AVIFAUNAL ASSESSMENT FOR THE PROPOSED GAMKA PV FACILITY AND ASSOCIATED INFRASTRUCTURE

BEAUFORD WEST, WESTERN CAPE

April 2022

CLIENT

Gamka PV (Pty) Ltd

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

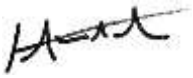
www.thebiodiversitycompany.com

Report Name	**AVIFAUNAL ASSESSMENT FOR THE PROPOSED GAMKA PV FACILITY AND ASSOCIATED INFRASTRUCTURE**
Report Contributor	**Ernest Porter**
	Ernest has gained birding experience in the Northern Cape, North West, Mpumalanga, Limpopo, Kwazulu Natal, Free State, Western Cape and also Gauteng. He is a qualified FGASA NQF2 Field Guide and a committee member of Black Eagle Project Roodekrans and The Botanical Society of South Africa (Bankenveld Branch).
Report Contributor	**Eric Robins**
	Eric has gained birding experience in the Northern Cape, North West, Mpumalanga and also Gauteng. He is a contributing scientist (No 21137) to the South African Bird Atlas Project 2
Report Writer	**Dr Lindi Steyn**
	Dr Lindi Steyn has completed her PhD in Biodiversity and Conservation from the University of Johannesburg. Lindi is a terrestrial ecologist with a special interest in ornithology. She has completed numerous studies ranging from Basic Assessments to Environmental Impact Assessments following IFC standards.
Report Writer/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.
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.

DECLARATION

I, Andrew Husted, 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.



Andrew Husted (Pr Sci 400213/11)

Terrestrial Ecologist

The Biodiversity Company

April 2022

DECLARATION

I, Lindi Steyn, declare that:

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

Lindi Steyn (Pr Sci 119992)

Terrestrial Ecologist

The Biodiversity Company

April 2022

Table of Contents

Tables

Figures

Document Guide

"Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Avifauna" gazetted 20 March 2020, published in Government Notice No. 320 with the relevance to this project as per the Bird and Wind- Energy Best -Practice Guideline (Birdlife SA).

Item	Pages	Comment
The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP)	ii	
Assessments are to be done in accordance with the Bird and Wind- Energy Best -Practice Guideline.	11	Regime 2 was needed
The project area and its characteristics which must be mapped including the extent, habitat, special features including topographical and water features, quarries, drainage lines, known breeding sites, existing uses of land, existing infrastructure such as powerlines and roads, and existing operational wind energy facilities within 30km of the site;	20-31, 47	Section 5.1 from a desktop perspective Section 7 field assessment perspective
Target avifaunal species that are likely to occur on the preferred site and for which monitoring is required	32	Section 5.2
The location of monitoring points	1	Section 3.2.1
Aspects to be monitored (for example, bird abundance and flight activity, presence of target species, proportion of flying time each target species spends at turbine rotor height, preferred flight paths, risk of identified target species to collision, areas for specific monitoring if any, etc.);	16	Section 3.2
Monitoring methodology for the abundance or activity monitoring and for direct observation or vantage point surveys, the latest version of the BirdLife South Africa Bird and Wind -Energy Best- Practice Guideline	16	Section 3.2
The assessment, as a minimum, must include the following aspects: • Discussion on bird abundance and movement within the site; • Discussion on presence of target or threatened species and their occurrence on the site at heights which could pose risks to collision; • Assessment of risk of identified target species to collision including the expected fatality rates of the target species based on a suitable model commonly used for risk determination, per species and for the site; • Identification and mapping where relevant, of any migratory or Preferential bird routes or corridors; • Where relevant, discussion on the risk of displacement • Where relevant, areas identified within the site as having a very high sensitivity for bird collision or displacement and in which the development should be avoided. These areas are to be mapped;	36-51	Section 5 and 6
A plan for post construction monitoring and reporting, which must include: • Timeframes and intervals for monitoring; • Any specific area for monitoring; • Methodology for searcher efficiency and scavenger removal; • Method for monitoring, i.e. transects or radial as well as extent of monitoring area; • Results of monitoring compared against expected fatality rates per target species as well as general species; • Reporting requirements, including organisations for submission of reports; • Years and intervals for monitoring to occur; and • All methods used to estimate bird numbers and movements	72	
Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	92	
A signed statement of independence by the specialist.	II	
A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	16	

A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant.	16	
A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations.	15	
A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant).	-	Not relevant
Additional environmental impacts expected from the proposed development.	56-69	
Any direct, indirect and cumulative impacts of the proposed development.	56-69	
The degree to which impacts and risks can be mitigated.	56-69,74-75	
The degree to which the impacts and risks can be reversed.	56-69,74-75	
The degree to which the impacts and risks can cause loss of irreplaceable resources.	58	
Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr).	70	
A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not;	75	
Any conditions to which this statement is subjected	75	

1 Introduction

The Biodiversity Company (TBC) was appointed to undertake a Regime 2 avifaunal assessment for the proposed Solar Photovoltaic (PV) facility near Beaufort West, Western Cape.

The project is in the north-eastern part of the Western Cape and falls within the Beaufort West Local Municipality and Central Karoo District Municipality. The property earmarked for the proposed project covers a combined area of approximately 2,670 ha, with the total footprint of 261 ha required for the proposed Gamka PV Facility. The property is located approximately 12.5 km south-east of the town of Beaufort West, north of the R61. Infrastructure associated with the PV facility includes access/internal roads, perimeter fencing, security infrastructure, a new substation/control building, battery energy storage system and an overhead transmission powerline (Separate assessment).

This assessment was deemed a requirement based on information provided by the National Web-Based Environmental Screening Tool (DEA, 2021), which demarcated the assessment area as highly sensitive for the animal environmental theme. The high animal sensitivity is as a result of the high likelihood of Ludwigs Bustard occurring.

The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March and 30 October 2020: "*Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria). This is contingent of the PV facility providing electricity output of 20 megawatts (MW) or more.

1.1 Project Description

The applicant, Gamka PV (Pty) Ltd, is proposing the construction of a PV solar energy facility (known as the Gamka PV) located on the Remaining Extent (Portion 0) of Farm 423 approximately 12 km south-east of Beaufort West in the Western Cape province as shown in Figure 1-1. The Gamka PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 120 MW (Figure 1-1).

The dominant land uses surrounding the study area includes livestock farming, urban developments, natural areas and protected areas such as the Steenbokkie Private Nature Reserve.

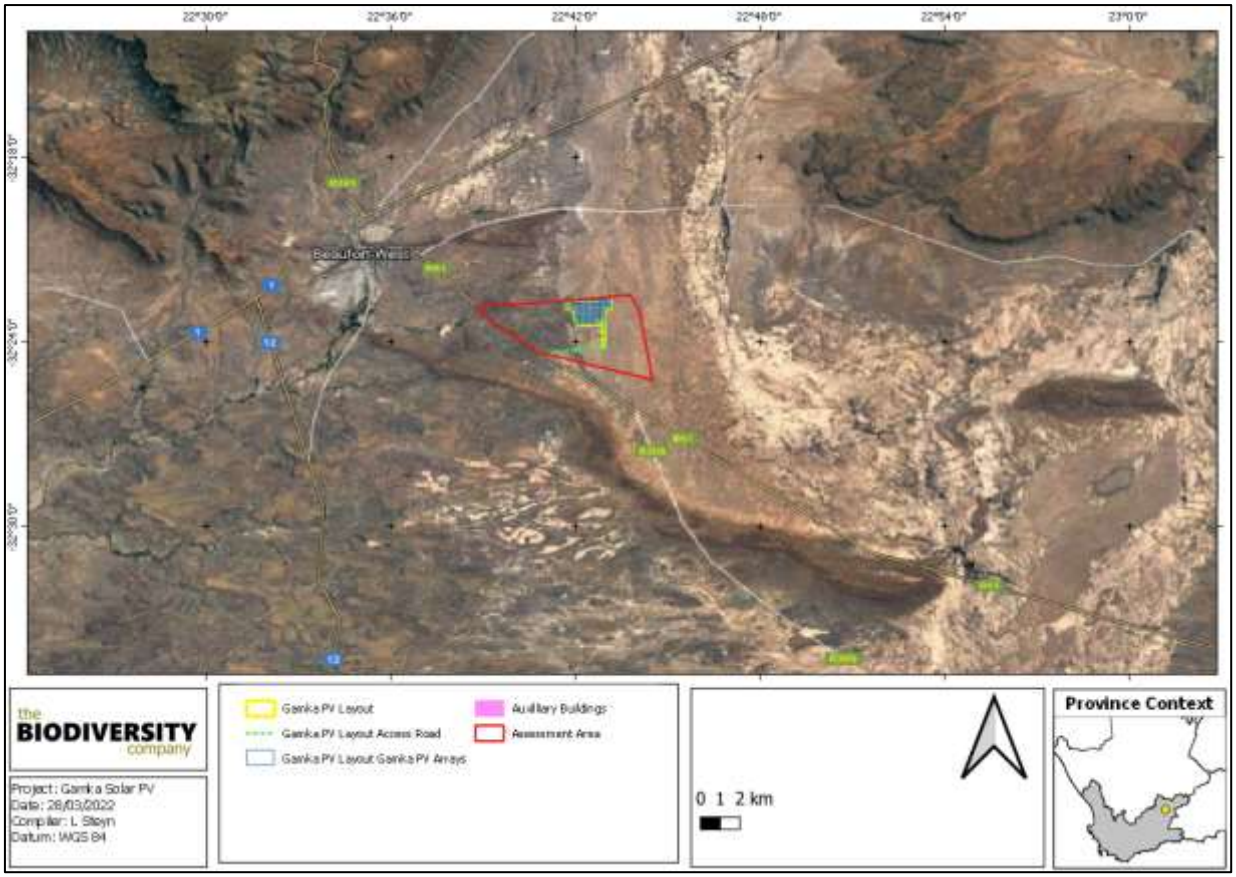


Figure 1-1 Locality of the project area

1.2 Project Context

Five additional 120 MW PV facilities are concurrently being considered on the property and are assessed through separate Basic Assessment processes, namely:

- Bulskop PV;
- Hardeveld PV;
- Rosenia PV;
- Hoodia PV; and
- Salsola PV.

A development footprint of approximately 261 ha is being assessed as part of this Basic Assessment Report (BAR) and the infrastructure associated with the 120 MW facility includes:

- PV modules and mounting structures;
- Inverters and transformers;
- Cabling;
- Battery Energy Storage System (BESS);
- Site and internal access roads (up to 8 m wide);

- Auxiliary buildings (33 kV switch room, gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.);
- Perimeter fencing and security infrastructure;
- Rainwater tanks;
- Temporary and permanent laydown areas;
- Facility substation.

The Gamka PV facility intends to connect to the National Grid via the Droerivier Main Transmission Substation (MTS) (approximately 17.5 km west of the facility), however, the grid connection infrastructure associated with this grid solution is being assessed as part of a separate Environmental Assessment Process.

The six (6) PV facilities and grid connection were collectively (or jointly) surveyed, and the combined extent of these areas is referred to as the assessment area (see Figure 1-2). For the purposes of this report, the extent of the Gamka PV facility is referred to as the project area (Figure 1-3).

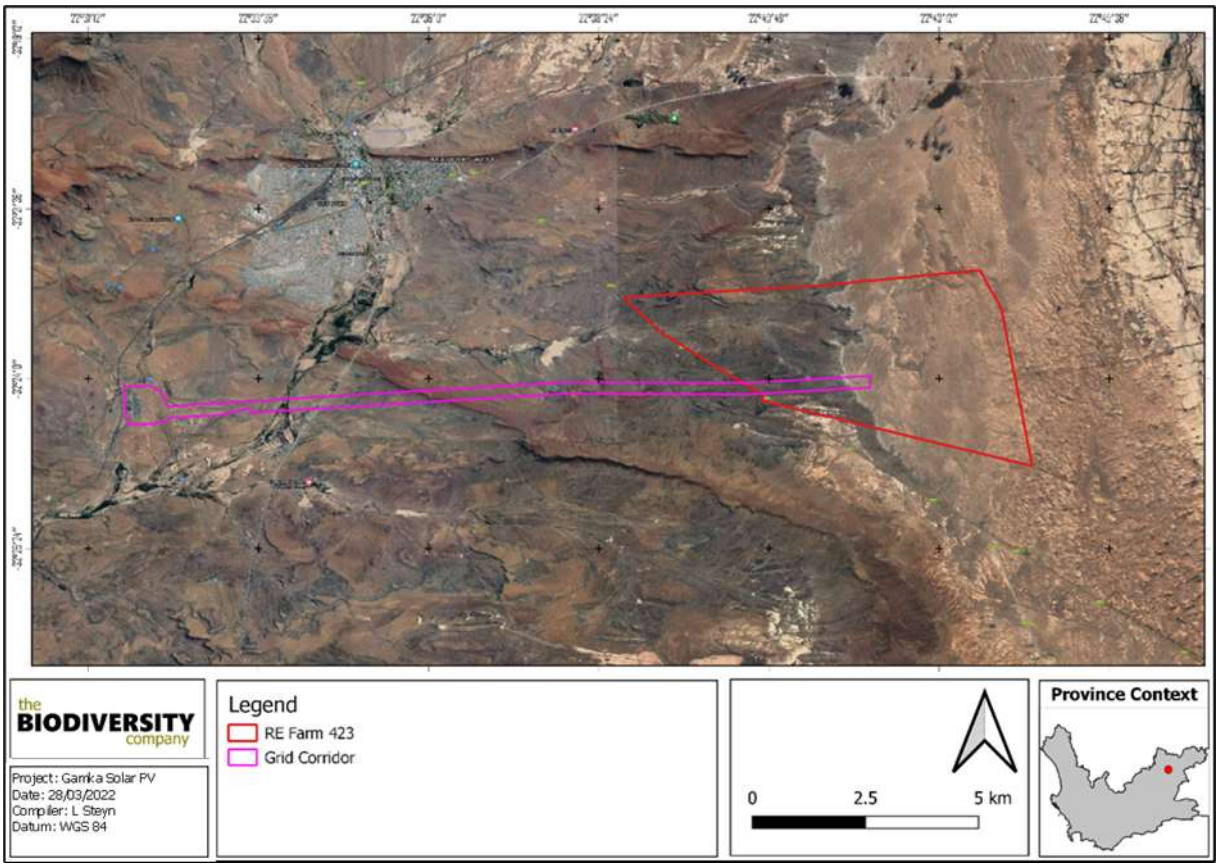


Figure 1-2 Assessment area

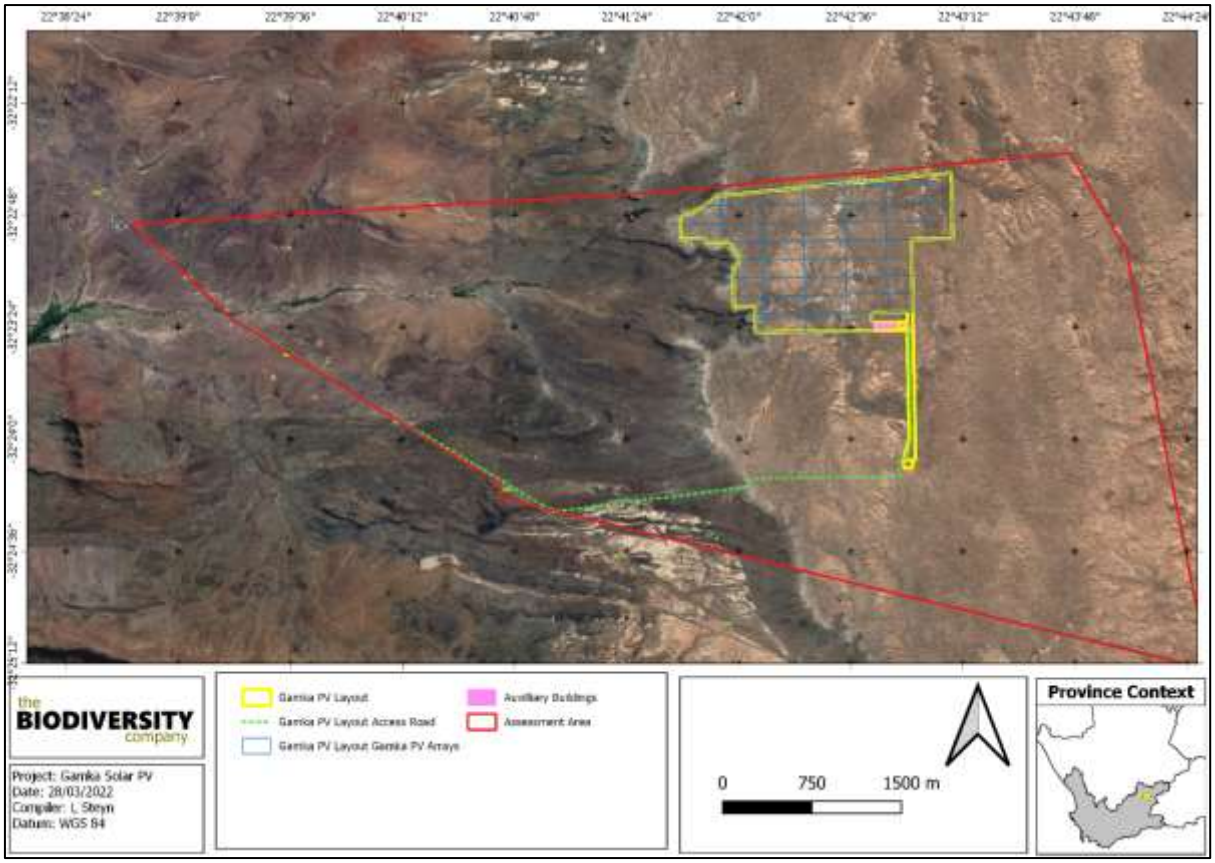


Figure 1-3 Gamka PV development area

1.3 Terms of Reference

The scope of the avifaunal assessment included the following:

- Description of the baseline avifaunal community;
- Identification of present or potentially occurring species of conservation concern (SCC);
- Sensitivity assessment and map to identify sensitive areas in the assessment area; and
- Impact assessment, mitigation measures to prevent or reduce the possible impacts. Key Legislative Requirements

The legislation, policies and guidelines listed below are applicable to the current project in terms of biodiversity and ecological support systems. The list below, although extensive, is not exhaustive and other legislation, policies and guidelines may apply in addition to those listed below (Table 1-1).

Table 1-1 A list of key legislative requirements and guidelines

Region	Legislation and Guidelines
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 1996)

	NEMA
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 320 of Government Gazette 43310 (March 2020)
	Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, GNR 1150 of Government Gazette 43855 (October 2020)
	The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
	The National Environmental Management: :Biodiversity Act (Act No. 10 of 2004) (NEMBA), Threatened or Protected Species Regulations
	The National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
	The Environment Conservation Act (Act No. 73 of 1989)
	National Protected Areas Expansion Strategy (NPAES)
	Natural Scientific Professions Act (Act No. 27 of 2003)
	National Biodiversity Framework (NBF, 2009)
	National Spatial Biodiversity Assessment (NSBA)
	National Heritage Resources Act, 1999 (Act 25 of 1999)
	Alien and Invasive Species Regulations and Alien and Invasive Species List 2020, published under NEMBA
	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.
	Best practice guidelines for avifaunal impact studies at solar developments, compiled by BirdLife South Africa (BLSA) in 2017 (Jenkins *et al*., 2017)
Provincial	Draft Western Cape Biodiversity Bill, 2019
	Western Cape Nature Conservation Laws Amendment Act, 2000 for provincially protected species.
	Western Cape Biodiversity Sector Plan 2017

2 Assumptions and Limitations

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

- Information relating to project activities, spatial data and infrastructure locations for the proposed development was obtained from information provided by the client. The potential impacts and recommendations described in this report apply specifically to the provided information;
- Although considerable time has been spent to ensure that information utilised in this report is verified. It is assumed that all third-party information utilised in the compilation of this report is correct at the time of compilation (e.g., spatial data, online databases, and species lists);
- Weather on day 1 and 2 of the winter survey were near zero temperatures and an icy wind limited sightings on day 1 and 2;
- Being an extremely remote area, the birds were unusually "skittish" and could have influenced the species observed;

- The winter survey was conducted during a time frame when the area has experienced an extreme drought for 6 years, the second survey was however conducted after sufficient rainfall had fallen.

3 Methodologies

3.1 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.). The 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; and
- Taylor *et al*. (2015), Eskom Red Data Book of Birds of South Africa, Lesotho, and Swaziland. Used for conservation status, nomenclature, and taxonomical ordering.

3.2 Field Assessment

The field assessment was conducted collectively for the gridlines and all 6 PV sites to ensure the cumulative impact is considered. This was further done to ensure the various habitats in the area is taken into account as adjacent habitats and their species might also be influenced by the development. A winter field survey was undertaken during 6th to 9th of September 2021, while a follow up summer survey was conducted during 7th to11th February 2022 to determine the presence of SCC. Effort was made to cover all the different habitat types within the limits of time and access. Areas surrounding the project area were also surveyed, this included areas on the Gamka River, both up and downstream of the project area, nearby dams and drainage plains (Figure 3-1). The purpose of these additional surveys was to determine if any larger water birds were present in the area to ensure they are not affected by the development.

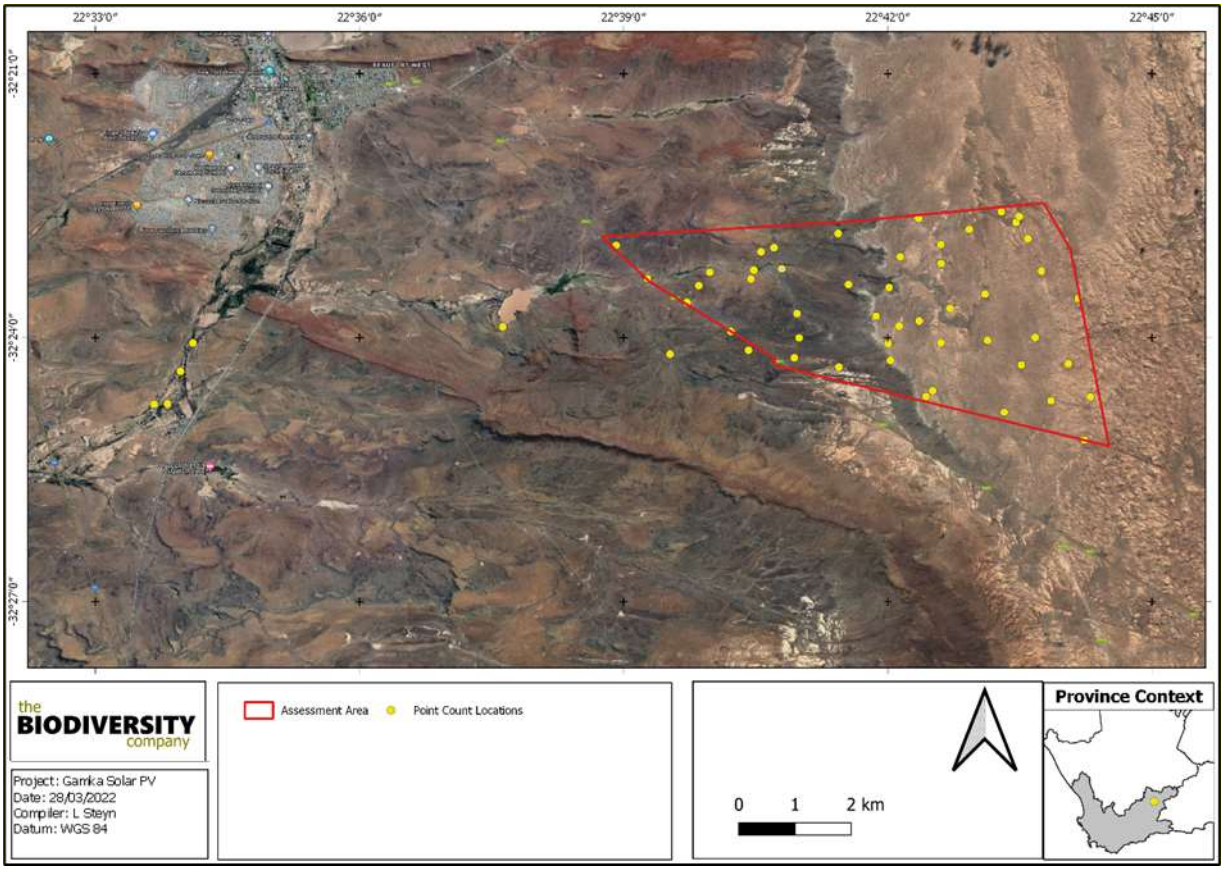


Figure 3-1 Map illustrating the field survey area

Sampling consisted of standardized point counts as well as random diurnal incidental surveys and vantage point surveys. Standardized point counts (following Buckland *et al.* 1993) were conducted to gather data on the species composition and relative abundance of species within the broad habitat types identified. Each point count was run over a 10 min period, with a 2 minute settling time. The horizontal detection limit was set at 50 m. At each point the observer would document the date, start time, and end time, habitat, numbers of each species, detection method (seen or heard), behaviour (perched or flying) and general notes on habitat and nesting suitability for conservation important species. To supplement the species inventory with cryptic and illusive species that may not be detected during the rigid point count protocol, diurnal incidental searches were conducted. This involved the opportunistic sampling of species between point count periods, river scanning and road cruising. Short term flight analysis and vantage point surveys were also conducted, these results are included as part of the incidental information.

