

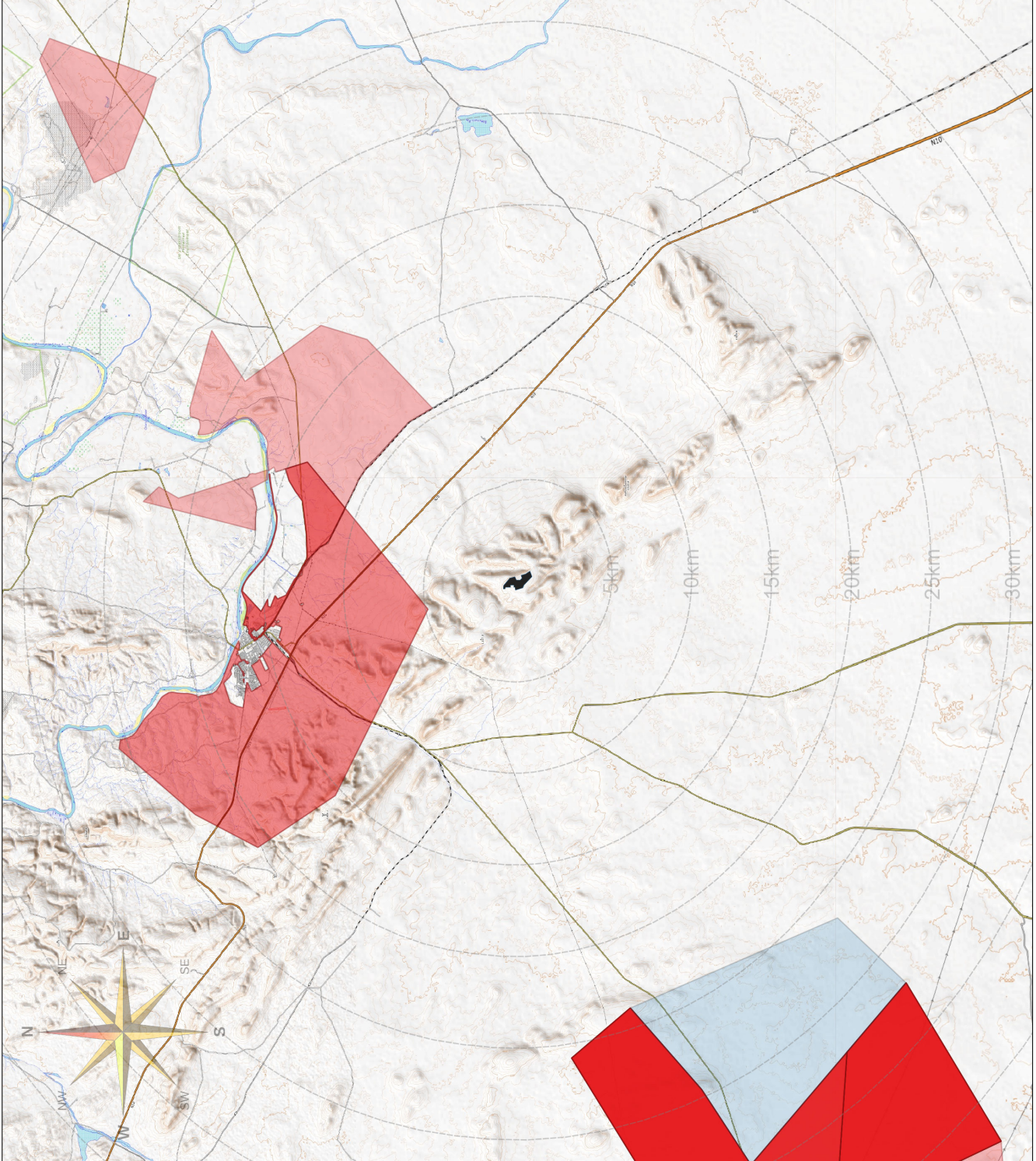


Figure 40: Approved renewable energy projects within 30 km from the proposed PV2 footprint (black polygon in the centre). Reddish polygons: Solar PV; Blueish polygons: Wind.

Appendices

Appendix A Avifauna Site Sensitivity Verification

The Site Sensitivity Verification for avifauna (ASSV) at the proposed Doringberg Photovoltaic facility (PV2) was conducted in full compliance with the National Environmental Management Act, 1998 (NEMA, Act 107 of 1998), the Environmental Impact Assessment Regulations, 2014 (as amended), and the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Avifauna (Government Notice 320 of 20 March 2020, as amended). This ASSV aligns with the DFFE National Web-based Environmental Screening Tool (version 3, 2021 onwards) and the minimum standards for specialist assessments (DEA 2021; BirdLife South Africa & EWT 2022). The process comprised a desktop review of the Screening Tool outputs for the project footprint and surrounding Project Area of Influence (PAOI), followed by targeted field verification to confirm, refine, or rebut the preliminary sensitivity ratings assigned by the Tool.

