AVIFAUNAL MITIGATIONS FOR THE PROPOSED BETA SOLAR POWER PLANT

SPECIALIST AVIFAUNAL REPORT- JANUARY 2022

First Draft Report

Photo 1 View of part of the proposed footprint area.
Photo: September 2014, R.F. Terblanche.

Prepared For: Environamics

Prepared By: Agreenco Environmental Projects (Pty) Ltd

Agreenco Environmental Projects (Pty) Ltd, Reg No 2012/157824/07
Unit 3 Eulophia Corner, 38 General Van Reyneveld Street, Persequor Park, Pretoria, ✉ 19896 Noordbrug, 2522, SOUTH AFRICA
☎ (012) 8077223, Fax (086) 663 8812, e-mail: info@agreenco.co.za, http://www.agreenco.co.za

Owners: HJM Nkosi, SJ Steenekamp, SJ van Wyk, AS Haagner

PROJECT INFORMATION

Project Title	Proposed avifaunal mitigations for the Proposed Beta Solar Power Plant
Client	Environamics
Contact person	Ms. Marèlie Botha marelie@environamics.co.za 082 220 8651
Service Provider	Agreenco Environmental Projects (Pty) Ltd Reg number: 2012/157824/07 VAT number: 4460236146
Physical Address	Unit 3 Eulophia Corner 38 General van Reyneveld Street Persequor Park Pretoria 0020
Postal Address	PO Box 19896 Noordbrug 2522
Project Number	C0217
Document compiled by:	ASH Haagner (M.Sc., Pr.Sci.Nat 400136/13)
Submission Dates	First Draft- 22 January 2022

Table of contents

Table of figures

List of tables

1 DECLARATION OF INDEPENDENCE AND QUALITY

This report is free of any external prejudice or influence and is dedicated to prescribing mitigations to protect undue impacts on the avifaunal community at the proposed Beta Solar Power Plant site near Hertzogville in the Free State Province of South Africa. All the work herein has been conducted by Agreenco Environmental Projects.

2 TERMS OF REFERENCE

Agreenco Environmental Projects (Pty) Ltd (Agreenco) was requested to provide a quotation to assist Environamics in proposing avifaunal mitigations on the proposed Beta SPP on a purely desktop basis. A prior ecological assessment was undertaken by a different specialist in 2014, although avifaunal-specific fieldwork was extremely limited, with no specific mitigations mentioned for avifauna.

The 2014 Environamics Scoping Study report was used for project descriptions, and data were gleaned from the SABAP2 database.

3 STUDY LIMITATIONS

- The specialist compiling this set of recommended mitigations has not been to the specific site, nor undertaken any assessments of the on-site avifauna. Total reliance for data relating to bid occurrences is gleaned from SABAP2 datasets, and the 2014 ecological report for the site. Hence, this is purely a desktop exercise.
- Due to the lack of site data, the recommendations will be generic by necessity and will err on the conservative side.
- We relied entirely on Environamics, as the EAP, to supply correct information on the site locality and extent, as well as project details. We assume that these are correct.
- The impacts of solar developments on avifauna are not completely understood in South Africa and are hampered by good monitoring data to evaluate the effectiveness of proposed mitigations.
- No cumulative assessment was undertaken, as no information was supplied for similar projects within a 30 km radius of the project site.

4 INTRODUCTION

Environamics has been appointed to undertake the environmental authorisation applications for the proposed Beta Solar Power Plant (SPP) and has retained the services of Agreenco to assist in recommending avifauna-specific mitigation measure that can be implemented.

4.1 Project description

The scoping document does not comprise maps or project layouts.
The proposed SPP will consist of a 84 MW photovoltaic solar facility, with associated infrastructure, on a section of the farm Talana 1241, near Hertzogville in the Free State Province. (Figure 1).

Figure 1 Map of larger area with indication of the location of the proposed footprint area.

Red outline	Boundaries of the farm
Grey area	Area of proposed footprint

Map information were analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2014, licenced software bought by the author of this document).

Figure 1. Locality of the proposed Beta SPP development site, from 2014 (Reinier Terblanche)

The total development footprint will cover approximately 180 Ha and the infrastructure is expected to consist of:

- A 180 Ha 84 MW array of ~3.5 m high photovoltaic solar panels that track sunlight and change orientation throughout the day.
- An on-site substation.
- Access and management roads of unspecified length.
- Auxiliary buildings.
- A external boundary fence.
- An internal power line of ~32 m length and ~4 m height.

No power-line routes were provided or assessed and are excluded from the mitigation recommendations.

4.2 Site description

As indicated above, the site is located between Hertzogville and Bultfontein in the Free State Province (Figure 1). It is surrounded by a matrix of extensive grazing farms, and is bordered by a provincial road (R708, south). Most habitats appear relatively natural from the site photos supplied and reconnaissance of satellite imagery.

Climate

A summary diagram of the climate encountered within the Western Free State Clay Grassland Gh9 type (which dominates the proposed development site) is shown in Figure 2 below. The climate is strongly seasonal and semi-arid, with an average rainfall volume of 451 mm/annum, falling between October and May. The summers are hot and wet, with summer temperatures ranging typically between 17-30°C. The winters are cold and dry, with wintertime temperatures ranging typically between -1 to 16°C. An average of 37 frost days occur each winter. The soils are perpetually moisture stressed, with mean annual evaporation of 2,494 mm.