3.2.1 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 distinguish similarities / differences in the species composition between the two identified avifaunal habitats, the matrix was converted into a Bray-Curtis dissimilarity matrix. The data was subject to fourth root transformation to downscale the contribution of very abundant species while upscaling the influence of less abundant species. However, the effect was negligible and ultimately the raw data proved more informative. Thirdly, raw count data was converted to relative abundance values and used to establish dominant species and calculate

the diversity of each habitat. The Shannon Diversity Index (H') was the metric used to estimate diversity. Lastly, present, and potentially occurring species were assigned to 13 major trophic guilds loosely based on the classification system developed by González-Salazar *et al.* (2014). Species were first classified by their dominant diet (carnivore, herbivore, granivore, frugivore, nectarivore, omnivore), then by the medium upon / within which they most frequently forage (ground, water, foliage, air) and lastly by their activity period (nocturnal or diurnal).

3.3 Site Ecological Importance

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

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

BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor as follows. The criteria for the CI and FI ratings are provided in Table 3-1 and Table 3-2, respectively.

Table 3-1 Summary of Conservation Importance criteria

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

Conservation Importance	Fulfilling Criteria
	No natural habitat remaining.

Table 3-2 Summary of Functional Integrity criteria

Functional Integrity	Fulfilling Criteria
Very High	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches. No or minimal current negative ecological impacts with no signs of major past disturbance.
High	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts with no signs of major past disturbance and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts with some major impacts and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (> 1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential. Several minor and major current negative ecological impacts.
Very Low	Very small (< 1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts.

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

Table 3-3 Matrix used to derive Biodiversity Importance from Functional Integrity and Conservation Importance

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

The fulfilling criteria to evaluate RR are based on the estimated recovery time required to restore an appreciable portion of functionality to the receptor as summarised in Table 3-4.

Table 3-4 Summary of Resource Resilience criteria

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

Subsequent to the determination of the BI and RR, the SEI can be ascertained using the matrix as provided in Table 3-5.

Table 3-5 Matrix used to derive Site Ecological Importance from Receptor Resilience and Biodiversity Importance

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

Interpretation of the SEI in the context of the proposed development activities is provided in Table 3-6.

Table 3-6 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

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

Site Ecological Importance	Interpretation in relation to proposed development activities
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

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

4 Receiving Environment

4.1 Desktop Spatial Assessment

The following features describes the general area and habitat, this assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and SANBI. The desktop analysis and their relevance to this project are listed in Table 4-1.

Table 4-1 Desktop spatial features examined.

Desktop Information Considered	Gamka PV	Section
Conservation Plan	The PV site overlaps with areas classified as: ESA1, ONA	5.1.1
Protected Areas (SAPAD & SACAD)	The project area is adjacent to the Steenbokkie Private Nature Reserve and 16 km from the Karoo National Park	5.1.1
Important Bird and Biodiversity Areas	The project area is approximately 8.km from the Karoo National Park IBA	5.1.2
Coordinated Avifaunal Road count	The project area is 31 km away from the closest CAR route.	5.1.3
Vegetation Type	The project area is situated in the Gamka Karoo and the Southern Karoo Riviere	5.1.5
Renewable energy projects in the area (REEA)	Five approved projects are found in the area	5.1.7
REDZ Phase 2	The project area falls within the Beaufort West REDZ zone	5.1.7
Coordinated Waterbird Count	The project area is approximately 6 km from the Beaufort West Bird Sanctuary (32222237)	5.1.4

4.1.1 Western Cape Biodiversity Spatial Plan

The Western Cape Biodiversity Spatial Plan (WCBSP) was updated in 2017. It classifies areas into Critical Biodiversity Area (CBA1), CBA2, Ecological Support Area (ESA1), ESA2, Other Natural Areas (ONA) and Protected Areas (PA). Figure 4-1 shows that the PV site overlaps with areas classified as: ESA1 and ONA.

The project area is located directly adjacent to the Steenbokkie Private Nature Reserve.

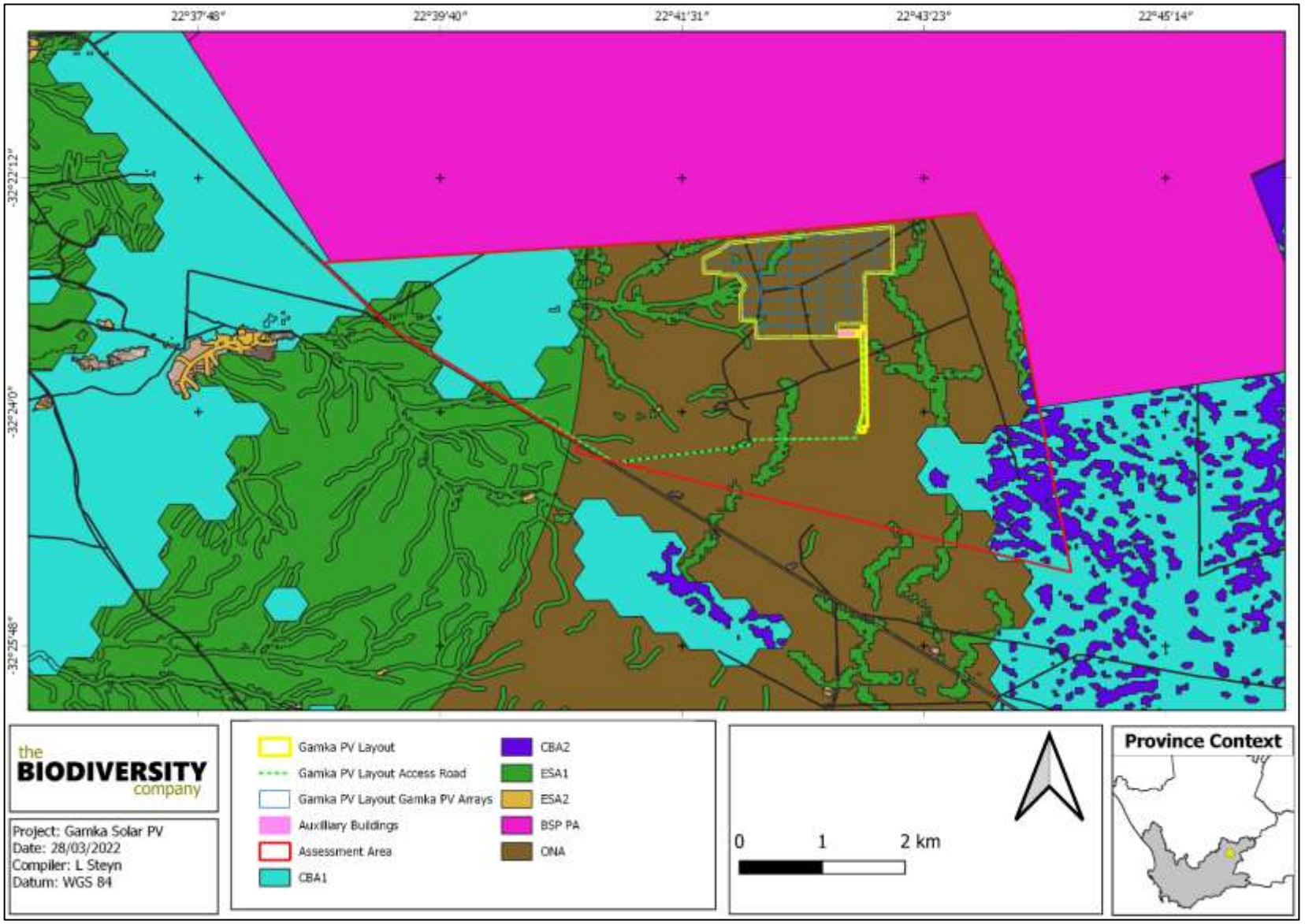


Figure 4-1 The project area superimposed on the Western Cape Biodiversity Spatial Plan (WCBCP, 2017)

4.1.2 Important Bird and Biodiversity Area

Important Bird & Biodiversity Areas (IBAs) are the sites of international significance for the conservation of the world's birds and other conservation significant species as identified by BirdLife International. These sites are also all Key Biodiversity Areas; sites that contribute significantly to the global persistence of biodiversity (Birdlife, 2017).

According to Birdlife International (2017), the selection of IBAs is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels.

Figure 4-2 shows that the project area is approximately 8 km from the Karoo National Park IBA. A total of 231 species have been recorded in this IBA, it is extremely important for Namib-Karoo biome-restricted assemblage species and it supports a host of other arid-zone specials and threatened species. Globally threatened species are Blue Crane *Grus paradiseus*, Martial Eagle *Polemaetus bellicosus*, Black Harrier *Circus maurus*, Secretarybird *Sagittarius serpentarius*, Kori Bustard *Ardeotis kori* and Ludwig's Bustard. Regionally threatened species are Verreauxs' Eagle, Lanner Falcon *Falco biarmicus*, Black Stork *Ciconia nigra*, Karoo Korhaan and African Rock Pipit.

Biome-restricted species that are common in the IBA include Karoo Long-billed Lark, Karoo Chat, Namaqua Warbler, Pale-winged Starling, Black-headed Canary, Layard's Tit-Babbler and the locally common Karoo Korhaan. Uncommon species in this category include Ludwig's Bustard, Karoo Lark, Sclater's Lark, Black-eared Sparrow-lark, Tractrac Chat, Sickle-winged Chat, Karoo Eremomela and Cinnamon-breasted Warbler (Birdlife, 2015).

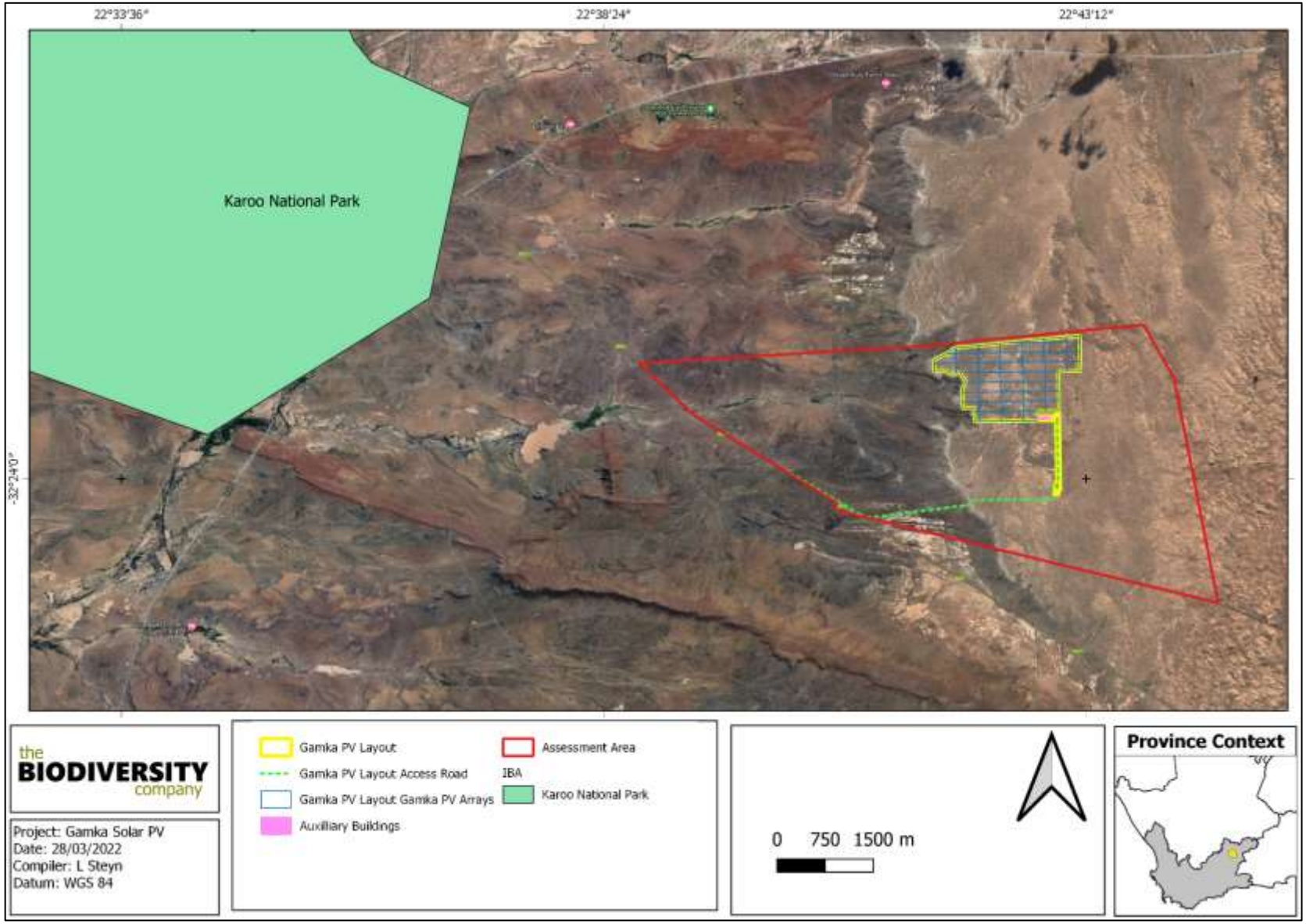


Figure 4-2 The important bird and biodiversity areas in relation to the project area (IBA, 2015)

4.1.3 Coordinated Avifaunal Roadcount (CAR)

The ADU/Cape bird club pioneered avifaunal roadcount of larger birds in 1993 in South Africa. Originally it was started to monitor the Blue Crane *Grus paradiseus* and Denham's/Stanley's Bustard *Neotis denhami*. Today it has been expanded to the monitoring of 36 species of large terrestrial birds (cranes, bustards, korhaans, storks, Secretarybird and Southern Bald Ibis) along 350 fixed routes covering over 19 000 km. Twice a year, in midsummer (the last Saturday in January) and midwinter (the last Saturday in July), roadcounts are carried out using this standardised method. These counts are important for the conservation of these larger species that are under threat due to loss of habitat through changes in land use, increases in crop agriculture and human population densities, poisoning as well as man-made structures like powerlines. With the prospect of wind and solar farms to increase the use of renewable energy sources monitoring of these species is most important (CAR, 2020). Figure 4-3 shows that the project area is 31 km away from the closest CAR route.

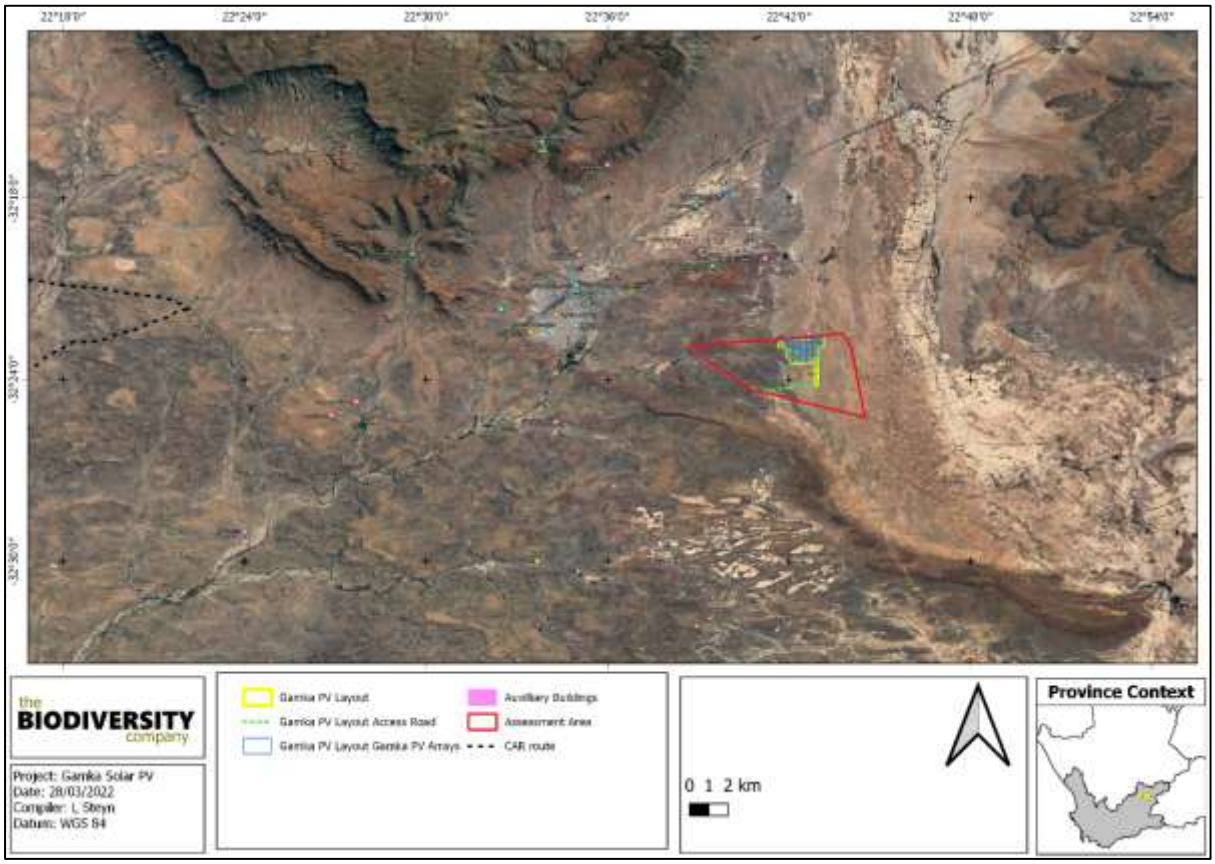


Figure 4-3 The project area in relation to the Coordinated Avifaunal Roadcount route

4.1.4 Coordinated Waterbird Count

The Animal demographic unit launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part South Africa's commitment to International waterbird conservation. Regular mid-summer and mid-winter censuses are done to determine the various features of water birds including population size, how waterbirds utilise water sources and determining the heath of wetlands. For a full description of CWAC please refer to http://cwac.birdmap.africa/about.php. The project area is approximately 6 km from the Beaufort West Bird Sanctuary (32222237) Coordinated Water bird count location, this count was last done in Figure 4-4 illustrates the

area that were focused on in the count. Table 4-2 shows the reporting rate of the water bird species associated with the dam system.

Table 4-2 Species recorded at the Beaufort West Bird Sanctuary during the CWAC during the period 1993-2011

Common name	Taxonomic name	Average Reporting Rate (%)
Sandpiper, Common	*Actitis hypoleucos*	3.86
Goose, Egyptian	*Alopochen aegyptiaca*	24.78
Teal, Cape	*Anas capensis*	35.74
Teal, Red-billed	*Anas erythrorhyncha*	10.96
Duck, Domestic	*Anas platyrhynchos*	1.00
Duck, African Black	*Anas sparsa*	1.80
Duck, Yellow-billed	*Anas undulata*	25.77
Heron, Grey	*Ardea cinerea*	1.96
Heron, Black-headed	*Ardea melanocephala*	2.08
Heron, Purple	*Ardea purpurea*	1.00
Ibis, Hadada	*Bostrychia hagedash*	11.43
Egret, Western Cattle	*Bubulcus ibis*	17.90
Thick-knee, Water	*Burhinus vermiculatus*	2.00
Sandpiper, Curlew	*Calidris ferruginea*	4.64
Stint, Little	*Calidris minuta*	50.36
Ruff	*Calidris pugnax*	20.47
Kingfisher, Pied	*Ceryle rudis*	2.00
Plover, Kittlitz's	*Charadrius pecuarius*	11.88
Plover, Three-banded	*Charadrius tricollaris*	15.19
Tern, Whiskered	*Chlidonias hybrida*	1.50
Tern, White-winged	*Chlidonias leucopterus*	85.36
Gull, Grey-headed	*Chroicocephalus cirrocephalus*	38.33
Stork, Black	*Ciconia nigra*	1.00
Kingfisher, Malachite	*Corythornis cristatus*	1.67
Duck, White-faced Whistling	*Dendrocygna viduata*	1.67
Egret, Little	*Egretta garzetta*	1.33
Coot, Red-knobbed	*Fulica cristata*	36.22
Moorhen, Common	*Gallinula chloropus*	7.57
Oystercatcher, African	*Haematopus moquini*	6.00
Eagle, African Fish	*Haliaeetus vocifer*	1.00
Stilt, Black-winged	*Himantopus*	20.35
Gull, Kelp	*Larus dominicanus*	25.00
Gull, Lesser Black-backed	*Larus fuscus*	1.00
Stork, Marabou	*Leptoptilos crumenifer*	5.00
Kingfisher, Giant	*Megaceryle maxima*	1.00
Cormorant, Reed	*Microcarbo africanus*	4.75
Wagtail, Cape	*Motacilla capensis*	32.42
Wagtail, Western Yellow	*Motacilla flava*	10.00
Pochard, Southern	*Netta erythrophthalma*	6.76
Heron, Black-crowned Night	*Nycticorax*	1.00
Duck, Maccoa	*Oxyura maccoa*	3.30

Cormorant, White-breasted	*Phalacrocorax lucidus*	4.00
Flamingo, Greater	*Phoenicopterus roseus*	1.67
Spoonbill, African	*Platalea alba*	1.14
Goose, Spur-winged	*Plectropterus gambensis*	2.75
Ibis, Glossy	*Plegadis falcinellus*	1.00
Grebe, Great Crested	*Podiceps cristatus*	10.00
Grebe, Black-necked	*Podiceps nigricollis*	5.45
Avocet, Pied	*Recurvirostra avosetta*	16.73
Martin, Brown-throated	*Riparia paludicola*	1.00
Hamerkop	*Scopus umbretta*	1.69
Shoveler, Cape	*Spatula smithii*	20.73
Grebe, Little	*Tachybaptus ruficollis*	16.06
Shelduck, South African	*Tadorna cana*	22.75
Tern, Greater Crested	*Thalasseus bergii*	14.00
Ibis, African Sacred	*Threskiornis aethiopicus*	133.37
Sandpiper, Wood	*Tringa glareola*	5.25
Greenshank, Common	*Tringa nebularia*	1.67
Sandpiper, Marsh	*Tringa stagnatilis*	1.86
Lapwing, Blacksmith	*Vanellus armatus*	52.31

Figure 4-4 Beaufort West Bird Sanctuary (32222237) Coordinated Water bird count location (CWAC, 2021)

4.1.5 Vegetation Types

The project area overlaps with the Gamka Karoo and the Southern Karoo Riviere (access road). The Southern Karoo Riviere occurs on alluvial soils and is characterised by the

presence of grasses and low, mostly thorny shrubs. On site, this azonal vegetation unit is embedded into the surrounding Grassland biome and is called Alluvial plains. The Gamka Karoo consists of sparsely vegetated, gently sloping plains dominated by microphyllus shrubs and grasses of the genera *Aristida* and *Eragrostis* (Figure 4-5).

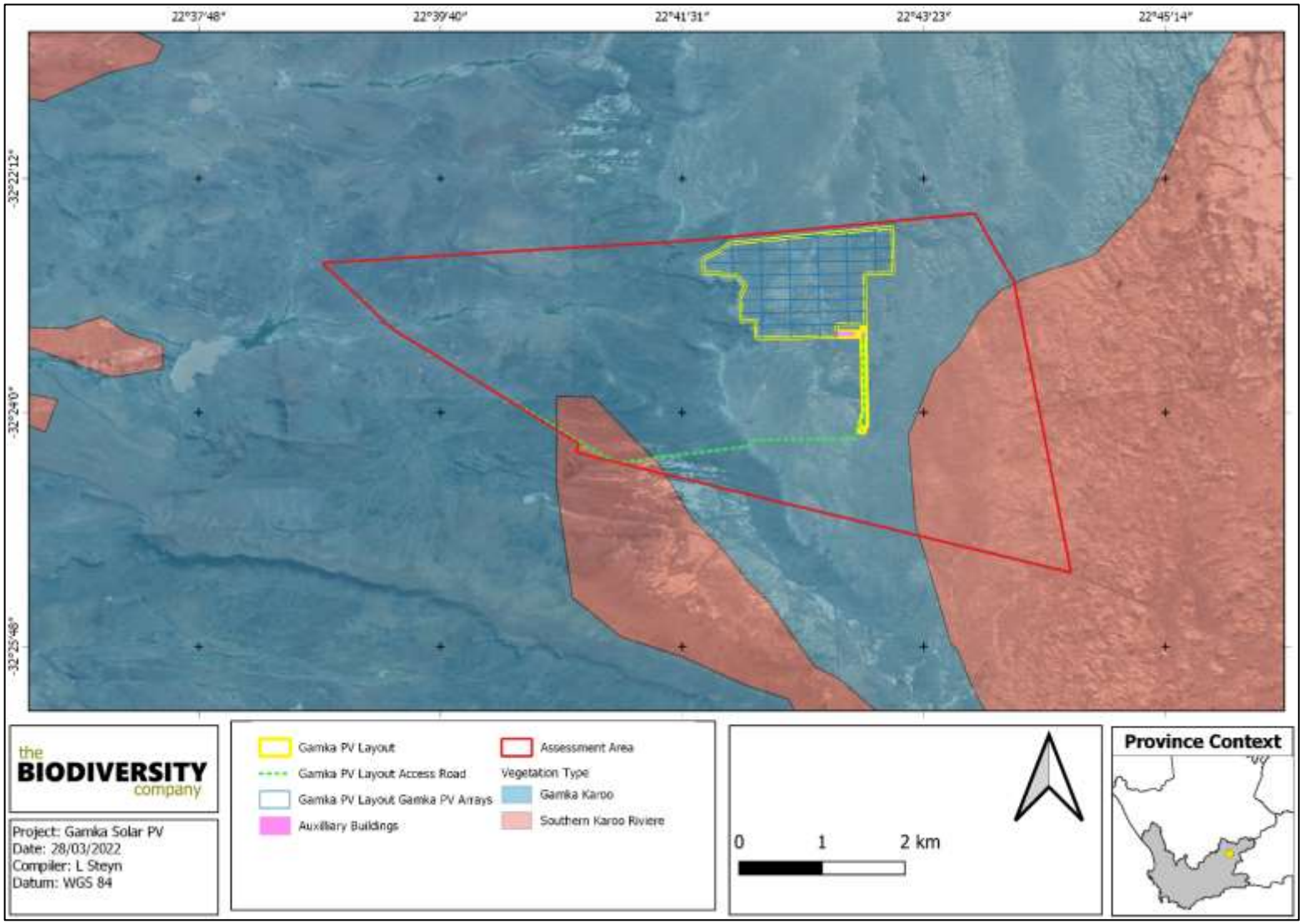


Figure 4-5 The project area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS, 2018)

4.1.6 Aquatic Habitat

The project area is in close proximity to a number of water sources (Figure 4-6). These water sources depending on their state will support a number of avifaunal species. The watercourses considered in this assessment were largely derived to be ephemeral drainage lines located within moderately modified to largely natural catchments. Modifications to the ephemeral systems were observed across the project area, attributed to overgrazing and bush clearing for firewood.

