 Kv lines will be constructed to facilitate connection of the three PV areas to the grid at the existing substation located in the project area (-26.965219°; 27.500074°). However, all three of these lines will cross the main valley-bottom wetland at different locations. Although one of the lines will parallel the existing transmission line (along the access road bridge across the wetland), the two other lines will cross 546 m upstream and 1 km downstream of this existing powerline corridor. The wetland represents a busy movement corridor for birds and the establishment of these two powerlines represents a significant novel collision risk. The wetland flight path is frequently utilised by a high abundance of ducks, wading birds, waterbirds and small seed-eating passerines. It also has the potential to be used by SCC such as Yellow-billed Stork, Caspian Tern, Black-winged Pratincole, African Marsh Harrier and African Grass Owl. Unmitigated this impact represents a High, unacceptable risk. However with mitigation (route alignment and installation of visual flight diverters) this impact can be reduced to a Medium residual impact. There remains, as ever, a collision and electrocution risk associated with the solar PV plant and substation themselves. From an electrocution point of view, few, potentially occurring SCC or priority species are likely to occur in the project area that have a wingspan large enough (>1.5 m) to bridge gaps between live and earthed components or between phases of powerlines. However electrocution of birds within the substations/switching areas cannot be ruled out. Although this is unlikely to involve SCC. Although the project area is situated within 20 km of a vulture restaurant collisions of vultures with the solar panels is unlikely. However, the risk of collision with transmission lines remains a distinct possibility although it can be greatly reduced through the installation of flight diverters and anti-perch structures.

Mitigation:

- If practically feasible, consider aligning all three 132 Kv powerlines to cross the wetland at the existing powerline corridor along the existing access road. Alignment of the powerlines will help to reduce the spatial extent of collision risk and help to increase the visibility of the lines and the potential that inbound birds will either fly above or below the powerline corridor.

- Install Eskom-approved flappers or coils on both new and old transmission lines (particularly the earth wire). These should be placed 1 m apart when crossing wetlands and can be further apart in non-wetland areas (Eskom guidelines specify five metres apart). Flight diverter structures should ideally alternate between light and dark shades to maximise visibility and contrast against background as seen from powerline level. The structures must be installed as the powerlines are being spanned. This will drastically help to increase the visibility of transmission lines especially the thinner earth line with which most collisions tend to be associated (Martin et al. 2010).

- It is recommended that at least one additional 3-day pre-construction survey (preferably 2) be completed in the height of the rainy season to better establish flight path use and attendance of SCC in line with Regime 2 survey protocols (Jenkins et al (2017).

- Additionally due to the significant potential for collisions on the 132 Kv lines crossing the valley-bottom wetland it is recommended (in line with Regime 2 protocol), that post-construction monitoring be conducted. This should involve both general avifaunal monitoring and fatality monitoring.

- General monitoring should involve two three-day site visits (peak summer and early winter) that repeat the methodologies used here (point counts and incidental searches) per year for two years.

- Fatality monitoring should involve standardised carcass searches (see Jenkins et al. 2017 for details on protocol) conducted on a bi-monthly (every second month) basis during the two-year post-construction monitoring period. Progress reports should be submitted every six months and an annual report submitted yearly. Carcass searches should occur around PV infrastructure but most importantly along the wetland beneath crossing points.

- All power cables within the project area should be thoroughly insulated and preferably buried in demarcated corridors.

- White strips placed along the edges of the panels appear to help to increase visibility and deter birds based on work done by Horvath et al. (2010) and are recommended as far as practically feasible.

- Install bird deterrent devices around panels and on transmission line poles, pylons and / or monopoles to limit time spent around infrastructure and therefore collision and electrocution risk.

- The BESS must be covered in non-reflective surfaces and protected against thermal discharge and the risk of veld fires as a result.

Table 8-2 Collision, electrocution and entrapment with PV infrastructure

Criteria	**Without mitigation**	**With mitigation**
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Definite (5)	Probable (3)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

8.2.3 Direct loss of SCC nests or suitable nesting habitat

Suitable breeding habitat for Blue Korhaan and potentially Melodious Lark was identified in the grassland habitat. The three PV arrays and associated infrastructure is planned to occur in these grasslands. However, these grasslands are relatively homogenous and it is currently uncertain as to whether these SCC actually breed in the area. Nevertheless largely intact grassland such as this still provides important foraging habitat for several regionally occurring grassland species. Without mitigation establishment of the solar PV in this area has the potential to have a High impact on regionally occurring SCC populations. However with mitigation (walkdowns and construction timing) this impact can be greatly reduced to Medium or potentially even a Low residual impact significance.

Mitigation:

- It is recommended that a thorough walkdown of the PV areas is conducted immediately prior to the onset of the initial clearing and earthmoving activities for construction. The walkdown should be aimed at detecting nests of any birds, particularly Blue Korhaan and Melodious Lark within the area earmarked for clearing and infrastructure establishment.
- If nests of are found during the walkdown the avifaunal specialist is to advise on the way forward which may involve, *inter alia*, delaying clearing activities in a particular portion of the project area to allow successful fledging.
- If other nests are found during clearing activities halt construction activities and call an avifaunal specialist immediately for advice on the way forward.
- Continue to avoid all areas of High avifaunal sensitivity, this must be enforced through on-ground demarcation and education of staff and contractors through inductions and signage.

Table 8-3 Direct loss of SCC nests or suitable nesting habitat

Criteria	Without mitigation	With mitigation
Extent	Moderate (3)	Low (2)
Duration	Permanent (5)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**High**	**Medium**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

8.2.4 Sensory disturbance and extirpation of SCC or large roosting flocks

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 by adopting temporal avoidance strategies by simply avoiding or lowering the intensity of construction activities during spring and summer. During operation, the residual impacts associated with sensory disturbance should drop to a Low significance.