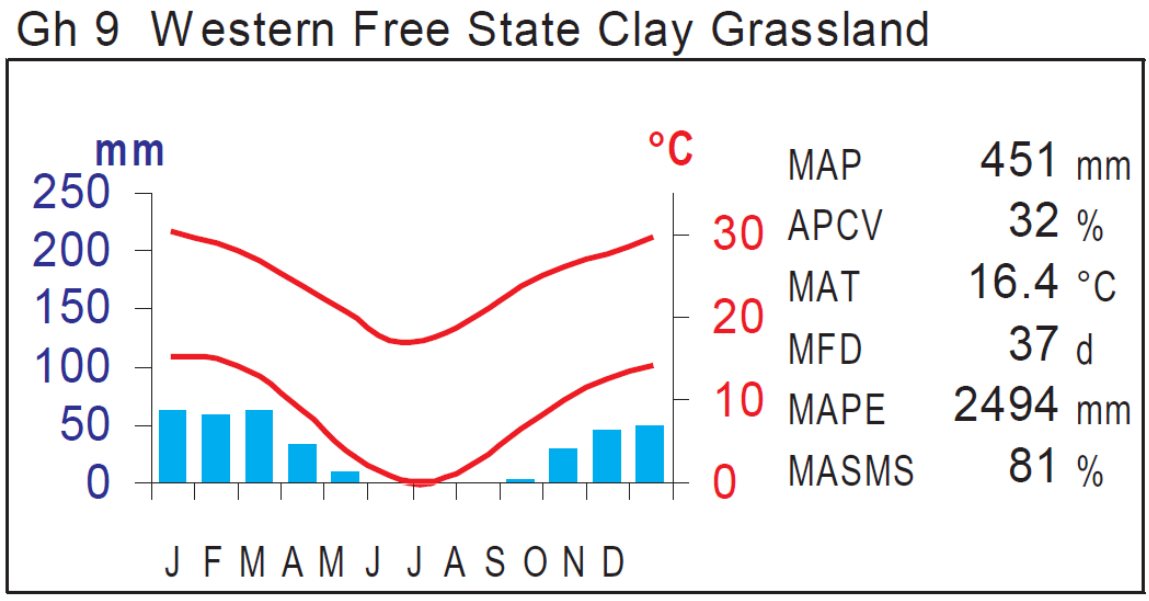

Figure 2. Climatic diagram representative of the Beta SPP area (Mucina & Rutherford, 2007)

Geology and soils

The underlying geology is predominantly alluvial deposits of shales, mudstone and sandstone.

Vegetation

There is one vegetation type according to maps, namely Western Free State Clay Grassland Gh9, which is considered Least Concern from a threat status perspective. Gh19 areas are grassland dominated, with some low shrubs and herbaceous plants present. Dominant grasses include *Aristida* and *Eragrostis* species, with *Themeda triandra* and *Cynodon dactylon*.

The following table is extracted from the 2014 ecological assessment report (Table 1).

HABITAT FEATURE	DESCRIPTION
Topography	The footprint proposed for the development is situated on very gentle slopes (flatlands).
Rockiness	No rocky ridges are present. Few patches of rocks are present.
Presence of wetlands	No wetlands are present at the proposed footprint.
Vegetation	Some small restricted bushclumps that mainly consist of *Searsia lancea* (Karee) and *Acacia karroo* (Sweet Thorn) trees are present but most of the site consists of grassland and shrubs. Shrubs and dwarf shrubs include *Gnidia polycephala, Chrysocoma ciliata, Pentzia* species and *Felicia* species. Most conspicuous taller shrub at the site is *Hertia pallens* (Springbokbos). Grassland with does not appear dense. Conspicuous grass species include *Aristida congesta* subsp. *barbicollis, Eragrostis lehmanniana* and *Cynodon dactylon. Themeda triandra* also occurs where the grass cover appears higher and in some areas a visible high cover of *Elionurus muticus* is witnessed.
Signs of disturbances	Overall the grass cover is moderate or low, there are dirt tracks and fences as part of a managed grazing system.
Connectivity of natural vegetation in the site and between the site and surrounding areas	The proposed footprint does not appear to be part of a corridor of particular conservation importance.

Table 1. Habitat and vegetation features for the proposed Beta SPP site, from 2014 Reinier Terblanche.

4.3 Why would a significant bird population occur at a site like Beta?

The general area in which the proposed Beta SPP site occurs does not harbour especially high numbers of bird species, nor populations of endemic, range-restricted or protected species. There are no Important Bird Areas (IBAs).

Notwithstanding the above, the DFFE screening tool outputs (Figure 3 and Figure 4) provided an avifaunal risk ranking for the site as having Low Sensitivity. However, the animal risk ranking does comprise areas of Medium Sensitivity due to the prior presence of Ludwig's Bustard (Endangered).

MAP OF RELATIVE AVIAN THEME SENSITIVITY

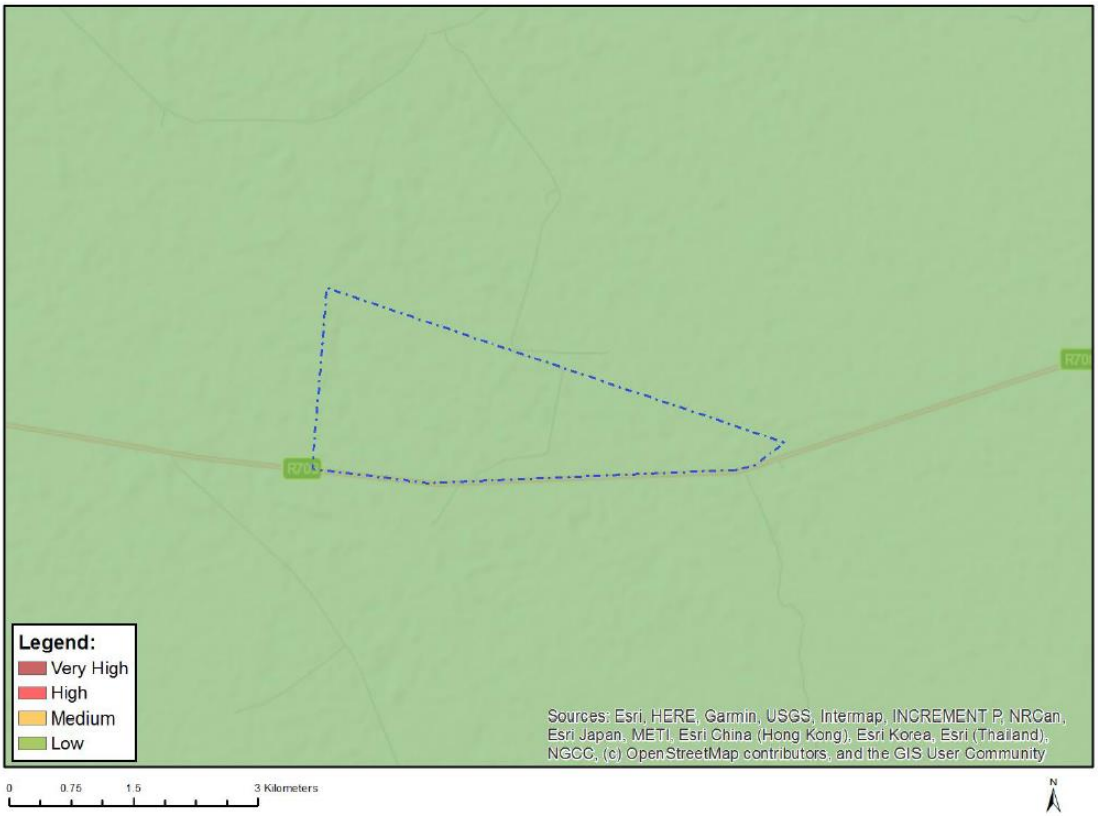

Figure 3. DFFE screening tool outputs of avifaunal sensitivity for the proposed Beta SPP site