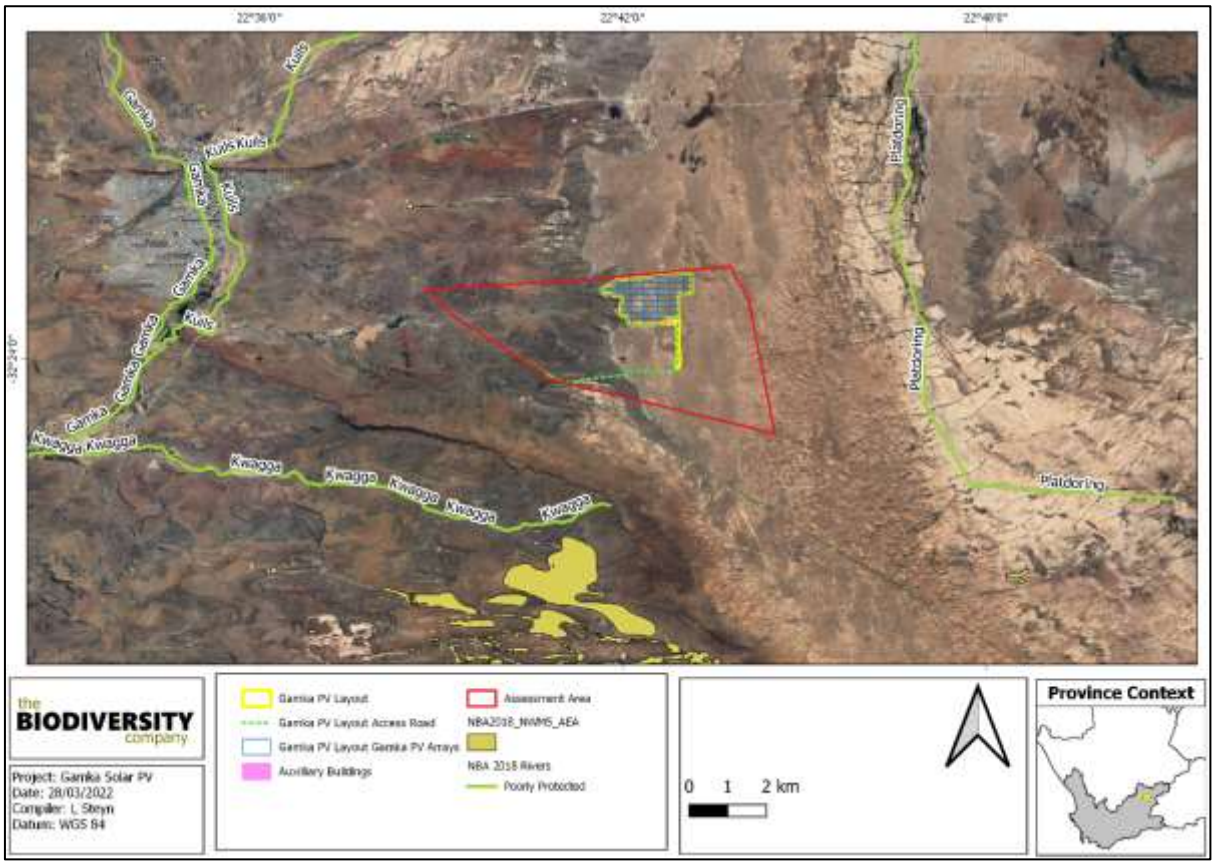


Figure 4-6 The project area in relation to the water resources

4.1.7 Renewable Energy Development Zones (REDZ)

In 2018 the Government Notice No. 114 in Government Gazette No. 41445 was published where 8 renewable energy development zones important for the development of large scale wind and solar photovoltaic facilities were identified. In 2021 an additional 3 sites were included. The REDZs were identified through the undertaking of 2 Strategic Environmental Assessments. More detailed information can be obtained from https://egis.environment.gov.za/redz. The project area overlaps with the Beaufort West phase 2 REDZ zone.

The Renewable Energy Database (http://egis.environment.gov.za/), shows that there are 5 approved projects in the nearby vicinity, and a further four applications that have been withdrew or lapsed (Figure 4-7). This increases the overall cumulative impact on the avifauna in the area.

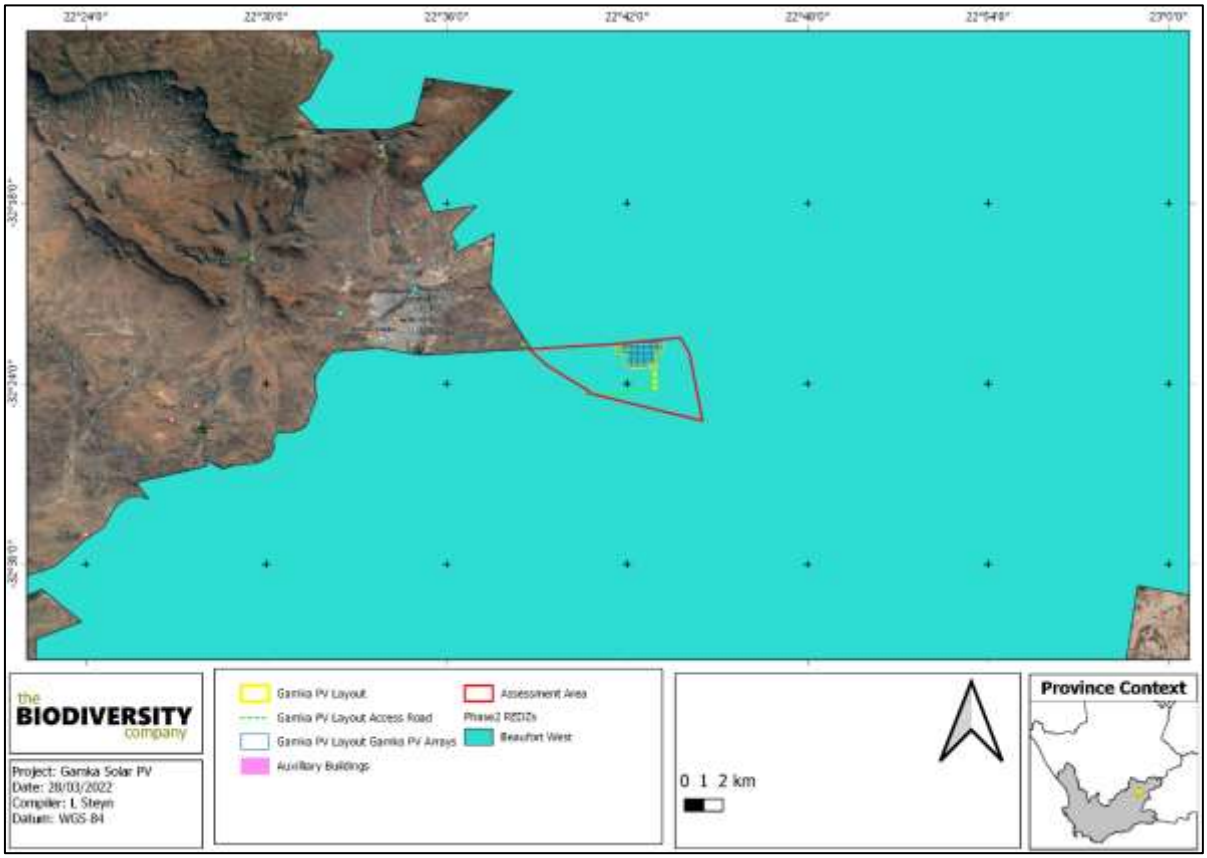


Figure 4-7 The Renewable Energy Development Zone and Database associated with the project area

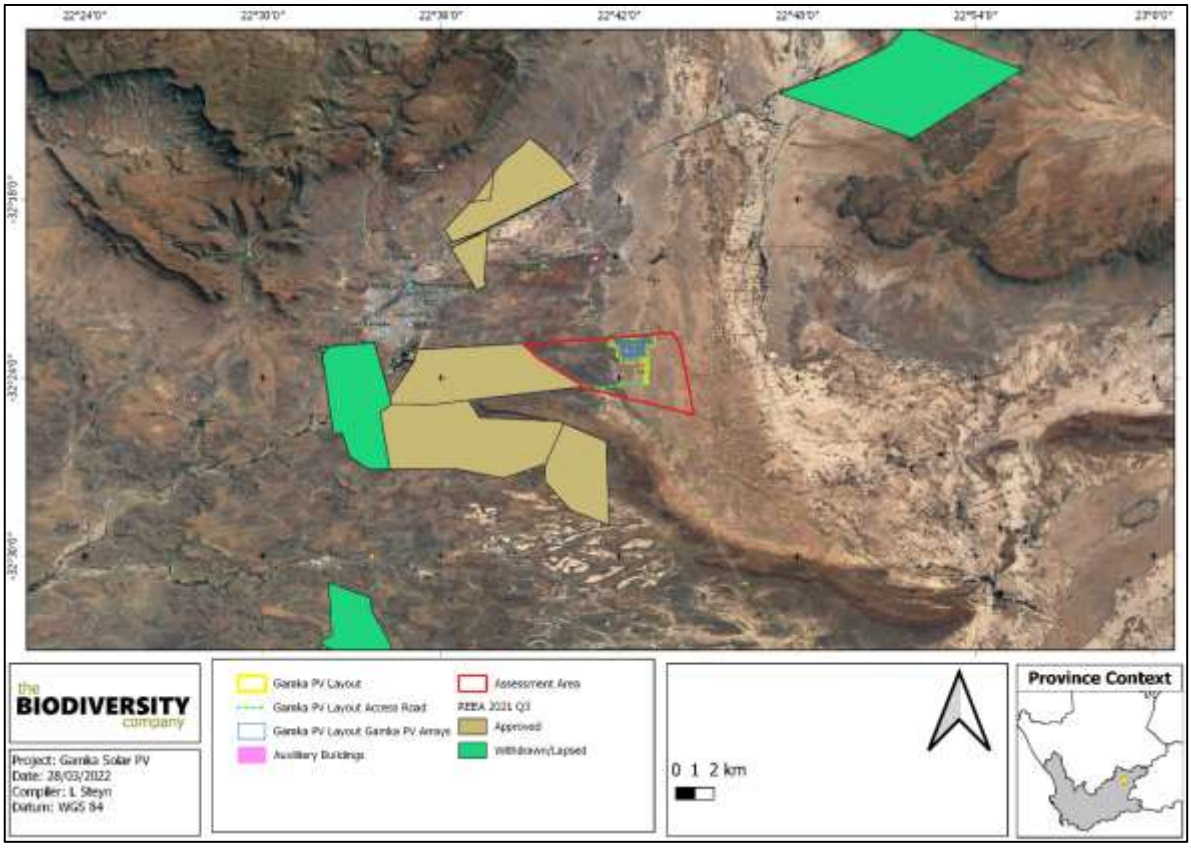


Figure 4-8 The project area in relation to the Renewable Energy Database projects

4.2 South African Bird Atlas Project 2

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 236 bird species have the potential to occur in the vicinity of the assessment area. The full list of potential bird species is provided in Appendix B, the list was compiled from all the pentads along the project area (3220_2240 and 3220_2235). Of the potential bird species, twenty (20) species are listed as SCC either on a regional or global scale (Table 4-3). The risks of collisions with powerlines, fences, electrocutions and habitat loss for the species of conservation concern is also indicated below. These risks are based on literature by EWT and Eskom on the association between birds and powerlines, Jenkins *et al*, 2017 and Birdlife, 2015.

Table 4-3 List of bird SCCs that are expected to occur in close vicinity to the assessment area and their reporting rates (SABAP2).

Species	Common Name	Conservation Status		Reporting Rate (%)		Likelihood of Occurrence	Risk		
		Regional (SANBI, 2016)	IUCN (2021)	3220_2240	3220_2235		Collisions	Electrocutions	Disturbance/Habitat Loss
Aquila verreauxii	Eagle, Verreaux's	VU	LC	4.4	0.8	High	X	X	X
Ardeotis kori	Bustard, Kori	NT	NT	13.2	2.4	High	X		X
Calidris ferruginea	Sandpiper, Curlew	LC	NT		8.0	Low			X
Ciconia nigra	Stork, Black	VU	LC		0.4	Moderate	X	X	X
Circus maurus	Harrier, Black	EN	EN		2.0	High	X	X	
Coracias garrulus	Roller, European	NT	LC		0.4	Low			X
Cursorius rufus	Courser, Burchell's	VU	LC	1.1		High			X
Eupodotis vigorsii	Korhaan, Karoo	NT	LC	96.7	22.3	High	X	X	X
Falco biarmicus	Falcon, Lanner	VU	LC	26.4	17.1	High			X
Glareola nordmanni	Pratincole, Black-winged	NT	NT		0.4	Low			X
Grus paradisea	Crane, Blue	NT	VU	36.3	2.4	High	X		X
Leptoptilos crumenifer	Stork, Marabou	NT	LC		6.4	Low	X		X
Neotis ludwigii	Bustard, Ludwig's	EN	EN	63.7	6.0	High	X	X	X
Numenius arquata	Curlew, Eurasian	NT	NT		0.8	Low			X
Oxyura maccoa	Duck, Maccoa	NT	EN		12.4	Moderate			X
Phoeniconaias minor	Flamingo, Lesser	NT	NT		15.5	High	X		X
Phoenicopterus roseus	Flamingo, Greater	NT	LC		16.7	High	X		X
Polemaetus bellicosus	Eagle, Martial	EN	EN	7.7		High	X	X	X
Sagittarius serpentarius	Secretarybird	VU	EN	9.9	0.8	High	X		X
Spizocorys sclateri	Lark, Sclater's	NT	NT	79.1		High			X

Aquila verreauxii (Verreaux's Eagle) is listed as VU on a regional scale and LC on a global scale. This species is locally persecuted in southern Africa where it coincides with livestock farms, but because the species does not take carrion, is little threatened by poisoned carcasses. Where hyraxes are hunted for food and skins, eagle populations have declined (IUCN, 2017). Based on the expected habitat, the close proximity of the mountain range and the availability of prey items, the likelihood of occurrence of this species at the project site is rated as high.

Ardeotis kori (Kori Bustard) is listed as NT both on a regional and global scale. It occurs in flat, arid, mostly open country such as grassland, karoo, bushveld, thornveld, scrubland and savanna but also including modified habitats such as wheat fields and firebreaks. Collisions with high voltage powerlines are a major threat to this species in the Karoo of South Africa (IUCN, 2007). The habitat at the assessment area is highly suitable for this species, therefore the likelihood of occurrence is rated as high.

Ciconia nigra (Black Stork) is native to South Africa, and inhabits old, undisturbed, open forests. They are known to forage in shallow streams, pools, marshes swampy patches, damp meadows, flood-plains, pools in dry riverbeds and occasionally grasslands, especially where there are stands of reeds or long grass (IUCN, 2017). It is unlikely that this species would breed in the assessment area due to the lack of forested areas, however some suitable foraging habitat remains in the form of the water resource areas, and as such the likelihood of occurrence is rated as moderate.

Circus maurus (Black Harrier) is listed as EN on a local n international basis and is restricted to southern Africa, where it is mainly found in the fynbos and Karoo of the Western and Eastern Cape. It is also found in the grasslands of Free State, Lesotho and KwaZulu-Natal. Harriers breed close to coastal and upland marshes, damp sites, near vleis or streams with tall shrubs or reeds. South-facing slopes are preferred in mountain areas where temperatures are cooler, and vegetation is taller (IUCN, 2017). During the non-breeding season, they will also be found in dry grassland areas further north and they also visit coastal river floodplains in Namibia. The likelihood of occurrence is rated as high.

Cursorius rufus (Burchell's Courser) is categorised as VU on a regional scale. It inhabits open short-sward grasslands, dry savannas, fallow fields, overgrazed or burnt grasslands and pastures, bare or sparsely vegetated sandy or gravelly deserts, stony areas dotted with small shrubs and saltpans (IUCN, 2017). The species is threatened in the south of its range by habitat degradation as a result of poor grazing practices and agricultural intensification. The likelihood of occurrence in the project area is rated as high.

Eupodotis vigorsii (Karoo Korhaan) is listed as NT on a regional scale. This species prefers dwarf arid shrubland of the Nama Karoo and succulent Karoo, especially with stony ground, while in the Western Cape it also occurs in cultivated land. This species were confirmed in the assessment area.

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

Grus paradiseus (Blue Crane) is listed as NT on a regional scale and as VU on a global scale. This species has declined, largely owing to direct poisoning, power-line collisions and loss of its grassland breeding habitat owing to afforestation, mining, agriculture and development (IUCN, 2017). This species breeds in natural grass- and sedge-dominated habitats, preferring secluded grasslands at high elevations where the vegetation is thick and short. Both open shrublands and wetlands are present in the assessment area as such this species has a high likelihood of occurrence.

Neotis ludwigii (Ludwig's Bustard) is listed as EN both locally and internationally. This species is found in the desert, grassland and shrubland specifically in rocky areas such as mountains and cliffs. The main reason for the decline in the numbers are ascribed to the collisions with powerlines. The habitat is highly suitable for this species, thus a high likelihood of occurrence were assigned to it. The species is listed as high likelihood of occurrence by the animal sensitivity screening tool and were observed in the field assessment.

Oxyura maccoa (Maccoa Duck) has a large northern and southern range, South Africa is part of its southern distribution. During the species' breeding season, it inhabits small temporary and permanent inland freshwater lakes, preferring those that are shallow and nutrient-rich with extensive emergent vegetation such as reeds (*Phragmites* spp.) and cattails (*Typha* spp.) on which it relies for nesting (IUCN, 2017). The likelihood of occurrence of this species in the assessment area was rated as moderate, as some perennial water sources are found, however without extensive edge vegetation.

Phoenicopterus minor (Lesser Flamingo) is listed as NT on a global and regional scale whereas *Phoenicopterus roseus* (Greater Flamingo) is listed as NT on a regional scale only. Both species have similar habitat requirements and the species breed on large undisturbed alkaline and saline lakes, salt pans or coastal lagoons, usually far out from the shore after seasonal rains have provided the flooding necessary to isolate remote breeding sites from terrestrial predators and the soft muddy material for nest building (IUCN, 2017). The Papdam just outside of the project footprint provides suitable habitat for this species, they could also utilise the water sources on the assessment area.

Polemaetus bellicosus (Martial Eagle) is listed as EN on a regional scale and on a global scale. This species has an extensive range across much of sub-Saharan Africa, but populations are declining due to deliberate and incidental poisoning, habitat loss, reduction in available prey, pollution and collisions with powerlines (IUCN, 2017). It inhabits open woodland, wooded savanna, bushy grassland, thorn-bush and, in southern Africa, more open country and even sub-desert (IUCN, 2017). With the presence of good habitat along with suitable prey species this species has a high likelihood of occurrence.

Sagittarius serpentarius (Secretarybird) occurs in sub-Saharan Africa and inhabits grasslands, open plains, and lightly wooded savanna. It is also found in agricultural areas and sub-desert (IUCN, 2017). The likelihood of occurrence is rated as high due to the large foraging areas and wetlands present in the assessment area.

Spizocorys sclateri (Sclaters Lark) is classified as NT both locally and internationally. This species is native to South Africa and Namibia. It is found in dry shrubland, where its habitat is threatened by increased numbers of livestock in its habitat. One of the known locations of occurrence in the Western Cape is in the assessment area, therefore a high likelihood of occurrence were assigned to it.

5 Field Assessment Results

5.1 Winter Assessment

5.1.1 Avifauna Species

The field assessment was conducted collectively for the gridlines and all 6 PV sites to ensure the cumulative impact is considered. This was further done to ensure the various habitats in the area is taken into account as adjacent habitats and their species might also be influenced by the development. Thirty-eight (38) bird species were recorded in the winter survey. The full list of species recorded, their threat status, guild and location observed is shown in Appendix B. Two of the species recorded were SCCs. The Karoo Korhaan was recorded in thirteen point counts, while one carcass of a Ludwigs Bustard was recorded under an existing powerline in the assessment area (Table 5-1). Both these species are sensitive to collisions, electrocutions and habitat disturbance.

Table 5-1 Species of Conservation Concern observed in the winter survey (NT, Near Threatened; EN, Endangered; LC, Least Concerned)

Common Name	Species	Conservation Status	
		Regional (SANBI, 2016)	IUCN (20121)
Eupodotis vigorsii	Korhaan, Karoo	NT	LC
Neotis ludwigii	Bustard, Ludwig's	EN	EN

Figure 5-1 Karoo Korhaan (Eupodotis vigorsii) observed on site

5.1.1.1 Dominant species

Table 5-2 provide lists of the dominant species for the winter survey together with the frequency with which each species appeared in the point count samples. The data shows the Red-Headed Finches, Karoo Korhaan, Cape Sparrow, and Pied Crow were the most abundant species during the winter survey. The most abundant species were made up of a variety of feeding groups, this speaks to the undisturbed nature of the area. Figure 5-2 is shows some of the species recorded during the survey.

Table 5-2 Dominant avifaunal species within the assessment area during the winter survey as defined as those species whose relative abundances cumulatively account for more than 76.6% of the overall abundance shown alongside the frequency with which a species was detected among point counts.

Species	Common Name	Conservation Status		Guild Code	Relative Abundance	Frequency (%)
		Regional (SANBI, 2016)	IUCN (2021)			
Amadina erythrocephala	Finch, Red-headed	Unlisted	LC	GGD	0,171	2,632
Eupodotis vigorsii	Korhaan, Karoo	NT	LC	OMD	0,126	34,211
Passer melanurus	Sparrow, Cape	Unlisted	LC	GGD	0,097	7,895
Corvus albus	Crow, Pied	Unlisted	LC	OMD	0,086	26,316
Chroicocephalus cirrocephalus	Gull, Grey-headed	Unlisted	LC	IGD	0,046	2,632
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC	IGD	0,040	7,895
Himantopus	Stilt, Black-winged	Unlisted	LC	IWD	0,034	2,632
Passer domesticus	Sparrow, House	Unlisted	LC	GGD	0,034	2,632
Pterocles namaqua	Sandgrouse, Namaqua	Unlisted	LC	GGD	0,034	2,632
Colius	Mousebird, White-backed	Unlisted	LC	FFD	0,029	2,632
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC	OMD	0,023	5,263
Corvus albicollis	Raven, White-necked	Unlisted	LC	OMD	0,023	5,263
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC	GGD	0,023	2,632

Figure 5-2 Some of the birds recorded in the assessment area: A) Red-headed Finch, B) Lark-like Bunting, C) Grey Tit, D) Spike-Heeled Lark and E) Pied Crow

5.1.1.2 Trophic Guilds

Trophic guilds are defined as a group of species that exploit the same class of environmental resources in a similar way (González-Salazar *et al,* 2014). The guild classification used in this assessment is as per González-Salazar *et al* (2014); they divided avifauna into 13 major groups based on their diet, habitat, and main area of activity. The analysis of the major avifaunal guilds reveals that the species composition during the winter survey was dominated by omnivores that feeds in multiple places (i.e. air, ground, in trees, etc.) during the day (OMD) (Figure 5-3). Granivores that feed on the ground (GGD) made up the second highest group, followed by insectivores (IGD). The feeding groups is a healthy mix of species and illustrates the undisturbed nature of the assessment area.