This ASSV was compiled in July 2025. Instead of duplicating tables and figures, reference is made to them as they appear in the main report.

A.1 Pragmatic Operational Project Area

This avifaunal assessment complies with the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species, as published in Government Notice No. 1150 in Government Gazette No. 43855 of 30 October 2020. One of its stipulations is that where the proposed activity is expected to affect Species of Conservation Concern (SCC) beyond the boundaries of the preferred site, the specialist must delineate the Project Area of Influence (PAOI) in accordance with the Species Environmental Assessment Guideline, and the study area must encompass the PAOI so defined.

Defining the PAOI for birds poses a uniquely complex challenge in environmental impact assessments. Unlike most other taxa, whose ecological requirements are comparatively constrained by habitat patches or home ranges, birds — especially migratory, nomadic, and wide-ranging species — operate across spatial and temporal scales that routinely transcend conventional project boundaries. The PAOI must therefore encompass not only the immediate footprint and its immediate surroundings, but also critical resource areas (*e.g.*, nesting areas, foraging areas, water points), movement corridors, seasonal concentration sites, and potentially even distant breeding or non-breeding grounds linked through flyways or dispersal events. Many of these connections remain unknown or poorly understood. In arid and semi-arid regions such as the Northern Cape, the challenge is further intensified by opportunistic breeding triggered by unpredictable rainfall, irruptive movements in response to resource pulses, and the patchy distribution of critical habitats across vast, largely unsurveyed landscapes. Collectively, these factors hinder the accurate delineation of a biologically meaningful area of influence on a map. In practice, the PAOI is therefore treated as a pragmatic operational area — a working polygon drawn to guide fieldwork planning, resource allocation, and impact scoping — rather than a precise reflection of all possible ecological influences.

Actual project effects on birds, particularly displacement, barrier effects, or altered resource use, may extend well beyond this mapped line, especially for mobile species whose movements are shaped by seasonal or episodic drivers. Ultimately, the PAOI for birds is less a fixed geographic polygon than a dynamic conceptual envelope — shaped by species ecology, seasonal phenology, and the best available evidence of utilisation and connectivity — an envelope that demands continual refinement through field verification, long-term monitoring, and iterative assessment, processes which require temporal and financial resources that frequently exceed what is practicable within typical EIA budgets and timeframes.

In this avifaunal assessment, the term **Pragmatic Operational Project Area (POPA)** is adopted instead of the conventional PAOI. The POPA is a pragmatic, operational project area to guide fieldwork planning, resource allocation, and impact scoping. It does not imply that the development's ecological effects cease at the border of this area; actual influences — particularly for wide-ranging avifauna — may extend further into the surrounding landscape.

The POPA for the PV2 facility encompasses the Doringberg range between the Burchell–Cuprum 132 kV power line in the north-west and Keikamspoort in the south-east, which constitutes the core breeding area of Verreaux's Eagle — a Species of Conservation Concern (SCC) — within the Doringberg range (Fig. 4). Adjacent toeslopes up to 7 km from the footprint are also included in the POPA.

A.2 Project background

Prieska Power Reserve (Pty) Ltd (PPR) proposes the development of a renewable energy hub at Prieska, Northern Cape, South Africa. The development will consist of a network of solar and wind energy facilities that will provide power for the production of renewable hydrogen and ammonia from water and air. The project will be implemented in phases. The focus of this avifaunal impact assessment is on the proposed Prieska Power Reserve, Doringberg PV facility, situated on a plateau in the Doringberg range approximately 16 km south of Prieska (Fig. 3, page 163). The PV solar field (77.7 ha) will consist of an array of fixed tilt solar panels. The generative capacity may be up to 77.7 MW.

A.3 General description of the receiving environment

A.3.1 Topography

The Doringberg mountain system in the POPA south of Prieska is characterised by a broad summit plateau dissected by several large valleys and gorges (Fig. 4). This dissection has fragmented the plateau into multiple plateau remnants—relatively flat, elevated areas that are either fully isolated or connected. These remnants are bounded by steep escarpments, valleys, and gorges, forming distinct topographic compartments within the larger plateau landscape. Where the mountain system opens into expansive lowlands, the toeslope (the predominantly linear or slightly concave basal zone) typically extends for several kilometres,

forming a broad, gently sloping apron. The PV2 footprint (measuring 1.9 km from north to south and is about 0.7 km at its widest point) is located on one of the plateau remnants (Fig. 5, page 165).

A.3.2 Vegetation

Based on the vegetation classification of Mucina & Rutherford (2006), the proposed PV2 is located in **Lower Gariep Broken Veld** (with sparse vegetation dominated by shrubs and dwarf shrubs), embedded within or transitioning to **Bushmanland Arid Grassland**, both within the Bushmanland Bioregion located of the Nama-Karoo Biome (Fig. 1; Fig. 2). The PV2 footprint is characterised by sparse vegetation dominated by shrubs and dwarf shrubs (Fig. 20).