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY

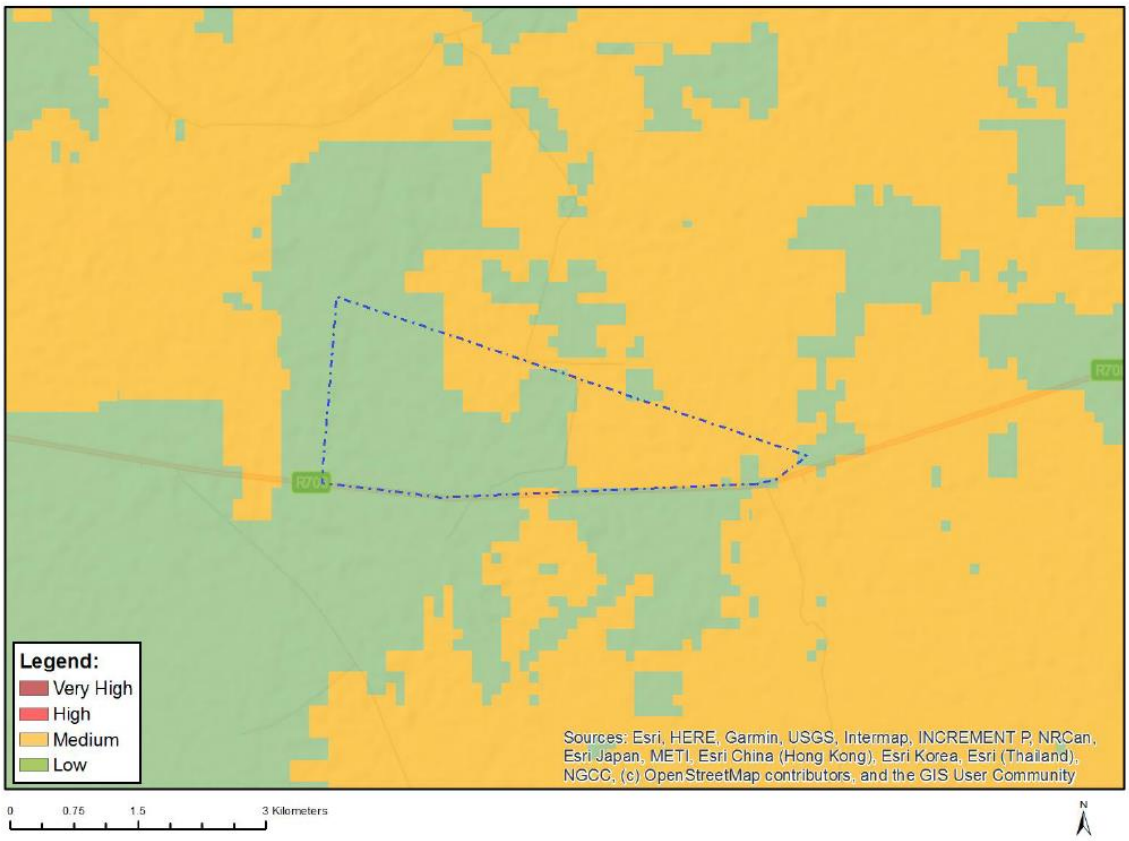

Figure 4. DFFE screening tool outputs of animal sensitivity for the proposed Beta SPP site (Ludwig's Bustard)

5 BASELINE DESCRIPTION OF THE AVIFAUNAL COMMUNITY

5.1 SABAP2 data

The Second South African Bird Atlas Project (SABAP2), an initiative of the Animal Demography Unit of the University of Cape Town, was consulted or data collected for the pentads in which the site is situated. There are four pentads that bisect the site, namely 2805_2535 (which has 1 atlas assessment recording 25 species in April 2010), 2805_2540 (which has 2 atlas assessments recording 51 species in June 2016 and December 2020), 2810_2535 (which has 0 atlas assessments recording 107 species in May 2011 and December 14) and 2810_2540 (which has 2 atlas assessment recording 43 species in March 2016), shown in Figure 5. Each pentad occupies approximately 7,700 Ha, whereas the total development site is 180 Ha. The pentads both cover much greater habitat diversity and comprise hills and pan habitats as well, which will substantially increase the species counts. These species counts should not be expected for the development site.

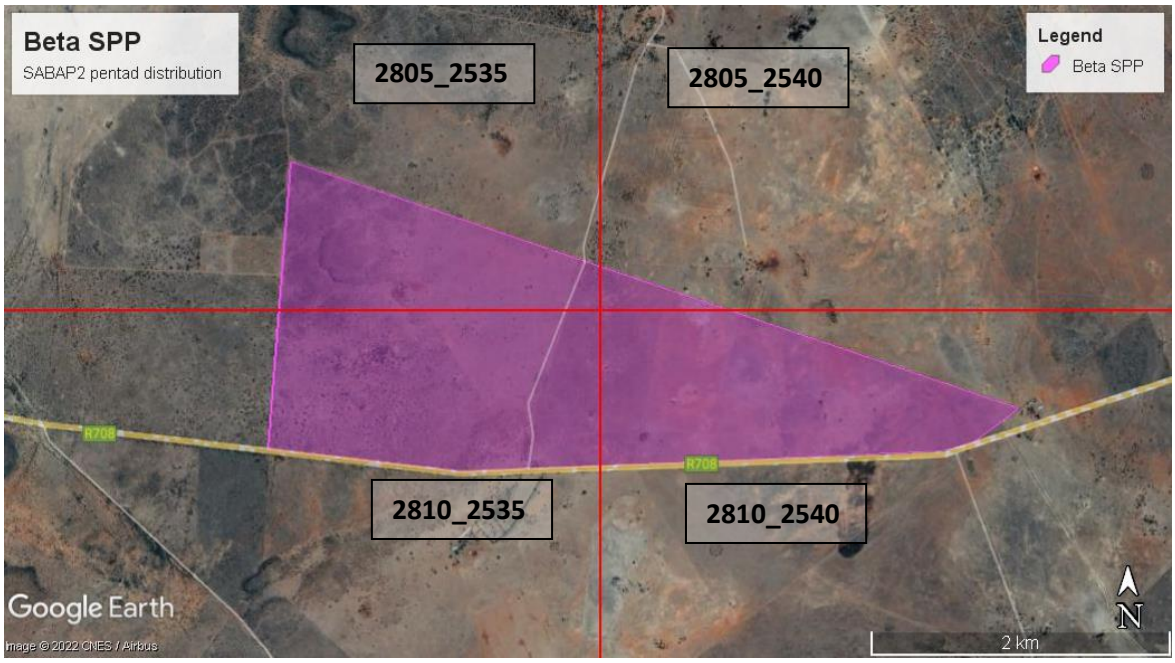

Figure 5. Location and extent of SABAP2 pentads relative to the proposed Beta SPP site

The total lists from the pentads were used to represent a conservative assessment of birds that utilise he general area (Table 2), which yields 125 combined species for the four pentads.