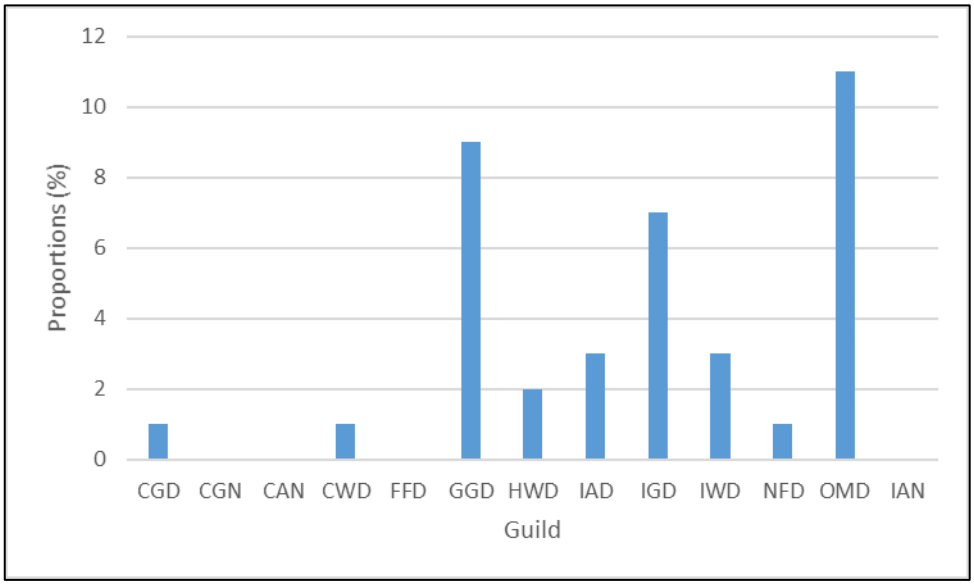


Figure 5-3 Avifaunal trophic guilds. CGD, carnivore ground diurnal; CGN, carnivore ground nocturnal, CAN, carnivore air nocturnal, CWD, carnivore water diurnal; FFD, frugivore foliage diurnal; GCD, granivore ground diurnal; HWD, herbivore water diurnal; IAD, insectivore air diurnal; IGD, insectivore ground diurnal; IWD, insectivore water diurnal; NFD, nectivore foliage diurnal; OMD, omnivore multiple diurnal; IAN, Insectivore air nocturnal.

5.2 Summer Assessment

5.2.1 Avifauna Species

Seventy-one (71) bird species were recorded in the summer survey, after the area received some rainfall. The full list of species recorded, their threat status, guild and location observed is shown in Appendix C. Four of the species recorded were SCCs, a further four species are classified as near-endemic species which highlight the habitat importance. All the species with the exception of the Blue Crane and Lanner Falcon were recorded on more than one occasion (Table 5-3). The Blue Crane, Karroo Korhaan and Lanner Falcon are species that are sensitive to collisions, electrocutions and habitat disturbance.

Table 5-3 Species of conservation concern observed in the summer survey (NT, Near Threatened; VU, Vulnerable; LC, Least Concerned; NE, Near-Endemic)

Common Name	Scientific Name	Regional (SANBI, 2016)	IUCN (2021)	Endemism in South Africa (E)
Blue Crane	*Grus paradisea*	NT	VU	
Karoo Korhaan	*Eupodotis vigorsii*	NT	LC	
Lanner Falcon	*Falco biarmicus*	VU	LC	
Sclater's Lark	*Spizocorys sclateri*	NT	NT	NE
Cape Clapper Lark	*Mirafra apiata*	Unlisted	LC	NE
Karoo Prinia	*Prinia maculosa*	Unlisted	LC	NE
Large-billed Lark	*Galerida magnirostris*	Unlisted	LC	NE
Namaqua Warbler	*Phragmacia substriata*	Unlisted	LC	NE

Figure 5-4 Some of the SCCs observed, A) Sclaters Lark, B) Karoo Korhaan and C) Lanner Falcon

5.2.1.1 Dominant species

Table 5-4 provide lists of the dominant species for the summer survey together with the frequency with which each species appeared in the point count samples. The data shows the Red-billed Quelea, Lesser Kestrel, Pied Crow and Grey-back Sparrow Lark were the most abundant species during the winter survey. The most abundant species were made up of a variety of feeding groups, this speaks to the undisturbed nature of the area. The predatory birds with the highest abundance were the Amur Falcons and Lesser Kestrels, these species are both migratory species, making this area an important congregatory area for them. Figure 5-5 is shows some of the species recorded during the survey.

Table 5-4 Dominant avifaunal species within the assessment area during the summer survey as defined as those species whose relative abundances cumulatively account for more than 85.5% of the overall abundance shown alongside the frequency with which a species was detected among point counts.

Common Name	*Scientific Name*	Regional Conservation Status (SANBI, 2016)	IUCN (2021)	Guild code	Relative abundance	Frequency (%)
Red-billed Quelea	*Quelea quelea*	Unlisted	LC	GGD	0,235	9,804
Lesser Kestrel	*Falco naumanni*	Unlisted	LC	CGD	0,140	5,882
Pied Crow	*Corvus albus*	Unlisted	LC	OMD	0,107	49,020
Grey-backed Sparrow-lark	*Eremopterix verticalis*	Unlisted	LC	GGD	0,103	47,059
Lark-like Bunting	*Emberiza impetuani*	Unlisted	LC	GGD	0,070	47,059
Karoo Long-billed Lark	*Certhilauda subcoronata*	Unlisted	LC	IGD	0,045	39,216
Wattled Starling	*Creatophora cinerea*	Unlisted	LC	OMD	0,040	1,961
Karoo Korhaan	*Eupodotis vigorsii*	NT	LC	OMD	0,032	27,451
Red-faced Mousebird	*Urocolius indicus*	Unlisted	LC	FFD	0,021	3,922
Spike-heeled Lark	*Chersomanes albofasciata*	Unlisted	LC	IGD	0,017	9,804
Amur Falcon	*Falco amurensis*	Unlisted	LC	CGD	0,014	1,961
Karoo Chat	*Emarginata schlegelii*	Unlisted	LC	IGD	0,013	17,647
Cape Clapper Lark	*Mirafra apiata*	Unlisted	LC	OMD	0,011	5,882
Namaqua Dove	*Oena capensis*	Unlisted	LC	GGD	0,011	7,843

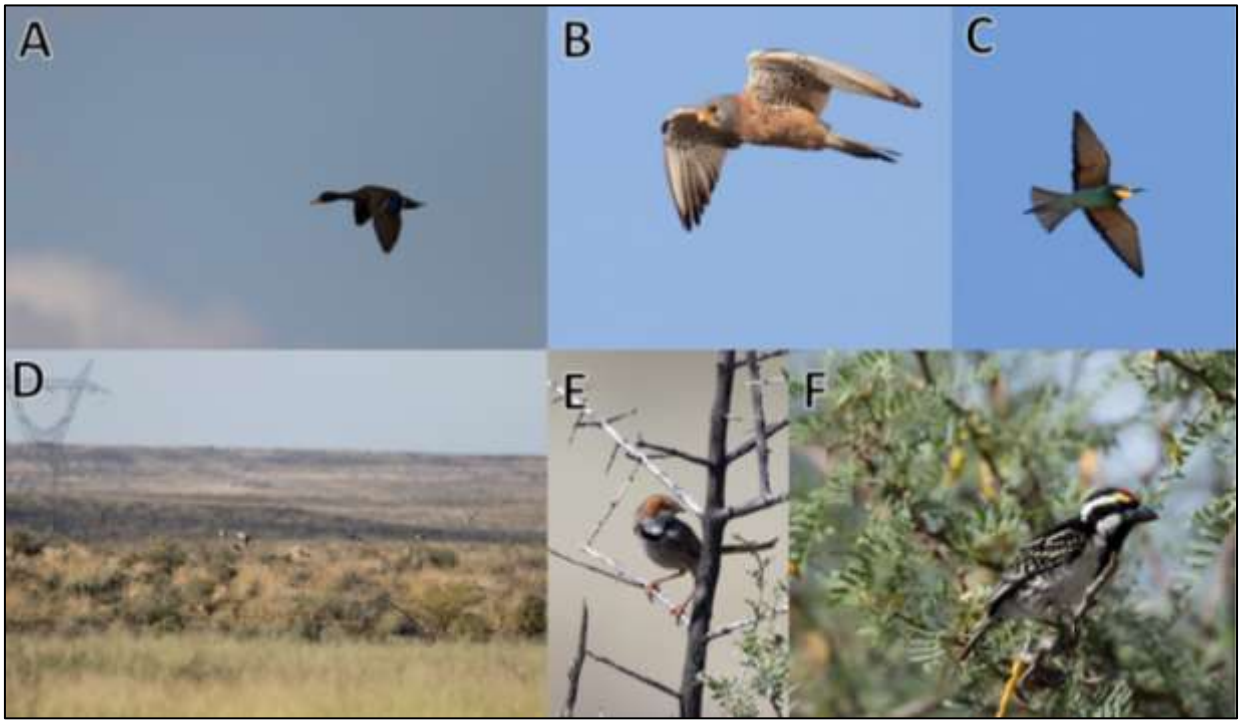


Figure 5-5 Some of the birds recorded in the assessment area: A) Yellow-billed Duck, B & D) Lesser Kestrel, C) European Bee-eater, E) Rufous-eared Warbler and F) Acacia Pied Barbet

5.2.1.2 Trophic Guilds

Trophic guilds are defined as a group of species that exploit the same class of environmental resources in a similar way (González-Salazar *et al,* 2014). The guild classification used in this assessment is as per González-Salazar *et al* (2014); they divided avifauna into 13 major groups based on their diet, habitat, and main area of activity. The analysis of the major avifaunal guilds reveals that the species composition during the summer survey was dominated by diurnal ground dwelling insectivores (IGD) (Figure 5-6). Granivores that feed on the ground (GGD) and Omnivores feeding in multiple areas (OMD) made up the second highest groups. The feeding groups is a healthy diversity of species, indicating that the area is still a functional ecosystem. The difference in the trophic winter and summer results is attributed to the rainfall before the second survey and the timing of the survey for migratory species.

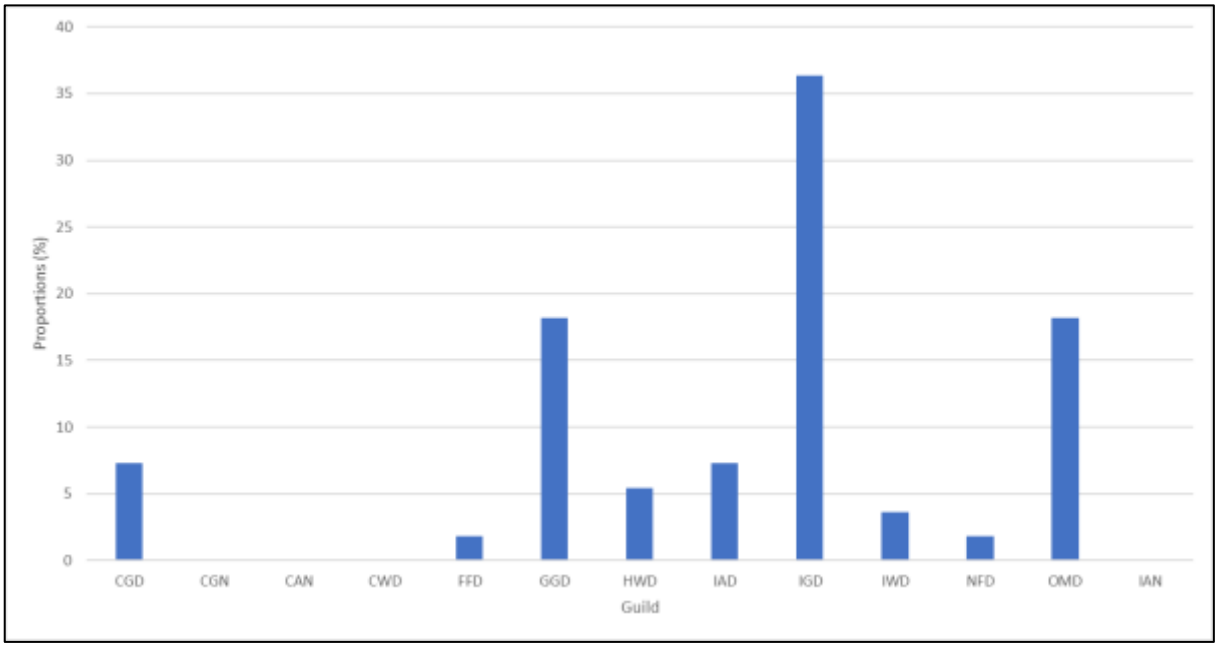


Figure 5-6 Avifaunal trophic guilds. CGD, carnivore ground diurnal; CGN, carnivore ground nocturnal, CAN, carnivore air nocturnal, CWD, carnivore water diurnal; FFD, frugivore foliage diurnal; GCD, granivore ground diurnal; HWD, herbivore water diurnal; IAD, insectivore air diurnal; IGD, insectivore ground diurnal; IWD, insectivore water diurnal; NFD, nectivore foliage diurnal; OMD, omnivore multiple diurnal; IAN, Insectivore air nocturnal.

5.3 Flight and Nest Analysis

Observing and monitoring flight paths and nesting sites are important in ascertaining habitat sensitivity and evaluating the impact risk significance of any proposed development. There are five (5) SCC, and twenty species that are regarded as priority species for solar energy development and powerline infrastructure. During the field survey recording flight-paths and nesting sites were undertaken for certain species. However, given the limited time available the results of this section must be interpreted with caution, as each species movement is likely to be more extensive and there may have been nesting sites that were not observed. Two of the SCCs were observed flying. The Blue Cranes moved in a southerly direction, while the Karoo Korhaan flew in an easterly direction. Three nests were observed just outside of the assessment area footprint, it was believed these nests were those of Pied Crows (Figure 5-8). Figure 5-7 below illustrates the location and extent of flight paths and nesting sites of select priority species within the assessment area.

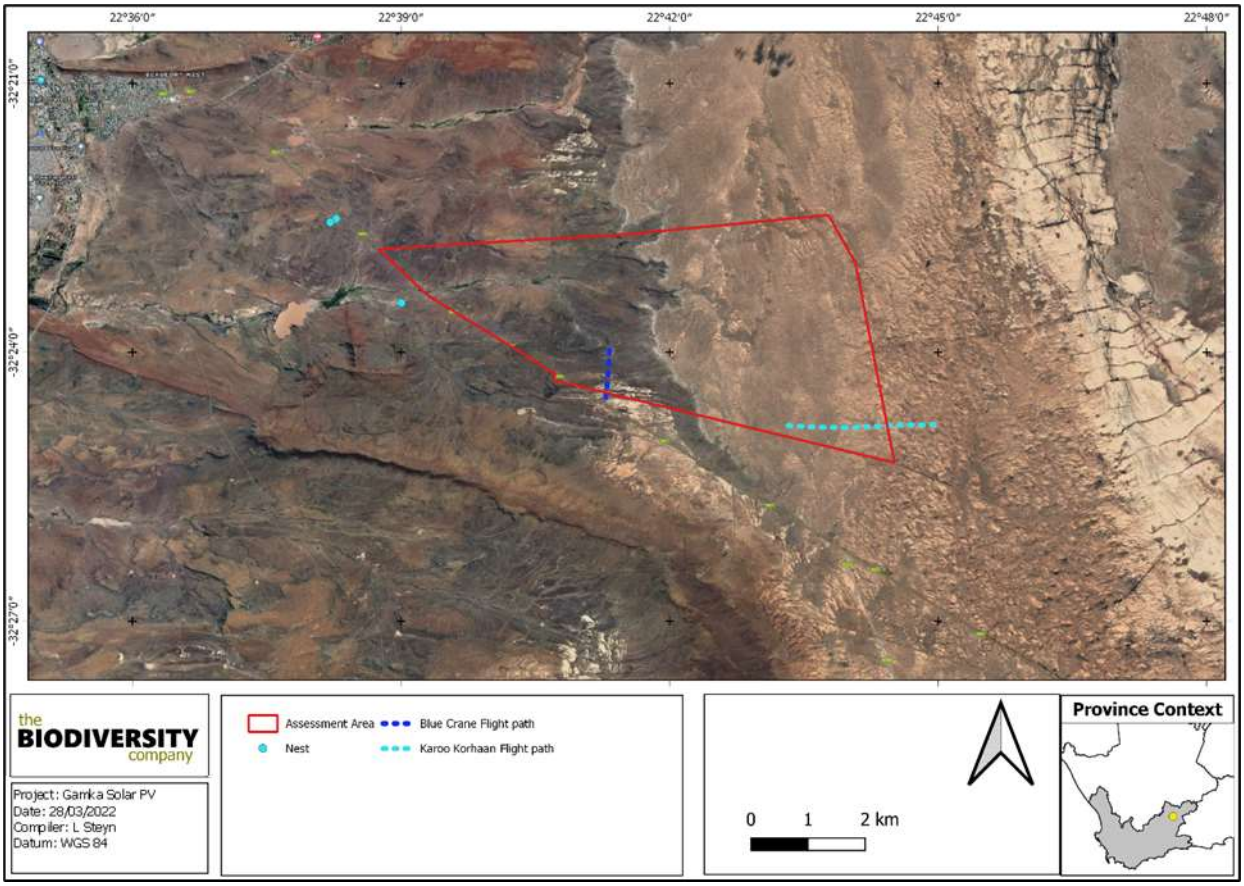


Figure 5-7 Flight paths and nest locations

Figure 5-8 Nests observed close to the assessment area: Likely to be Pied Crow nests

5.4 Species of Conservation Concern

Five SCCs were observed during the two assessments. The Sclater's Lark, Ludwigs Bustard and Karoo Korhaan are all very likely to have nests in the assessment area, they nest on the ground in scraped areas between scrubs or scattered rocks. The Blue Crane could also possibly nest in the assessment area, but it is less likely, as they tend to nest near water in open veld, the assessment area is some distance away from the closest perennial water source. The Lanner Falcon breeds on cliff ledges it is thus less likely to have a permanent nest in the assessment area.

Based on the nesting behaviour and the habitat type in the assessment area, it can be said that three of the five SCCs are permanent residents in the assessment area.

Sclater's Lark

Upon consultation with a local farmer, it came to light that Sclaters Lark breeds and frequents the assessment area. This was further confirmed by a local bird guide Stefan Theron who undertakes bird assessments for the SABAP. The Sclater's Lark is endemic to Southern Africa and is found primarily in scarcely vegetated gravel and stony plains. In South Africa it is mainly found in the Northern Cape, Eastern Cape (only adhaoc observations) and the Western Cape around Beaufort West. This species has been assessed by the IUCN in 2017 as being Near Threatened, it has been listed as such since the first assessment of this species in 1988 (IUCN, 2021). This species is found in low numbers as a result of their localised distribution and low breeding success, further to this large portion of their range does not overlap with protected areas (Hockey *et al.,* 2005).

The assessment area overlaps with one of the areas where the Sclater's Lark has been recorded in 79.13% of 91 surveys (SABAP2, 2021), this data provides a presence/absence dataset but does not allow for population densities (Figure 5-9). However, based on this data it can conclusively be said that this is a permanent home range of these habitat specialist species. Figure 5-10 shows the area identified by Stefan Theron for the known areas where this species has been observed. The location where this recent assessment observed this species overlap with the provided area.

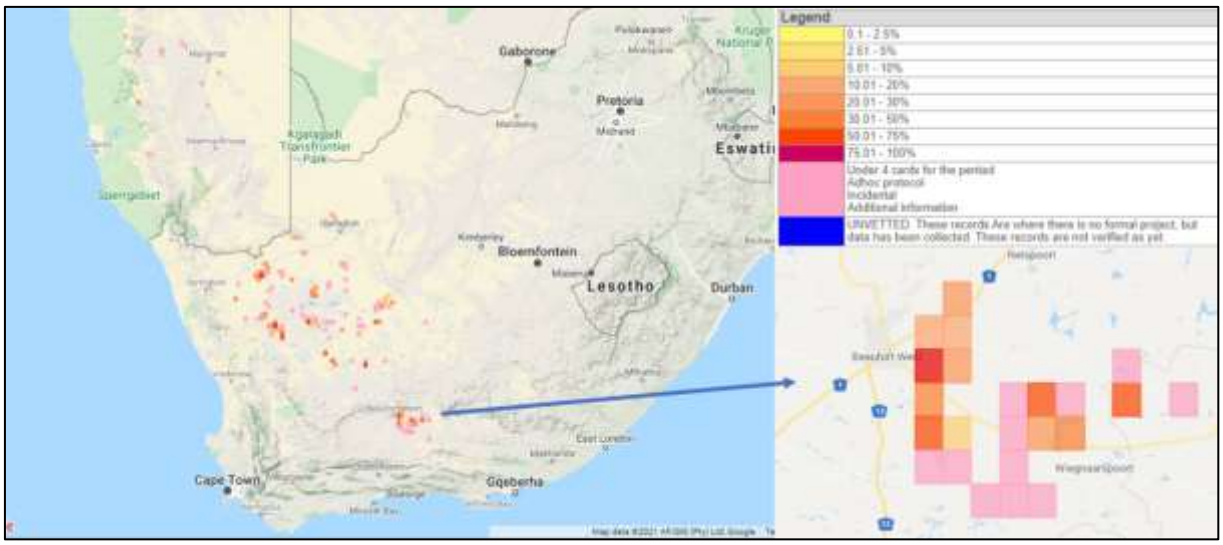


Figure 5-9 The distribution and records of the Sclater's Lark throughout Southern Africa and around Beaufort West.

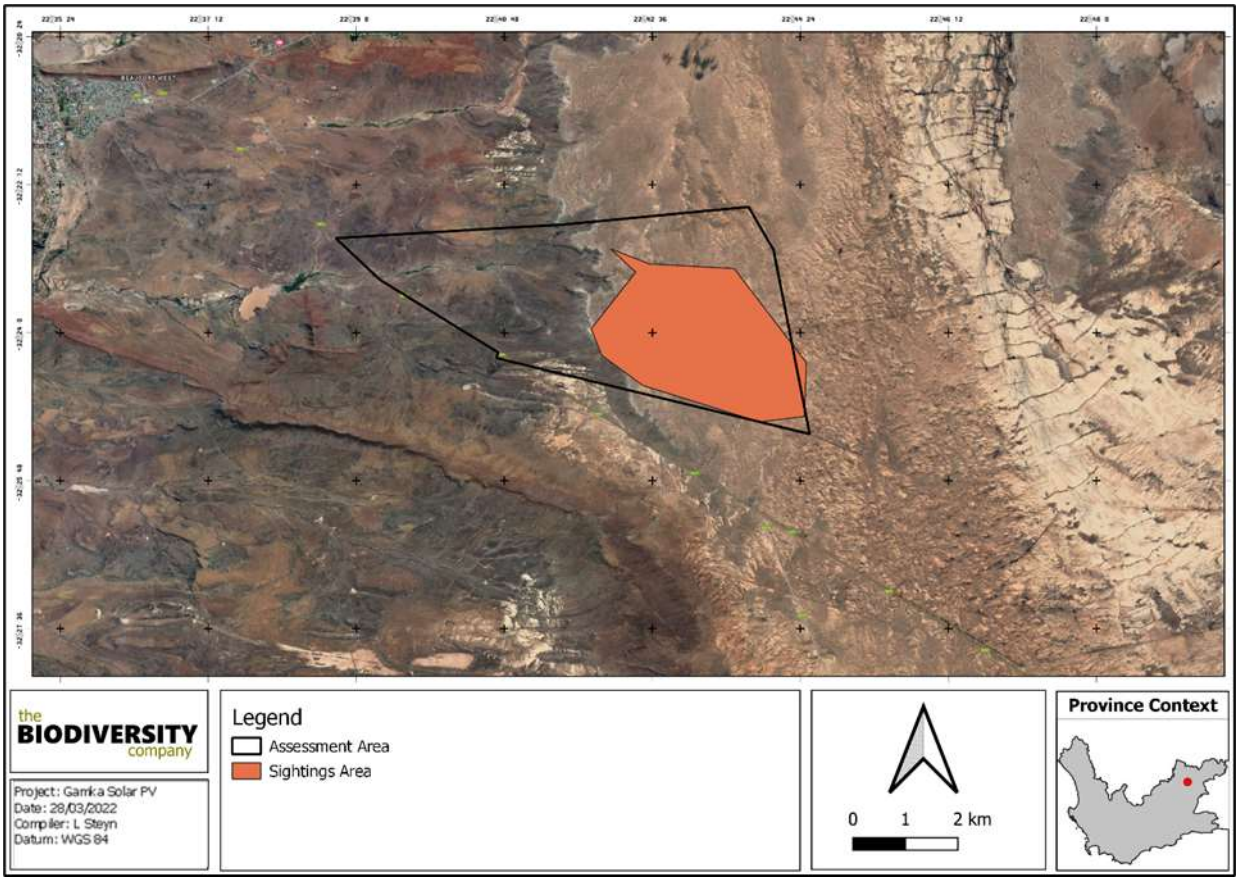


Figure 5-10 Sclaters Lark habitat and know sighting locations

This species is usually found an accessible distance from surface water. Its diet mainly consists of grains but in some instances is substituted by insects. They are a highly predictable breeder and will nest in the same patch at the same time irrespective of the rainfall of climate patterns. Breeding takes place mainly from August – December, but has been observed as early as June. One egg will be laid by a monogamous pair and will incubate for 11-13 days, after which the chick will fledge after 14 days (Del Hoyo *et al.,* 2004).