Mitigation:

- Attempt as far as possible to conduct the majority of the high intensity construction activities during winter to minimize disturbance of avifauna during sensitive life stages such as lekking, courting, nesting and fledging).
- Keep lighting to a minimum and fit external lighting with downward facing hoods.
- Demarcate natural areas beyond the surface infrastructure footprint and restrict access of personnel into these areas through education and signposting.
- All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limit (40km/h), to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited.
- Schedule activities and operations during least sensitive periods, to avoid migration, nesting and breeding seasons (July-September).

Table 8-4 Sensory disturbance and extirpation of SCC or large roosting flocks

Criteria	Without mitigation	With mitigation
Extent	Moderate (3)	Low (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

8.2.5 Cumulative effect on regional birdlife

Many solar developments are planned for the Free State. However, there are no officially recognised renewable applications within a 30 km radius of the project area. This project has the potential to add to the cumulative loss of wetland habitat for grassland SCC. This impact is, however, likely to be minimised by avoiding all areas of High avifaunal sensitivity. This impact is considered to have a Low residual impact, on the premise that extensive grasslands still occur in the region.

Mitigation:

- Avoid all areas rated as High avifaunal sensitivity
- Minimise above-ground electrical infrastructure and avoid transmission line crossing of the large floodplain.
- Rehabilitate all non-developed areas.
- Rehabilitated following decommissioning to re-instate grassland.

Table 8-5 Cumulative effect on regional birdlife

Criteria	Without mitigation	With mitigation
Extent	Low (2)	Very low (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

9 Environmental Management Plan Inputs

Table 9-1 below provides an outline of the avifauna-specific management actions and performance criteria against which project due diligence can be gauged from an avifaunal perspective in future. These actions should be incorporated into the EMPr.

Table 9-1 Avifaunal EMP inputs

Project phase	Potential impact	Mitigation	Responsible person/ entity	Management actions & performance criteria
Construction, Operation and Decommissioning	Loss, degradation and fragmentation of sensitive avifaunal habitat	Refer to 8.2.1	Developer ECO	Incorporate sensitivity shapefiles provided by TBC into masterplan of PV facility. Use these spatial files to demarcate the sensitive areas on the ground and signpost them as environmentally sensitive no-go areas.
				Develop and implement a CEMPr. The CEMPr must make clear the areas of High and Medium avifaunal sensitivity in relation to the construction footprint. The plan must also specify rules regarding speed limits, environmental no-go areas (floodplain wetland and 41 m buffer as well as far northern wetlands and grasslands,) off-road driving; use of existing access routes. The plan must also specify reporting deliverables and timeframes.
				Produce a map every year showing the development of the PV footprint in relation to the High and Medium sensitivity habitats. Data must be available in georeferenced shapefile format. Initiate an offset strategy if clearing of sensitive land is anticipated or has happened incidentally.
				Illustrate and briefly discuss habitat loss maps in a brief environmental annual ops report.
				Educate staff and contractors on the location and rules regarding sensitive areas identified in the project area.
				Commission annual external audit of CEMPr and EMPr compliance as well as annual ops report
Construction and Operation	Collision, electrocution and entrapment with PV infrastructure	Refer to 8.2.2	Developer ECO and trained staff	Install Eskom-approved flappers or coils on both new and old transmission lines (particularly the earth wire). These should be placed 1 m apart when crossing wetlands and can be further apart in non-wetland areas (Eskom guidelines specify five metres apart). Flight diverter structures should ideally alternate between light and dark shades to maximise visibility and contrast against

				background as seen from powerline level. The structures must be installed as the powerlines are being spanned. This will drastically help to increase the visibility of transmission lines especially the thinner earth line with which most collisions tend to be associated (Martin et al. 2010).
				Conduct post-construction monitoring. This should involve both general avifaunal monitoring and fatality monitoring. General monitoring should involve two three-day site visits (peak summer and early winter) that repeat the methodologies used here (point counts and incidental searches) per year for two years. Fatality monitoring should involve standardised carcass searches (see Jenkins et al. 2017 for details on protocol) conducted on a bi-monthly (every second month) basis during the two-year post-construction monitoring period. Progress reports should be submitted every six months and an annual report submitted yearly. Carcass searches should occur around PV infrastructure but most importantly along the wetland beneath crossing points.
				Create bird and other biodiversity awareness signs and posters (interesting species and who to call regarding incidents).
				Increase awareness and the training undertaken by staff through incorporating biodiversity aspects (e.g. sensitive areas and species and who to report an incident or carcass to) into inductions.
				Although unlikely, if a nest of a suspected priority species (e.g. African Grass Owl, African Marsh Harrier or any raptor or large-terrestrial bird) is found in the project area, halt clearing activities, mark the nest both on the ground (dropper and flag) and with a GPS, signpost and report. A relevant avifaunal specialist should be consulted for advise on the way forward regarding the nest.
Pre-construction to Construction	Direct loss of SCC nests or suitable nesting habitat	Refer to 8.2.3	Developer ECO	It is recommended that a thorough walkdown of the PV areas is conducted immediately prior to the onset of the initial clearing and earthmoving activities for construction. The walkdown should be aimed at detecting nests of any birds, particularly Blue Korhaan and Melodious Lark within the area earmarked for clearing and infrastructure establishment. If nests are found during the walkdown the avifaunal specialist is to advise on the way forward which may involve, inter alia, delaying clearing activities in a particular portion of the project area to allow successful fledging.
				In the annual environmental ops report, document noise, dust and light levels recorded preferably near the floodplain wetland. Suggest what actions could be taken to minimise these disturbances wherever possible.
Construction and Operation	Sensory disturbance and extirpation of SCC	Refer to 8.2.4	Developer ECO	In the annual environmental ops report, document noise, dust and light levels. Suggest what actions could be taken to minimise these disturbances wherever possible.

