mora
ecological services
(Pty)LTD

PROPOSED KHAUTA SOLAR PV

AND ASSOCIATED INFRASTRUCTURE, IN RIEBEECKSTAD, FREE STATE.

PROJECT INFORMATION

Project title	Specialist Avifaunal Assessment for Proposed 110MW Khauta South Solar PV Facility
Report reference	AVI/KS/0822
Document prepared for	Enviroworks
Document prepared by	MORA Ecological Services (Pty) Ltd
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SPECIALIST INFORMATION AND LEGAL REQUIREMENTS

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6):

The details of -	
○ the specialist who prepared the report; and	Page 9
○ the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page 10
A declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 12
An indication of the scope of, and the purpose for which, the report was prepared;	
○ An indication of the quality and age of base data used for the specialist report;	Page 21
○ A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Page 31
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Page 26
A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Page 26
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Page 16
An identification of any areas to be avoided, including buffers;	Page 35
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Page 35
A description of any assumptions made and any uncertainties or gaps in knowledge;	Page 8
A description of the findings and potential implications of such findings on the impact of the proposed activity, or activities;	Page 30
Any mitigation measures for inclusion in the EMPr;	Page 35
Any conditions for inclusion in the environmental authorisation;	Page 35
Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Page 35
A reasoned opinion-	Page 35
○ whether the proposed activity, activities or portions thereof should be authorised;	
○ regarding the acceptability of the proposed activity or activities; and	Page 35
○ if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Page 35
A description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
Any other information requested by the competent authority.	Not applicable
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not applicable

EXECUTIVE SUMMARY

Project background

The proposed Khauta South Solar PV Facility is planned to be developed on Portion 9 of Farm Commandants Pan No. 382; Farm Tafel Baai No. 413; and Portion 12 of Farm Nooitgedacht No. 74 near Riebeeckstad (near Welkom). The farm coordinates are 27°53'58.99"S and 26°51'47.70"E. The proposed area of development is within the Matjhabeng Local Municipality, in the Lejweleputswa District Municipality, Free State Province. The proposed site is accessible via the R70 and R34 and secondary road S173. The project is intended to consist the Planning, Design, and Construction of the Khauta South Solar PV Facility.

The infrastructure associated with the proposed 110 MW Khauta South Solar PV Facility includes:

- PV modules and mounting structures (monofacial or bifacial) with fixed, single or double axis tracking mounting structures;
- Battery Energy Storage System (BESS);
- Site and internal access roads (up to 6 m wide);
- Auxiliary buildings (offices, parking etc.);
- Temporary laydown area (and a latter permanent laydown area for BESS);
- Facility Substation;
- Grid connection infrastructure, includes (underground cabling where practical) medium-voltage cabling between the project components and the facility substation.
- Perimeter fencing; and
- Rainwater and/or groundwater storage tanks.

The development footprint will cover approximately 168 Ha which was assessed as part of the full Scoping and Environmental Impact Assessment (EIA) process.

No alternative sites were assessed or identified; however, the no-go alternative was evaluated from an avifaunal perspective.

Avifaunal community

The overall avifaunal species occurring at the proposed development site are dominantly represented by bishops, cisticolas, doves, larks, mousebirds, sparrows, swallows and widowbirds. None of the priority bird species were encountered during the fixed point surveys. The observed waterbirds are represented in Appendix D.

Impacts and mitigations for Solar PV array and associated infrastructure

Displacement of priority avian species from important habitats.

Rated Medium (M) but can be reduced to Low (L) with effective implementation and ongoing monitoring of required mitigations as specified;

Displacement of resident avifauna through increased disturbance.

Rated Medium (M) but can be reduced to Low (L) with effective implementation and ongoing monitoring of required mitigations as specified;

Loss of important avian habitats.

Rated Medium (M) but can be reduced to Low (L) with effective implementation and ongoing monitoring of required mitigations as specified;

Collisions with PV panels leading to avian injury or loss of life.

Rated Medium (M) but can be reduced to Low (L) with effective implementation and ongoing monitoring of required mitigations as specified;

Cumulative impacts of the above.

The cumulative and residual impacts should be prioritised. With the effective implementation and ongoing monitoring of required mitigations as specified, all potential impacts for the PV array and associated infrastructure will remain on a Low (L) environmental significance.

Impact statement

Despite some residual and cumulative impacts, there is no objection for the proposed Khauta South Solar PV Facility development from an avifaunal perspective. The overall impact of the project on avifauna can be effectively mitigated, should the controls prescribed in this report be adequately followed, with sufficient monitoring of mitigation effectiveness.

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TERMS OF REFERENCE

MORA Ecological Services (Pty) LTD was requested by Enviroworks to conduct a specialist avifaunal assessment towards their pursuit of obtaining the requisite environmental authorisations for the proposed Khauta South Solar PV Facility. The most important objective of this specialist avifaunal assessment is to determine the bird species community and the potential impacts the proposed development may have on avifauna species. The following tasks were undertaken by MORA Ecological Services (Pty) Ltd to achieve the assessment objective:

- Site visits to identify the avian habitats associated with the proposed development;
- Field data collection to define the current avifauna community within the development site and the identification of Red Data and/or endemic species which could potentially be affected by the proposed development and associated infrastructure;
- Integration of the site data collected (species counts) and the Southern African Bird Atlas Project 2 avian atlases to develop a comprehensive avifaunal database likely to be present within the development footprint;
- Identify potential negative impacts on the avifaunal diversity and species composition at the site of the proposed development and assess the significance of these impacts;
- To provide recommendations and mitigation measures for the potential impacts in order to avert or lower their significance on the avifaunal diversity and species composition.

The site details provided were that the EIA footprint is approximately 168 Ha on Portion 9 of Farm Commandants Pan No. 382; Farm Tafel Baai No. 413; and Portion 12 of Farm Nooitgedacht No. 74. The survey was conducted throughout all identified habitats using various methods i.e. walked transects, vehicle drive transects, powerline inspection and the fixed point survey.

STUDY LIMITATIONS

- MORA Ecological Services (Pty) Ltd relied on Enviroworks, as the EAP, to supply correct information on the site locality and extent, as well as project details which were assumed to be 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.

SPECIALIST DETAILS, CURRICULUM VITAE AND DECLARTION

The surveys and assessment were undertaken by Mokgatla Jerry Molepo, a competent avifaunal specialist and Director of MORA Ecological Services (Pty) Ltd.

Curriculum vitae

EDUCATION:

- MSc Zoology, Nelson Mandela University (Percy FitzPatrick Institute of African Ornithology Centre of Excellence)

Research Project Topic: Foraging behaviour and thermal physiology in Cape Sugarbirds: sex-specific responses to temperature.

- BSc Honours in Zoology, University of Limpopo

Research Project Topic: Morphometrics and plumage variation in the South African Fiscal flycatcher *Sigelus silens* Shaw 1809.

- BSc Botany & Zoology, University of Venda
- Grade 12, Marobathota High School

CERTIFICATES:

- SASS5 Aquatic Biomonitoring, GroundTruth
- Hydropedology and Wetland Functioning, Terra Soil Science & Water Business Academy
- Section 21 (c) & (i) Water Use Authorisation Training, Department of Water and Sanitation
- Basic Project Management, Hudisa Business School

PROFESSIONAL MEMBERSHIP:

- South African Council for Natural Scientific Professions (SACNASP) – Professionally registered as Professional Natural Scientist. **Registration number:** 009509
- British Ecological Society (BES). **Membership number**: 1010709
- Zoological Society of Southern Africa (ZSSA). **Membership number**: 691

WORK EXPERIENCE:

- MORA Ecological Services (Pty) Ltd: April 2018 – Current, Environmental Specialist, and my duties include; (i) Conducting Biodiversity, Aquatic Impact Assessments, Rehabilitation (ii) Compilation of specialist reports.
- Arcus Consulting: May - November 2017, Subcontracted avifaunal surveyor for the proposed Highlands Wind Energy Farm, Somerset East, Eastern Cape.
- Centre for African Conservation Ecology (ACE), Nelson Mandela University: 2015 - 2016, Field guide/ environmental educator. Responsibilities: taking school learners on trial walks inside the Nelson Mandela University Nature Reserve.
- South African National Biodiversity Institute (SANBI): May – December 2014, Zoological Systematics Technician. Responsibilities: (i) Insect identification and curation, and (ii)

compiling the animal checklist of South Africa, (iii) Sourcing wildlife crime reports on endangered animals and plants for Barcode of Wildlife Project, (iv) Monitoring the bird population in the Botanical Garden.