Following the assessment regime protocols suggested by BirdLife South Africa (Jenkins *et al*, 2017), the site should be considered for Regime 2 (large >150 Ha and screened as Low avifaunal sensitivity). We would recommend post-construction monitoring conditions.

Table 2. List of avifaunal species recorded during SABAP2 assessments for the wider pentads

No	Species	No	Species
1	Acacia Pied Barbet	44	Crowned Lapwing
2	African Hoopoe	45	Desert Cisticola
3	African Pipit	46	Diederik Cuckoo
4	African Red-eyed Bulbul	47	Double-banded Courser
5	African Sacred Ibis	48	Dusky Sunbird
6	African Stonechat	49	Eastern Clapper Lark
7	Amur Falcon	50	Egyptian Goose
8	Ant-eating Chat	51	European Bee-eater
9	Ashy Tit	52	Fairy Flycatcher
10	Barn Swallow	53	Familiar Chat
11	Black Stork	54	Fawn-colored Lark
12	Black-chested Prinia	55	Fiscal Flycatcher
13	Black-chested Snake Eagle	56	Greater Kestrel
14	Black-faced Waxbill	57	Greater Striped Swallow
15	Black-headed Heron	58	Green-winged Pytilia
16	Blacksmith Lapwing	59	Grey Heron
17	Black-throated Canary	60	Grey-backed Sparrow-Lark
18	Black-winged Kite	61	Hadada Ibis
19	Black-winged Stilt	62	Helmeted Guineafowl
20	Blue Korhaan	63	House Sparrow
21	Bokmakierie	64	Kalahari Scrub Robin
22	Brown-crowned Tchagra	65	Kori Bustard
23	Brown-throated Martin	66	Lark-like Bunting
24	Brubru	67	Laughing Dove
25	Cape Longclaw	68	Lesser Kestrel
26	Cape Penduline Tit	69	Little Grebe
27	Cape Robin-Chat	70	Little Swift
28	Cape Shoveler	71	Long-billed Crombec
29	Cape Sparrow	72	Long-tailed Widowbird
30	Cape Starling	73	Marsh Owl
31	Cape Turtle Dove	74	Melodious Lark
32	Cape Wagtail	75	Mountain Wheatear
33	Capped Wheatear	76	Namaqua Dove
34	Cardinal Woodpecker	77	Neddicky
35	Chat Flycatcher	78	Northern Black Korhaan
36	Chestnut-vented Warbler	79	Orange River White-eye
37	Cinnamon-breasted Bunting	80	Pale Chanting Goshawk
38	Cloud Cisticola	81	Pied Avocet
39	Common Buzzard	82	Pied Crow
40	Common Moorhen	83	Pin-tailed Whydah
41	Common Quail	84	Pririt Batis
42	Common Scimitarbill	85	Quailfinch
43	Crested Barbet	86	Rattling Cisticola

No	Species	No	Species
87	Red-billed Firefinch	107	Southern Masked Weaver
88	Red-billed Quelea	108	Southern Red Bishop
89	Red-billed Teal	109	Speckled Pigeon
90	Red-breasted Swallow	110	Spike-heeled Lark
91	Red-crested Korhaan	111	Spotted Thick-knee
92	Red-eyed Dove	112	Spur-winged Goose
93	Red-faced Mousebird	113	Swainson's Spurfowl
94	Red-headed Finch	114	Three-banded Plover
95	Red-knobbed Coot	115	Wattled Starling
96	Rock Dove	116	Western Cattle Egret
97	Rufous-naped Lark	117	White Stork
98	Sabota Lark	118	White-backed Mousebird
99	Scaly-feathered Weaver	119	White-backed Vulture
100	Secretarybird	120	White-browed Sparrow-Weaver
101	Shaft-tailed Whydah	121	White-rumped Swift
102	Sickle-winged Chat	122	Yellow Canary
103	Sociable Weaver	123	Yellow-bellied Eremomela
104	South African Cliff-Swallow	124	Yellow-billed Duck
105	Southern Fiscal	125	Yellow-crowned Bishop
106	Southern Grey-headed Sparrow		

**Italics denotes endemic species*

***Bold denotes Red Data species**

5.2 General species description

The typical species occurring in the four wider pentads are common across the western highveld, with good representation from the widespread larks, pipits, cisticolas, finches, widowbirds, bishops, and whydahs in particular. Aerial feeding swallows, and swifts were also well represented. Raptors and game birds were well represented.

5.3 Species of conservation importance

The IUCN uses 9 categories of conservation status to apply across taxa (IUCN, 2001). These are summarised in Table 3. The assessment of Red Data status follows Taylor (2015) and the ESKOM Red Data Book of Birds of South Africa, Lesotho and Swaziland.

Table 3. *IUCN red-list conservation criteria.*

Extinct	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), and throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

Extinct in the Wild	A taxon is extinct in the wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed extinct in the wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), and throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered	A taxon is critically endangered when the best available evidence indicates that it meets any of the criteria for critically endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered	A taxon is endangered when the best available evidence indicates that it meets any of the criteria for endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable	A taxon is vulnerable when the best available evidence indicates that it meets any of the criteria for vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened	A taxon is near threatened when it has been evaluated against the criteria but does not qualify for critically endangered, endangered or vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern	A taxon is least concern when it has been evaluated against the criteria and does not qualify for critically endangered, endangered, vulnerable or near threatened. Widespread and abundant taxa are included in this category.
Data Deficient	A taxon is data deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate.
Not Evaluated	A taxon is not evaluated when it is has not yet been evaluated against the criteria.

There are Red Data species that could possibly occur on site, even as vagrants and the likelihood of their occurrence must be assessed. The potential red data species for the Beta site, along with probability estimates and notes are presented below. Note- wetland species are excluded.
No Red Data species were recorded during the 2014 ecological survey, although suitable habitat does exist on site for the following species:

- *Secretarybird*- Vulnerable. Recorded in one the pentads during prior SABAP2 assessments and habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.

- *Black Stork*- Vulnerable. Recorded in one of the pentads during prior SABAP2 assessments but habitat on site does not appear suitable, and, therefore, should be expected to have a very low likelihood of occasionally occurring on site.
- *Kori Bustard*- Vulnerable. Recorded in one of the pentads during prior SABAP2 assessments and habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- *White-backed Vulture*- Critically Endangered. Recorded in one of the pentads during prior SABAP2 assessments and habitat on site appears suitable, and, therefore, should be expected to have at least a low likelihood of occasionally occurring on site. if animal carcases are present.