The alteration in habitat and climate change has been described as the main threats to this species by the IUCN (2021), Simmons (2015) and Peacock (2015). With this species habitat requirements and the sensitivity to change it is imperative that this not be disturbed. The species were not recorded in this survey in September of 2021, however, six individuals were recorded in the February 2022 assessment. The species were recorded specifically close to a water trough.

Blue Crane

Grus paradiseus (Blue Crane) are endemic to Southern Africa occurring mainly in the southern and eastern Mpumalanga Highveld through the Free State, KwaZulu-Natal and the Eastern Cape. Blue cranes are omnivorous with their diet consisting of plant material such as small bulbs, seeds and roots, and animals such as insects (especially grasshoppers), small reptiles, frogs, fish, crustaceans and small mammals (SANBI, 2015). This species has declined, largely owing to direct poisoning, power-line collisions and loss of its grassland breeding habitat owing to afforestation, mining, agriculture and development (IUCN, 2017). This species breeds in natural grass- and sedge-dominated habitats, preferring secluded grasslands at high elevations where the vegetation is thick and short. Two birds of this species were observed in the

assessment area. The risk of powerline collisions is enhanced by their habit to fly in a v-shape formation sometimes at a rate of 60-70km, this increases the likelihood of multiple bird strikes at once.

Ludwigs Bustard

Neotis ludwigii (Ludwig's Bustard) is listed as EN on a global scale (BirdLife International, 2018). The species has a large range centred on the dry biomes of the Karoo and Namib in southern Africa, being found in the extreme south-west of Angola, western Namibia and South Africa. This species inhabits open lowland and upland plains with grass and light thornbush, sandy open shrub-veld and semi-desert in the arid and semi-arid Namib and Karoo biomes. Ludwig's Bustard is nomadic and a partial migrant, moving to the western winter-rainfall part of its range in winter. The diet includes invertebrates, small vertebrates and vegetable matter. The global population is estimated to be 100 000 – 499 999 individuals. The primary threat to the species is collisions with overhead powerlines, irrespective of size, with potentially thousands of individuals involved in such collisions each year (Jenkins *et al.* 2011). Collision rates on high voltage transmission lines in the Karoo may exceed one Ludwig's Bustard per kilometre per year. Bustards have limited frontal vision so may not see powerlines, even if they are marked (Martin and Shaw 2010). A carcass of one individual was observed within the assessment area.

Lanner Falcon

Falco biarmicus (Lanner Falcon) occurs in southern and south-eastern Europe, the Middle East, south-western Asia and much of sub-Saharan Africa, excluding the lowland forests of the DRC and West Africa. Its more common in open grasslands, cleared or open woodlands and agricultural land. The pair is monogamous and roost on cliffs, but may also utilise buildings, pylons and trees for nesting. Nesting season is from late May to early September. Agrochemicals is said to their main threat in South Africa, it is assumed it will be from direct exposure as well as through bio-accumulation from their prey species. Two individuals of this species were during the second assessment.

Karoo Korhaan

Eupodotis vigorsii (Karoo Korhaan) is found in dwarf arid shrubland of the Nama Karoo and Succulent Karoo. They are resident and sedentary species which means their movement is restricted to their home range and they do not migrate locally. The diets consist mainly of invertebrates, reptiles and plant matter, on which they feed while walking along. The pairs are monogamous and often breed in family groups. Helpers can assist in defending the territory or feeding of the young. They nest on the ground with the main egg-laying season being between June and February. Main threats include habitat degradation due to agricultural practices and ecosystem stresses due to climate change (IUCN, 2022). This species were recorded during 13 point counts in the winter assessment and 12 point counts during the summer assessment.

5.5 Risk Species

A number of species were found that would be regarded as at risk species (Table 5-5 and Figure 5-11). Risk species are species that would be sensitive to habitat loss, that are regarded as collision prone species and species that would have an electrocution risk. These could be species that are not necessarily SCC but could be impacted on by this development. Even though the panels does not pose an extensive collision risk for larger birds, powerlines

associated with the infrastructure, guidelines (anchor lines) and connection lines does pose a risk. The fence could also pose a collision risk for various species as described in section 9.2.

Table 5-5 At risk species found in the surveys.

Common Name	Scientific Name	Collisions	Electrocutions	Disturbance / habitat loss
African Sacred Ibis	*Threskiornis aethiopicus*	X	X	
Blue Crane	*Grus paradisea*	X		X
Booted Eagle	*Hieraaetus pennatus*	X	X	X
Common (Steppe) Buzzard	*Buteo buteo*	X	X	
Egyptian Goose	*Alopochen aegyptiaca*	X	X	
Hadeda (Hadada) Ibis	*Bostrychia hagedash*	X	X	
Helmeted Guineafowl	*Numida meleagris*	X	X	
Lanner Falcon	*Falco biarmicus*			X
Lesser Kestrel	*Falco naumanni*			X
Pale Chanting Goshawk	*Melierax canorus*	X	X	
Reed Cormorant	*Microcarbo africanus*	X		
Yellow-billed Duck	*Anas undulata*	X		
White-necked Raven	*Corvus albicollis*		X	
Pied Crow	*Corvus albus*		X	
Karoo Korhaan	*Eupodotis vigorsii*	X	X	X
Ludwig's Bustard	*Neotis ludwigii*	X	X	X
South African Shelduck	*Tadorna cana*	X		
Sclaters Lark	*Spizocorys sclateri*			X

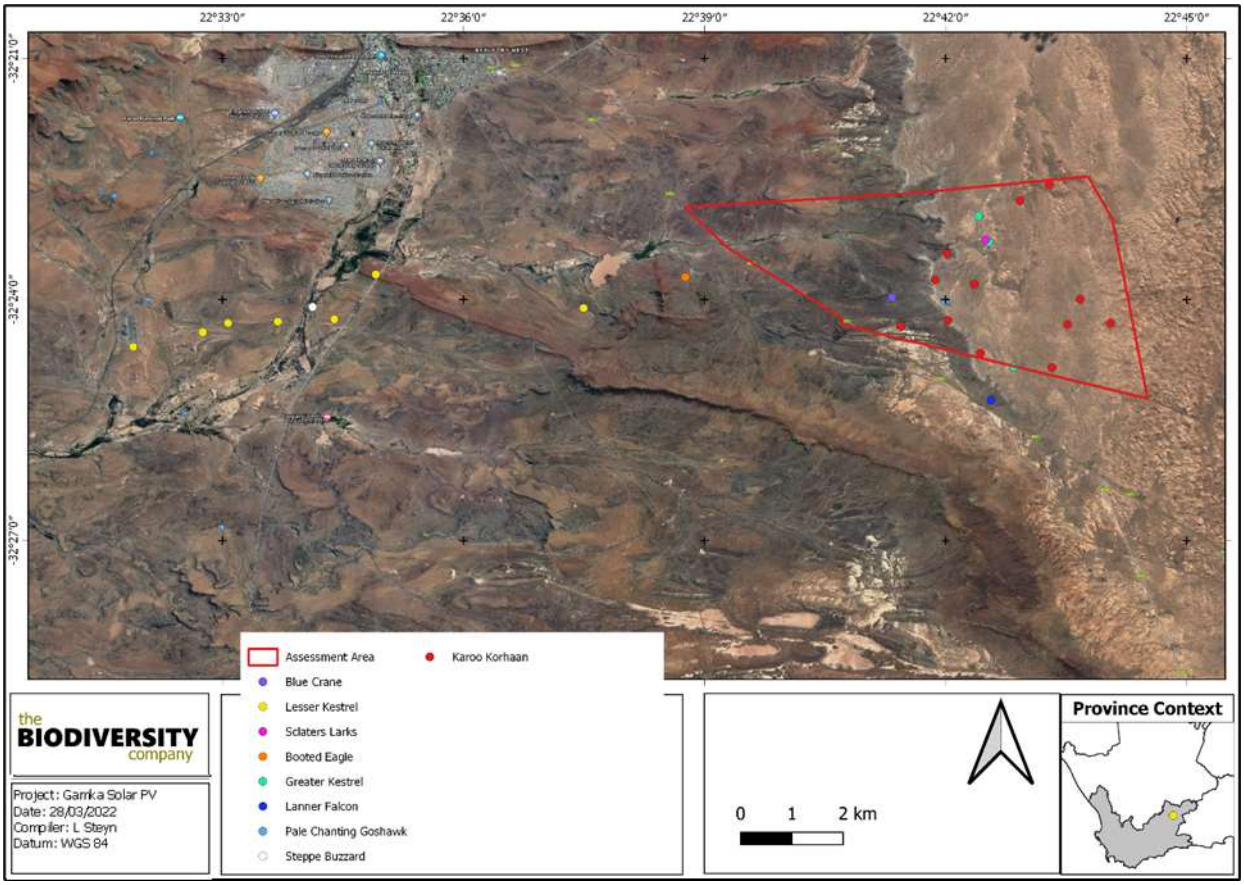


Figure 5-11 Locations of the risk species recorded

6 Fine-Scale Habitat Use

Fine-scale habitats within the landscape are important in supporting a diverse avifauna community as they provide differing nesting, foraging and reproductive opportunities. The assessment area overlaps with four avifaunal habitat types namely Karoo Riviere Shrubland, Southern Karoo Riviere Grassland, Water resource and Ridges (Figure 6-5). These habitats were based on the species compositions in the various areas. It is important to note that some areas of interests were identified around the project footprint as these areas could also support species that could be influenced by the development.

The Southern Karoo Riviere Shrubland were made up of short shrubs and some grasses (Figure 6-1). Some portions had sandy substrate while others had rocky substrate. The vegetation is denser in some areas, while other areas had larger bare patches. This habitat were all low growing flora species that allows for shrubland specialist avifauna species to be present. Species found here included; Karoo Korhaan, Spiked-heeled Lark and Long-billed Pipit. The predatory birds recorded in this vegetation type included the Southern Pale Chanting Goshawk, Amur Falcon, Lesser Kestrel, Greater Kestrel and Lanner Falcon.

Figure 6-1 Southern Karoo Riviere Shrubland habitat type

The Southern Karoo Riviere Grassland were made up of grasses and short shrubs (Figure 6-2). The vegetation is denser in some areas, while other areas had larger bare patches. This habitat were all low growing flora species that allows for grassland specialist avifauna species to be present. Species found here included; Karoo Korhaan, Cape-Clapper Lark, Capped Wheatear, Lark, Long-billed Pipit, Lesser Kestrel and Helmeted Guineafowl.

Figure 6-2 Southern Karoo Riviere Grassland habitat type

The water resource habitat type is made up various drainage lines, plains, nearby dams as well as the Gamka River (Figure 6-3). During the winter survey only one dam locally known as Pap Dam had water, while during the summer survey three additional dams had water. Apart from just providing water, this habitat also has a plant composition that is unique to the area. Some hydrophytic vegetation and larger trees were observed in these areas. This vegetation lends itself to breeding spots for species such as Laughing Dove, Southern Masked Weavers and Cape Sparrow. Species observed exclusively in this vegetation type are: Kittlitz's Plover, South African Shellduck, Yellow-billed Duck, Acacia Pied Barbet, Lilac-breasted Roller and Egyptian Goose.

Figure 6-3 Water resources found in the area

Ridges, are high lying areas characterised by a rocky landscape with very little sand or clay present in the substrate (Figure 6-4). Plant species encountered here were mostly succulents and grasses with spiny shrubs also recorded. No trees were encountered due to this limited substrate. This habitat was small areas in between the Karoo-riviere shrubland habitat type. Some species found in the Karoo-riviere shrubland habitat were also found here, however this area did support a species composition that were somewhat different to the greater area and were separated for that reason. Species found here included: Yellow Canary, White-throated Canary, White-rumped swifts and Little Swifts.

Figure 6-4 Ridge habitat found in the assessment area

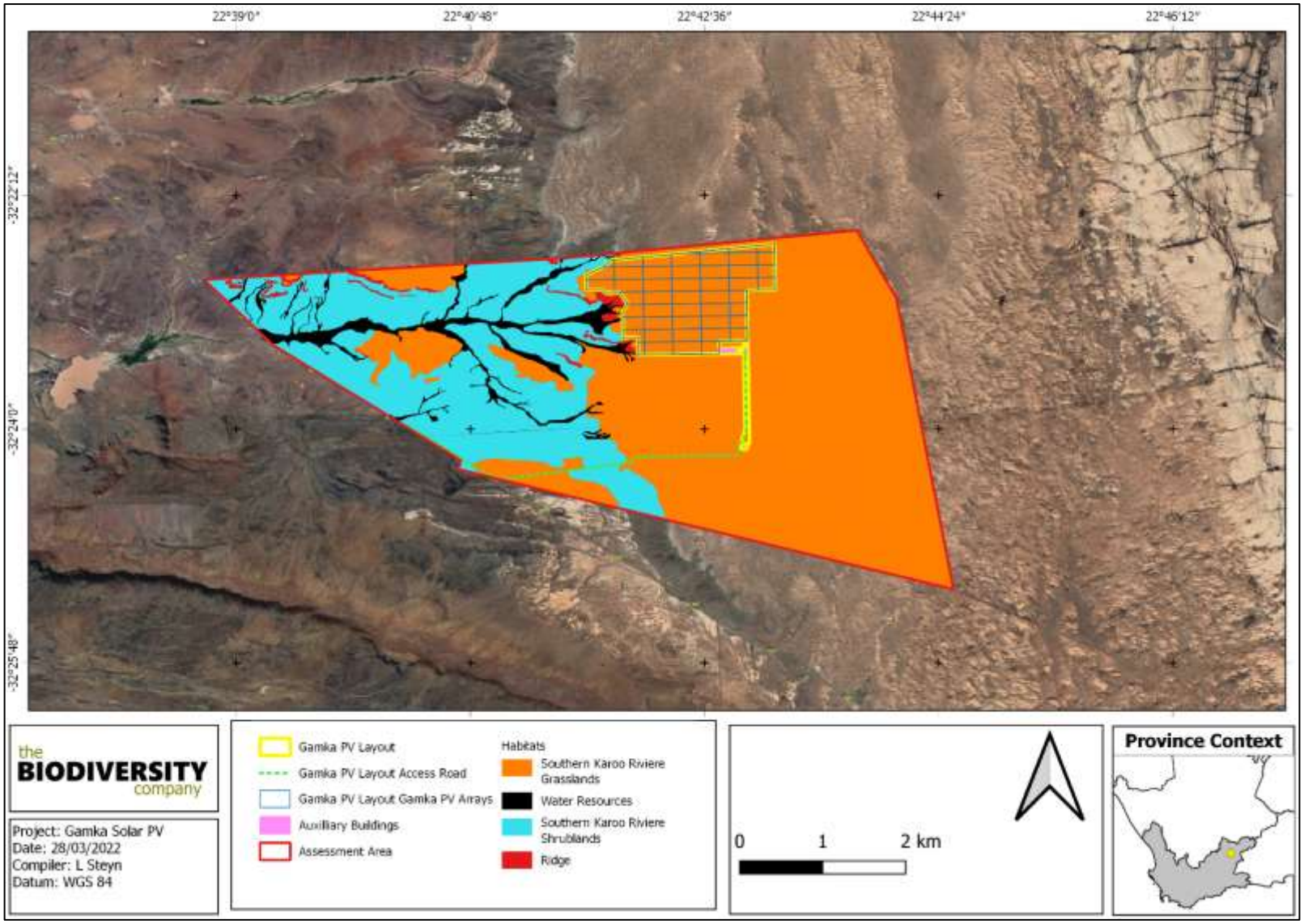


Figure 6-5 The avifauna habitats found in the assessment area.

7 Site Sensitivity

The Department of Environment, Forestry and Fisheries (DEFF) National Screening Tool classifies a section of the assessment area as highly sensitive from an avifaunal perspective (Figure 7-1). Consequently, by application of the protocol and associated guidelines, this project warrants an avifaunal assessment. 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. However, this layer is applicable to wind energy developments and for all other projects, the user must evaluate the animal species sensitivity's theme for any avifaunal triggers. The animal sensitivity rates the whole area as highly sensitive; this rating is as a result of the known occurrence of Ludwigs Bustards (Figure 7-2).

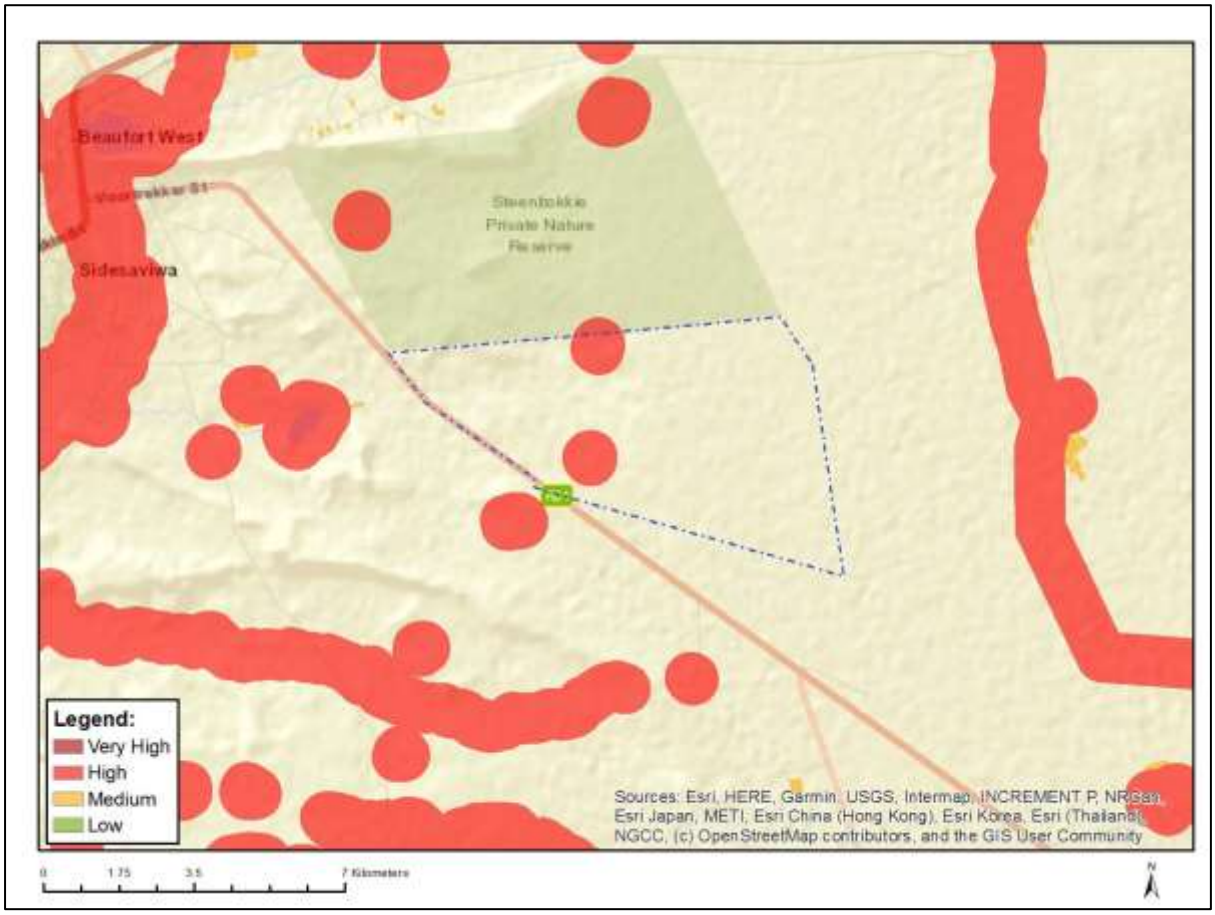


Figure 7-1 Map depicting relative avian species theme sensitivity of the project (National Environmental Screening Tool, 2021)

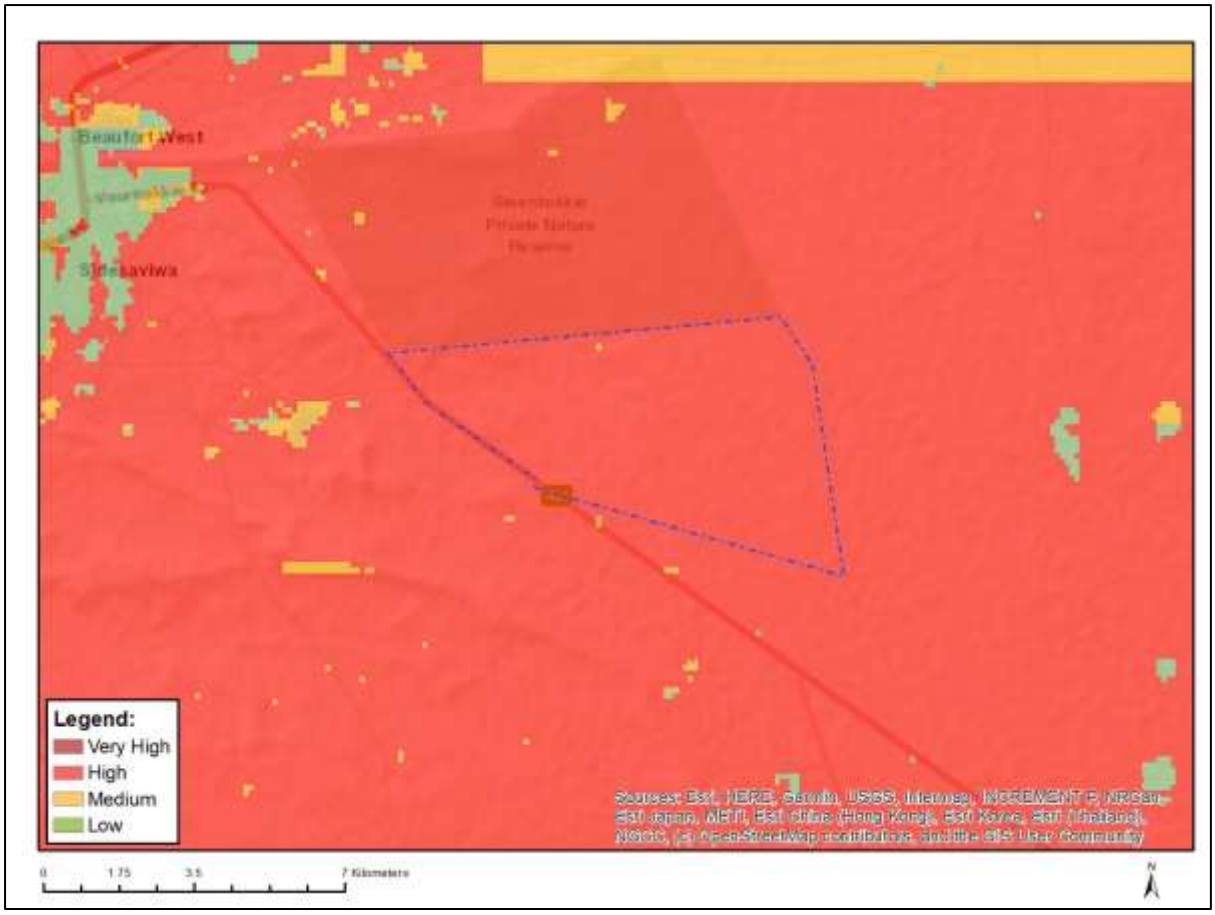


Figure 7-2 Map depicting relative animal species theme sensitivity of the project

The four (4) habitat types were subjected to the SEI methods as described in section 4.3 and allocated a sensitivity category (Table 7-1). The location and extent of these habitats are illustrated in Figure 6-5. The sensitivities of the habitat types delineated are illustrated in Figure 7-3. The infield assessment result collaborates the screening tool results.

Table 7-1 Summary of habitat types delineated within the field assessment area of the project.

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Ridges	Medium	Medium	Medium	Low	High
	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU); Presence of range-restricted species.	Medium (> 5 ha but < 20 ha) semi-intact area; Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity		Ridges provide habitat for a wide variety of avifauna species. Ridges are also necessary for sustainability of ecosystems such as recharging wetlands or rivers. The vegetation found on ridges are unique and highly susceptible to change and disturbance. Based on the lack of rain in the area the vegetation/habitat is unlikely to recover fully after > 15 years.	
Southern Karoo Riviere Shrubland	Medium	Medium	Medium	Low	High

	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU); Presence of range-restricted species.	Medium (> 5 ha but < 20 ha) semi-intact area; Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity		The average rainfall in the Beaufort West area is ~220mm, the assessment area itself based on the local farmers, prior to 2022, experienced a 6 year drought. As a result of the low rainfall in the area, shrubland species will likely not be able to recover. This is also true for the seed germination of these species. The change in the habitat will result in avifauna species being forced out of the area. Even though the vegetation under the panels will only be brush cut they will still be exposed to heat variations caused by the panels that will influence their growth patterns and can lead to the loss of more sensitive species. This micro habitat change has been found to result in both a change in plant biomass and species diversity (eg Armstong *et al.,* 2016). The habitat is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore. Once the habitat has re-established, more resilient bird species will move into the area	
Southern Karoo Riviere Grassland	Medium	Medium	Medium	Low	High
	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU); Presence of range-restricted species.	Medium (> 5 ha but < 20 ha) semi-intact area; Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity		The average rainfall in the Beaufort West area is ~220mm, the assessment area itself based on the local farmers, prior to 2022, experienced a 6 year drought. As a result of the low rainfall in the area, shrubland species will likely not be able to recover. This is also true for the seed germination of these species. The change in the habitat will result in avifauna species being forced out of the area. The habitat is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore. Once the habitat has re-established, more resilient bird species will move into the area	
Water Resources	High	Very High	Very High	Very Low	Very High

				Larger trees are associated with this habitat, the re-establishment of the trees is unlikely if the water flow is disrupted. The removal of the trees will result in the loss of nest sites. The loss of the water sources will directly influence the avifauna species and force them to move to other areas with available water. The "heat island effect" caused by PV panels has been found to increase the ambient temperature around the panels by between 2-4 degrees (Barron-Gafford *et al.,* 2016 and Yue *et al.,* 2021) in this dry habitat this will result in a higher evaporation rate in the water resources. The loss of water in these areas will in turn result in the loss of associated vegetation. .	
	Confirmed or highly likely occurrence of CR, EN, VU species; Presence of Rare species.				