- Department of Zoology, University of Venda: 2009 – 2013, I was a Research Assistant under Dr. T.C Munyai who was conducting a long-term research project which monitored the effects of climate change on biota and processes influencing ecosystem functioning and species diversity patterns.
- Percy FitzPatrick Institute of African Ornithology: March – April 2014, I was a Research Assistant under Dr. Rita Covas' Sociable Weaver Research Project. This is a long-term study which looks at the reproductive success of Sociable weavers at Benfontein Nature Reserve in Kimberley.

Key experience in specialist projects

Year	Project	Location:	Role(s)
2022	Avifaunal Impact Assessment for the proposed 132kV for Musina-Makhado Special Economic Zone North Site	Musina, Limpopo	Avifaunal Specialist/Ornithologist
2022	Avifaunal Impact Assessment for the proposed Khauta PV Solar including 44kV and 132kV Powerline	Welkom, Free State	Avifaunal Specialist/Ornithologist
2022	Avifaunal Impact Assessment for the proposed NAOS PV Solar including 132kV Powerline	Free State	Avifaunal Specialist/Ornithologist
2022	Preconstruction Avifaunal Assessment for the proposed Lichtenburg PV Solar including 132kV Powerline	Lichtenburg, North West	Avifaunal Specialist/Ornithologist
2022	Preconstruction Botanical Assessment for the proposed Lichtenburg PV Solar including 132kV Powerline	Lichtenburg, North West	Ecologist
2022	Biodiversity Assessment, Land Capability and Veld Condition Assessment for PPC Cement SA Slurry	Slurry, North West	Ecologist
2021	Avifaunal Impact Assessment for the proposed Upington-Aries 2x 400kV	Upington, Northern Cape	Avifaunal Specialist/Ornithologist
2021	Habitat Assessment Post Rehabilitation for PPC Cement SA Dwaalboom Factory	Dwaalboom, Limpopo	Ecologist
2021	Habitat Assessment Post Rehabilitation for Gibson Bay Wind Energy Farm	Humansdorp, Eastern Cape	Ecologist
2021	Wetland Rehabilitation for the sewer pipeline construction in Daveyton	Ekurhuleni East College Campus, Daveyton, Gauteng	Wetland Ecologist
2021	12 Months Wetland Rehabilitation Supervision for Ekangala Ext F Waterborne Sanitation Project	City of Tshwane Metropolitan Municipality, Ekangala, Gauteng	Aquatic Ecologist

DECLARATION BY THE SPECIALIST

I, Mokgatla Jerry Molepo 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 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

MORA Ecological Services (Pty) Ltd

Name of Company

22/08/2022

Date

INTRODUCTION

King's Landing Trading 507 (Pty) Ltd t/a Enviroworks (hereafter referred to as Enviroworks) was appointed by WKN Windcurrent SA (Pty) Ltd. (the Applicant), hereafter refer to as "Khauta South Solar PV Facility RF (Pty) Ltd" to undertake a full Scoping and Environmental Impact Assessment (inclusive of specialist work) and Water Use License (inclusive of specialist work) for the proposed construction of a 110 megawatt (MW) photovoltaic (PV) solar energy facility and associated infrastructure (hereafter referred to as Khauta South Solar PV Facility).

Enviroworks has retained services of MORA Ecological Services (Pty) Ltd to undertake the avifaunal specialist assessment. There are numerous Listed Activities that are triggered by the proposed development, which are contained in the Project Description and Scoping documents, respectively.

PROJECT DESCRIPTION

The proposed Khauta Solar PV development of a 110 MW photovoltaic solar farm Portion 9 of Farm Commandants Pan No. 382; Farm Tafel Baai No. 413; and Portion 12 of Farm Nooitgedacht No. 74, Riebeeckstad Near Welkom, Matjhabeng Local Municipality, Free State Province (Figure 1.)

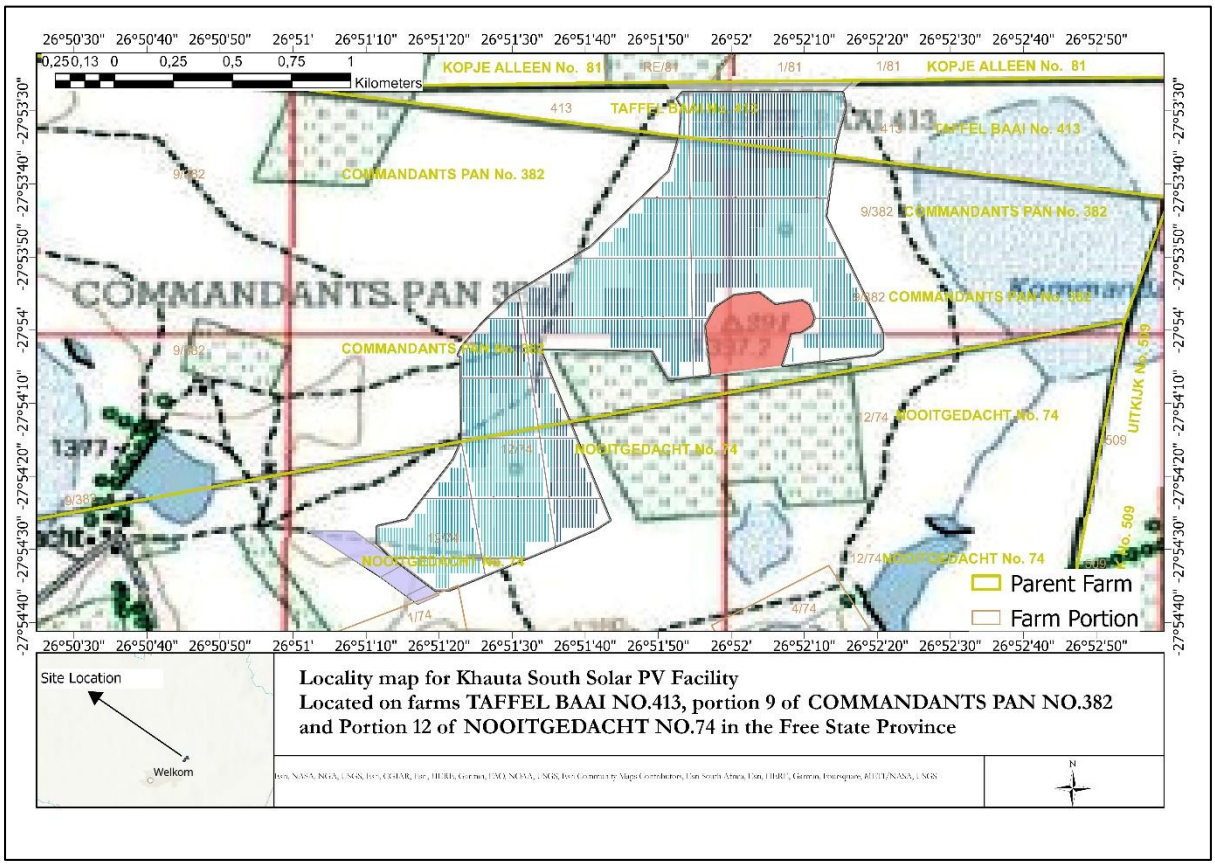

Figure 1. Locality of the proposed Khauta 110 MW Solar PV development site, with associated infrastructure.

The total EIA footprint will cover approximately 168 Ha and the infrastructure is expected to consist of a 110 megawatt (MW) photovoltaic (PV) solar energy facility and associated infrastructure.

The infrastructure associated with the proposed 110 MW Khauta South Solar PV Facility includes:

- PV modules and mounting structures (monofacial or bifacial) with fixed, single or double axis tracking mounting structures;
- Battery Energy Storage System (BESS);
- Site and internal access roads (up to 6 m wide);
- Auxiliary buildings (offices, parking etc.);
- Temporary laydown area (and a latter permanent laydown area for BESS);
- Facility Substation;
- Grid connection infrastructure includes (underground cabling where practical) medium-voltage cabling between the project components and the facility substation.
- Perimeter fencing; and
- Rainwater and/or groundwater storage tanks

No alternative sites were identified or assessed; however, the no-go alternative was evaluated from an avifaunal perspective.