- *Lanner Falcon*- Vulnerable. Not recorded in the pentads but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- *Ludwig's Bustard*- Endangered. Not recorded in the pentads but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- *Martial Eagle*- Endangered. Not recorded in the pentads but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- *Burchell's Courser*- Vulnerable. Not recorded in the pentads or during the site visit but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- *Black Harrier*- Endangered. Not recorded in the pentads. Habitat suitability is marginal on the SPP site, thus has very low likelihood of sporadic occurrence.
- *Blue Crane*- Near-Threatened. Not recorded in the pentads but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site.
- *Abdim's Stork*- Near-Threatened. Not recorded in the pentads but habitat on site appears suitable, and, therefore, should be expected to have at least a reasonable likelihood of occasionally occurring on site
- *Black-winged Pratincole*- Near Threatened. Not recorded in the pentads. Habitat suitability is marginal on the SPP site thus has very low likelihood of sporadic occurrence.
- *European Roller*- Near-Threatened. Not recorded in the pentads. Habitat suitability is marginal on the SPP site thus has very low likelihood of sporadic occurrence.

The Red Data species listed above as occurring in the wider area or having reasonable likelihood of even occasional occurrence will be considered in the impact assessment and the methodology for mitigations.

5.4 Range-restricted or endemic species

South Africa has a rich diversity of nationally and regionally endemic species that are found nowhere else on earth and, therefore, warrant consideration for assessment of sensitivity to potential developments.

The following endemic or near-endemic (most of the global range is within South Africa's borders) species were recorded during prior SABAP2 assessments:

- *Cloud Cisticola*- Near-endemic.
- *Fiscal Flycatcher*- Near-endemic.
- *Melodious Lark*- Near-endemic.
- *South African Cliff Swallow*- Breeding Endemic to South Africa, Lesotho and Swaziland.
- *Sickle-winged Chat*- Near-endemic.
- *Blue Korhaan*- Breeding Endemic to South Africa, Lesotho and Swaziland.
- *Fairy Flycatcher*- Near-endemic.

All of these endemic or near-endemic species listed above that have been recorded during past SABAP2 assessments have wide distributional ranges and reportedly healthy populations and should not present any substantial threats as a result of development of this site.

6 METHODS

6.1 Methodology

It is reiterated here that no formal avifaunal assessments were undertaken for the proposed Beta SPP site. An informal ecological assessment was undertaken in 2014 by Reinier Terblanche, however no specific bird lists were produced.

All data have been gleaned from the SABAP2 assessments for the four wider pentads that bisect the site. This is purely a desk-top exercise.

7 IMPACTS OF SOLAR PLANTS ON AVIFAUNA

BirdLife South Africa has a strong position statement on the impacts of solar power generation on birds but favours the technology and methodology above wind and fossil fuels. Their main concerns involve the displacement and exclusion of globally or nationally threatened bird species, endemic or range-restricted species, or rare species from important habitats. The issues stemming from their position statement and contemporary studies are as follows:

1. Displacement of threatened species from important habitats;
2. Loss of habitat for resident species, especially where cumulative impacts exist;
3. Disturbance of resident species throughout construction, operation and maintenance;
4. Collisions with photovoltaic panels;
5. Reflective surfaces of panels creating a mirror affect and possibly attracting waterbirds;
6. Electrocution and collision at powerline infrastructure;
7. New powerline construction.

They suggest the following course of actions in terms of mitigating the impacts on birds:

- Undertaking sufficient pre-construction monitoring to determine the presence of threatened, rare, endemic or range-restricted species. SABAP2 data is recommended to supplement adequate field surveys.
- Constructing PV plants close to existing power lines and, if new lines are required, motivate the need for lines to be adequately marked with anti-collision devices and bird-friendly designs to prevent electrocution.
- Not constructing PV plants in formally or informally protected areas or Important Bird Areas (IBAs), but in areas of low relevance for nature conservation.
- Constructing PV plants in already degraded areas.
- Avoiding construction near drainage lines with trees where birds will be concentrated (e.g., in Karoo where most PV plant are likely to be constructed).
- Avoiding construction near large trees (e.g., in the Karoo) which serve as nesting and roosting sites for raptors and vultures.
- Building solar arrays outside known waterbird flight paths.
- Not using chemicals/pesticides for the maintenance of land/vegetation and rather use mowing or grazing to retard vegetation growth.
- Constructing new power lines in such a way that they have minimal impact on birds (i.e., bird-friendly designs, appropriate wire marking devices).
- Deconstruction of the plant after the expected economic life span

The impacts that were considered relevant to the proposed Beta SPP development and that have been included in the impact assessment for scoring are shown in Table 4 for the PV array (with associated infrastructure).

Table 4. Avifaunal impacts specific to the Beta PV areas and associated infrastructure as used in the impact ratings

Avifaunal impacts specific to the Beta PV areas and infrastructure	
Displacement of priority avian species from important habitats.	The area is not within an IBA; however, and has been identified as 'Low Avian Sensitivity' by DFFE's screening tool, however it carries 'Moderate Animal Sensitivity' for the reported presence or core range of the Endangered Ludwig's Bustard. Some priority species were recorded for the wider SABAP2 pentads (**Black Stork, Kori Bustard, Secretarybird** and **White-backed Vulture**) or have a reasonable chance of at least occasional occurrence based on habitat and distribution (**Black Harrier, Ludwig's Bustard, Martial Eagle, Abdim's Stork, European Roller, Black-winged Pratincole, Blue Crane, Burchell's Courser, and Lanner Falcon**).
	These impacts are expected to start during the construction phase, will last through the operational phase, into and after decommissioning. The habitats are likely to be directly impacted/disturbed and the increased disturbance is likely to deter protected species from accessing the area.
	These impacts have unknown cumulative status.
Displacement of resident avifauna through increased disturbance.	The wider avifaunal community is diverse, with numerous endemic or near-endemic species that have been recorded in the wider SABAP2 pentads (*Cloud Cisticola, Fairy Flycatcher, Fiscal Flycatcher, Sickle-winged Chat, South African Cliff Swallow, Blue Korhaan, Melodious Lark*).
	These impacts are expected to start during the construction phase, will last through the operational phase, into and after decommissioning. Many of the resident species are expected to be displaced, either temporarily or permanently, due to the habitat transformation and ongoing human presence and disturbance.
	These impacts have unknown cumulative status.
Loss of important avian habitats	Portions of the site occurs in an area considered by DFFE's screening tool as having 'Moderate Animal Sensitivity' (Ludwig's Bustard). These areas were expected to be disturbed and transformed during construction.
	These impacts are expected to start during the construction phase, will last through the operational phase, into and after decommissioning. The transformation of some of the avian habitats will be permanent
	These impacts have unknown cumulative status.
Collisions with PV panels leading to injury or loss of avian life	The panels are reported to either be built with fixed inclinations or to be built with variable inclination so as to track the sun movement. At times, these panels will be horizontal, potentially attracting birds through the 'lake effect'. At other times, the panels may be horizontal, and, during the day, they may create a mirror effect and result in bird collisions, or, at night, may result in collisions with migrating birds.
	These impacts are expected to start during the construction phase, will last through the operational phase, but will cease upon decommissioning and demolition.