Interpretation of the SEI in the context of the proposed development activities is provided in Table 7-2.

Table 7-2 Guidelines for interpreting Site Ecological Importance in the context of the proposed development activities

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

The average rainfall in the Beaufort West area is ~220mm, the assessment area itself based on the local farmers have prior to 2022 experienced a 6 year drought. Based on the low rainfall in the area, shrubland species will not likely be able to recover. This is also true for the seed germination of these species. This change in the habitat will result in avifauna species being forced out of the area. The habitat is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore. Once the habitat has established somewhat some more resilient bird species will move into the area.

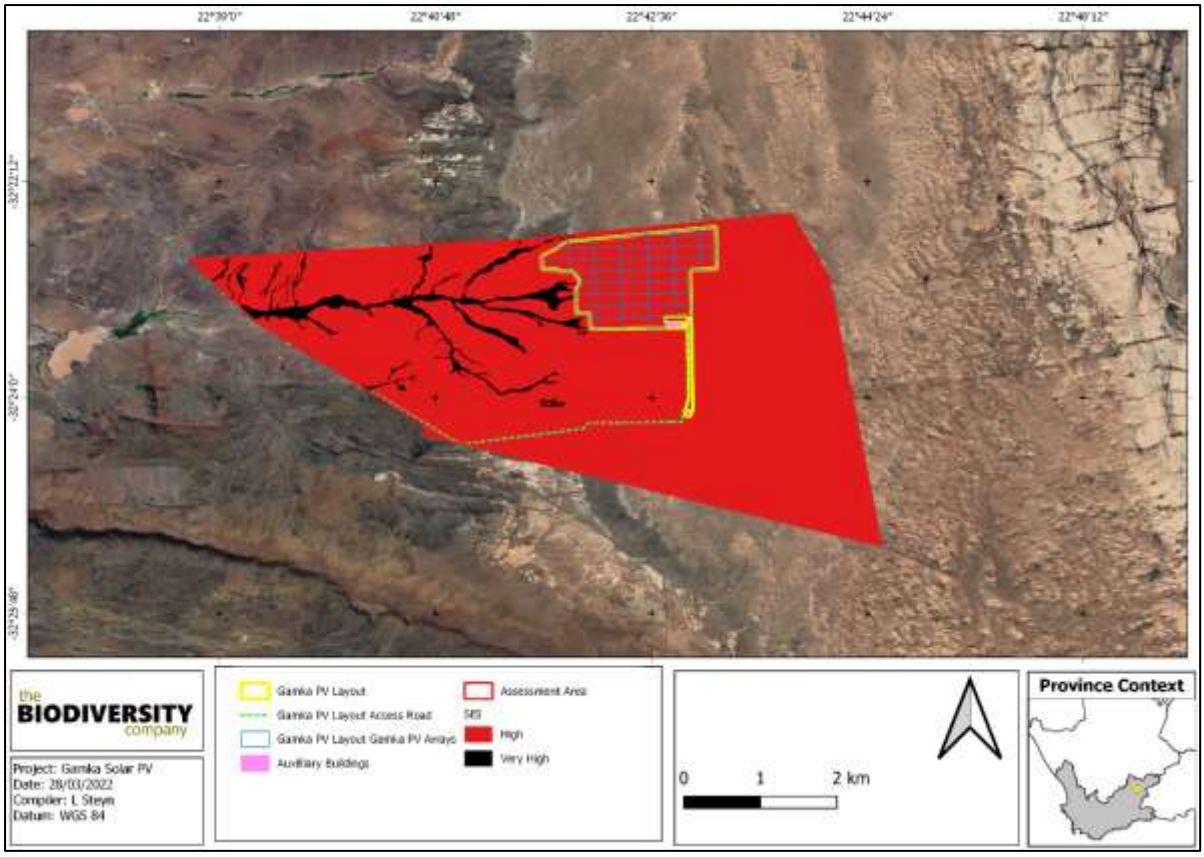


Figure 7-3 Site Ecological Importance of the assessment area

8 Impact Assessment

Potential impacts were evaluated against the data captured during the fieldwork to identify relevance to the assessment area, specifically the proposed development footprint area. The relevant impacts were then subjected to a prescribed impact assessment methodology (Appendix D).

8.1 Current Impacts

The current impacts observed during the survey are listed below. Photographic evidence of a selection of these impacts is shown in Figure 8-1.

- Multiple high voltage powerlines;
- Grazing and trampling of natural vegetation by livestock;
- Farm roads and main roads (and associated traffic and wildlife road mortalities);
- Erosion;
- Hunting;
- Fences; and
- Alien and/or Invasive Plants (AIP).

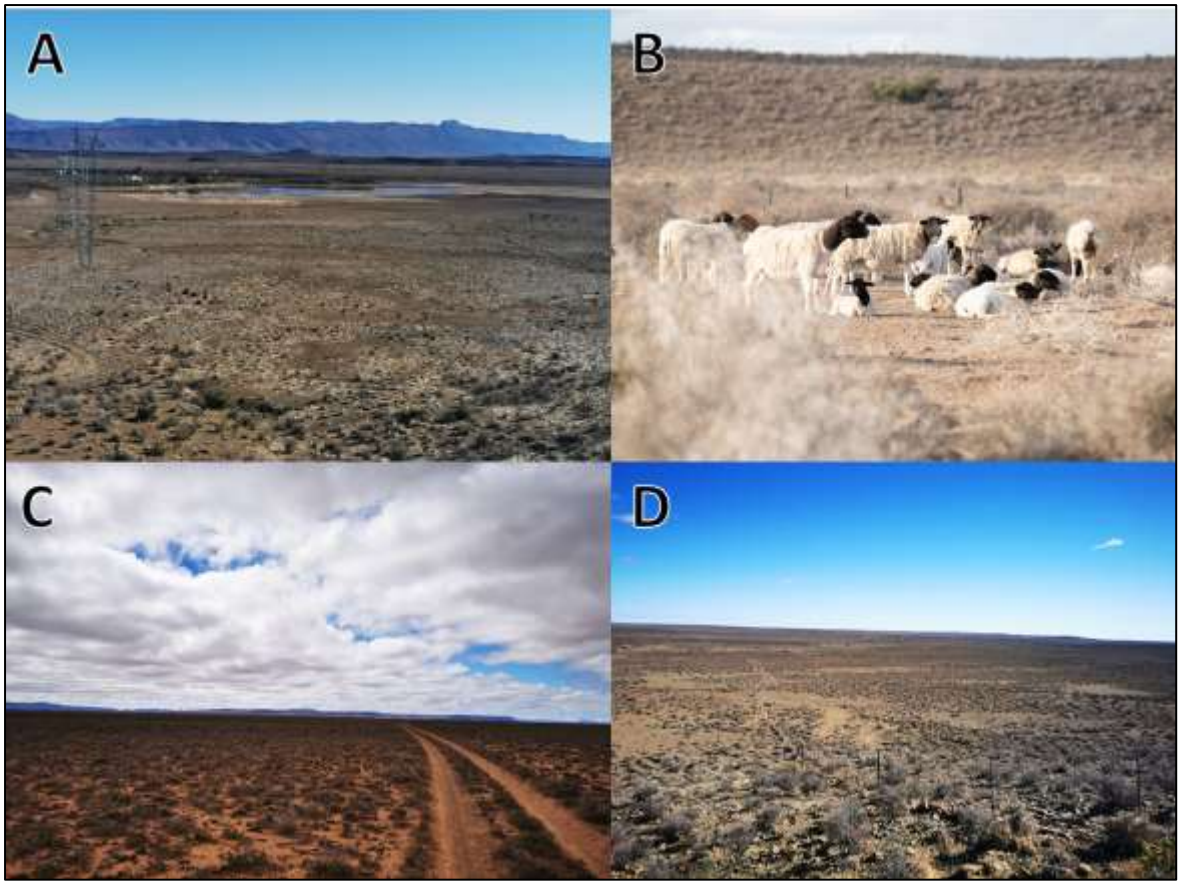


Figure 8-1 Some of the identified impacts within the assessment area; A Powerlines, B) Livestock, C) Farm Road and D) Fences

8.2 Avifauna Impact Assessment

This section describes the potential impacts on avifauna associated with the construction, operation and decommissioning phases of the proposed development and is only relevant to the PV site and associated infrastructure and does not consider the powerline grid system. During the construction phase vegetation clearing and brush cutting of vegetation for the associated infrastructure will lead to direct habitat loss. Vegetation clearing and disturbance will create a disturbance and will therefore potentially lead to the displacement of avifaunal species. The operation of construction machinery on site will generate noise and cause dust pollution. Should non-environmentally friendly dust suppressants be used, chemical pollution can take place. Increased human presence can lead to poaching and the increase in vehicle traffic will potentially lead to roadkill.

The principal impacts of the operational phase are electrocution, collisions, fencing, chemical pollution due to chemical for the cleaning of the PV panels and habitat loss. Solar panels have been implicated as a potential risk for bird collisions. Collisions are thought to arise when birds (particularly waterbirds) mistake the panels for waterbodies, known as the “lake effect” (Lovich & Ennen, 2011), or when migrating or dispersing birds become disorientated by the polarised light reflected by the panels. This “lake-effect” hypothesis has not been substantiated or refuted to date (Visser *et al.,* 2019). It can however be said that the combination of powerlines, fencing and large infrastructure will influence avifauna species. Visser *et al.* (2019) performed a study at a utility-scale photovoltaic solar energy facility in the Northern Cape and found that most of the species affected by the facility were passerine species. Larger species were said

to be more influenced by the facilities when they were found foraging close by and were disturbed by predators which resulted in collisions.

Large passerines are particularly susceptible to electrocution because owing to their relatively large bodies, they are able to touch conductors and ground/earth wires or earthed devices simultaneously. The chances of electrocution are increased when feathers are wet, during periods of high humidity or during defecation. Prevailing wind direction also influences the rate of electrocution casualties. The PV panels and their connections pose a risk as they can be utilised by larger birds as perch locations.

Fencing of the PV site can influence birds in six ways (Birdlife SA, 2015);

1. Snagging: Occurs when a body part is impaled on one or more barbs or razor points of a fence.
2. Snaring: When a birds foot/leg becomes trapped between two overlapping wires.
3. Impact injuries: birds flying into a fence, the impact may kill or injure the bird
4. Snarling: When birds try and push through a mesh or wire stands, ultimately becoming trapped (uncommon).
5. Electrocution: Electrified fence can kill or severely injure birds.
6. Barrier effect: Fences may limit flightless birds (e.g. Moulting waterfowl) from resources.

Chemical pollution from PV cleaning, if not environmentally friendly will result in either long term or short term poisoning. Should this chemical run into the water sources it would also impact the whole bird population and not just species found in and around the PV footprint.

PV sites require the overall removal or maintenance of vegetation, this is a measure that is implemented to restrict the risk of fire (Birdlife, 2017). The change in temperature associated with the panels will also result in a change in the vegetation composition found underneath the panels. The removal or alteration of the of vegetation results in the loss of habitat for a number of species in this case it would be displacing shrubland endemics and SCCs.

During the decommissioning phase should the infrastructure not be removed, and the area rehabilitated, the infrastructure will eventually start oxidising possibly resulting in heavy metal pollution of the water sources. The habitat will, even after rehabilitation, not return to a pre-development state but the rehabilitation of the area will reduce the likelihood of alien plant infestation and erosion.

8.2.1 Alternatives Considered

No layout alternatives were considered. Extensive upfront consultation with the various specialists provided insight into suitable options to avoid and/or mitigated many of the impacts associated with the planning and design phase. Therefore, the preferred layout alternatives for each facility were the only layout alternative considered. NO -go areas would include the rest of the farm as this would allow for sufficient area for the avifauna species to move into.

8.2.2 Loss of Irreplaceable Resources

Portion of an ESA (although somewhat modified) area will be lost as well as unique habitat areas. Potential nesting sites for SCCs and possibly SCCs themselves will be lost.

8.2.3 Cumulative Impact

Cumulative impacts are assessed in context of the extent of the proposed assessment area; other developments in the area; and general habitat loss and transformation resulting from other activities in the area.

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. This section describes the potential impacts of the project that are cumulative for avifauna.

Localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers (such as nearby solar farm activities within the area). These include dust deposition, noise and vibration, disruption of corridors or habitat, groundwater drawdown, groundwater and surface water quality, and transport.

The six proposed facilities are predominantly located in Southern Karoo Riviere Grassland habitat type, as delineated (and refined) for this assessment. The total footprint area proposed to be developed for the six PV facilities measures 1,471 ha. A total area of the Southern Karoo Riviere Grassland habitat type within the 30 km radius farm portion equates to approximately 52.000 ha of very similar habitat. The total combined size of the footprint taken up by solar facilities equates to 2.8% of similar habitat. Further to this, considering the number of known and planned PV facilities and the associated powerlines in the area the cumulative impact is expected to be moderate. These would collectively result in a large area of habitat disturbance/loss, and it increases the risk of collisions and electrocutions for avifauna. This risk is important to consider as a number of species expected and recorded for the area are in a high risk category for collisions and electrocutions.

8.2.4 Identification of Potential Impacts

The assessment of impact significance considers pre-mitigation as well as implemented of post-mitigation scenarios. Although different species and groups will react differently to the development, the risk assessment was undertaken bearing in mind the potential impacts to the priority species listed in section 5.2 of this report. The SCCs were considered for all as these species will move around and utilise the habitat in all the PV assessment areas.

8.2.4.1 Pre-construction Phase

The pre-construction phase activities are considered a low risk as they typically involve desktop assessments and initial site inspections. This phase of the assessment would include, amongst others, site visits of various contractors, environmental and social impact

assessment and compiling of management plans. Only one minor impact was assessed regarding the planning phase:

- Temporary disturbance of avifauna due to increased human presence and possible use of machinery and/or vehicles.

8.2.4.2 Construction Phase

The following potential impacts were considered:

- Habitat Loss (Destroy, fragment, and degrade habitat, ultimately displacing avifauna);
- Sensory disturbances (e.g. noise, dust, vibrations);
- Collection of eggs and poaching;
- Roadkill by the construction vehicles (some birds gets blinded by lights or has a freeze response to disturbance ;
- Chemical pollution associated with dust suppressants; and
- Displacement or death of SCCs.

8.2.4.3 Operational Phase

The following potential impacts were considered:

- Habitat Loss (Destroy, fragment, and degrade habitat, ultimately displacing avifauna);
- Sensory disturbances (e.g. noise, light, dust, vibrations);
- Collection of eggs and poaching;
- Roadkill;
- Collisions with PV and associated infrastructure;
- Electrocution by infrastructure and connections to PV;
- Chemical pollution associated with measures to keep PV clean;
- Fencing of PV site, especially a risk for larger birds; and
- Displacement or death of SCCs.

8.2.4.4 Decommissioning Phase

The following impacts were considered for the PV sites:

- Habitat Loss (Destroy, fragment, and degrade habitat, ultimately displacing avifauna);
- Sensory disturbances (e.g. noise, dust, vibrations);
- Roadkill;
- Collisions with PV and associated infrastructure; and

- Fencing of PV site, especially a risk for larger birds.

8.2.5 Assessment of Impact Significance of Gamka PV

Table 8-1 shows the rating of the impact pre- and post-mitigation. The impact of this disturbance was rated as 'Low' prior to the mitigation and was 'Absent' post mitigation.

8.2.5.1 Construction Phase

Table 8-2 summarises the significance of potential impacts associated with the Gamka PV site on avifauna before and after implementation of mitigation measures. The construction will impact an ESA area, it was found to be somewhat disturbed therefore the impact was rated as 'Moderately High' pre-mitigation and 'Moderate" post mitigation. Mitigations such as the restriction and demarcation of the footprint can reduce this impact, it can however not be mitigated completely as some habitat will still be lost or fragmented. By installing signs and including a toolbox talk regarding environmental awareness during meetings, collection of eggs and poaching can successfully be mitigated. These impacts can then be reduced from 'Moderate' to 'Low'. Based on the known occurrence of 5 SCCs of which some are likely breeding in the assessment area the pre-mitigation impact was rated as 'Moderately High'. This impact can be mitigated in spite of the displacement of species, their habitat being fragmented/lost, and their breeding success being influenced. This can be reduced to a "Moderate" level if the remaining farm portion not proposed for development are managed in support of conservation.

8.2.5.2 Operational Phase

Table 8-3 summarises the significance of the operational phase impacts on avifauna before and after implementation of mitigation measures. The impact significance of electrocution and collisions were rated as 'Moderately High' prior to mitigations, this was rated based on the large number of risk species known to occur in the area. Implementation of mitigation measures reduced the significance of these impacts to a 'Moderate' level. It cannot be reduced completely as the risk will still persist, the addition of white stripes on the edges of the PV panels and nest proofing will reduce the impact but will not completely remove it. The impact significance of the fencing was rated as 'Moderately High', based on the high number of species at risk that are present. Implementation of mitigation measures as specified by Birdlife South Africa (2017) reduced the significance of the impact to a 'Low" level. Even with the implementation of all these mitigations there is still a likelihood that the species would be impacted. The continues displacement and death of SCCs were rated as "Moderately High" pre-mitigations, the development would still likely disrupt breeding sites and new nest locations could take a number of years to be established. During that time the development will continue to pose a risk of collisions and death of the species. The rating is lowered to "Moderate" based on the minimisation of the habitat loss, and management of the remaining areas not proposed for development.

8.2.5.3 Decommissioning Phase

Table 8-4 summarises the impacts during the decommissioning phase pre- and post-mitigations. The habitat will be disturbed again and will need to be rehabilitated post removal of the infrastructure. The impact of habitat loss and disturbance were rated as "Moderate" pre-mitigations and "Low' post-mitigations. The removal of the infrastructure and more specifically the solar panels will reduce the impact of collisions from "Moderately" to "Absent". The risk of

fencing becoming slack and causing birds to become entangled is “Moderate”, should this be removed along with all the other infrastructure the impact can successfully be reduced to “Absent”.

Table 8-1 Assessment of significance of potential impacts on avifauna associated with the pre-construction phase of the Gamka PV project

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Temporary disturbance of avifauna due to increased human presence and possible use of machinery and/or vehicles.	2	2	2	2	3		2	2	2	2	2	
	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Likely	**Low**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology with limited sensitivity/importance	Possible	**Absent**

Table 8-2 Assessment of significance of potential impacts on avifauna associated with the construction phase of the Gamka project

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Habitat Loss (Destroy, fragment and degrade CBA1 and CBA2 habitat, ultimately displacing avifauna)	4	3	3	3	5		3	3	3	3	4	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Definite	**Moderately High**	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Highly likely	**Moderate**
Sensory disturbances (e.g. noise, dust, vibrations)	4	2	4	4	3		3	2	2	4	2	
	Life of operation or less than 20 years: Long Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Likely	**Moderate**	One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Possible	**Low**
Collection of eggs and poaching	3	3	4	4	3		2	2	2	4	2	
	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Likely	**Moderate**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Possible	**Low**

Roadkill	3	3	3	4	4		2	2	2	4	3	
	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderate**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Likely	**Low**
Chemical pollution associated with dust suppressants	3	3	4	4	4		2	2	2	4	3	
	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Highly likely	**Moderately High**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Likely	**Low**
Displacement or death of SCCs.	4	3	4	4	4		4	2	3	4	4	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Highly likely	**Moderately High**	Life of operation or less than 20 years: Long Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderate**

Table 8-3 Assessment of significance of potential impacts on avifauna associated with the operational phase of the Gamka project

Impact	Prior to mitigation						Post mitigation					
	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Habitat Loss (Destroy, fragment and degrade habitat, ultimately displacing avifauna)	5	4	3	3	3		4	3	3	3	4	
	Permanent	Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Likely	**Moderate**	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology moderately sensitive/ /important	Highly likely	**Moderate**
Sensory disturbances (e.g. noise, dust, vibrations)	4	3	3	4	3		2	2	2	4	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Likely	**Low**
Collection of eggs and poaching	4	3	4	4	3		3	2	2	4	2	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Likely	**Moderately High**	One year to five years: Medium Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Possible	**Low**

								affected < 100m				
Roadkill	4	3	3	4	3		2	2	2	4	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Likely	**Low**
Collisons with PV and associated infrastructure	4	3	4	5	4		3	3	4	4	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology critically sensitive /important	Highly likely	**Moderately High**	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Likely	**Moderate**
Electrocution by infrastructure and connections to PV	4	3	4	5	4		3	3	3	4	2	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology critically sensitive /important	Highly likely	**Moderately High**	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Possible	**Moderate**
Chemical pollution associated with	4	3	4	4	5		2	2	2	4	2	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site	Great / harmful/ ecosystem	Ecology highly	Definite	**Moderately High**	One month to one year:	Development specific/ within the	Small / ecosystem structure	Ecology highly	Possible	**Low**

measures to keep PV clean		boundary / < 5000ha impacted / Linear features affected < 1000m	structure and function largely altered	sensitive /important			Short Term	site boundary / < 100 ha impacted / Linear features affected < 100m	and function largely unchanged	sensitive /important		
Fencing of PV site	4	3	4	4	5		2	3	2	4	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Definite	**Moderately High**	One month to one year: Short Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Likely	**Low**
Displacement or death of SCCs.	4	3	4	4	4		4	2	3	4	4	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Highly likely	**Moderately High**	Life of operation or less than 20 years: Long Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Highly likely	**Moderate**

Table 8-4 Assessment of significance of potential impacts on avifauna associated with the decommissioning phase of the Gamka project

Impact	**Prior to mitigation**	**Post mitigation**

	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance	Duration of Impact	Spatial Scope	Severity of Impact	Sensitivity of Receiving Environment	Probability of Impact	Significance
Habitat Loss (Destroy, fragment and degrade habitat, ultimately displacing avifauna)	4	3	4	3	3		2	2	2	4	2	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology moderately sensitive/ /important	Likely	**Moderate**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Possible	**Low**
Sensory disturbances (e.g. noise, dust, vibrations)	4	3	3	4	3		2	2	2	4	3	
	Life of operation or less than 20 years: Long Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Significant / ecosystem structure and function moderately altered	Ecology highly sensitive /important	Likely	**Moderate**	One month to one year: Short Term	Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	Small / ecosystem structure and function largely unchanged	Ecology highly sensitive /important	Likely	**Low**
Roadkill	3	3	4	4	3		1	1	1	4	1	
	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Likely	**Moderate**	One day to one month: Temporary	Activity specific/ < 5 ha impacted / Linear features affected < 100m	Insignificant / ecosystem structure and function unchanged	Ecology highly sensitive /important	Highly unlikely	**Absent**
Collisons with PV and associated infrastructure	3	3	4	4	3		1	1	1	4	1	
	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Likely	**Moderate**	One day to one month: Temporary	Activity specific/ < 5 ha impacted / Linear features affected < 100m	Insignificant / ecosystem structure and function unchanged	Ecology highly sensitive /important	Highly unlikely	**Absent**

	3	3	4	4	3		1	1	1	4	1	
Fencing of PV site	One year to five years: Medium Term	Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	Great / harmful/ ecosystem structure and function largely altered	Ecology highly sensitive /important	Likely	**Moderate**	One day to one month: Temporary	Activity specific/ < 5 ha impacted / Linear features affected < 100m	Insignificant / ecosystem structure and function unchanged	Ecology highly sensitive /important	Highly unlikely	**Absent**

9 Specialist Management Plan

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

Table 9-1 presents the recommended mitigation measures and the respective timeframes, targets, and performance indicators for the avifaunal study.