SITE DESCRIPTION

As shown in Figure 1 above, the site is located on in Riebeeckstad, a surburb 5km east of Welkom in the Free State province. The area is surrounded by a matrix of mining and agricultural practices. The proposed site is accessible via the R70 and R34 and secondary road S173. The farm coordinates are 27°53'58.99"S and 26°51'47.70"E.

Vegetation

The proposed area of development falls within the Grassland biome. The broad ecological of the Matjhabeng Municipality is represented by grassland ecosystems with seven vegetation types. The vegetation types are namely Bloemfontein Karroid Shrubland, Central Free State Grassland, Highveld Alluvial Vegetation, Highveld Salt Pans, Vaal-Vet Sandy Grassland, Western Free State Clay Grassland and Winburg Grassy Shrubland. The proposed area of study is specifically situated on the Highveld Alluvial Vegetation. The Highveld Alluvial Vegetation occurs along alluvial drainage lines and floodplains within the Grassland biome. The vegetation within the *Highveld Alluvial Vegetation* is characterised by low lying areas and flat topography that supports the riparian thicket mostly dominated by the woody *Vachellia karroo* commonly known as the sweet thorn. The Highveld Alluvial Vegetation type (Figure 2) is a seasonally flooded grassland with susceptibility of invasive alien plant encroachment due to being disturbed.

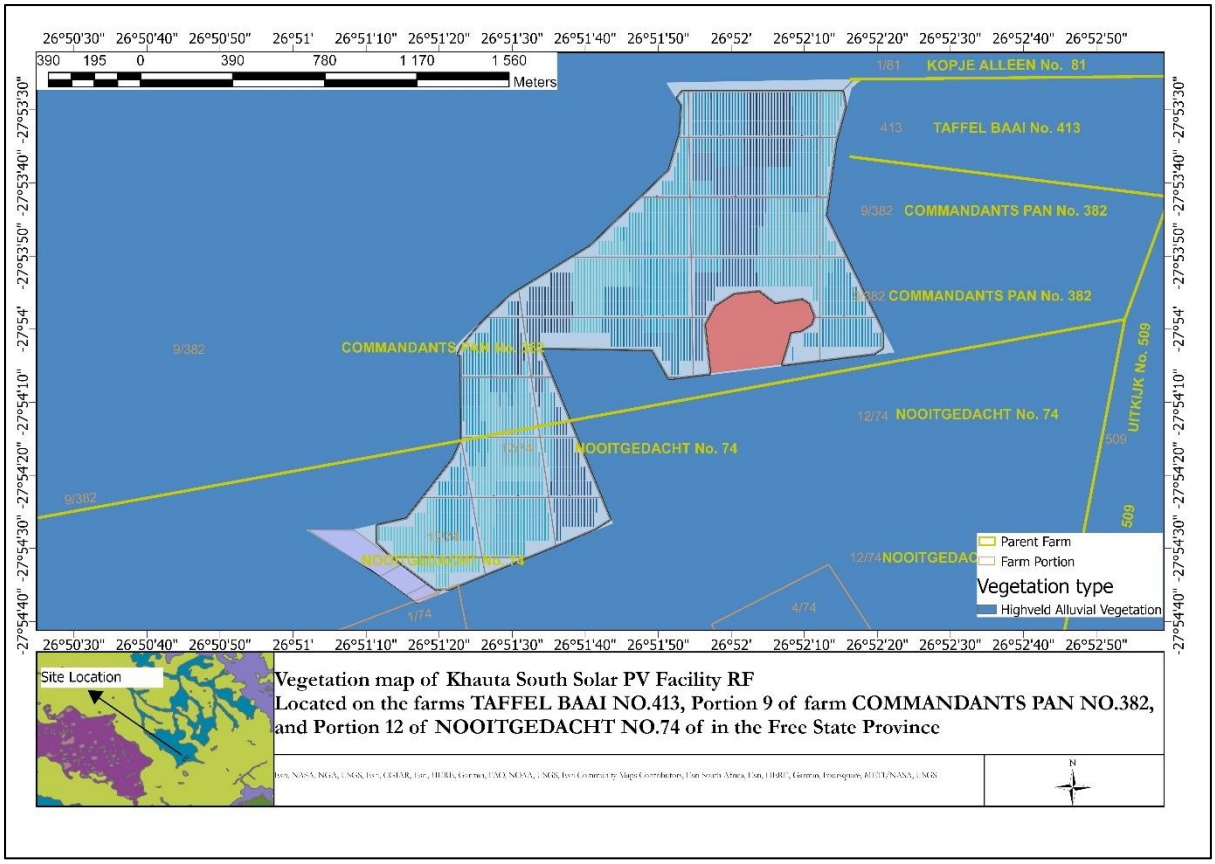

Figure 2. Vegetation map of the proposed Khauta 110 MW Solar PV development site, with associated infrastructure.

Geology and soils

The typical geology of the Highveld Alluvial Vegetation is characterised by deep sand to clayey (but mostly coarse sand) alluvial soils developed over Quaternary alluvial (fluviatile) sediments. The rivers are perennial and often in flood in summer. Erosion of banks, deposition of new fine soil on alluvium can be of considerable extent. Smaller channels that are a cross-connection between adjacent channels of major rivers can dry out in winter (Mucina & Rutherford, 2006).

Climate

The Highveld Alluvial Vegetation falls in a seasonal, mainly summer rainfall region. Precipitation in the western part of the Highveld is unpredictable (MAP 300-400mm) increasing sharply towards the eastern north (up to 600mm in places). The overall MAP is almost 500mm (373mm at the western distribution limit and 593mm at the northern distribution limit). The area has a typical continental thermal regime, showing subtropical features is typical of the summer season (daily temperature often surpassing 35°C), while cold temperate features (such as frequent frost) prevail in winter (Mucina & Rutherford, 2006).

Significance of avifauna population at Khauta

The general area of which the proposed 110 MW Khauta Solar PV site occurs does not have a high number of avian species. A majority of the observed avian population is of least conservation concern. The DFFE screening tool outputs (Figure 3) provided an avifaunal risk ranking according to the minimum requirements as stipulated in the Species Environmental Guideline Assessment (2020)

protocol (Appendix E). Figure 3 shows that the site of the proposed development has a Low Avian Sensitivity. Due to the presence of a wetland within 500 m from the proposed development area, Figure 4 shows a Medium to High Animal Sensitivity in the buffer regions. This indicates that the development footprint should not expand during the development phases as this will impact on threatened and/or rare fauna species (Appendix E). Of the observed aquatic species, none are of conservation concern. Nonetheless, birds are highly mobile in nature and have wide geographical distributions that vary seasonally and annually and may not have been present during the assessments. SABAP2 datasets (Table 2), however, also suggested the area of the proposed development to be less sensitive.

Figure 3. DFFE screening tool outputs of avifaunal sensitivity for the proposed 110 MW Khauta Solar PV site.