Avifaunal impacts specific to the Beta PV areas and infrastructure	
	These impacts have unknown cumulative status.

**Italics denotes endemic or near-endemic species*

***Bold denotes Red Data species**

8 IMPACT ASSESSMENT RATINGS

The methodology for assessing the impact ratings was supplied by Environamics as the EAP for the proposed SPP project.

The methodology is included as Appendix A: Method of Environmental Assessment at the end of this report. The rating rankings are as shown in Table 5 below.

The findings of the impact assessment ratings are shown in Table 6 for the PV array.

Table 5. Impact rating scoring used for the avifaunal impact assessment at the proposed Beta SPP site

Rating	Rating explanation
6-28	Low- negative
29-50	Medium- negative
51-73	High- negative
74-96	Very high- negative

Table 6. Avifaunal impact ratings for the PV array and associated infrastructure at the proposed Beta SPP site

PROPOSED BETA SPP IMPACT RATING FOR PV ARRAY AND ASSOCIATED INFRASTRUCTURE **Description of risk and suggested mitigation**	**Applicable project phase**	**Probability**	**Duration**	**Extent**	**Reversibility**	**Irreplaceability**	**Cumulative effects**	**Total**	**Intensity/ Magnitude**	**Significance (unmitigated)**	**Significance (mitigated)**	**Before mitigation**	**After mitigation**
Displacement of priority avian species from important habitats	Construc-tion	3	2	1	3	3	2	14	3	42		Medium-negative	
Mitigated displacement: limit construction footprint and retain indigenous vegetation wherever possible, limit access to remainder of area, avoid breeding season (summer), lay-down areas on only disturbed zones, construct in shortest timeframe, control noise to minimum		1	1	1	2	2	2	9	3		27		Low-negative
Displacement of resident avifauna through increased disturbance	Construc-tion	4	2	1	2	2	2	13	3	30		Medium-negative	
Mitigated displacement: limit construction footprint and retain indigenous vegetation, limit access to remainder of area, avoid breeding season (summer), lay-down areas on only disturbed zones, construct in shortest timeframe, control noise to minimum		2	1	1	1	2	2	9	3		22		Low-negative
Loss of important avian habitats	Construc-tion	3	2	1	3	3	3	16	2	32		Medium-negative	
Mitigated habitat loss: limit construction footprint, limit access to remainder of area, lay-down areas on only disturbed zones, construct in shortest timeframe, use existing roads as far as possible, rehabilitate with native vegetation		2	2	1	2	2	2	12	2		24		Low-negative
Displacement of priority avian species from important habitats	Operation	3	3	1	3	2	3	15	3	45		Medium-negative	

PROPOSED BETA SPP IMPACT RATING FOR PV ARRAY AND ASSOCIATED INFRASTRUCTURE **Description of risk and suggested mitigation**	**Applicable project phase**	**Probability**	**Duration**	**Extent**	**Reversibility**	**Irreplaceability**	**Cumulative effects**	**Total**	**Intensity/ Magnitude**	**Significance (unmitigated)**	**Significance (mitigated)**	**Before mitigation**	**After mitigation**
Mitigated displacement: limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with native vegetation, limit roadways and vehicle speeds		2	3	1	2	2	2	12	3		36		Medium-negative
Displacement of resident avifauna through increased disturbance	Operation	4	3	1	2	2	3	15	2	30		Medium-negative	
Mitigated displacement: limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with native vegetation, limit roadways and vehicle speeds		3	3	1	2	2	2	13	2		26		Low-negative
Collisions with PV panels leading to injury or loss of avian life	Operation	3	3	1	4	2	3	16	2	32		Medium-negative	
Mitigated collisions: panels to be flat at night, preferably low-sheen/matt surfaces, quarterly fatality monitoring		2	3	1	3	2	2	13	2		26		Low-negative
Displacement of priority avian species from important habitats	Decom-missioning	2	1	1	2	2	1	9	2	18		Low-negative	
Mitigated displacement: none required due to low significance											18		Low-negative
Displacement of resident avifauna through increased disturbance	Decom-missioning	2	1	1	2	2	1	9	2	18		Low-negative	
Mitigated displacement: none required due to low significance											18		Low-negative
Cumulative displacement of priority avian species from important habitats	Through-out	3	4	2	3	3	4	19	3	57		High-negative	

PROPOSED BETA SPP IMPACT RATING FOR PV ARRAY AND ASSOCIATED INFRASTRUCTURE **Description of risk and suggested mitigation**	**Applicable project phase**	**Probability**	**Duration**	**Extent**	**Reversibility**	**Irreplaceability**	**Cumulative effects**	**Total**	**Intensity/ Magnitude**	**Significance (unmitigated)**	**Significance (mitigated)**	**Before mitigation**	**After mitigation**
Mitigate displacement: limit development footprint and habitat transformation, limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with native vegetation and retain indigenous vegetation throughout as far as possible, limit roadways and vehicle speeds; rehabilitate thoroughly post-decommissioning with locally native species		2	3	1	2	2	3	13	3		39		Medium-negative
Cumulative displacement of resident avifauna	Through-out	4	3	2	3	2	3	17	2	34		Medium-negative	
Mitigate displacement: limit development footprint and habitat transformation, limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with native vegetation and retain indigenous vegetation throughout as far as possible, limit roadways and vehicle speeds; rehabilitate thoroughly post-decommissioning with locally native species		3	3	1	2	2	2	13	2		26		Low-negative
Cumulative loss of important avian habitats	Through-out	4	4	2	3	2	3	18	3	54		High-negative	
Mitigate habitat loss: limit development footprint and habitat transformation, rehabilitate with native vegetation and retain indigenous vegetation throughout as far as possible, limit roadways; rehabilitate thoroughly post-decommissioning with locally native species		3	3	1	2	2	2	13	3		39		Medium-negative

The impact ratings shown above rank the proposed Beta SPP development site as Medium-Negative for the SPP array and associated infrastructure before mitigations. After mitigations, the impact rating is borderline with a Low-Negative rating (28 score), as summarised in Table 7.
Overall, considering all impacts and all infrastructure, the average impact rating for the proposed Beta SPP development on avifauna is Medium-Negative, however this can be reduced to Low-Negative with sufficient application of adequate mitigations. It must be noted that the overall score is near the lower limit of a Medium-Negative impact (28 Score).