10 Conclusion

During the brief late summer site visit a total of 59 species were observed within the project area through a combination of point counts and incidental observations. Of the three habitats the highest avian diversity was observed in the Grassland habitat. The Grassland and Wetland habitats supports the most diverse and unique avifaunal assemblage due to their relatively intact state and overall higher microhabitat diversity, structural complexity and resource availability.

The survey yielded one species of conservation concern (SCC) in the project area namely Blue Korhaan (*Eupodotis caerulescens*). An additional 11 SCC are considered highly likely to occur within the project area based on habitat availability and suitability. These include African Marsh Harrier (*Circus ranivorus*), Yellow-billed Stork (*Mycteria ibis*), African Grass Owl (*Tyto capensis*), Caspian Tern (*Sterna caspia*), Blue Crane (*Anthropoides paradiseus*), Melodious Lark (*Mirafra cheniana*), Greater Flamingo (*Phoenicopterus roseus*), Lesser Flamingo (*Phoeniconaias minor*), Abdim's Stork (*Ciconia abdimii*), Black-winged Pratincole (*Glareola nordmanni*) and Maccoa Duck (*Oxyura maccoa*). Of these, potentially suitable breeding habitat exists for Caspian Tern, African Grass Owl and Melodious Lark.

In terms of avifaunal sensitivity the large east-west flowing valley-bottom wetland that bisects the project area was designated High sensitivity while the largely intact Grasslands surrounding the wetland and croplands are assigned a Medium sensitivity. The solar PV areas and associated infrastructure (e.g. BESS, collectors, OSS) do, however occur in the Medium sensitivity grassland. These areas have been assigned a Medium Sensitivity on account of the largely natural condition of the grassland and its capacity to support most of the regionally occurring grassland SCC. Noteworthy species in this regard include Blue Korhaan (observed) and Melodious Lark (potentially occurring), both of which are Near-Threatened and likely to breed in this habitat. These grasslands also provide important foraging habitat for Amur Falcon and Black-winged Pratincole. All croplands were afforded a Very Low sensitivity. On a regional scale the National Environmental Screening Tool flags small pans and dams in the nearby vicinity of the project area as being of High Sensitivity for both Yellow-billed Stork and Caspian Tern. The Avifauna Theme shows that the project is situated within 20 km radius of a known vulture restaurant situated near Parys which the screening tool classifieds as being of High sensitivity.

Five impacts to avifauna are anticipated as a result of the establishment PV plant. These included (1) Habitat loss, degradation and fragmentation including loss of important bird congregations (2) Collision, electrocution and entrapment with PV infrastructure, (3) Direct loss of SCC nests or suitable nesting habitat, (4) Sensory disturbance and extirpation of SCC or large roosting flocks and (5) Cumulative effect on regional birdlife.

Habitat loss was assigned a residual risk of Medium on account of the anticipated loss of natural grassland habitat of Medium sensitivity. Efforts have been made to shift the infrastructure out of the High sensitivity habitat which would have constituted a High residual impact significance.

Collision and electrocution was assigned a Medium significance. Of particular significance is the potential for collisions with electrical transmission infrastructure. Based on the current infrastructure layout three short (<3 km) 132 Kv lines will be constructed across the main valley-bottom wetland at different locations. Although one of the lines will parallel the existing transmission line (along the access road bridge across the wetland), the two other lines will cross 546 m upstream and 1 km downstream of this existing powerline corridor. The wetland represents a busy movement corridor for birds and the establishment of these two powerlines represents a significant novel collision risk. However with mitigation (route alignment and installation of visual flight diverters) this impact can be reduced to a Medium residual impact.

Loss of SCC nests or breeding habitat due to the loss of grassland is a noteworthy possible impact. This is because the grasslands provide suitable breeding habitat for Blue Korhaan and potentially Melodious Lark. However, their breeding status in these grasslands remains uncertain. With mitigation (walkdowns and construction timing) this impact can be greatly reduced to Medium or potentially even a Low residual impact significance. The remaining impacts are deemed to have a Low residual risk.

The following recommendations are made:

- If practically feasible, consider aligning all three 132 Kv powerlines to cross the wetland at the existing powerline corridor along the existing access road.
- Install Eskom-approved flappers or coils on both new and old transmission lines (particularly the earth wire).
- Commission at least one additional 3-day pre-construction survey (preferably 2) be completed in mid-summer to better establish flight path use and attendance of SCC in line with Regime 2 survey protocols.
- Due to the significant potential for collisions on the 132 Kv lines crossing the valley-bottom wetland it is recommended (in line with Regime 2 protocol), that post-construction monitoring be conducted. This should involve both general avifaunal monitoring and fatality monitoring (see Section 8.2.2 for details).

Overall, it is the opinion of the specialist that the project is feasible from an avifaunal perspective, provided the suggested mitigation and recommendations are effectively applied.