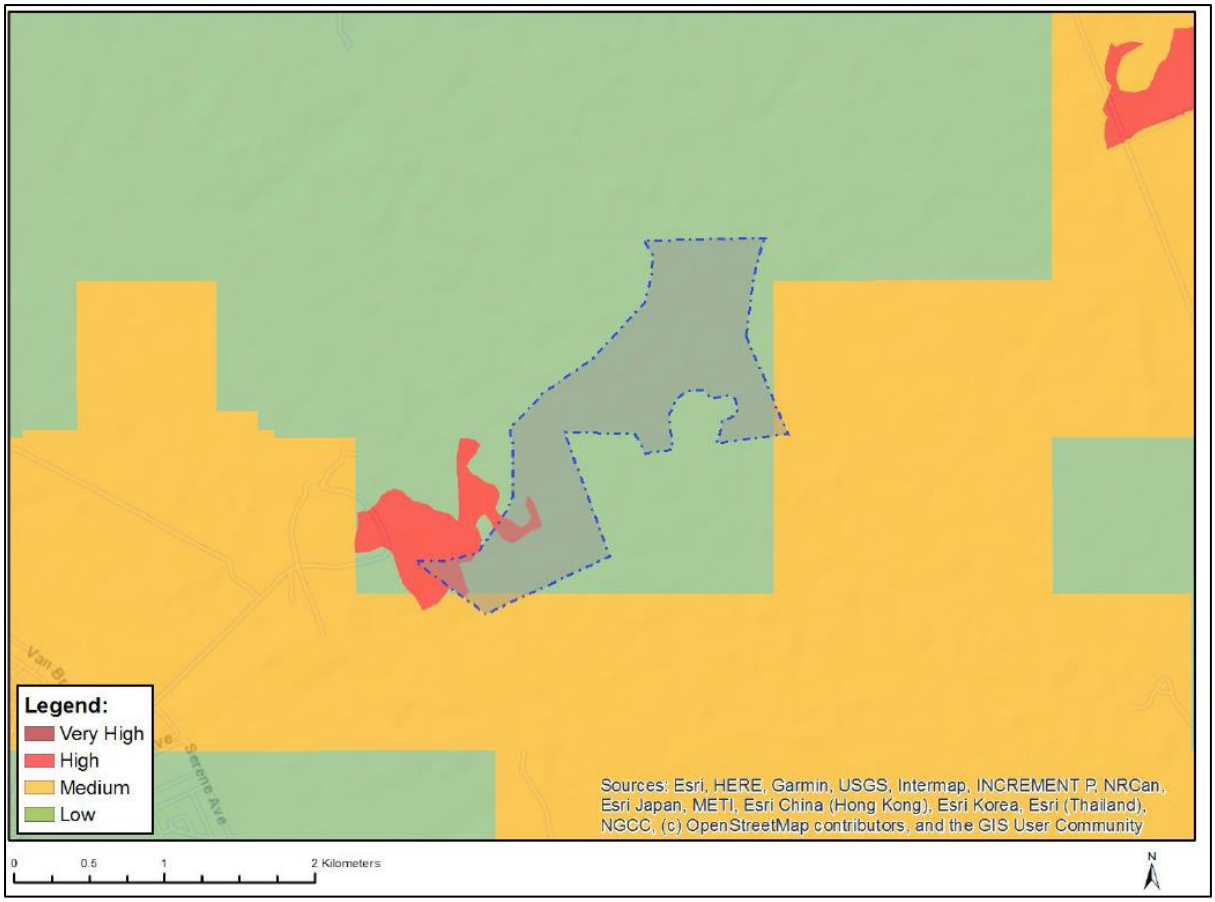

Figure 4. DFFE screening tool outputs of relative animal species sensitivity for the proposed 110 MW Khauta Solar PV site.

LEGAL FRAMEWORK RELATING TO AVIFAUNA AND PROPOSED DEVELOPMENT

International law and conventions

The importance of sustainable development and the protection of environmental resources have globally become a driving factor in the construction of new legislation governing industrial practices and their impact on the environment. South Africa has signed and ratified a number of global treaties, protocols and conventions, agreeing to implement the policies, which endorse sustainable development and promote a positive environmental legacy for future generations. A considerable international convention to which South Africa is in agreement with in signatory is namely the Convention on Biological Diversity (CBD). The CBD is notably the key international convention for sustainable development. The CBD has three main objectives which lead and encourage a sustainable future. These are:

- The conservation of biological diversity;
- The sustainable use of its components; and
- The fair and equitable sharing of the benefits from the use of genetic resources.

Although the convention does not include specific recommendations or guidelines pertaining to birds and solar infrastructure interactions and impacts, it does make provisions for sustaining and

restoring biodiversity. The convention covers all possible domains that are directly or indirectly related to biodiversity and its role in development, ranging from science, politics and education to agriculture, business and culture.

South African Constitution

The foundation of South Africans Environmental law is set in the Constitution of the Republic of South Africa (1996), specifically "Chapter 2- The Bill of Rights: section 24". This has allowed for the rapid development of environmentally based legislations which guard, enforce and guide all parties to maintain the human rights granted in the Constitution. These rights include:

- The right to an environment that is not harmful to their health or well-being; and
- To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

National Environmental Management Act (NEMA)

The crucial environmental legislation which aims to strengthen the rights granted in the South African Constitution and incorporate international agreements is the National Environmental Management Act (NEMA), Act 107 of 1998. This act is the foundation of environmental law in South Africa and has set the framework for additional legislation to build on. The Act establishes principles for decision-making on environmental matters, as well as providing motive for institutions which promote cooperative governance, and which can coordinate environmental action plans. Section 2(4) specifies that sustainable development requires the consideration of all relevant factors. In the regard to biodiversity and South Africa's ecological integrity, development should not result in the disturbance of ecosystems and loss of biological diversity, if not possible, these effects must be minimised and remedied. A low-risk, cautious approach should always be applied, considering limits of current knowledge concerning consequences and actions. Always anticipate possible negative impacts on the environment and people's environmental rights, identified impacts should be prevented and where they cannot be altogether prevented, are minimised and mitigated. Outlined NEMA principles with regard to biodiversity are to:

- Prevent pollution and ecological degradation
- Promote conservation; and
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

National Environmental Management of Biodiversity Act (NEMBA)

The National Environmental Management of Biodiversity Act (NEMBA) Act 10 of 2004 was designed to provide a management and conservation outline for biological diversity, as drafted under the NEMA. NEMBA focuses on the management and conservation of biodiversity, with its relevant components, which includes the use of indigenous biological resources in a sustainable manner, the fair and equitable sharing of benefits arising from bio-prospecting, cooperative governance in biodiversity management and conservation within the structures of NEMA. The Act, in protecting biodiversity, deals with the protection of threatened ecosystems and species, the control of alien invasive species, genetically modified organisms and regulates bio-prospecting. As with NEMA,

NEMBA incorporates and gives effect to international agreements relating to biodiversity. The Act gives the Minister of Environmental Affairs, Forestry and Fisheries the power to categorise any process or activity in a listed ecosystem, as a threatening process, thereafter, be regarded as an activity contemplated in Section 24(2) (b) of NEMA which states that: Specified activities may not be commenced without prior authorisation from the Minister or MEC and specify such activities. NEMBA is the most prominent statute containing provisions directly aimed at the conservation of birds with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). The NEMBA Regulations on Threatened or Protected Species (TOPS, 2007) lists all of the species (including avian) that are threatened with extinction and therefore, nationally protected under an approach to sustainable use and development. Periodically, Red Data books are published, and the data used to update these lists of protected species.

Norms, Guidelines and Standards

South Africa has structured a number of policies and guidelines to promote conservation and management of biodiversity. The National Spatial Biodiversity Assessment (NSBA) was constructed to help meet targets set by the NEMBA, in reducing the loss of biodiversity on a global, regional and national scale, while also attending to poverty alleviation. The National Biodiversity Strategy and Action Plan (NBSAP) has also been drafted in order to begin the process of construction a National Biodiversity Framework, as called for in NEMBA. NBSAP has identified a number of key points to implement in order for biodiversity to be conserved and benefit both current and future generations. One point is that biodiversity cannot be conserved through protected areas only. All stakeholders, including private industry, must be involved in biodiversity management.

BirdLife South Africa (Jenkins *et al*., 2017) compiled the Best Practice Guidelines on Birds and Solar Energy to guide the assessment and monitoring of the impact of solar generating facilities on birds in South Africa. This guideline has been followed as far as possible in the compilation of this report.

REGIONAL SOLAR ENERGY DEVELOPMENT

The regional setting of existing or planned solar energy developments is required to undertake an assessment of the cumulative impacts that avifauna experience. This is in addition to other forms of habitat transformation that have taken place.

Table 1. *A summary of similar projects within a 30 km radius of the proposed 110 MW Khauta Solar PV*

No	Distance from area (km)	DEFF Reference	Project Status
1	17.7	14/12/16/3/3/3/1/644	Approved
2	16.6	14/12/16/3/3/1/1472	Approved
3	14.8	14/12/16/3/3/1/1444	Approved
4	25.8	14/12/16/3/3/1/1322	Approved
5	16.6	14/12/16/3/3/1/1471	Approved
6	0.79	14/12/16/3/3/2/2192	Approved
7	1.96	14/12/16/3/3/2/2193	Approved
8	1.59	14/12/16/3/3/2/2195	Approved

BASELINE DESCRIPTION OF THE AVIFAUNAL COMMUNITY

SABAP2 data

The Second South African Bird Atlas Project 2 (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. SABAP2 is the second bird atlas project that was initiated in July 2007. SABAP2 was designed to run indefinitely with the aim to create valuable long-term dataset for southern Africa. The objective of the SABAP2 project is to accurately provide specified information on bird distributions, taken over a period of years. The site of the proposed 110 MW Khauta Solar PV development and associated infrastructure is located in pentad 2750_2650 (Figure 3). The pentad occupies approximately 7,700 Ha, whereas the total EIA footprint is approximately 168 Ha. The pentad covers greater avian diversity and comprises priority habitats (waterbodies), which will substantially increase the species counts. These species counts should not be expected for the development site.