Table 7. Summary of avifaunal impact ratings for the proposed Beta SPP

	Average impact rating	***Significance class***	***Average mitigated impact***	***Significance class***
Avifaunal impacts of the PV array and associated infrastructure	36	Medium-negative	28	Low-negative

The impacts that scored Medium-Negative or higher for the PV array will require mitigation and are described in the following section.
Nine of the eleven avifaunal impacts for the proposed Beta SPP project's PV array scored an impact rating of Medium-Negative or higher, prior to any mitigations being accounted for.
Mitigations are required to bring the following PV array-associated risks within acceptable levels (Low-Negative impact rating, below 28 score):

- Displacement of priority avian species from important habitats during the construction and operational phases- This scored Medium-Negative due to priority species being involved, that have high irreplaceability, low reversibility, relatively high probability of suffering impacts, and a relatively severe intensity or consequence multiplier. Priority species (Red Data species in this instance) are threatened with extinction to some degree and extremely sensitive to disturbance and habitat loss. Both of these are expected to occur during the construction of the PV array and associated infrastructure. It is expected that priority species have at least a medium chance of being displaced from habitat that they would otherwise have utilised, albeit occasionally, with this displacement persisting throughout the life of the project. Priority species were recorded during SABAP2 surveys for the surrounding pentads or are protected species that have not yet been recorded but have a reasonable likelihood of occurring (section 5.3 and 5.4 earlier in this report).
- Displacement of resident avifauna through increased disturbance during the construction and operational phases- This scored Medium-Negative due to a relatively healthy resident avifaunal community with several endemic/near-endemic species present (see Section 5.4). There is a very high probability of this occurring and at a relatively high intensity or consequence rating. Habitat disturbance, transformation and loss is expected to occur during the construction of the PV array and the associated infrastructure and to persist for the duration of the project.
- Loss of important avian habitats during the construction and operational phases- This scored Medium-Negative as the DEFF screening tool highlighted the area being of 'Moderate Animal

Sensitivity' for the Endangered Ludwig's Bustard. These impacts are expected to persist for the duration of the SPP project, and perhaps thereafter.

- Collisions with the PV panels leading to avifaunal injury or loss of life during the operational phase- This scored Medium-Negative due to the planned operation of the PV panels' orientation and changes in orientation (described in section 7 of this report) resulting in potential collisions. This was coupled with the relatively high probability of occurrence, the duration being throughout the operational phase of the project and the impacts being entirely irreversible. Aerial feeding birds, and those fleeing from human disturbance or predators, are at risk of day-time collisions with vertically-oriented panels, whereas migrating birds are at risk for night-time collisions with vertically-oriented panels. Waterbirds are most at risk of collisions with day-time horizontally-oriented panels due to the 'lake effect' reported in some studies.
- Cumulative impacts- Cumulative impacts associated with displacement of priority avian species from important habitats are assumed to be High-Negative, as are the cumulative loss of important avian habitats whilst the cumulative displacement of resident avifauna scored Medium-Negative.

9 MITIGATION REQUIREMENTS

As shown in the risk assessment ratings, many of the avifaunal impacts are considered Medium-Negative or higher and, therefore, warrant intervention to decrease the risks to an acceptable level (Low-Negative rating). The mitigations required for the PV array and associated infrastructure is shown in Table 8.

Table 8. Mitigations required for the Beta SPP PV array avifaunal impacts to achieve acceptable impact ratings

	Significance reduction	*Before mitigation*	*After mitigation*
Displacement of priority avian species from important habitats during construction phase		Medium-negative	
Mitigated displacement: limit construction footprint and retain indigenous vegetation wherever possible, limit access to remainder of area, avoid breeding season (summer), lay-down areas only disturbed zones, construct in shortest timeframe, control noise to minimum	36%		Low-negative
Displacement of resident avifauna through increased disturbance during construction phase		Medium-negative	
Mitigated displacement: limit construction footprint and retain indigenous vegetation, limit access to remainder of area, avoid breeding season (summer), lay-down areas only disturbed zones, construct in shortest timeframe, control noise to minimum	31%		Low-negative
Loss of important avian habitats during construction phase		Medium-negative	
Mitigated habitat loss: limit construction footprint, limit access to remainder of area, lay-down areas only disturbed zones, construct in shortest timeframe, use existing roads as far as possible, rehabilitate with native vegetation	27%		Low-negative
Displacement of priority avian species from important habitats during operational phase		Medium-negative	
Mitigated displacement: limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with native vegetation, limit roadways and vehicle speeds	20%		Medium-negative
Displacement of resident avifauna through increased disturbance during operational phase		Medium-negative	
Mitigated displacement: limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with native vegetation, limit roadways and vehicle speeds	13%		Low-negative
Collisions with PV panels leading to injury or loss of avian life during operational phase		Medium-negative	

	Significance reduction	*Before mitigation*	*After mitigation*
Mitigated collisions: panels to be flat at night, preferably low sheen/matt surfaces, quarterly fatality monitoring	19%		Low-negative
Cumulative displacement of priority avian species from important habitats, throughout project life		High-negative	
Mitigate displacement: limit development footprint and habitat transformation, limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with native vegetation and retain indigenous vegetation throughout as far as possible, limit roadways and vehicle speeds; rehabilitate thoroughly post-decommissioning with locally native species	32%		Medium-negative
Cumulative displacement of resident avifauna, throughout project life		Medium-negative	
Mitigate displacement: limit development footprint and habitat transformation, limit ongoing human activity to the minimum required for ongoing operation, control noise to minimum, rehabilitate with native vegetation and retain indigenous vegetation throughout as far as possible, limit roadways and vehicle speeds; rehabilitate thoroughly post-decommissioning with locally native species	24%		Low-negative
Cumulative loss of important avian habitats, throughout project life		High-negative	
Mitigate habitat loss: limit development footprint and habitat transformation, rehabilitate with native vegetation and retain indigenous vegetation throughout as far as possible, limit roadways; rehabilitate thoroughly post-decommissioning with locally native species	28%		Medium-negative

The majority of the mitigations listed in Table 8 above for the PV array and associated infrastructure are quite standard, involving minimising impact footprints during construction, limiting site access beyond direct disturbance zones, reducing noise, constructing in winter (avoiding breeding season), and trying to stick to existing roads. Implementing these mitigations reduces the significance by 13-36% and results in acceptable Low-Negative impact ratings.
However, it is quite imperative to retain as much of the natural vegetation as possible, due to the high threat status of the habitats. The grasses can perhaps be mowed, instead of the whole area being cleared and grubbed.