Table 9-1 Summary of management outcomes pertaining to impacts to avifauna and their habitats

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
Management outcome: Habitats				
Areas of already fragmented indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible. The development footprint must be demarcate to ensure the development does not infringe on the surrounding areas.	Life of operation	Project manager, Environmental Officer	Areas of indigenous vegetation	Ongoing
The site ecological importance for SCCs is rated as high, and therefore it is recommended that the remaining part of the farm be left undeveloped.	Life of operation	Project manager, Environmental Officer	No further development on the rest of the farm portion	Ongoing
Where possible, existing access routes and walking paths must be made use of.	Construction/Operational Phase	Environmental Officer & Design Engineer	Roads and paths used	Ongoing
Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood and wind events. This will also reduce the likelihood of encroachment by alien invasive plant species.	Closure Phase/Rehabilitation phase	Environmental Officer & Contractor	Assess the state of rehabilitation and encroachment of alien vegetation	Quarterly for up to two years after the closure
Any woody material removed can be shredded and used in conjunction with the topsoil to augment soil moisture and prevent further erosion.	Closure Phase/ Post Closure Phase	Environmental Officer & Contractor	Road edges and project area footprint	During Phase
Rehabilitation of the disturbed areas existing in the project area must be made a priority. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are endemic to this vegetation type.	Operational/Closure Phase	Environmental Officer & Contractor	Road edges and footprint	During Phase
Erosion control and alien invasive management plan must be compiled.	Life of operation	Environmental Officer & Contractor	Erosion and alien invasive species	Ongoing
Environmentally friendly dust suppressants need to be utilised	Operational phase	Environmental Officer & Contractor	Water pollution	During Phase
A fire management plan needs to be compiled and implemented to restrict the impact fire might have on the surrounding areas.	Life of operation	Environmental Officer & Contractor	Fire Management	During Phase
Management outcome: Avifauna				

Impact Management Actions	Implementation		Monitoring	
	Phase	Responsible Party	Aspect	Frequency
The areas to be developed must be specifically demarcated to prevent movement of staff or any individual into the surrounding environments. Signs must be put up to enforce this.	Construction/Operational Phase	Project manager, Environmental Officer	Infringement into these areas	Ongoing
All personnel should undergo environmental induction with regards to avifauna and in particular awareness about not harming, collecting, or hunting terrestrial species (e.g., guineafowl and francolin), and owls, which are often persecuted out of superstition. Signs must be put up to enforce this.	Life of operation	Environmental Officer	Evidence of trapping etc	Ongoing
The duration of the construction should be kept to a minimum to avoid disturbing avifauna.	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Construction/Closure Phase	During Phase
Outside lighting should be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided and sodium vapor (red/green) motion detection lights should be used wherever possible.	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Light pollution and period of light.	During Phase
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.	Life of operation	Health and Safety Officer	Compliance to the training.	Ongoing
Schedule or limit (where feasible) activities during least sensitive periods, to avoid migration, nesting and breeding seasons (May – August)	Construction/Operational Phase	Project manager, Environmental Officer & Design Engineer	Activities should take place during the day in winter.	During Phase
All project activities must be undertaken with appropriate noise mitigation measures to avoid disturbance to avifauna population in the region	Construction/Operational Phase	Project manager, Environmental Officer	Noise	During Phase
All areas to be developed must be walked through prior to any activity to ensure no nests or avifauna species are found in the area. Should any Species of Conservation Concern be found and not move out of the area or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.	Planning, Construction and Decommissioning	Project manager, Environmental Officer	Presence of Nests and faunal species	During Phase
The design of the proposed PV must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa (Jenkins *et al.,* 2017).	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds or bird strikes	During Phase
Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.	Planning and construction	Environmental Officer &	Presence of bird collisions	During phase

		Contractor, Engineer		
All the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
Use environmentally friendly cleaning and dust suppressant products	Construction and operation	Environmental Officer & Contractor, Engineer	Presence of chemicals in and around the project area	During phase
Fencing mitigations: • Top 2 strands must be smooth wire • Routinely retention loose wires • Minimum 30cm between wires • Place markers on fences	Planning, construction, and operation	Environmental Officer & Contractor, Engineer	Presence of birds stuck /dead in fences Monitor fences for slack wires	During phase
As far as possible power cables within the project area should be thoroughly insulated and preferably buried.	Planning and construction	Environmental Officer & Contractor, Engineer	Exposed cables	During phase
Any exposed parts must be covered (insulated) to reduce electrocution risk	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of electrocuted birds	During phase
White strips should be placed along the edges of the panels, to reduce similarity to water and deter birds and insects (Horvath *et al,* 2010). Consider the use of bird deterrent devices to limit collision risk.	Planning and construction	Environmental Officer & Contractor, Engineer	Presence of dead birds in the project area	During phase

10 Monitoring Plan

Monitoring is to take place between September and February so that mitigation measures can be adapted to ensure the development does not have a long term impact on the SCCs in the area and more specifically the Sclater's Lark, as this is a unique subpopulation found just in the Beaufort West area. A follow-up assessment on avian biodiversity and species abundance within the assessment area and surrounding areas must be conducted within one year after the facility has been in operation and should be repeated every 3-5 years. Information obtained from the monitoring must be provided to BirdLife Renewable Energy Programme on energy@birdlife.org.za. The data must be presented as described in Jenkins *et al.,* 2017. Table 10-1 lists monitoring guidelines to be followed.

Table 10-1 Monitoring guidelines

Avian group	Survey Type	Survey objective	Timing
Raptor and larger ground birds	Drive transect & Incidental	To evaluate the population size To determine the abundance of the species and their use of habitat types To determine the effect of the PV on these species	Timing must overlap with birds breeding season as well as for migratory visitors
Passerines	Point Counts	Point count gives you a good representation of the species diversity and distribution throughout the various habitats. Also allows for an understanding of the impact of the PV on the various habitats. Ensure the Sclater's Lark is not detrimentally affected	Summer survey must be performed.
All species	Nest monitoring	To ensure the breeding patterns and attempts are not interrupted or	Summer during the breeding season

		discontinued nest monitoring will be done from a distance with binoculars.	

11 Conclusion

The assessment area consisted of four avifauna habitats; Ridges, Karoo Riviere-Shrubland, Karoo Riviere Grassland and Water Resources, these habitats were still mostly in a natural state with the exception of some areas that have been disturbed by livestock grazing. Five species of conservation concern (SCC), Karoo Korhaan (*Eupodotis vigorsii*), Blue Crane (*Grus paradisea*), Lanner Falcon (*Falco biarmicus*), Sclater's Lark (*Spizocorys sclateri*) and Ludwigs Bustard (*Neotis ludwigii*) were confirmed in the assessment area. The Sclater's Lark, Ludwigs Bustard and Karoo Korhaan are all very likely to have nests in the assessment area, they nest on the ground in scraped areas between scrubs or scattered rocks. The Blue Crane could also possibly nest in the assessment area, but it is less likely, as they tend to nest near water in open veld, the assessment area is some distance away from the closest perennial water source. The Lanner Falcon breeds on cliff ledges it is thus less likely to have a permanent nest in the assessment area. Based on the nesting behaviour and the habitat type in the assessment area, it can be said that three of the five SCCs are residents in the assessment area.

The project will result in habitat loss and degradation of an area where five species of conservation concern are known to occur. Three of which have a very high likelihood of breeding in the assessment area. The development will lead to the clearing of vegetation and an altering in the undeveloped/isolated nature of the area. Based on the low receptor resilience and the medium functional integrity, the assessment area was given a high site ecological importance (SEI), with the exception of the water sources that were assigned a very high SEI based on the importance in this dry area.

The 'average' post-mitigation impact significance for the respective phases ranges from low to moderate. The impacts considered could be mitigated to an acceptable level of significance. A total area of the Southern Karoo Riviere Grassland habitat type taken up by solar facilities equates to 2.8% of similar habitat within a 30 km radius. Further to this, considering the number of known and planned PV facilities and the associated powerlines in the area the cumulative impact is expected to be moderate.

The mitigation hierarchy implemented in this report is as per the information provided in section 2(4)(a)(i) of NEMA as well as the overall policy on Environmental offsetting (Biodiversity Offset Guidelines, section 24 J of NEMA, Sept 2021).

The table below (Table 11-1) is provided as a guide to the various stages and implementations in this project.

Table 11-1 Components associated with this project that is applicable to the mitigation hierarchy

Mitigation Hierarchy	Comment
Avoid	• The original farm area measured is 2,670 ha, and a total of 1,471 ha will be developed for the solar facilities. Based on this, a total of 55% of the original area will be developed.

	• The avoidance of the water trough and nearby surrounds where the Sclaters Lark is found in the area has been included in the design changes. • Other avoidance mitigations provided includes: the development should take place in the winter months (as much is feasible) in order to avoid the main breeding and migratory seasons as well as activity outside of the direct footprint must be avoided. • Perform walk throughs prior to the development to ensure all birds are flushed out of the area, should any SCC nests be found, the ECO must contact an appropriate specialist to advise on the way forward; • Changes to the design were also recommended, one such example is the change in the outside lighting design to avoid impacting the avifauna.
Minimise	Mitigation measures have been prescribed to minimise the overall impact significance for the respective phases. The impacts could be mitigated to an acceptable level of significance.
Rehabilitate	Based on the permanent nature of the project, this rehabilitation and restoration option cannot be mitigated for, as the footprint will be cleared/disturbed. The areas surrounding the footprint, should they be disturbed for the construction phase of the project, these areas can be rehabilitated to their previous state.
Offset	Considering the avoidance mitigations and if the remaining extent of the farm be left undeveloped an offset strategy would not be required.

12 Impact Statement

No fatal flaws were identified for the project. Taking into consideration the extent of 'avoidance' and "mitigated" impact significances achieved for the project, it is the opinion of the specialist that the authorisation of the proposed project may be favourably considered and that the prescribed mitigation measures be considered for authorisation.

13 References

ADU (Animal Demography Unit). (2022). Virtual Museum.

BGIS (Biodiversity GIS). (2018). http://bgis.sanbi.org/

Birdlife South Africa. (2015). Checklist of Birds - List of Threatened Species. https://www.birdlife.org.za/publications

BirdLife South Africa. (2017). Important Bird Areas Factsheet. http://www.birdlife.org

Del Hoyo, J., Elliott, A. and Christie, D. 2004. *Handbook of the Birds of the World, Vol. 9: Cotingas to Pipits and Wagtails*. Lynx Editions, Barcelona, Spain.

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

Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. (Eds). (2005). Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

IUCN. (2017). The IUCN Red List of Threatened Species. www.iucnredlist.org

Jenkins, A.R., Ralston-Paton, S., & Smit-Robinson, H. (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.

Mucina, L. and Rutherford, M.C. (Eds.) (2006). The Vegetation of South Africa, Lesotho and Swaziland, Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Peacock, F. 2015. Sclater's Lark Spizocorys sclateri. In: Taylor, M. R.; Peacock, F.; Wanless, R. M. (ed.), *The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*, pp. 322-324. BirdLife South Africa, Johannesburg, South Africa.

SABAP2 (Bird Atlas Project). (2017). http://vmus.adu.org.za/.

SANBI. (2017). Technical guidelines for CBA Maps: Guidelines for developing a map of Critical Biodiversity Areas & Ecological Support Areas using systematic biodiversity planning. Driver, A., Holness, S. & Daniels, F. (Eds). 1st Edition. South African National Biodiversity Institute, Pretoria.

Simmons, R. E. 2015. Sclater's Lark *Spizocorys sclateri*. In: Simmons, R. E.; Brown, C. J.; Kemper, J. (ed.), *Birds to watch in Namibia: red, rare and endemic species*, pp. 208-209. Ministry of Environment and Tourism, Namibia Nature Foundation.

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

van Rooyen, C.S. and Ledger, J.A. 1999. Birds and utility structures: developments in southern Africa. In: Ferrer, M. and Walston, L. J., Rollins, K.E., Smith, K.P., LaGory, K.E., Sinclair, K., Turchi, C., Wendelin, T. & Souder, H. 2015. A review of avian monitoring and mitigation information at existing utility- scale solar facilities.

Visser, E., Perold, V., Ralston-Paton, S., Cardenal, A. C., & Ryan, P. G. (2019). Assessing the impacts of a utility-scale photovoltaic solar energy facility on birds in the Northern Cape, South Africa. Renewable energy, 133, 1285-1294.

14 Appendices

14.1 Appendix A: Avifaunal species expected in the area.

Species	Common Name	Conservation Status		Reporting Rate	
		Regional (SANBI, 2016)	IUCN (2021)	3220_2240	3220_2235
Accipiter melanoleucus	Sparrowhawk, Black	Unlisted	LC	0.4	
Acrocephalus baeticatus	Reed-warbler, African	Unlisted	Unlisted	2.2	37.1
Acrocephalus gracilirostris	Swamp-warbler, Lesser	Unlisted	LC	1.1	36.3
Actitis hypoleucos	Sandpiper, Common	Unlisted	LC		11.6
Alopochen aegyptiaca	Goose, Egyptian	LC	LC	38.5	86.1
Amadina erythrocephala	Finch, Red-headed	Unlisted	LC	51.6	34.7
Anas capensis	Teal, Cape	Unlisted	LC		83.7
Anas erythrorhyncha	Teal, Red-billed	Unlisted	LC		68.5
Anas platyrhynchos	Duck, Mallard	Unlisted	LC		0.4
Anas sparsa	Duck, African Black	Unlisted	LC		15.1
Anas undulata	Duck, Yellow-billed	Unlisted	LC		80.5
Anhinga rufa	Darter, African	Unlisted	LC		0.4
Anthoscopus minutus	Penduline-tit, Cape	Unlisted	LC	4.4	8.4
Anthus cinnamomeus	Pipit, African	Unlisted	LC	61.5	59.8
Anthus leucophrys	Pipit, Plain-backed	Unlisted	LC	30.8	12.0
Anthus nicholsoni	Nicholson's pipit	Unlisted	Unlisted	12.1	23.1
Anthus similis	Pipit, Long-billed	Unlisted	LC		2.0
Anthus vaalensis	Pipit, Buffy	Unlisted	LC	1.1	0.0
Apalis thoracica	Apalis, Bar-throated	Unlisted	LC		5.6
Apus affinis	Swift, Little	Unlisted	LC	30.8	79.7
Apus	Swift, Common	Unlisted	LC	3.3	2.8
Apus barbatus	Swift, African Black	Unlisted	LC	3.3	5.2
Apus caffer	Swift, White-rumped	Unlisted	LC	34.1	40.6
Aquila verreauxii	Eagle, Verreaux's	VU	LC	4.4	0.8
Ardea alba	Egret, Great	Unlisted	LC		1.2
Ardea cinerea	Heron, Grey	Unlisted	LC	7.7	55.0
Ardea melanocephala	Heron, Black-headed	Unlisted	LC		31.5
Ardeola ralloides	Heron, Squacco	Unlisted	LC		8.0
Ardeotis kori	Bustard, Kori	NT	NT	13.2	2.4
Arenaria interpres	Turnstone, Ruddy	Unlisted	LC		2.0
Batis pririt	Batis, Pririt	Unlisted	LC	53.8	41.8
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC	40.7	86.5
Bradypterus baboecala	Rush-warbler, Little	Unlisted	LC		15.1
Bubo africanus	Eagle-owl, Spotted	Unlisted	LC	39.6	3.2

Bubulcus ibis	Egret, Cattle	Unlisted	LC		62.9
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC	57.1	38.6
Burhinus vermiculatus	Thick-knee, Water	Unlisted	LC		1.2
Buteo	Buzzard, Common (Steppe)	Unlisted	LC	6.6	5.2
Buteo rufofuscus	Buzzard, Jackal	Unlisted	LC	7.7	1.6
Calandrella cinerea	Lark, Red-capped	Unlisted	LC	71.4	48.2
Calendulauda albescens	Lark, Karoo	Unlisted	LC	2.2	0.8
Calendulauda sabota	Lark, Sabota	Unlisted	LC	38.5	12.0
Calidris alba	Sanderling	Unlisted	LC		0.0
Calidris ferruginea	Sandpiper, Curlew	LC	NT		8.0
Calidris melanotos	Sandpiper, Pectoral	Unlisted	LC		0.4
Calidris minuta	Stint, Little	LC	LC		43.8
Calidris pugnax	Ruff	Unlisted	LC		39.4
Caprimulgus rufigena	Nightjar, Rufous-cheeked	Unlisted	LC	22.0	8.8
Cecropis cucullata	Swallow, Greater Striped	Unlisted	LC	28.6	51.8
Cercotrichas coryphoeus	Scrub-robin, Karoo	Unlisted	LC	61.5	83.7
Certhilauda subcoronata	Lark, Karoo Long-billed	Unlisted	LC	85.7	59.8
Ceryle rudis	Kingfisher, Pied	Unlisted	LC		5.2
Charadrius hiaticula	Plover, Common Ringed	Unlisted	LC		2.0
Charadrius pecuarius	Plover, Kittlitz's	Unlisted	LC		69.7
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC	50.5	83.7
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC	98.9	30.3
Chlidonias hybrida	Tern, Whiskered	Unlisted	LC		9.2
Chlidonias leucopterus	Tern, White-winged	Unlisted	LC		20.7
Chroicocephalus cirrocephalus	Gull, Grey-headed	Unlisted	LC		84.5
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC	1.1	9.6
Ciconia ciconia	Stork, White	Unlisted	LC		1.6
Ciconia nigra	Stork, Black	VU	LC		0.4
Cinnyris chalybeus	Sunbird, Southern Double-collared	Unlisted	LC	20.9	49.4
Cinnyris fuscus	Sunbird, Dusky	Unlisted	LC	6.6	34.3
Circaetus cinereus	Snake-eagle, Brown	Unlisted	LC		0.4
Circaetus pectoralis	Snake-eagle, Black-chested	Unlisted	LC		0.4
Circus maurus	Harrier, Black	EN	VU		2.0
Cisticola aridulus	Cisticola, Desert	Unlisted	LC		3.2
Cisticola fulvicapilla	Neddicky, Neddicky	Unlisted	LC		3.2
Cisticola juncidis	Cisticola, Zitting	Unlisted	LC		6.0
Cisticola subruficapilla	Cisticola, Grey-backed	Unlisted	LC	18.7	52.2
Cisticola tinniens	Cisticola, Levaillant's	Unlisted	LC		56.6
Colius	Mousebird, White-backed	Unlisted	LC	42.9	93.6

Colius striatus	Mousebird, Speckled	Unlisted	LC		0.4
Columba guinea	Pigeon, Speckled	Unlisted	LC	68.1	90.8
Columba livia	Dove, Rock	Unlisted	LC		33.9
Coracias caudatus	Roller, Lilac-breasted	Unlisted	LC		0.8
Coracias garrulus	Roller, European	NT	LC		0.4
Corvus albicollis	Raven, White-necked	Unlisted	LC	49.5	13.1
Corvus albus	Crow, Pied	Unlisted	LC	91.2	81.7
Corvus capensis	Crow, Cape	Unlisted	LC	73.6	25.9
Corythornis cristatus	Kingfisher, Malachite	Unlisted	Unlisted		4.0
Cossypha caffra	Robin-chat, Cape	Unlisted	LC	41.8	77.7
Coturnix	Quail, Common	Unlisted	LC	3.3	1.2
Creatophora cinerea	Starling, Wattled	Unlisted	LC	3.3	72.9
Crithagra albogularis	White-throated Canary	LC	LC	54.9	57.0
Crithagra atrogularis	Canary, Black-throated	Unlisted	LC	38.5	83.7
Crithagra flaviventris	Canary, Yellow	Unlisted	LC	30.8	8.8
Crithagra gularis	Seedeater, Streaky-headed	Unlisted	LC		1.2
Curruca layardi	Warbler, Layards	Unlisted	LC	2.2	9.2
Curruca subcoerulea	Tit-babbler, Chestnut-vented	Unlisted	Unlisted	56.0	79.3
Cursorius rufus	Courser, Burchell's	VU	LC	1.1	
Cursorius temminckii	Courser, Temminck's	Unlisted	LC	1.1	
Cypsiurus parvus	Palm-swift, African	Unlisted	LC		17.5
Delichon urbicum	House-martin, Common	Unlisted	LC		0.8
Dendrocygna viduata	Duck, White-faced Whistling	Unlisted	LC		2.0
Dendropicos fuscescens	Woodpecker, Cardinal	Unlisted	LC	23.1	3.6
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC	5.5	
Egretta garzetta	Egret, Little	Unlisted	LC		1.2
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC	7.7	22.3
Emarginata schlegelii	Chat, Karoo	Unlisted	LC	84.6	49.8
Emarginata sinuata	Chat, Sickle-winged	Unlisted	LC	36.3	4.8
Emarginata tractrac	Chat, Tractrac	LC	LC	91.2	5.6
Emberiza capensis	Bunting, Cape	Unlisted	LC	61.5	41.0
Emberiza impetuani	Bunting, Lark-like	Unlisted	LC	81.3	37.5
Emberiza tahapisi	Bunting, Cinnamon-breasted	Unlisted	LC		0.4
Eremomela icteropygialis	Eremomela, Yellow-bellied	Unlisted	LC	42.9	22.7
Eremopterix australis	Sparrow-lark, Black-eared	Unlisted	LC	9.9	1.2
Eremopterix verticalis	Sparrowlark, Grey-backed	Unlisted	LC	50.5	23.1
Estrilda astrild	Waxbill, Common	Unlisted	LC	15.4	55.8
Euplectes afer	Bishop, Yellow-crowned	Unlisted	LC		0.8
Euplectes orix	Bishop, Southern Red	Unlisted	LC	34.1	70.1

Eupodotis vigorsii	Korhaan, Karoo	NT	LC	96.7	22.3
Falco amurensis	Falcon, Amur	Unlisted	LC		0.4
Falco biarmicus	Falcon, Lanner	VU	LC	26.4	17.1
Falco naumanni	Kestrel, Lesser	Unlisted	LC		4.0
Falco peregrinus	Falcon, Peregrine	Unlisted	LC		0.8
Falco rupicoloides	Kestrel, Greater	Unlisted	LC	70.3	0.0
Falco rupicolus	Kestrel, Rock	Unlisted	LC	50.5	40.6
Fulica cristata	Coot, Red-knobbed	Unlisted	LC		80.5
Galerida magnirostris	Lark, Large-billed	Unlisted	LC	81.3	1.6
Gallinago nigripennis	Snipe, African	Unlisted	LC		0.4
Gallinula chloropus	Moorhen, Common	Unlisted	LC		67.3
Glareola nordmanni	Pratincole, Black-winged	NT	NT		0.4
Glaucidium perlatum	Owlet, Pearl-spotted	Unlisted	LC		3.2
Grus paradisea	Crane, Blue	NT	VU	36.3	2.4
Halcyon albiventris	Kingfisher, Brown-hooded	Unlisted	LC	5.5	42.2
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC	1.1	1.2
Hieraaetus pennatus	Eagle, Booted	Unlisted	LC	25.3	27.9
Himantopus	Stilt, Black-winged	Unlisted	LC	1.1	81.3
Hirundo albigularis	Swallow, White-throated	Unlisted	LC	28.6	50.2
Hirundo dimidiata	Swallow, Pearl-breasted	Unlisted	LC		8.0
Hirundo rustica	Swallow, Barn	Unlisted	LC	27.5	23.5
Indicator	Honeyguide, Greater	Unlisted	LC		0.0
Indicator minor	Honeyguide, Lesser	Unlisted	LC	1.1	2.8
Lagonosticta senegala	Firefinch, Red-billed	Unlisted	LC	31.9	14.3
Lamprotornis bicolor	Starling, Pied	Unlisted	LC	45.1	86.1
Laniarius ferrugineus	Boubou, Southern	Unlisted	LC		0.4
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC	62.6	92.0
Leptoptilos crumenifer	Stork, Marabou	NT	LC		6.4
Malcorus pectoralis	Warbler, Rufous-eared	Unlisted	LC	92.3	63.7
Megaceryle maxima	Kingfisher, Giant	Unlisted	Unlisted		2.0
Melaenornis infuscatus	Flycatcher, Chat	Unlisted	LC	58.2	19.9
Melaenornis silens	Flycatcher, Fiscal	Unlisted	LC	45.1	74.5
Melaniparus afer	Tit, Grey	Unlisted	Unlisted	6.6	0.4
Melierax canorus	Goshawk, Southern Pale Chanting	Unlisted	LC	62.6	29.5
Merops apiaster	Bee-eater, European	Unlisted	LC	14.3	24.7
Microcarbo africanus	Cormorant, Reed	Unlisted	LC		23.9
Micronisus gabar	Goshawk, Gabar	Unlisted	LC		11.6
Milvus aegyptius	Kite, Yellow-billed	Unlisted	Unlisted		2.0
Mirafra fasciolata	Lark, Eastern Clapper	Unlisted	LC	5.5	2.4