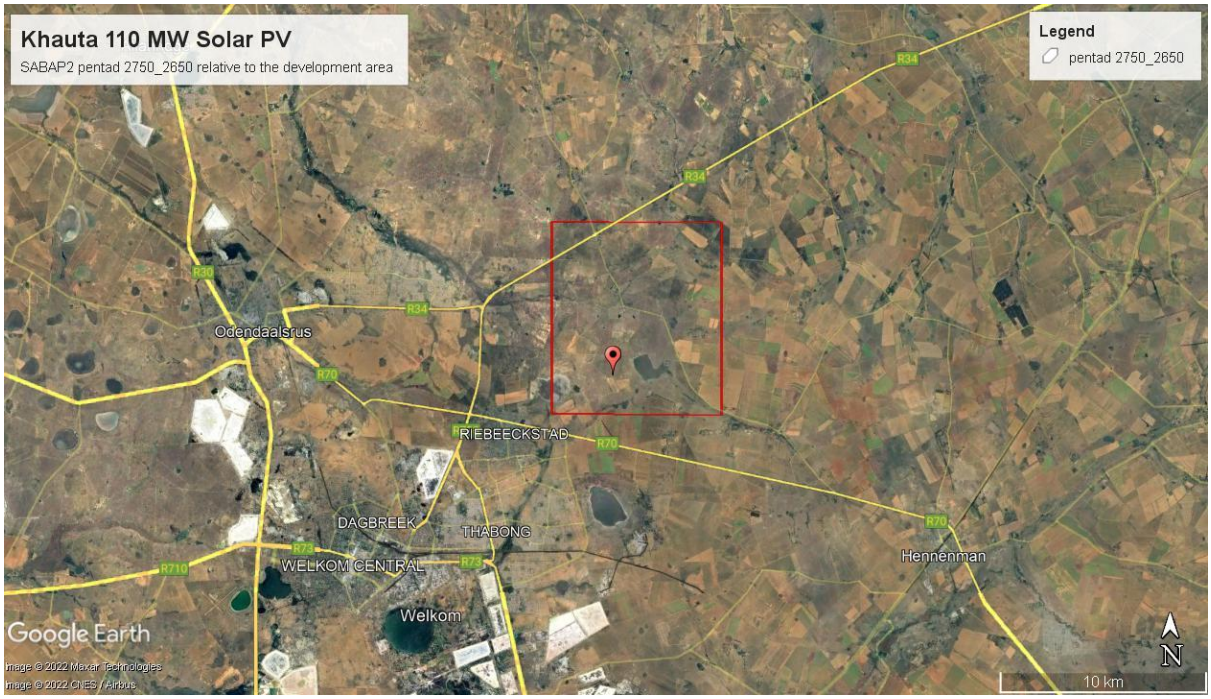

Figure 5. Location and extent of SABAP2 2750_2650 pentad relative to the 110 MW Khauta Solar PV development site.

According to the SABAP2 species list in Table 2, it is estimated that a total of 98 bird species could occur in the broader area. A total of 72 birds species were observed during the assessments (as shown in Appendix C). Of the 72 recorded bird species, 10 bird species have been previously observed during the second bird atlas project. A total of 7 bird species were not previously during the second bird atlas project. This may be attributed the seasonal movement patterns of birds. There are many long-distance migrant species that will only be recorded during early to mid-summer and also some regional migrants and nomadic species that are more likely to occur in winter. One of the 7 newly observed species include the endemic Northern Black Korkhaan.

Table 2. List of avifaunal species encountered on site during structured surveys or recorded during SABAP2 assessments for the wider pentads.

No.	Species	Observed during assessments
1	Acacia Pied Barbet	0
2	African Pipit	1
3	African Sacred Ibis	0
4	African Stonechat	0
5	Amur Falcon	0
6	Ant-eating Chat	1
7	Ashy Tit	0
8	Barn Swallow	0
9	Black-chested Prinia	0
10	Black-headed Heron	0
11	Blacksmith Lapwing	0
12	Black-throated Canary	0
13	Black-winged Kite	0
14	Black-winged Pratincole	0
15	Black-winged Stilt	0
16	Blue Korhaan	0
17	Bokmakierie	0
18	Brown-crowned Tchagra	0
19	Cape Longclaw	0
20	Cape Sparrow	0
21	Cape Turtle Dove	0
22	Cape Wagtail	0
23	Cardinal Woodpecker	0
24	Chestnut-vented Warbler	0
25	Cloud Cisticola	0
26	Common Buzzard	0
27	Common Cuckoo	0
28	Common Ostrich	0
29	Common Scimitarbill	0
30	Common Waxbill	0
31	Crowned Lapwing	1
32	Diederik Cuckoo	0
33	Eastern Clapper Lark	0
34	Egyptian Goose	0
35	Fiscal Flycatcher	0
36	Greater Striped Swallow	1
37	Grey Heron	0
38	Hadada Ibis	0
39	Helmeted Guineafowl	0
40	House Sparrow	0
41	Kalahari Scrub Robin	0
42	Laughing Dove	0

No.	Species	Observed during assessments
43	Lesser Grey Shrike	0
44	Lesser Kestrel	0
45	Levaillant's Cisticola	0
46	Long-billed Crombec	0
47	Long-tailed Paradise Whydah	0
48	Long-tailed Widowbird	1
49	Marsh Owl	0
50	Namaqua Dove	0
51	Neddicky	0
52	Northern Black Korhaan	1
53	Orange River White-eye	0
54	Pale Chanting Goshawk	0
55	Pink-billed Lark	0
56	Pin-tailed Whydah	0
57	Pririt Batis	0
58	Quailfinch	1
59	Red-backed Shrike	0
60	Red-billed Firefinch	0
61	Red-billed Quelea	1
62	Red-billed Teal	0
63	Red-eyed Dove	0
64	Red-faced Mousebird	0
65	Red-headed Finch	0
66	Red-knobbed Coot	0
67	Reed Cormorant	0
68	Rock Dove	0
69	Rock Kestrel	0
70	Rufous-naped Lark	0
71	Sabota Lark	0
72	Scaly-feathered Weaver	0
73	Secretarybird	0
74	South African Cliff Swallow	0
75	Southern Fiscal	0
76	Southern Grey-headed Sparrow	0
77	Southern Masked Weaver	0
78	Southern Red Bishop	0
79	Speckled Pigeon	0
80	Spike-heeled Lark	0
81	Spotted Eagle-Owl	0
82	Spur-winged Goose	1
83	Swainson's Spurfowl	0
84	Violet-eared Waxbill	0
85	Wattled Starling	0
86	Western Barn Owl	0
87	Western Cattle Egret	0

No.	Species	Observed during assessments
88	Whiskered Tern	0
89	White-backed Mousebird	0
90	White-browed Sparrow-Weaver	0
91	White-faced Whistling Duck	0
92	White-winged Widowbird	0
93	Willow Warbler	0
94	Yellow Canary	0
95	Yellow-bellied Eremomela	0
96	Yellow-billed Duck	0
97	Yellow-crowned Bishop	0
98	Zitting Cisticola	1

General species description

The overall avifaunal species occurring at the proposed development site are dominantly represented by bishops, cisticolas, doves, larks, mousebirds, sparrows, swallows and widowbirds. None of the priority bird species were encountered during the fixed point surveys. The observed aquatic species are represented in Appendix D.

Species of conservation importance

The IUCN uses 9 categories of conservation status to apply across taxa (IUCN, 2001). These are summarised in Table 3 below. 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.

Of the 98 listed avifaunal species encountered on site during structured surveys or recorded during SABAP2 assessments for the wider pentads, none are classified as Red Data Species.