Furthermore, to avoid the impacts associated with PV panel collisions, during day-time panels should be vertically-oriented/angled (as needed for optimal operation), whereas at night-time panels should be horizontally-oriented. Waterbirds are most at risk of collisions with day-time horizontally-oriented panels due to the 'lake effect' reported in some studies. Implementing these

mitigations should reduce the significance by 19% and results in acceptable Low-Negative impact ratings.

It is the assumed cumulative impacts that increase the cumulative risks and, therefore, warrant mitigations.
Mitigating the cumulative impacts would require limiting the impact of Beta to an absolute minimum, which is not necessarily feasible but should be pursued. The mitigations to reduce cumulative impacts involve limiting the disturbance footprint (overall size), limiting human activity and noise throughout the project life, disturbing as little natural vegetation as possible, retaining the natural vegetation beneath the panels and around infrastructure, limiting the extent and width of roadways, reducing the speeds that vehicles travel, and then thoroughly rehabilitating the entire footprint back to natural grassland after decommissioning.
Implementing successful mitigations would reduce the cumulative impacts of displacement of priority species by 32% to Medium-Negative, would reduce the cumulative impacts of displacement of resident avifauna by 24% to an acceptable Low-Negative score, and would reduce the cumulative impacts of loss of important avian habitats by 28% to Medium-Negative.

10 RESIDUAL IMPACTS POST-MITIGATION

Displacement of priority avian species from important habitats, displacement of resident avifauna and loss of important avifaunal habitats- project-specific and cumulative impacts will remain, even after mitigations are implemented. These should be balanced against the gains made in displacing fossil fuels with solar energy. The residual impacts are on the low side of the Medium-Negative scale. Due to the expected residual impacts, pre- and post-construction monitoring is recommended. This study was not based on site-specific data and only on SABAP2 data and changes in bird presence, abundance and species richness should be noted on a bi-annual basis (winter and summer) by an avifaunal specialist and compared over time. Monitoring collision impacts can be undertaken by site staff on a quarterly basis.

These residual impacts will be difficult, if not impossible, and expensive to mitigate to Low-Negative levels. Offsetting, as a last resort, with effective monitoring controls or effectiveness, could be considered, should the overall project environmental impact be considered too great, and should other specialists require additional mitigations or offsets.

11 CONCLUSION AND RECOMMENDATIONS

The proposed Beta SPP is situated in an area of moderate avifaunal diversity and has the potential to impact many priority species.

The total avifaunal dataset is limited, hence pre- and post-construction monitoring must be undertaken by a suitably qualified avifaunal specialist.

There are individual impacts that are relatively high, however most can be effectively mitigated through the controls prescribed in this report. The overall mitigated impacts can result in the project having an overall Low-Negative impact rating on avifauna.

It is largely the cumulative impacts on avifauna, as a result of loss of important habitats, and the displacement of priority and resident birds that are concerns.

<u>Specific conditions recommended for the EA from an avifaunal perspective</u>

1. Implement mitigation controls during the construction phase as specified in Section 15: MITIGATION REQUIREMENTS. Monitor and report on their effectiveness.
2. Implement mitigation controls during the operational phase as specified in Section 15: MITIGATION REQUIREMENTS. Monitor and report on their effectiveness.
3. Consult with the avifaunal specialist regarding the positions and designs of bird perching/nesting deterrents and powerline markers.
4. Monitoring of implementation of mitigation controls, along with reporting, should be undertaken at least quarterly throughout the construction phase, and bi-annually during the operational phase. Monitoring, at the minimum, should consist of:
    a. quarterly monitoring of the PV array area for evidence of PV collisions;
    b. bi-annual monitoring of the resident avifaunal population, including priority species, to compare the impacts to the baseline avifaunal community description in this report.
5. As much of the natural habitat as possible should be preserved during construction and operation to lessen the operational impacts and to reduce the irreversibility of impacts.
6. Effective restoration of the natural habitats that were intact before the development should be implemented and reported on after decommissioning.

12 REFERENCES

1. Animal Demography Unit, Department of Zoology, University of Cape Town. 2007-2021 (ongoing). Second Southern African Bird Atlas Project (SABAP2). http://sabap2.birdmap.africa
2. BirdLife South Africa (undated). Position Statement on the effects of Solar Power Facilities on Birds. http://www.birdlife.org.za/images/stories/conservation/birds_and_wind_energy/solar_power.pdf .
3. Department of Environment, Fisheries and Forestry. National Web-based Environmental Screening Tool. http://screening.environment.gov.za
4. Eeva, T. And Lehikoinen, E. 1995. Eggshell Quality, Clutch Size and Hatching Success of the Great Tit (*Parus niger*) and the Pied Flycatcher (*Ficedula hypoleuca*) in an Air Pollution Gradient. Oecologia 102: 312-323.
5. IUCN. 1994. IUCN Red List Categories. Gland, Switzerland: IUCN.
6. Jenkins, A.R., Ralston-Paton, S. and Smit-Robinson, H.A. 2017. Guidelines for Assessing and Monitoring the Impact of Solar Power Generating Facilities on Birds in Southern Africa. BirdLife South Africa.
7. Mora, M.A. 1991. Organochlorines and Breeding Success in Cattle Egrets from the Mexicali Valley, Baja California, Mexico. Colonial Waterbirds 14(2): 127-132.
8. Mucina, L. & Rutherford, M.C. (Eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
9. Siegfried, W.R. 1971. Aspects of The Feeding Ecology of Cattle Egrets (*Ardeola Ibis*) In South Africa. Journal of Animal Ecology 41(1).
10. Taylor, M.R., Peacock, F. and Wanless, R.W. (eds). 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa.
11. Van Rooyen, C.S. 2004. The Management of Wildlife Interactions with Overhead Lines. *In* The Fundamentals and Practice of Overhead Line Maintenance (13k kV and above). Eskom Technology Services International.

13 APPENDICES

13.1 Appendix A: Method of Environmental Assessment

The environmental assessment aims to identify the various possible environmental impacts that could results from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed.
Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e., site, local, national or global whereas intensity is defined by the severity of the impact e.g., the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in the Table below.
Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact Rating System

Impact assessment must take account of the nature, scale and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

Table 1: The rating system

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		

1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.

4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.		

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.