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12 Appendix

12.1 Appendix A – Present and potentially occurring avifauna

Common Name	Scientific Name	Status					SABAP2				Total
							2655_2730		2655_2725		
		Global	Regional	NEMBA	FS	LO	FP	AP	FP	AP	
Common Ostrich	*Struthio camelus*	LC	LC			4	46.2	9.4	52	13	x
Orange River Francolin	*Scleroptila gutturalis*	LC	LC		OG	2	61.5	0	32	0	x
Natal Spurfowl	*Pternistis natalensis*	LC	LC		OG	2					
Swainson's Spurfowl	*Pternistis swainsonii*	LC	LC		OG	1	84.6	9.4	52	17.4	x
Common Quail	*Coturnix coturnix*	LC	LC		OG	2					
Harlequin Quail	*Coturnix delegorguei*	LC	LC		OG	2					
Helmeted Guineafowl	*Numida meleagris*	LC	LC		OG	1	84.6	21.9	68	21.7	x
Fulvous Whistling Duck	*Dendrocygna bicolor*	LC	LC		PG	3					
White-faced Whistling Duck	*Dendrocygna viduata*	LC	LC		PG	2	15.4	0	8	0	x
White-backed Duck	*Thalassornis leuconotus*	LC	LC		PG	2					
Maccoa Duck	*Oxyura maccoa*	NT	NT		PG	2					
Egyptian Goose	*Alopochen aegyptiaca*	LC	LC		PG	2	84.6	6.3	60	17.4	x
South African Shelduck	*Tadorna cana*	LC	LC		OG	1	15.4	0	12	0	x
Spur-winged Goose	*Plectropterus gambensis*	LC	LC		OG	2	53.8	0	16	4.3	x
Knob-billed Duck	*Sarkidiornis melanotos*	LC	LC		PG	2					
Cape Teal	*Anas capensis*	LC	LC		PG	1					
African Black Duck	*Anas sparsa*	LC	LC		PG	2					
Yellow-billed Duck	*Anas undulata*	LC	LC		OG	1	53.8	9.4	48	8.7	x
Cape Shoveler	*Anas smithii*	LC	LC		PG	2					
Red-billed Teal	*Anas erythrorhyncha*	LC	LC		OG	1	23.1	6.3	0	0	x
Hottentot Teal	*Anas hottentota*	LC	LC		PG	2					
Southern Pochard	*Netta erythrophthalma*	LC	LC		PG	2					
Greater Honeyguide	*Indicator indicator*	LC	LC		PG	3					
Lesser Honeyguide	*Indicator minor*	LC	LC		PG	2					
Golden-tailed Woodpecker	*Campethera abingoni*	LC	LC		PG	2					
Cardinal Woodpecker	*Dendropicos fuscescens*	LC	LC		PG	2					
Acacia Pied Barbet	*Tricholaema leucomelas*	LC	LC		PG	1	30.8	0	12	0	x
Black-collared Barbet	*Lybius torquatus*	LC	LC		PG	2					

Common Name	Scientific Name	Status				LO	SABAP2				Total
							2655_2730		2655_2725		
		Global	Regional	NEMBA	FS		FP	AP	FP	AP	
Crested Barbet	*Trachyphonus vaillantii*	LC	LC		PG	1	23.1	0	48	21.7	x
African Grey Hornbill	*Tockus nasutus*	LC	LC		PG	3					
African Hoopoe	*Upupa africana*	LC	LC		PG	2	7.7	0	8	8.7	x
Green Wood-hoopoe	*Phoeniculus purpureus*	LC	LC		PG	2	7.7	0	16	4.3	x
Common Scimitarbill	*Rhinopomastus cyanomelas*	LC	LC		PG	3					
Malachite Kingfisher	*Alcedo cristata*	LC	LC		PG	2					
Brown-hooded Kingfisher	*Halcyon albiventris*	LC	LC		PG	2					
Giant Kingfisher	*Megaceryle maxima*	LC	LC		PG	2					
Pied Kingfisher	*Ceryle rudis*	LC	LC		PG	2	7.7	0	16	4.3	x
White-fronted Bee-eater	*Merops bullockoides*	LC	LC		PG	2					
Little Bee-eater	*Merops pusillus*	LC	LC		PG	2					
Blue-cheeked Bee-eater	*Merops persicus*	LC	LC		PG	2					
European Bee-eater	*Merops apiaster*	LC	LC		PG	2	53.8	9.4	36	4.3	x
White-backed Mousebird	*Colius colius*	LC	LC			2	15.4	0	8	0	x
Speckled Mousebird	*Colius striatus*	LC	LC			1	15.4	0	8	4.3	x
Red-faced Mousebird	*Urocolius indicus*	LC	LC			2	23.1	0	48	17.4	x
Jacobin Cuckoo	*Clamator jacobinus*	LC	LC		PG	2					
Red-chested Cuckoo	*Cuculus solitarius*	LC	LC		PG	2					
Diederik Cuckoo	*Chrysococcyx caprius*	LC	LC		PG	2	46.2	0	56	8.7	x
Burchell's Coucal	*Centropus burchellii*	LC	LC		PG	2					
Rose-ringed Parakeet	*Psittacula krameri*				PG	3					
African Palm Swift	*Cypsiurus parvus*	LC	LC		PG	2					
Alpine Swift	*Tachymarptis melba*	LC	LC		PG	3					
Common Swift	*Apus apus*	LC	LC		PG	2	7.7	0	8	0	x
African Black Swift	*Apus barbatus*	LC	LC		PG	2					
Little Swift	*Apus affinis*	LC	LC		PG	2	53.8	3.1	32	8.7	x
Horus Swift	*Apus horus*	LC	LC		PG	2					
White-rumped Swift	*Apus caffer*	LC	LC		PG	2	30.8	0	32	4.3	x
Western Barn Owl	*Tyto alba*	LC	LC		PG	2					
African Grass Owl	*Tyto capensis*	LC	VU		PG	2					
Southern White-faced Owl	*Ptilopsis granti*	LC	LC		PG	2					
Spotted Eagle-Owl	*Bubo africanus*	LC	LC		PG	2					
Marsh Owl	*Asio capensis*	LC	LC		PG	2					
Fiery-necked Nightjar	*Caprimulgus pectoralis*	LC	LC		PG	2					