Monticola brevipes	Rock-thrush, Short-toed	Unlisted	LC		4.0
Motacilla capensis	Wagtail, Cape	Unlisted	LC	59.3	95.6
Muscicapa striata	Flycatcher, Spotted	Unlisted	LC		1.6
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC	64.8	6.4
Myrmecocichla monticola	Wheatear, Mountain	Unlisted	LC	36.3	20.7
Nectarinia famosa	Sunbird, Malachite	Unlisted	LC	30.8	76.1
Neotis ludwigii	Bustard, Ludwig's	EN	EN	63.7	6.0
Netta erythrophthalma	Pochard, Southern	Unlisted	LC		14.3
Numenius arquata	Curlew, Eurasian	NT	NT		0.8
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC	44.0	63.3
Nycticorax	Night-Heron, Black-crowned	Unlisted	LC		1.6
Oena capensis	Dove, Namaqua	Unlisted	LC	59.3	45.8
Oenanthe familiaris	Chat, Familiar	Unlisted	LC	62.6	84.9
Oenanthe pileata	Wheatear, Capped	Unlisted	LC	57.1	15.1
Onychognathus morio	Starling, Red-winged	Unlisted	LC	20.9	76.9
Onychognathus nabouroup	Starling, Pale-winged	Unlisted	LC	14.3	13.9
Oriolus oriolus	Oriole, Eurasian Golden	Unlisted	LC		2.0
Ortygospiza atricollis	Quailfinch, African	Unlisted	LC	3.3	6.4
Oxyura maccoa	Duck, Maccoa	NT	NT		12.4
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC	49.5	43.4
Passer domesticus	Sparrow, House	Unlisted	LC	64.8	94.0
Passer melanurus	Sparrow, Cape	Unlisted	LC	94.5	94.4
Pavo cristatus	Peacock, Common	Unlisted	LC		0.4
Phalacrocorax lucidus	Cormorant, White-breasted	Unlisted	LC	1.1	11.2
Phoeniconaias minor	Flamingo, Lesser	NT	NT		15.5
Phoenicopterus roseus	Flamingo, Greater	NT	LC		16.7
Phoeniculus purpureus	Wood-hoopoe, Green	Unlisted	LC		0.8
Phragmacia substriata	Warbler, Namaqua	Unlisted	Unlisted	29.7	72.5
Phylloscopus trochilus	Warbler, Willow	Unlisted	LC		5.2
Platalea alba	Spoonbill, African	Unlisted	LC	13.2	33.1
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC	7.7	20.7
Plegadis falcinellus	Ibis, Glossy	Unlisted	LC		20.3
Ploceus capensis	Weaver, Cape	Unlisted	LC		0.4
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC	67.0	95.6
Pluvialis squatarola	Plover, Grey	Unlisted	LC		0.8
Podiceps cristatus	Grebe, Great Crested	Unlisted	LC		0.8
Podiceps nigricollis	Grebe, Black-necked	Unlisted	LC		26.3
Polemaetus bellicosus	Eagle, Martial	EN	VU	7.7	
Polyboroides typus	Harrier-Hawk, African	Unlisted	LC		0.8

Prinia maculosa	Prinia, Karoo	Unlisted	LC	54.9	91.6
Pternistis capensis	Spurfowl, Cape	Unlisted	LC		0.4
Pterocles namaqua	Sandgrouse, Namaqua	Unlisted	LC	61.5	28.3
Ptyonoprogne fuligula	Martin, Rock	LC	LC	54.9	90.0
Pycnonotus nigricans	Bulbul, African Red-eyed	Unlisted	LC	50.5	95.2
Quelea	Quelea, Red-billed	Unlisted	LC	26.4	23.9
Recurvirostra avosetta	Avocet, Pied	Unlisted	LC		65.7
Rhinoptilus africanus	Courser, Double-banded	Unlisted	LC	64.8	4.0
Riparia paludicola	Martin, Brown-throated	Unlisted	LC	1.1	63.3
Sagittarius serpentarius	Secretarybird	VU	VU	9.9	0.8
Saxicola torquatus	Stonechat, African	Unlisted	LC		0.4
Scleroptila afra	Francolin, Grey-winged	Unlisted	LC		0.4
Scopus umbretta	Hamerkop	Unlisted	LC		20.3
Serinus alario	Canary, Black-headed	Unlisted	LC	31.9	18.3
Serinus canicollis	Canary, Cape	Unlisted	LC	1.1	62.9
Spatula smithii	Shoveler, Cape	LC	LC		78.9
Spilopelia senegalensis	Dove, Laughing	Unlisted	LC	49.5	97.2
Spizocorys conirostris	Lark, Pink-billed	Unlisted	LC	8.8	
Spizocorys sclateri	Lark, Sclater's	NT	NT	79.1	
Sporopipes squamifrons	Finch, Scaly-feathered	Unlisted	LC	42.9	10.0
Stenostira scita	Flycatcher, Fairy	Unlisted	LC	56.0	43.0
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC	80.2	76.5
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC	1.1	92.4
Struthio camelus	Ostrich, Common	Unlisted	LC	47.3	1.2
Sturnus vulgaris	Starling, Common	Unlisted	LC		78.9
Sylvietta rufescens	Crombec, Long-billed	Unlisted	LC	37.4	27.1
Tachybaptus ruficollis	Grebe, Little	Unlisted	LC		71.3
Tachymarptis melba	Swift, Alpine	Unlisted	LC	26.4	35.9
Tadorna cana	Shelduck, South African	Unlisted	LC	44.0	90.0
Tchagra tchagra	Tchagra, Southern	Unlisted	LC		0.8
Telophorus zeylonus	Bokmakierie, Bokmakierie	Unlisted	LC	48.4	85.3
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC		79.7
Tricholaema leucomelas	Barbet, Acacia Pied	Unlisted	LC	68.1	86.5
Tringa glareola	Sandpiper, Wood	Unlisted	LC		20.3
Tringa nebularia	Greenshank, Common	Unlisted	LC		19.9
Tringa stagnatilis	Sandpiper, Marsh	Unlisted	LC	1.1	15.5
Turdus smithi	Thrush, Karoo	Unlisted	LC	46.2	94.0
Tyto alba	Owl, Barn	Unlisted	LC	31.9	1.6
Upupa africana	Hoopoe, African	Unlisted	LC	36.3	72.9

Urocolius indicus	Mousebird, Red-faced	Unlisted	LC	45.1	79.3
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC	44.0	90.0
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC	41.8	15.1
Vidua chalybeata	Indigobird, Village	Unlisted	LC		0.8
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC	12.1	33.5
Zosterops pallidus	White-eye, Orange River	Unlisted	LC		0.8
Zosterops virens	White-eye, Cape	Unlisted	LC	42.9	87.6

14.2 Appendix B: Avifauna species recorded in the winter survey

Species	Common Name	Conservation Status		Guild Code	Relative Abundance	Frequency
		Regional (SANBI, 2016)	IUCN (2021)			
Acrocephalus gracilirostris	Swamp-warbler, Lesser	Unlisted	LC	IGD	0,011	5,263
Alopochen aegyptiaca	Goose, Egyptian	LC	LC	HWD	0,011	2,632
Amadina erythrocephala	Finch, Red-headed	Unlisted	LC	GGD	0,171	2,632
Anas undulata	Duck, Yellow-billed	Unlisted	LC	HWD	0,011	2,632
Anthus similis	Pipit, Long-billed	Unlisted	LC	IGD	0,006	2,632
Apus affinis	Swift, Little	Unlisted	LC	IAD	0,006	2,632
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC	OMD	0,023	5,263
Charadrius pecuarius	Plover, Kittlitz's	Unlisted	LC	IWD	0,006	2,632
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC	IGD	0,040	7,895
Chroicocephalus cirrocephalus	Gull, Grey-headed	Unlisted	LC	IGD	0,046	2,632
Cinnyris fuscus	Sunbird, Dusky	Unlisted	LC	NFD	0,006	2,632
Colius colius	Mousebird, White-backed	Unlisted	LC	FFD	0,029	2,632
Corvus albicollis	Raven, White-necked	Unlisted	LC	OMD	0,023	5,263
Corvus albus	Crow, Pied	Unlisted	LC	OMD	0,086	26,316
Corythornis cristatus	Kingfisher, Malachite	Unlisted	Unlisted	CWD	0,006	2,632
Cossypha caffra	Robin-chat, Cape	Unlisted	LC	OMD	0,006	2,632
Crithagra albogularis	White-throated Canary	LC	LC	GGD	0,017	2,632
Crithagra flaviventris	Canary, Yellow	Unlisted	LC	GGD	0,017	2,632
Emberiza capensis	Bunting, Cape	Unlisted	LC	OMD	0,006	2,632
Eupodotis vigorsii	Korhaan, Karoo	NT	LC	OMD	0,126	34,211
Himantopus himantopus	Stilt, Black-winged	Unlisted	LC	IWD	0,034	2,632
Hirundo dimidiata	Swallow, Pearl-breasted	Unlisted	LC	IAD	0,011	2,632
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC	IAD	0,006	2,632
Melaenornis infuscatus	Flycatcher, Chat	Unlisted	LC	IGD	0,011	5,263
Melaniparus afer	Tit, Grey	Unlisted	Unlisted	IGD	0,006	2,632
Melierax canorus	Goshawk, Southern Pale Chanting	Unlisted	LC	CGD	0,011	2,632
Motacilla capensis	Wagtail, Cape	Unlisted	LC	IGD	0,011	2,632
Neotis ludwigii	Bustard, Ludwig's	EN	EN	OMD	0,006	2,632
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC	OMD	0,006	2,632
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC	GGD	0,023	2,632
Passer domesticus	Sparrow, House	Unlisted	LC	GGD	0,034	2,632
Passer melanurus	Sparrow, Cape	Unlisted	LC	GGD	0,097	7,895
Pternistis capensis	Spurfowl, Cape	Unlisted	LC	OMD	0,006	2,632
Pterocles namaqua	Sandgrouse, Namaqua	Unlisted	LC	GGD	0,034	2,632

Spilopelia senegalensis	Dove, Laughing	Unlisted	LC	GGD	0,006	2,632
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC	GGD	0,017	2,632
Tadorna cana	Shelduck, South African	Unlisted	LC	OMD	0,017	2,632
Tricholaema leucomelas	Barbet, Acacia Pied	Unlisted	LC	OMD	0,006	2,632
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC	IWD	0,006	2,632

14.3 Appendix C: Avifaunal species recorded in the summer survey

Common Name	Scientific Name	RD (Regional, Global)	Guild code	Relative abundance	Frequency
African Pipit	*Anthus cinnamomeus*		IGD	0,003	3,922
African Red-eyed Bulbul	*Pycnonotus nigricans*		OMD	0,003	1,961
African Reed Warbler	*Acrocephalus baeticatus*		IWD	0,001	1,961
African Sacred Ibis	*Threskiornis aethiopicus*		CGD	0,001	1,961
Amur Falcon	*Falco amurensis*		CGD	0,014	1,961
Bokmakierie	*Telophorus zeylonus*		OMD	0,010	9,804
Cape Clapper Lark	*Mirafra apiata*		OMD	0,011	5,882
Cape Crow	*Corvus capensis*		OMD	0,006	5,882
Cape Sparrow	*Passer melanurus*		GGD	0,003	3,922
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*		GGD	0,004	5,882
Cape Wagtail	*Motacilla capensis*		IGD	0,001	1,961
Capped Wheatear	*Oenanthe pileata*		IGD	0,006	5,882
Chestnut-vented Tit-Babbler (Warbler)	*Curruca subcoerulea*		IGD	0,001	1,961
Common Quail	*Coturnix coturnix*		OMD	0,001	1,961
Egyptian Goose	*Alopochen aegyptiaca*		HWD	0,001	1,961
Greater Striped Swallow	*Cecropis cucullata*		IAD	0,004	3,922
Grey-backed Cisticola	*Cisticola subruficapilla*		IGD	0,006	3,922
Grey-backed Sparrow-lark	*Eremopterix verticalis*		GGD	0,103	47,059
Hadeda (Hadada) Ibis	*Bostrychia hagedash*		OMD	0,001	1,961
Karoo Chat	*Emarginata schlegelii*		IGD	0,013	17,647
Karoo Korhaan	*Eupodotis vigorsii*	NT, LC	OMD	0,032	27,451
Karoo Long-billed Lark	*Certhilauda subcoronata*		IGD	0,045	39,216
Karoo Prinia	*Prinia maculosa*		IGD	0,007	9,804
Karoo Scrub Robin	*Cercotrichas coryphoeus*		IGD	0,006	7,843
Large-billed Lark	*Galerida magnirostris*		IGD	0,007	5,882
Lark-like Bunting	*Emberiza impetuani*		GGD	0,070	47,059
Lesser Kestrel	*Falco naumanni*		CGD	0,140	5,882
Lesser Swamp Warbler	*Acrocephalus gracilirostris*		IGD	0,001	1,961
Lilac-breasted Roller	*Coracias caudatus*		IAD	0,001	1,961
Malachite Sunbird	*Nectarinia famosa*		NFD	0,001	1,961
Namaqua Dove	*Oena capensis*		GGD	0,011	7,843
Namaqua Warbler	*Phragmacia substriata*		IGD	0,006	3,922
Neddicky	*Cisticola fulvicapilla*		IGD	0,003	3,922
Nicholson's Pipit	*Anthus nicholsoni*		IGD	0,006	3,922
Pale Chanting Goshawk	*Melierax canorus*		CGD	0,001	1,961
Pied Crow	*Corvus albus*		OMD	0,107	49,020
Pin-tailed Whydah	*Vidua macroura*		GGD	0,003	1,961

Pririt Batis	*Batis pririt*	IGD	0,001	1,961
Red-backed Shrike	*Lanius collurio*	IGD	0,001	1,961
Red-billed Quelea	*Quelea quelea*	GGD	0,235	9,804
Red-faced Mousebird	*Urocolius indicus*	FFD	0,021	3,922
Red-knobbed coot	*Fulica cristata*	HWD	0,001	1,961
Rufous-eared Warbler	*Malcorus pectoralis*	IGD	0,004	1,961
Sabota Lark	*Calendulauda sabota*	OMD	0,001	1,961
Southern Masked Weaver	*Ploceus velatus*	GGD	0,003	3,922
Southern Red Bishop	*Euplectes orix*	GGD	0,006	3,922
Spike-heeled Lark	*Chersomanes albofasciata*	IGD	0,017	9,804
Three-banded Plover	*Charadrius tricollaris*	IWD	0,001	1,961
Tractrac Chat	*Emarginata tractrac*	IGD	0,004	3,922
Wattled Starling	*Creatophora cinerea*	OMD	0,040	1,961
White-rumped Swift	*Apus caffer*	IAD	0,008	3,922
White-throated Canary	*Crithagra albogularis*	GGD	0,008	3,922
White-throated Swallow	*Hirundo albigularis*	IAD	0,001	1,961
Yellow-billed Duck	*Anas undulata*	HWD	0,003	1,961
Zitting Cisticola	*Cisticola juncidis*	IGD	0,003	3,922

Incidental Records

Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*
Karoo Long-billed Lark	*Certhilauda subcoronata*
African Red-eyed Bulbul	*Pycnonotus nigricans*
Helmeted Guineafowl	*Numida meleagris*
Neddicky	*Cisticola fulvicapilla*
Zitting Cisticola	*Cisticola juncidis*
Grey-backed Cisticola	*Cisticola subruficapilla*
Nicholson's Pipit	*Anthus nicholsoni*
Southern (Common) Fiscal	*Lanius collaris*
Cape Bunting	*Emberiza capensis*
Karoo Chat	*Emarginata schlegelii*
European Bee-eater	*Merops apiaster*
Cape Clapper Lark	*Mirafra apiata*
Rufous-eared Warbler	*Malcorus pectoralis*
Speckled Pigeon	*Columba guinea*
African Pipit	*Anthus cinnamomeus*
Lanner Falcon	*Falco biarmicus*
Cape Crow	*Corvus capensis*
Reed Cormorant	*Microcarbo africanus*
Common (Steppe) Buzzard	*Buteo buteo*

Amur Falcon	*Falco amurensis*	
African Rock Pipit	*Anthus crenatus*	
Booted Eagle	*Hieraaetus pennatus*	
Spike-heeled Lark	*Chersomanes albofasciata*	
Greater Kestrel	*Falco rupicoloides*	
Crowned Lapwing	*Vanellus coronatus*	
Tractrac Chat	*Emarginata tractrac*	
Acacia Pied Barbet	*Tricholaema leucomelas*	
Sclater's Lark	*Spizocorys sclateri*	
Common Swift	*Apus apus*	
Sabota Lark	*Calendulauda sabota*	
Blue Crane	*Grus paradisea*	NT, VU

14.4 Appendix D:Impact Assessment Methodology

Methodology

Potential impacts were evaluated against the data captured during the desktop and field assessment to identify relevance to the Project area. The relevant impacts associated with the proposed development were then subjected to a prescribed impact assessment methodology which is described below.

Impacts were assessed in terms of the construction and operational phases. The operational phase refers to that phase of the project where the construction has been completed and the development is completed. Due to the nature of this development, the operational phase is assessed as lasting indefinitely and there is no closure or post-closure phases in this scenario.

Mitigation measures were only applied to impacts deemed relevant based on the impact analysis. The likelihood and consequence descriptors are presented in Table 14-1 and Table 14-2. The significance rating matrix is presented in Table 14-3.

Table 14-1 Likelihood descriptors

Probability of impact	Rating
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	**Rating**
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

Table 14-2 Consequence Descriptors

Severity of impact	Rating
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	**Rating**
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100 ha impacted / Linear features affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear features affected > 3000m	5
Duration of impact	**Rating**
One day to one month: Temporary	1
One month to one year: Short Term	2
One year to five years: Medium Term	3
Life of operation or less than 20 years: Long Term	4
Permanent	5

Table 14-3 Significance Rating Matrix

	CONSEQUENCE (Severity + Spatial Scope + Duration)															
LIKELIHOOD (Frequency of activity + Frequency of impact)	0	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Absent
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	Low
	3	6	9	12	15	18	21	24	27	301	33	36	39	42	45	
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	Moderate
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	

	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	Moderately High
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	High
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	Critical
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	

14.5 CV of Specialist

Lindi Steyn

PhD Biodiversity and Conservation

(*Pr Sci Nat*)

Cell: +27 72 129 3759

Email: Lindi@thebiodiversitycompany.com

Identity Number: 8805250059080

Date of birth: 25 May 1988

Profile Summary

Working experience throughout South Africa and neighbouring countries.

Specialist experience with mining, road development, engineering, renewable energy, protected areas, and biodiversity offsets.

Specialist guidance, support and facilitation for the compliance with legislative processes, for in-country requirements.

Specialist expertise include Avifauna and Terrestrial Ecology.

Areas of Interest

Mining, Oil & Gas, Renewable Energy & Bulk Services Infrastructure Development, Sustainability and Conservation.

Research publication with a conservation influence.

Key Experience

- Environmental Impact Assessment
- Terrestrial Ecological Assessments
- Rehabilitation Plans and Monitoring
- Avifaunal Conservation Surveys
- Conservation Management Plans
- Laboratory analysis
- The use of avifaunal species as indicators of pollution.

Countries worked in

South Africa

Swaziland

Zimbabwe

Lesotho

Nationality

South African

Languages

English – Proficient

Afrikaans – Proficient

Qualifications

- PhD Biodiversity and Conservation, University of Johannesburg, South Africa.
- MSc Biodiversity and Conservation, University of Johannesburg, South Africa.
- BSc Hons Biodiversity and Conservation.
- BSc Botany and Zoology.
- Certificate in Field Guiding, Damelin.
- Certificate in Ecotraining.
- Field Guiding FGASA level 1 certificate (2007).

Birding

SELECTED PROJECT EXPERIENCE

Project Name:

Client: African Grass-owl (*Tyto Capensis*) Study

Personal position / role on project: Avifauna Specialist

Location: Ventersdorp North West (2021)

Main project features: Conduct a Grass Owl screening study for the presence of Grass Owls or habitat in a 10 km area in the Ventersdorp area.

Project Name: Biodiversity baseline, impact review and offset for the proposed Lanseria waste water treatment works

Client: Zitholele

Personal position / role on project: Terrestrial Ecologist/Project Manager

Location: Lanseria Gauteng (2020)

Main project features: Compile a Biodiversity offset plan for the proposed development.

Project Name: Avifauna baseline and impact assessment for the proposed Kwamhlanga to Gemsbok Powerline.

Client: WSP

Personal position / role on project: Terrestrial Ecologist/Avifaunal specialist

Location: Kwamhlanga Mpumalanga (2020)

Main project features: To conduct a terrestrial and avifaunal environmental and impact assessment for the expected impact footprint area.

Project Name: A terrestrial specialist baseline and impact assessment for the Beitbridge Border Crossing upgrade, in the Beitbridge Town, Zimbabwe.

Client: Kongiwe.

Personal position / role on project: Avifaunal specialist

Location: Zimbabwe (Beitbridge) – October 2019

Main project features: To conduct a dry season (winter) ecological baseline and impact assessment for the proposed project. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

Project Name: The Environmental and Social Impact Assessment (ESIA) the proposed Nondvo Dam

Personal position / role on project: Terrestrial Ecologist

Location: Swaziland (2019)

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the proposed dam. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

Project Name: An environmental and impact assessment for the proposed Jozini (N2) road expansion for SANRAL, KwaZulu Natal, South Africa.

Personal position / role on project: Terrestrial Ecologist.

Location: KwaZulu Natal, South Africa (2018).

Main project features: To conduct a terrestrial environmental and impact assessment for the expected impact footprint area.

Project Name: Biodiversity Assessment associated with Greylingstad Waste Water Treatment work and reticulation network, Mpumalanga, South Africa.

Personal position / role on project: Terrestrial Ecologist

Location: South Africa (2018).

Main project features: Conduct a detailed terrestrial ecology basic assessment for the expected impact footprint area.

Project Name: An Environmental and impact assessment for the proposed Kalabasfontein Coal Mining Expansion Project, Mpumalanga, South Africa.

Personal position / role on project: Terrestrial Ecologist/ Avifaunal specialist

Location: Mpumalanga, South Africa (2018)

Main project features: To conduct a terrestrial environmental and impact assessment for the expected impact footprint area.

OVERVIEW

An overview of the specialist technical expertise includes the following:

- Terrestrial Ecological Assessments.
- Faunal surveys which includes mammals, birds, amphibians and reptiles.
- Conservation Plans and Monitoring for terrestrial component.
- Avifaunal surveys.
- Biodiversity offset plans.
- Bioaccumulation assessments for birds
- Toxicity analysis of air dust samples, sediment, water and biota.

EMPLOYMENT EXPERIENCE

- **CURRENT EMPLOYMENT: The Biodiversity Company (May 2018 – Present)**
- I started working at The Biodiversity Company in mid-2018.
- The team at The Biodiversity Company have conducted stand-alone specialist studies and provided overall guidance of studies with a pragmatic approach for the management of biodiversity that takes into account all the relevant stakeholders, most importantly the environment that is potentially affected. We manage risks to the environment to reduce impacts with practical, relevant and measurable methods.
- My roles include:
  - Faunal and Floral surveys for baseline, basic or impact assessments
  - Report writing
  - GIS map work
  - Project management
  - Management Plan compilations
  - Technical assistant for fieldwork for the aquatics and wetland departments
  - Specialist inputs to the above-mentioned services.
-
- **EMPLOYMENT: University of Johannesburg (January 2012 – July 2018)**
- UJ assigned me to the role of laboratory assistant and assistant lecture.
  - Research
  - Report writing
  - Performed toxicity testing on biota, sediment, water and air dust samples.
  - Completed day to day administration of the laboratory.
  - Assisted with field work involving all the different specialist work which includes mammalogy, aquatics and botany.
  - Lectured courses, including parasitology and Biology for teachers
-
- **ACADEMIC QUALIFICATIONS**

University of Johannesburg, Johannesburg, South Africa (2018): PHILOSOPHIAE DOCTOR (PhD) – Biodiversity and Conservation

Title: *The effect of DDT on the histology, reproductive success and overall health of the House Sparrow in designated areas.*

University of Johannesburg, Johannesburg, South Africa (2013): MAGISTER SCIENTIAE (MSc)- Biodiversity and Conservation

Title: Comparative determination of the numbers of four garden bird species, the House Sparrow, *Passer domesticus*, the Cape Glossy Starling, *Lamprotornis nitens*, the Cape Turtle Dove, *Streptopelia capicola* and the Laughing Dove, *Streptopelia senegalensis* in the Johannesburg and Vaalwater areas with study into possible causes of expected declines.

University of Johannesburg, Johannesburg, South Africa (2011): BACCALAUREUS SCIENTIAE CUM HONORIBUS (Hons) – Zoology

Title: The influence of agriculture on selected Mpumalanga Pans.

University of Johannesburg, Johannesburg, South Africa (2010): BACCALAUREUS SCIENTIAE IN NATURAL AND ENVIRONMENTAL SCIENCES. Majors: Zoology and Botany.

Damelin, Bramley, Johannesburg: National Certificate in Field Guiding (Lodge Management) (2007)

Damelin, Bramley, Johannesburg: Field guiding FGASA level 1 certificate (2007)

Damelin, Bramley, Johannesburg: Ecotraining- Karongwe & Selati (2007)

PUBLICATIONS

Steyn, L., Bouwman, H., Maina, J.N. (2018). Associations between DDT and egg parameters of the House Sparrow *Passer domesticus* from the Thohoyandou area of South Africa, Chemosphere.

Steyn, L., Bouwman, H., Maina, J.N. (2018). The effect of DDT and its metabolites on the structure of the shells of the eggs of the House Sparrow, *Passer domesticus*: A morphometric study. 7th International Toxicology Symposium in Africa.

Steyn, L., Bouwman, H., Maina, A.W, Hoffman, J., Maina, J.N. (2018). Bone density and asymmetry are not related to DDT in House Sparrows: insights from micro-focus X-ray computed tomography. Chemosphere.

Steyn, L., Maina, J.N. (2016). Comparison of the numbers of three species of birds in an urban- and a rural area of South Africa and possible relationship to the numbers of free (surface) macrophages in the respiratory systems. Journal of Ornithology

Willoughby, B., Steyn, L., Maina, J.N. (2015). X-ray microcomputed tomography study of the microstructure and the morphometry of the shell of the ostrich, *Struthio camerus*, egg. Anatomical record

Steyn, L., Maina, J.N. (2013). Die verwagte afname van die getalle van vier voël spesie, die Huismossie, Kleinglansspreeu, Gewone Tortelduif en die Rooiborsduifie in Gauteng en Limpopo provinsies en moontelike oorsake van die dalings. Die Suid-Afrikaanse akademie vir wetenskap en kuns afdeling biologiese wetenskappe, Pretoria.