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 Northern Black Korhaan (*Afrotis afraoides)* was heard twice patch calling 200 m North and 20 m South on the grassland habitat. The Northern Black Korkhaan has been confirmed to be of Least Concern as it has wide distributional ranges and reportedly healthy populations. Therefore, the Northern Black Korkhaan should not present any substantial threats as a result of development of this site.

METHODS

Methodology

Prior to conducting field assessments, a comprehensive literature review of available published and unpublished literature pertaining to bird interactions with solar plants, substations and power lines was undertaken. The aim of the desktop study was to summarise various issues involved specifically for the 110MW Khauta Solar PV Facility and associated infrastructure. Additionally, a list of previously recorded birds was obtained from Southern African Bird Atlas Project 2 (SABAP 2), and

Google Earth was also used to determine potential habitats for birds. The field methodology was thereafter conducted for assessing the impact of the proposed development on the extant avifaunal population. All habitat types were covered during assessments, and all attempts were made to ensure a representative spread of sampling localities and survey effort that reflected overall habitat composition.

Resident avifaunal population assessment

In determining the *in situ* local avifauna and avian habitats present on the proposed development area, site visits were from the 18th to the 22nd of April 2022. The survey was conducted by two competitive fieldworkers, and the survey time was from 06h00 am until 18h00 pm. Birds were observed using 8 x 42 Bushnell binoculars and photographic were taken where possible.

Data collection methods included the following:

- Vehicle drive surveys: Vehicle surveys were predominantly done along the farm dirt roads and twin tracks as well as the service road of the existing power line infrastructure. Only priority species were recorded during drive transects.
- Walked-transects: Walking a fixed-length transect within a given time and recording all bird species seen or heard within a specified transect width.

All data were analysed by first creating abundance matrices of species (Appendix C), followed by computing species richness (a measure of diversity) and reporting rate (a measure of abundance).

RESULTS OF AVIFAUNAL POPULATION ASSESSMENT

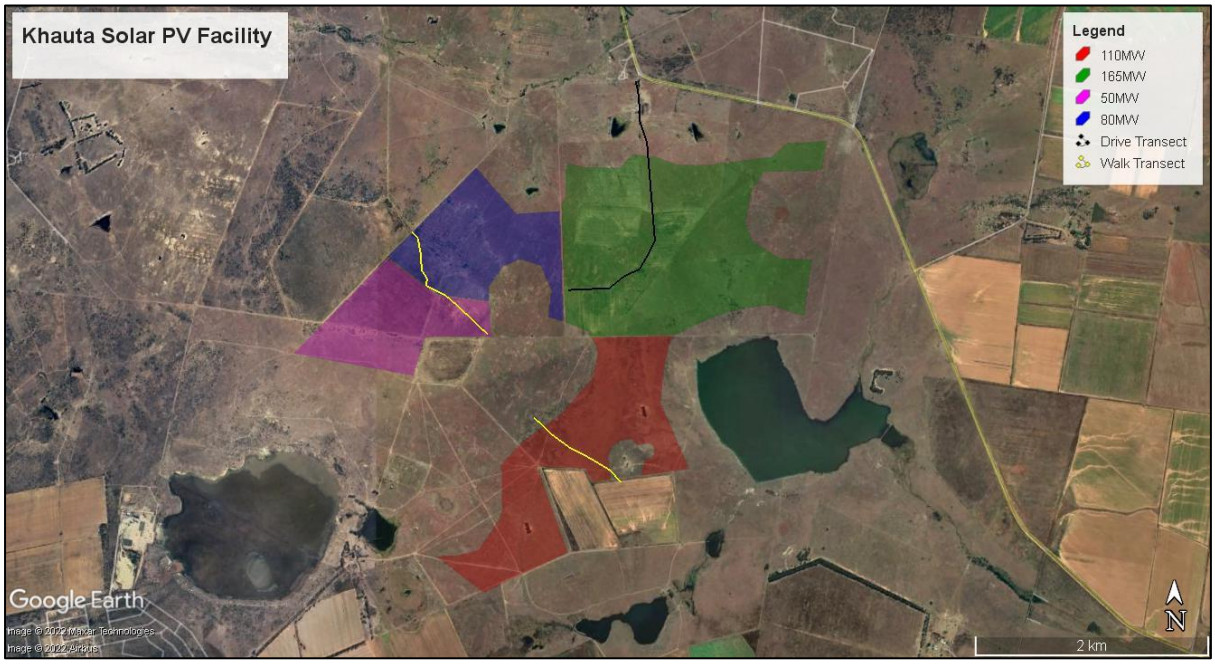

Figure 6. Locations of avifaunal survey transects in relation to the 110 MW Khauta Solar PV Facility.

Species richness, species evenness, and species abundance`

The overall species richness of the site is considered low (3,383). Species evenness reflected that the site was relatively high as a value of 0 indicates complete unevenness and a value of 1 indicates complete evenness. A diversity index score of below 1.5 is considered poor, between 1.5 and 2.5 is moderate, between 2.5 and 3.5 is high, and greater than 3.5 is extreme. The site can be concluded to have a low to moderate species diversity.

Table 4. Avifaunal species richness, evenness and diversity recorded during vehicle drive and walked transects

Margalef's richness	Evenness	Shannon D	Simpson D
d	J'	H'(loge)	1-Lambda'
3,383	0,8039	2,408	0,8665

IMPACTS OF KHAUTA SOLAR PV 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 power line 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 Solar 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 Solar PV plants in formally or informally protected areas or Important Bird Areas (IBAs), but in areas of low relevance for nature conservation.
- Constructing Solar PV plants in already degraded areas.
- Avoiding construction near drainage lines with trees where birds will be concentrated
- Avoiding construction near large trees 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 were considered relevant to the proposed Khauta Solar PV development and that have been included in the impact assessment for scoring are shown in Table 5 below for the Khauta Solar PV array (with associated infrastructure).

Table 5. Avifaunal impacts specific to the Khauta Solar PV areas and associated infrastructure as used in the impact ratings.

Avifaunal impacts specific to the Solar PV areas and infrastructure	
Displacement of priority avian species from important habitats.	The area has been identified as 'High Avian Sensitivity' by DFFE's screening tool. No priority species were recorded on the site or have been confirmed for the wider SABAP2 pentads in wetland habitats.
	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 are also considered as cumulative due to the expected number of planned solar developments in a 30 km radius, and the current extent of regional ecosystem disturbance by mining and agricultural activities.

Avifaunal impacts specific to the Solar PV areas and infrastructure	
Displacement of resident avifauna through increased disturbance.	The resident avifaunal community has a moderately low diversity and only one individual of the endemic Northern Black Korhaan was recorded on site which is of Least Concern.
	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 are also considered as cumulative due to the expected number of planned solar developments in a 30 km radius, and the current extent of regional ecosystem disturbance by mining and agricultural activities.
Loss of important avian habitats	The area has been identified as 'High Avian Sensitivity' by DFFE's screening tool. No priority species were recorded on the site or have been confirmed for the wider SABAP2 pentads in wetland habitats.
	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 are also considered as cumulative due to the expected number of planned solar developments in a 30 km radius, and the current extent of regional ecosystem disturbance by mining and agricultural activities.
Collisions with PV panels leading to injury or loss of avian life	The panels may be horizontal and during daytime, they may create a mirror effect and result in bird collisions, or, during night-time, 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.
	These impacts are also considered as cumulative due to the expected number of planned solar developments in a 30 km radius.

IMPACT ASSESSMENT RATINGS

The methodology for assessing the impact ratings was supplied by Enviroworks as the EAP for the proposed 110 MW Khauta Solar PV Facility.

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 6 below. The findings of the impact assessment ratings are shown in the tables below. Table 6 is for the PV array and associated infrastructure.

Table 6. Impact rating scoring used for the avifaunal impact assessment at the proposed Khauta Solar PV development site.

Significance Points	Environmental Significance	Description

Significance Points	Environmental Significance	Description
125 – 150	Very high (VH)	An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options.
100 – 124	High (H)	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.
75 – 99	Medium-high (MH)	If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be relooked.
40 – 74	Medium (M)	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
<40	Low (L)	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.
+	Positive impact (+)	A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project.

Table 7. Avifaunal impact ratings for the PV array and associated infrastructure at the proposed Khauta Solar PV development site.