Common Name	Scientific Name	Status				LO	SABAP2				Total
							2655_2730		2655_2725		
		Global	Regional	NEMBA	FS		FP	AP	FP	AP	
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	LC	LC		PG	3					
European Nightjar	*Caprimulgus europaeus*	LC	LC		PG	4					
Rock Dove	*Columba livia*	LC	LC		PG	2	23.1	0	28	4.3	x
Speckled Pigeon	*Columba guinea*	LC	LC			1	92.3	0	76	26.1	x
Laughing Dove	*Streptopelia senegalensis*	LC	LC			1	92.3	15.6	88	34.8	x
Cape Turtle Dove	*Streptopelia capicola*	LC	LC			1	92.3	9.4	80	43.5	x
Red-eyed Dove	*Streptopelia semitorquata*	LC	LC		PG	2	84.6	3.1	80	21.7	x
Namaqua Dove	*Oena capensis*	LC	LC		PG	2	69.2	0	36	4.3	x
Northern Black Korhaan	*Afrotis afraoides*	LC	LC		PG	1	92.3	12.5	84	17.4	x
Blue Korhaan	*Eupodotis caerulescens*	NT	LC		PG	1	7.7	0	4	0	x
Blue Crane	*Anthropoides paradiseus*	VU	NT	PS	OG	2					
Red-chested Flufftail	*Sarothrura rufa*	LC	LC		PG	2					
African Rail	*Rallus caerulescens*	LC	LC		PG	2					
African Crake	*Crecopsis egregia*	LC	LC		PG	2					
Black Crake	*Amaurornis flavirostra*	LC	LC		PG	2					
Baillon's Crake	*Porzana pusilla*	LC	LC		PG	2					
Spotted Crake	*Porzana porzana*	LC	LC		PG	3					
African Swamphen	*Porphyrio madagascariensis*	LC	LC		PG	2					
Common Moorhen	*Gallinula chloropus*	LC	LC		PG	2	7.7	0	4	0	x
Red-knobbed coot	*Fulica cristata*	LC	LC		OG	2	46.2	6.3	20	0	x
African Snipe	*Gallinago nigripennis*	LC	LC		PG	1	7.7	0	4	0	x
Common Greenshank	*Tringa nebularia*	LC	LC		PG	2	0	3.1	0	0	x
Wood Sandpiper	*Tringa glareola*	LC	LC		PG	2	15.4	0	4	4.3	x
Common Sandpiper	*Actitis hypoleucos*	LC	LC		PG	2					
Ruddy Turnstone	*Arenaria interpres*	LC	LC		PG	3					
Little Stint	*Calidris minuta*	LC	LC		PG	2					
Ruff	*Philomachus pugnax*	LC	LC		PG	2					
African Jacana	*Actophilornis africanus*	LC	LC		PG	2					
Spotted Thick-knee	*Burhinus capensis*	LC	LC		PG	1	7.7	0	12	0	x
Black-winged Stilt	*Himantopus himantopus*	LC	LC		PG	2	7.7	0	4	0	x
Pied Avocet	*Recurvirostra avosetta*	LC	LC		PG	2					
Common Ringed Plover	*Charadrius hiaticula*	LC	LC		PG	3					
Kittlitz's Plover	*Charadrius pecuarius*	LC	LC		PG	2					
Three-banded Plover	*Charadrius tricollaris*	LC	LC		PG	1	15.4	0	12	0	x

Common Name	Scientific Name	Status					SABAP2				Total
							2655_2730		2655_2725		
		Global	Regional	NEMBA	FS	LO	FP	AP	FP	AP	
Chestnut-banded Plover	*Charadrius pallidus*	NT	NT		PG	3					
Caspian Plover	*Charadrius asiaticus*	LC	LC		PG	3					
Blacksmith Lapwing	*Vanellus armatus*	LC	LC		PG	1	92.3	18.8	84	34.8	x
African Wattled Lapwing	*Vanellus senegallus*	LC	LC		PG	2	30.8	6.3	0	0	x
Crowned Lapwing	*Vanellus coronatus*	LC	LC		PG	1	100	12.5	84	26.1	x
Double-banded Courser	*Rhinoptilus africanus*	LC	LC		PG	3	53.8	3.1	44	0	x
Temminck's Courser	*Cursorius temminckii*	LC	LC		PG	3					
Black-winged Pratincole	*Glareola nordmanni*	NT	NT		PG	2					
Grey-headed Gull	*Chroicocephalus cirrocephalus*	LC	LC		PG	2					
Caspian Tern	*Sterna caspia*	LC	VU		PG	2					
Whiskered Tern	*Chlidonias hybrida*	LC	LC		PG	2	0	3.1	0	0	x
White-winged Tern	*Chlidonias leucopterus*	LC	LC		PG	2					
Western Osprey	*Pandion haliaetus*	LC	LC		PG	2					
European Honey Buzzard	*Pernis apivorus*	LC	LC		PG	3					
Black-shouldered Kite	*Elanus caeruleus*	LC	LC		PG	1	53.8	12.5	56	13	x
African Fish Eagle	*Haliaeetus vocifer*	LC	LC		PG	2					
White-backed Vulture	*Gyps africanus*	CR	CR	EN	PG	4					
Cape Vulture	*Gyps coprotheres*	EN	EN	EN	PG	3					
African Marsh Harrier	*Circus ranivorus*	LC	EN		PG	2					
Black Harrier	*Circus maurus*	VU	EN		PG	3					
Pallid Harrier	*Circus macrourus*	NT	NT		PG	3					
African Harrier-Hawk	*Polyboroides typus*	LC	LC		PG	2					
Gabar Goshawk	*Melierax gabar*	LC	LC		PG	2					
Little Sparrowhawk	*Accipiter minullus*	LC	LC		PG	2					
Black Sparrowhawk	*Accipiter melanoleucus*	LC	LC		PG	2					
Common (Steppe) Buzzard	*Buteo buteo*	LC	LC		PG	2	7.7	6.3	0	0	x
Jackal Buzzard	*Buteo rufofuscus*	LC	LC		PG	2					
Booted Eagle	*Hieraaetus pennatus*	LC	LC		PG	3					
Martial Eagle	*Polemaetus bellicosus*	VU	EN	EN	PG	3					
Secretarybird	*Sagittarius serpentarius*	VU	VU		PG	3	7.7	0	0	0	x
Lesser Kestrel	*Falco naumanni*	LC	LC		PG	2	30.8	0	32	0	x
Greater Kestrel	*Falco rupicoloides*	LC	LC		PG	2	15.4	0	0	0	x
Red-footed Falcon	*Falco vespertinus*	NT	NT		PG	3					
Amur Falcon	*Falco amurensis*	LC	LC		PG	1	23.1	6.3	20	4.3	x

Common Name	Scientific Name	Status				LO	SABAP2				Total
							2655_2730		2655_2725		
		Global	Regional	NEMBA	FS		FP	AP	FP	AP	
Lanner Falcon	*Falco biarmicus*	LC	VU		PG	3	7.7	0	0	0	x
Peregrine Falcon	*Falco peregrinus*	LC	LC		PG	3					
Little Grebe	*Tachybaptus ruficollis*	LC	LC		PG	2	38.5	3.1	8	0	x
Great Crested Grebe	*Podiceps cristatus*	LC	LC		PG	4					
Black-necked Grebe	*Podiceps nigricollis*	LC	LC		PG	3					
African Darter	*Anhinga rufa*	LC	LC		PG	2					
Reed Cormorant	*Phalacrocorax africanus*	LC	LC			1	46.2	0	32	0	x
White-breasted Cormorant	*Phalacrocorax lucidus*	LC	LC			2					
Black Heron	*Egretta ardesiaca*	LC	LC		PG	2					
Little Egret	*Egretta garzetta*	LC	LC		PG	2					
Yellow-billed Egret	*Egretta intermedia*	LC	LC		PG	2					
Great Egret	*Egretta alba*	LC	LC		PG	3					
Grey Heron	*Ardea cinerea*	LC	LC		PG	2	15.4	3.1	20	0	x
Black-headed Heron	*Ardea melanocephala*	LC	LC		PG	1	53.8	12.5	44	17.4	x
Goliath Heron	*Ardea goliath*	LC	LC		PG	2					
Purple Heron	*Ardea purpurea*	LC	LC		PG	2					
Western Cattle Egret	*Bubulcus ibis*	LC	LC		PG	1	76.9	15.6	64	13	x
Squacco Heron	*Ardeola ralloides*	LC	LC		PG	2					
Green-backed Heron	*Butorides striata*	LC	LC		PG	2					
Black-crowned Night Heron	*Nycticorax nycticorax*	LC	LC		PG	2					
Little Bittern	*Ixobrychus minutus*	LC	LC		PG	2					
Hamerkop	*Scopus umbretta*	LC	LC		PG	2					
Greater Flamingo	*Phoenicopterus roseus*	LC	NT		PG	2					
Lesser Flamingo	*Phoeniconaias minor*	NT	NT		PG	2					
Glossy Ibis	*Plegadis falcinellus*	LC	LC		PG	2	30.8	0	36	4.3	x
Hadeda Ibis	*Bostrychia hagedash*	LC	LC		PG	1	69.2	6.3	84	47.8	x
African Sacred Ibis	*Threskiornis aethiopicus*	LC	LC		PG	2	46.2	0	44	0	x
African Spoonbill	*Platalea alba*	LC	LC		PG	2	23.1	0	20	0	x
Great White Pelican	*Pelecanus onocrotalus*	LC	VU		PG	3					
Pink-backed Pelican	*Pelecanus rufescens*	LC	VU		PG	3					
Yellow-billed Stork	*Mycteria ibis*	LC	EN		PG	2	7.7	0	0	0	x
Black Stork	*Ciconia nigra*	LC	VU		PG	4					
Abdim's Stork	*Ciconia abdimii*	LC	NT		PG	2					
White Stork	*Ciconia ciconia*	LC	LC		PG	2	0	3.1	0	0	x