Construction Phase	Preferred Alternative (Alternative 1)	
	Before Mitigation	After Mitigation
POTENTIAL IMPACTS ASPECTS		
POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Displacement of priority avian species from important habitats	Minimise the construction footprint and reserve indigenous vegetation wherever possible. Avoid constructing during the breeding season (summer). Construct development in shortest timeframe and control pollution
Magnitude:	6	4
Duration:	2	1
Extent:	1	1
Irreplaceable:	3	2
Reversibility:	3	2
Probability:	3	1
Total SP:	45	10
Significance rating:	Medium (M)	Low (H)
POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Displacement of resident avifauna through increased disturbance	Minimise the construction footprint and reserve indigenous vegetation wherever possible. Avoid constructing during the

		breeding season (summer). Construct development in shortest timeframe and control pollution
Magnitude:	6	4
Duration:	2	1
Extent:	1	1
Irreplaceable:	2	2
Reversibility:	2	1
Probability:	4	2
Total SP:	52	18
Significance rating:	Medium (M)	Low (H)
POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Loss of important avian habitats	Use designated roads to access the site. Minimise the construction footprint and reserve indigenous vegetation wherever possible. Avoid constructing during the breeding season (summer). Construct development in shortest timeframe and control noise pollution. Rehabilitate area with indigenous flora
Magnitude:	6	6
Duration:	2	4
Extent:	1	1
Irreplaceable:	3	3
Reversibility:	3	3
Probability:	3	2
Total SP:	45	34
Significance rating:	Medium (M)	Low (H)
POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Displacement of priority avian species from important habitats	Minimise the construction footprint and reserve indigenous vegetation wherever possible. Avoid constructing during the breeding season (summer). Construct development in shortest timeframe and control pollution
Magnitude:	6	4
Duration:	2	1
Extent:	1	1
Irreplaceable:	3	2
Reversibility:	3	2
Probability:	3	1
Total SP:	45	10
Significance rating:	Medium (M)	Low (H)

POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Displacement of resident avifauna through increased disturbance	Minimise construction footprint and reserve indigenous vegetation wherever possible. Avoid development expansion and constructing during the avoid breeding season (summer). Construct development in shortest timeframe, control noise pollution
Magnitude:	6	2
Duration:	3	3
Extent:	1	1
Irreplaceable:	2	2
Reversibility:	2	2
Probability:	3	3
Total SP:	42	30
Significance rating:	Medium (M)	Low (H)
Operation Phase	**Preferred Alternative (Alternative 1)**	
	Before Mitigation	**After Mitigation**
POTENTIAL IMPACTS ASPECTS		
POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Collisions with PV panels leading to injury or loss of avian life	Ensure panels are flat during the night time, preferably low-sheen/matt surfaces. Conduct quarterly fatality monitoring assessments
Magnitude:	6	4
Duration:	3	3
Extent:	1	1
Irreplaceable:	2	2
Reversibility:	4	3
Probability:	3	2
Total SP:	48	26
Significance rating:	Medium (M)	Low (H)
Decommissioning Phase	**Preferred Alternative (Alternative 1)**	
	Before Mitigation	**After Mitigation**
POTENTIAL IMPACTS ASPECTS		
POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Displacement of priority avian species from important habitats	None required due to low significance
Magnitude:	4	4
Duration:	2	1
Extent:	1	1
Irreplaceable:	2	2
Reversibility:	2	2
Probability:	2	1
Total SP:	22	10
Significance rating:	Low (H)	Low (H)
POTENTIAL ENVIRONMENTAL IMPACT /	Displacement of resident avifauna through increased	None required due to low significance

NATURE OF IMPACT:	disturbance	
Magnitude:	2	2
Duration:	2	2
Extent:	1	1
Irreplaceable:	2	2
Reversibility:	2	2
Probability:	2	2
Total SP:	18	18
Significance rating:	Low (H)	Low (H)
Post Decommissioning Phase	**Preferred Alternative (Alternative 1)**	
	Before Mitigation	**After Mitigation**
POTENTIAL IMPACTS ASPECTS		
POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Cumulative displacement of priority avian species from important habitats	Minimise 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
Magnitude:	6	4
Duration:	5	3
Extent:	2	2
Irreplaceable:	3	2
Reversibility:	3	2
Probability:	3	2
Total SP:	57	26
Significance rating:	Medium (M)	Low (H)
POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Cumulative displacement of resident avifauna	Minimise development footprint and habitat transformation, limit ongoing human activity to the minimum required for ongoing operation, control noise pollution, rehabilitate with indigenous flora and reserve indigenous vegetation throughout as far as possible, limit roadways and vehicle speeds
Magnitude:	6	4
Duration:	2	2
Extent:	1	1
Irreplaceable:	2	2
Reversibility:	2	2
Probability:	2	2

Total SP:	26	22
Significance rating:	Low (H)	Low (H)
POTENTIAL ENVIRONMENTAL IMPACT / NATURE OF IMPACT:	Cumulative loss of important avian habitats	Minimise development footprint and habitat transformation, rehabilitate with indigenous flora and reserve indigenous vegetation throughout as far as possible
Magnitude:	4	4
Duration:	4	3
Extent:	2	1
Irreplaceable:	2	2
Reversibility:	2	2
Probability:	3	2
Total SP:	42	24
Significance rating:	Medium (M)	Low (H)

The impact ratings shown above rank the proposed 110 MW Khauta Solar PV development site as Medium (M) for the PV array and associated infrastructure before mitigations. After mitigations, the impact rating is borderline with a Low (L) rating (20.71 score), as summarised in Table 8 below.

Overall, considering all impacts and all infrastructure, the average impact rating for the proposed 110 MW Khauta Solar PV development on avifauna is Medium, however this can be reduced to Low with sufficient application of recommended mitigations.

Table 8. Summary of avifaunal impact ratings for the proposed 110 MW Khauta Solar PV development

	Average impact rating	Significance class	Average mitigated impact	Significance class
Avifaunal impacts of the PV array and associated infrastructure	40.18	Medium (M)	20.73	Low (L)

MITIGATION REQUIREMENTS

The majority of the mitigations listed in Table 7 above for the PV array and associated infrastructure involve minimising impact footprints during construction, limiting site access beyond direct disturbance zones, reducing noise pollution, constructing in winter (to avoid the breeding season), and using designated roads as much as possible. Implementing these mitigations reduces the significance by 30.21 - 51.59% which results in acceptable Low (L) impact ratings.

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'. Implementing these mitigations should reduce the significance by 54% and results in acceptable Low (L) impact ratings.

NO-GO AREAS, BUFFERS AND ALTERNATIVES

No no-go areas are applicable to the project site from an avifaunal perspective.

No alternative site locations have been provided.

CONCLUSION AND RECOMMENDATIONS

The proposed 110 MW Khauta Solar PV is situated in an area of high avian sensitivity due to the presence of priority habitats. Assessments for the present waterbodies were conducted where only species of Least Concern were encountered. As a result, from a avifaunal perspective, there is no objection to the development of the proposed Khauta Solar PV Facility and associated infrastructure, provided to the recommended mitigation measures are strictly followed. The overall impacts (including cumulative) for the project is considered to be low and will not cause detrimental impacts to the avifauna species located within the development area.

Specific conditions recommended for the EA from an avifaunal perspective

1. Implement mitigation controls during the construction phase as specified in the MITIGATION REQUIREMENTS. Monitor and report on their effectiveness.

2. Implement mitigation controls during the operational phase as specified in the MITIGATION REQUIREMENTS. Monitor and report on their effectiveness.

3. 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 Solar PV array area for evidence of PV collisions;

4. 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.

5. Effective restoration of the natural habitats that were intact before the development should be implemented and reported on after decommissioning.

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APPENDICES

Appendix A: Method of Environmental Assessment

For each potential impact, the EXTENT (Spatial scale), MAGNITUDE (degree of the impact), DURATION (time scale), PROBABILITY (occurrence), IRREPLACEABILITY (loss of resources) and the REVERSIBILITY (degree to which the proposed impact can be reversed) will be assessed by the EAP as well as the Specialists. The assessment of the above criteria will be used to determine the significance of each impact, with and without the implementation of the proposed mitigation measures. The scale to be used to assess these variables and to define the rating categories are tabulated in the Table 9 below.