Common Name	Scientific Name	Status				LO	SABAP2				Total
							2655_2730		2655_2725		
		Global	Regional	NEMBA	FS		FP	AP	FP	AP	
Marabou Stork	*Leptoptilos crumeniferus*	LC	NT		PG	4					
Eurasian Golden Oriole	*Oriolus oriolus*	LC	LC		PG	3					
Fork-tailed Drongo	*Dicrurus adsimilis*	LC	LC		PG	2					
African Paradise Flycatcher	*Terpsiphone viridis*	LC	LC		PG	2					
Brubru	*Nilaus afer*	LC	LC		PG	3					
Brown-crowned Tchagra	*Tchagra australis*	LC	LC		PG	2					
Crimson-breasted Shrike	*Laniarius atrococcineus*	LC	LC		PG	3					
Bokmakierie	*Telophorus zeylonus*	LC	LC		PG	2	15.4	0	8	4.3	x
Chinspot Batis	*Batis molitor*	LC	LC		PG	2					
Pririt Batis	*Batis pririt*	LC	LC		PG	2					
Pied Crow	*Corvus albus*	LC	LC			1	15.4	9.4	0	8.7	x
Red-backed Shrike	*Lanius collurio*	LC	LC		PG	3	30.8	0	4	0	x
Lesser Grey Shrike	*Lanius minor*	LC	LC		PG	3	15.4	0	8	0	x
Southern Fiscal	*Lanius collaris*	LC	LC		PG	1	92.3	6.3	76	21.7	x
Ashy Tit	*Parus cinerascens*	LC	LC		PG	2					
Brown-throated Martin	*Riparia paludicola*	LC	LC		PG	2	7.7	0	20	4.3	x
Banded Martin	*Riparia cincta*	LC	LC		PG	2	7.7	0	0	0	x
Barn Swallow	*Hirundo rustica*	LC	LC		PG	1	46.2	9.4	40	13	x
White-throated Swallow	*Hirundo albigularis*	LC	LC		PG	2	30.8	0	28	17.4	x
Greater Striped Swallow	*Cecropis cucullata*	LC	LC		PG	1	61.5	6.3	60	17.4	x
South African Cliff Swallow	*Petrochelidon spilodera*	LC	LC		PG	1	76.9	0	20	0	x
Rock Martin	*Hirundo fuligula*	LC	LC		PG	3					
African Red-eyed Bulbul	*Pycnonotus nigricans*	LC	LC			2	46.2	0	52	17.4	x
Fairy Flycatcher	*Stenostira scita*	LC	LC		PG	3					
Long-billed crombec	*Sylvietta rufescens*	LC	LC		PG	3					
Little Rush Warbler	*Bradypterus baboecala*	LC	LC		PG	2					
African Reed Warbler	*Acrocephalus baeticatus*	LC	LC		PG	2					
Marsh Warbler	*Acrocephalus palustris*	LC	LC		PG	3					
Great Reed Warbler	*Acrocephalus arundinaceus*	LC	LC		PG	2					
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	LC	LC		PG	2	7.7	0	8	4.3	x
Willow Warbler	*Phylloscopus trochilus*	LC	LC		PG	2					
Chestnut-vented Tit-Babbler	*Sylvia subcaerulea*	LC	LC		PG	2	30.8	0	4	0	x
Garden Warbler	*Sylvia borin*	LC	LC		PG	2					
Common Whitethroat	*Sylvia communis*	LC	LC		PG	4					

Common Name	Scientific Name	Status				LO	SABAP2				Total
							2655_2730		2655_2725		
		Global	Regional	NEMBA	FS		FP	AP	FP	AP	
Cape White-eye	*Zosterops virens*	LC	LC		PG	2	15.4	0	20	8.7	x
Orange River White-eye	*Zosterops pallidus*	LC	LC		PG	2					
Lazy Cisticola	*Cisticola aberrans*	LC	LC		PG	3					
Rattling Cisticola	*Cisticola chiniana*	LC	LC		PG	2					
Tinkling Cisticola	*Cisticola rufilatus*	LC	LC		PG	3					
Wailing Cisticola	*Cisticola lais*	LC	LC		PG	3					
Levaillant's Cisticola	*Cisticola tinniens*	LC	LC		PG	1	84.6	6.3	24	0	x
Neddicky	*Cisticola fulvicapilla*	LC	LC		PG	1	38.5	0	36	0	x
Zitting Cisticola	*Cisticola juncidis*	LC	LC		PG	1	46.2	0	44	4.3	x
Desert Cisticola	*Cisticola aridulus*	LC	LC		PG	2	38.5	0	12	0	x
Cloud Cisticola	*Cisticola textrix*	LC	LC		PG	2	69.2	3.1	36	4.3	x
Wing-snapping Cisticola	*Cisticola ayresii*	LC	LC		PG	2	7.7	0	0	0	x
Tawny-flanked Prinia	*Prinia subflava*	LC	LC		PG	1	7.7	0	28	4.3	x
Black-chested Prinia	*Prinia flavicans*	LC	LC		PG	1	76.9	9.4	64	4.3	x
Bar-throated Apalis	*Apalis thoracica*	LC	LC		PG	2					
Melodious Lark	*Mirafra cheniana*	NT	LC		PG	2					
Rufous-naped Lark	*Mirafra africana*	LC	LC		PG	2	53.8	0	72	8.7	x
Eastern clapper Lark	*Mirafra fasciolata*	LC	LC		PG	2	23.1	0	16	4.3	x
Sabota Lark	*Calendulauda sabota*	LC	LC		PG	2					
Fawn-coloured Lark	*Calendulauda africanoides*	LC	LC		PG	3					
Spike-heeled Lark	*Chersomanes albofasciata*	LC	LC		PG	1	69.2	3.1	48	8.7	x
Chestnut-backed Sparrow-lark	*Eremopterix leucotis*	LC	LC		PG	2	38.5	0	8	0	x
Red-capped Lark	*Calandrella cinerea*	LC	LC		PG	2	46.2	3.1	52	0	x
Pink-billed Lark	*Spizocorys conirostris*	LC	LC		PG	1	7.7	0	8	4.3	x
Karoo Thrush	*Turdus smithi*	LC	LC		PG	2					
Fiscal Flycatcher	*Sigelus silens*	LC	LC		PG	2					
Spotted flycatcher	*Muscicapa striata*	LC	LC		PG	2					
Cape Robin-Chat	*Cossypha caffra*	LC	LC		PG	1	15.4	0	28	17.4	x
Kalahari Scrub Robin	*Erythropygia paena*	LC	LC		PG	2	23.1	0	0	0	x
African StoneChat	*Saxicola torquatus*	LC	LC		PG	1	100	3.1	68	8.7	x
Mountain Wheatear	*Oenanthe monticola*	LC	LC		PG	3	7.7	0	0	0	x
Capped Wheatear	*Oenanthe pileata*	LC	LC		PG	2	30.8	3.1	28	13	x
Familiar Chat	*Cercomela familiaris*	LC	LC		PG	2	7.7	0	4	0	x
Ant-eating Chat	*Myrmecocichla formicivora*	LC	LC		PG	1	76.9	12.5	80	17.4	x

Common Name	Scientific Name	Status				LO	SABAP2				Total
							2655_2730		2655_2725		
		Global	Regional	NEMBA	FS		FP	AP	FP	AP	
Cape Glossy Starling	*Lamprotornis nitens*	LC	LC		PG	2	38.5	0	40	13	x
Pied Starling	*Lamprotornis bicolor*	LC	LC			1	23.1	0	12	0	x
Wattled Starling	*Creatophora cinerea*	LC	LC		PG	2	23.1	0	32	13	x
Common Myna	*Acridotheres tristis*					2	76.9	0	76	39.1	x
Amethyst Sunbird	*Chalcomitra amethystina*	LC	LC		PG	2					
White-bellied Sunbird	*Cinnyris talatala*	LC	LC		PG	2	7.7	0	8	4.3	x
Scaly-feathered Finch	*Sporopipes squamifrons*	LC	LC			2					
White-browed Sparrow-Weaver	*Plocepasser mahali*	LC	LC			1	100	9.4	92	47.8	x
Cape Weaver	*Ploceus capensis*	LC	LC			3					
Southern Masked Weaver	*Ploceus velatus*	LC	LC			1	100	12.5	88	43.5	x
Red-billed Quelea	*Quelea quelea*	LC	LC			1	84.6	9.4	44	17.4	x
Yellow-crowned Bishop	*Euplectes afer*	LC	LC			1	46.2	6.3	36	4.3	x
Southern Red Bishop	*Euplectes orix*	LC	LC			1	92.3	12.5	80	30.4	x
White-winged Widowbird	*Euplectes albonotatus*	LC	LC			1	30.8	3.1	32	4.3	x
Red-collared Widowbird	*Euplectes ardens*	LC	LC			2					
Long-tailed Widowbird	*Euplectes progne*	LC	LC			1	84.6	34.4	64	8.7	x
Thick-billed Weaver	*Amblyospiza albifrons*	LC	LC		PG	2					
Orange-breasted Waxbill	*Amandava subflava*	LC	LC		PG	1					
African Quail-finch	*Ortygospiza fuscocrissa*	LC	LC		PG	1	53.8	0	40	8.7	x
Red-headed Finch	*Amadina erythrocephala*	LC	LC		PG	2	23.1	3.1	48	8.7	x
Black-faced Waxbill	*Estrilda erythronotos*	LC	LC		PG	2					
Common Waxbill	*Estrilda astrild*	LC	LC		PG	1					
Violet-eared Waxbill	*Uraeginthus granatinus*	LC	LC		PG	4					
Blue Waxbill	*Uraeginthus angolensis*	LC	LC		PG	2	7.7	0	8	4.3	x
Green-winged Pytilia	*Pytilia melba*	LC	LC		PG	1					
Red-billed Firefinch	*Lagonosticta senegala*	LC	LC		PG	2					
African Firefinch	*Lagonosticta rubricata*	LC	LC		PG	2					
Jameson's Firefinch	*Lagonosticta rhodopareia*	LC	LC		PG	1					
Bronze Mannikin	*Lonchura cucullata*	LC	LC		PG	2					
Pin-tailed Whydah	*Vidua macroura*	LC	LC		PG	1	23.1	0	32	8.7	x
Long-tailed Paradise Whydah	*Vidua paradisaea*	LC	LC		PG	2					
Village Indigobird	*Vidua chalybeata*	LC	LC		PG	3					
Dusky Indigobird	*Vidua funerea*	LC	LC		PG	4					
Purple Indigobird	*Vidua purpurascens*	LC	LC		PG	4					

Common Name	Scientific Name	Status				LO	SABAP2				Total
							2655_2730		2655_2725		
		Global	Regional	NEMBA	FS		FP	AP	FP	AP	
House Sparrow	*Passer domesticus*					2	61.5	0	48	13	x
Cape Sparrow	*Passer melanurus*	LC	LC			1	92.3	9.4	72	17.4	x
Southern Grey-headed Sparrow	*Passer diffusus*	LC	LC		PG	2	30.8	0	32	4.3	x
African Pied Wagtail	*Motacilla aguimp*	LC	LC		PG	3					
Cape Wagtail	*Motacilla capensis*	LC	LC		PG	1	30.8	0	36	13	x
Cape Longclaw	*Macronyx capensis*	LC	LC		PG	1	84.6	3.1	48	0	x
African Pipit	*Anthus cinnamomeus*	LC	LC		PG	1	76.9	6.3	68	17.4	x
Plain-backed Pipit	*Anthus leucophrys*	LC	LC		PG	3	7.7	0	8	0	x
Buffy Pipit	*Anthus vaalensis*	LC	LC		PG	2	7.7	0	4	0	x
Long-billed Pipit	*Anthus similis*	LC	LC		PG	2					
Yellow-fronted Canary	*Crithagra mozambica*	LC	LC		PG	2					
Black-throated Canary	*Crithagra atrogularis*	LC	LC		PG	1	69.2	0	28	8.7	x
Yellow Canary	*Crithagra flaviventris*	LC	LC		PG	2	46.2	0	12	0	x
Streaky-headed Seedeater	*Crithagra gularis*	LC	LC		PG	3	0	3.1	8	0	x
Cinnamon-breasted Bunting	*Emberiza tahapisi*	LC	LC		PG	4					
Golden-breasted Bunting	*Emberiza flaviventris*	LC	LC		PG	2					
Yellow-billed Kite	*Milvus aegyptius*	LC	LC		PG	2					

Key: Status: CR = Critically Endangered; DD = Data Deficient; EN = Endangered; LC = Least Concern; NA = Not Assessed; NT = Near Threatened; OG = Ordinary Game; PG = Protected Game; PS = Protected Species; VU = Vulnerable. Likelihood of Occurrence (LO): 1 = Present; 2 = High; 3 = Moderate. Sources: Taylor et al. (2015); BirdLife South Africa (2016); SABAP 2 (2022)