Table 9. Evaluation components, ranking scales and descriptions (criteria)

Evaluation component	Ranking scale and description (criteria)
MAGNITUDE of NEGATIVE IMPACT (at the indicated spatial scale)	10 - Very high: Bio-physical and/or social functions and/or processes might be severely altered. 8 - High: Bio-physical and/or social functions and/or processes might be considerably altered. 6 - Medium: Bio-physical and/or social functions and/or processes might be notably altered. 4 - Low : Bio-physical and/or social functions and/or processes might be slightly altered. 2 - Very Low: Bio-physical and/or social functions and/or processes might be negligibly altered. 0 - Zero: Bio-physical and/or social functions and/or processes will remain unaltered
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	10 - Very high (positive): Bio-physical and/or social functions and/or processes might be substantially enhanced. MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale) 8 - High (positive): Bio-physical and/or social functions and/or processes might be considerably enhanced. 6 - Medium (positive): Bio-physical and/or social functions and/or processes might be notably enhanced. 4 - Low (positive): Bio-physical and/or social functions and/or processes might be slightly enhanced. 2 - Very Low (positive): Bio-physical and/or social functions and/or processes might be negligibly enhanced. 0 - Zero (positive): Bio-physical and/or social functions and/or processes will remain unaltered.
DURATION	5 - Permanent 4 - Long term: Impact ceases after operational phase/life of the activity > 60 years. 3 - Medium term: Impact might occur during the operational phase/life of the activity – 60 years. 2 - Short term: Impact might occur during the construction phase - < 3 years. 1 - Immediate
EXTENT (or spatial scale/influence of impact)	5 - International: Beyond National boundaries. 4 - National: Beyond Provincial boundaries and within National boundaries. 3 - Regional: Beyond 5 km of the proposed development and within Provincial boundaries. 2 - Local: Within 5 km of the proposed development. 1 - Site-specific: On site or within 100 m of the site boundary. 0 - None
IRREPLACEABLE loss of resources	5 – Definite loss of irreplaceable resources. 4 – High potential for loss of irreplaceable resources. 3 – Moderate potential for loss of irreplaceable resources. 2 – Low potential for loss of irreplaceable resources. 1 – Very low potential for loss of irreplaceable resources. 0 - None
REVERSIBILITY of impact	5 – Impact cannot be reversed. 4 – Low potential that impact might be reversed. 3 – Moderate potential that impact might be reversed. 2 – High potential that impact might be reversed. 1 – Impact will be reversible. 0 – No impact.
PROBABILITY (of occurrence)	5 - Definite: >95% chance of the potential impact occurring. 4 - High probability: 75% - 95% chance of the potential impact occurring. 3 - Medium probability: 25% - 75% chance of the potential impact occurring 2 - Low probability: 5% - 25% chance of the potential impact occurring. 1 - Improbable: <5% chance of the potential impact occurring.
Evaluation component	**Ranking scale and description (criteria)**

CUMULATIVE impacts	High: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern. Medium: The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern. Low: The activity is localised and might have a negligible cumulative impact. None: No cumulative impact on the environment.

Appendix B: Photographs of sampled habitat types

Figure 7. Wetland habitat where fixed point avifaunal surveys were conducted to confirm avian sensitivity.

Figure 8. Grassland habitat where walked and vehicle drive transects were conducted.

Appendix C: Species composition of encountered avifaunal community during assessments

Species	Latitude	Longitude	Count
Acacia Pied Barbet	-27.907902	26.843531	2
African Hoopoe	-27.916925	26.836192	1
African Pipit	-27.909076	26.858182	1
African Red-eyed Bulbul	-27.910063	26.801454	3
Ant-eating Chat	-27.908875	26.858105	2
Black-chested Prinia	-27.898816	26.830829	1
Black-collared Barbet	-27.906003	26.843055	1
Black-necked Grebe	-27.909007	26.841942	2
Black-throated Canary	-27.919612	26.830635	3
Blue Waxbill	-27.89983	26.82638	4
Brown-crowned Tchagra	-27.897747	26.834178	3
Cape Canary	-27.908259	26.798844	2
Cape Robin-Chat	-27.905888	26.842869	2
Cape Shoveler	-27.908972	26.841965	4
Cape Sparrow	-27.907872	26.843463	5
Cape Starling	-27.906091	26.843131	2
Cape Wagtail	-27.904712	26.841865	2
Cape White-eye	-27.907862	26.843527	5
Cape White-eye	-27.952685	26.878907	5
Cardinal Woodpecker	-27.907733	26.797124	1
Common Myna	-27.906826	26.843283	1
Common Quail	-27.893548	26.853135	1
Common Starling	-27.907856	26.843518	2
Crested Barbet	-27.898274	26.833829	1
Crested Barbet	-27.94826	26.875652	1
Crowned Lapwing	-27.90784	26.843572	80
Desert Cisticola	-27.900365	26.859523	1
Diederik Cuckoo	-27.912376	26.796965	1
Fairy Flycatcher	-27.911496	26.797039	1
Fiscal Flycatcher	-27.910071	26.801444	2
Glossy Ibis	-27.90787	26.843458	20
Greater Striped Swallow	-27.907878	26.84348	7
Grey-backed Cisticola	-27.959002	26.88451	1
Hadada Ibis	-27.90792	26.843508	20
Helmeted Guineafowl	-27.907888	26.843485	50
Laughing Dove	-27.907864	26.843464	4
Little Grebe	-27.908972	26.841965	1
Little Swift	-27.907848	26.84357	6
Namaqua Dove	-27.953595	26.879423	1
Orange River Francolin	-27.909	26.841967	5
Orange River White-eye	-27.907787	26.843539	8
Pied Crow	-27.955158	26.883181	2

Species	Latitude	Longitude	Count
Pink-billed Lark	-27.87773	26.869486	9
Pririt Batis	-27.904911	26.841862	2
Quailfinch	-27.891214	26.871008	6
Red-billed Quelea	-27.900395	26.859561	100
Red-headed Finch	-27.908913	26.858133	10
Reed Cormorant	-27.90898	26.841941	5
Ring-necked Dove	-27.920875	26.82891	4
Rufous-naped Lark	-27.870025	26.868383	3
Southern Fiscal	-27.90789	26.84348	1
Southern Grey-headed Sparrow	-27.918922	26.831331	1
Speckled Mousebird	-27.95253	26.88215	1
Speckled Pigeon	-27.905384	26.842253	3
Spike-heeled Lark	-27.909071	26.858294	3
Spur-winged Goose	-27.89056	26.868725	3
Violet-eared Waxbill	-27.911051	26.803446	4
Wattled Starling	-27.91237	26.805016	30
White-bellied Sunbird	-27.907837	26.843453	1
White-breasted Cormorant	-27.908995	26.841953	3
White-browed Sparrow-Weaver	-27.907873	26.843499	6
White-faced Whistling Duck	-27.908972	26.841965	17
Yellow Canary	-27.905992	26.843027	30
Yellow-crowned Bishop	-27.911122	26.797046	1
Zitting Cisticola	-27.891272	26.871027	2

Appendix D: List species of water birds encountered at the Big Pan

Species	Count	Conservation status
African Black Duck	2	Least Concern
Black-necked Grebe	2	Least Concern
Egyptian Goose	16	Least Concern
Glossy Ibis	7	Least Concern
Red-billed Teal	6	Least Concern
Red-knobbed Coot	50	Least Concern
Reed Cormorant	7	Least Concern
South African Shelduck	3	Least Concern
Spur-winged Goose	35	Least Concern
Western Cattle Egret	37	Least Concern
White-breasted Cormorant	3	Least Concern
Yellow-billed Duck	30	Least Concern

Appendix E: Site sensitivity ratings to species data in the screening tool

Sensitivity Rating	Description of Sensitivity Rating
Very high	Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km^2 is considered critical habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under the CR, EN, or VU criteria of the IUCN or species listed as Critically/Extremely Rare under South Africa's National Red List Criteria. For each species reliant on a critical habitat, all remaining suitable habitat has been manually mapped at a fine scale.
High	Recent occurrence records for all threatened (CR, EN, VU) and/or Rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2002) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat. For birds, species distribution models (SDMs) and SABAP2 data (http://sabap2.birdmap.africa/) were combined to delineate the 'high' sensitivity areas
Medium	Medium Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
Low	Low Areas where no species of conservation concern (SCC) are known or expected to occur.

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