A.3.3 Areas of conservation concern

The PV2 footprint is located in a mosaic of ecological support areas (ESA) and other natural areas (Fig. 22, page 182; Holness & Oosthuysen 2016; <https://bgis.sanbi.org/Projects/Detail/203>).

The nearest formally protected area is Witsand Provincial nature Reserve located more than 50 km north-east of the study area.

The nearest important bird area (IBA) is Augrabies Falls National Park located more than 150 km west of the study area.

The nearest Ramsar site is Baberspan located approximately 450 km to the north-east (<https://www.ramsar.org/wetland/south-africa>).

A.4 Methods

A list (see Table 1, page 130) was compiled of all bird species with distributions overlapping with the study area using to the methods outlined in Section 4.6 (page 43).

The fieldwork for this ASSV relied on fieldwork conducted from 26 July to 21 August 2021, and again from 6 to 13 October 2021, by the author in the study area for avifaunal impact assessments of other proposed Prieska Power Reserve elements (*e.g.* Van Niekerk 2021).

Avifaunal Impact Assessments from other Prieska Power Reserve projects were also consulted, including those related to a proposed wind farm on the plateaus in the POPA (Van Rooyen & Froneman 2023a,b) and a solar PV installation on a toeslope (Van Rooyen & Froneman 2022).

A.5 Species of Conservation Concern (SCC)

The distributions of 33 species of conservation concern overlaps with the study area (Table 1 A). They include two Critically Endangered species, six Endangered species, nine Vulnerable species, and 16 Near Threatened species (Table 1 A). Background information on each of these species is presented in Section 5 (page 53 *ff*) of the main report. The National Web-based Environmental Screening Tool does not contain Near Threatened species.

The Animal Species Theme Sensitivity of the Screening Tool (Utilities Infrastructure | Electricity | Generation | Renewable | Solar | PV) indicates high sensitivity for the western third of the POPA, and medium sensitivity for the rest, including the project footprint (Fig. 35, page 195). Both sensitivity levels are each linked to the same two species, namely the Verreaux's Eagle R131 and Ludwig's Bustard R232 (Fig. 35). The "feature" of low sensitivity areas are not specified, but it appears to correspond with steep topography (Fig. 35).

A.5.1 Critically Endangered Species

White-backed Vulture R123 and Lappet-faced Vulture R124, both associated with woodland habitats, are known to roost on pylons approximately 25 km south-west of the POPA (Van Rooyen & Froneman 2023a). Expect perhaps for visits to carcasses if available on the plateaus, it is considered unlikely to make use of the plateaus otherwise.

A.5.2 Endangered Species

A Ludwig's Bustard R232 was recorded on the PV2 plateau on 10 August 2021 (iNaturalist #348006334). The habitat on the plateaus and toeslopes are ideal for this species and it could use the area frequently.

There are single records of Tawny Eagle (Van Rooyen & Froneman 2023a) and Martial Eagle R140 (iNaturalist #348007084) on toeslopes some distance from the plateaus. Both species could potentially be resident in the area, but they naturally occur at low density.

The Black Stork R084 could possibly breed in the Doringberg range, but was not recorded during surveys.

Occurrence of Black Harrier R168 in the study area is at best considered transitory. The Saddle-billed Stork R088 is only sporadically recorded in the Northern Cape and considered unlikely to occur in the study area.

A.5.3 Vulnerable Species

The PV2 footprint is located in the midst of the core breeding area for Verreaux's Eagle R131 in the Doringberg range with at least six breeding pairs nesting less than 6 km from the footprint (iNaturalist #348005045, iNaturalist #348005839, iNaturalist #348006121, iNaturalist #348006501, iNaturalist #348006687, iNaturalist #348006874).

The Cape Vulture R122 was recorded once as a bird in flight over the study area.

Of the remaining seven Vulnerable species with distributions that overlaps with the study area, the Secretarybird R118 is the most likely to visit the study area.

A.6 Conclusions

The Site Sensitivity Verification confirmed utilisation of the PV2 development footprint and surrounding environs by several avifaunal Species of Conservation Concern, most notably Verreaux's Eagle and Ludwig's Bustard. Whereas the eagle is a breeding resident, the bustard is expected to be at least a visitor to the POPA, including areas previously rated as Medium sensitivity by the Screening Tool.

Given the confirmed presence and habitat use by these SCC, the avifaunal sensitivity of the entire POPA is upgraded to High. This rating applies to both the western third of the POPA (already flagged as High by the Screening Tool) and the proposed development footprint. A full Avifauna Impact Assessment is therefore recommended in accordance with the Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species (Government Notice No. 1150, published in Government Gazette No. 43855 of 30 October 2020).

Appendix B Bird Monitoring Program

Given the relative scarcity of information on the interaction between birds and PV facilities, and further acknowledging uncertainties regarding residual risks remaining after implementation of recommended mitigation strategies, it is recommended that the Bird Monitoring Program (BMP) detailed herein must be incorporated into the Environmental Management Program for the proposed development.

Aim: To directly assess the impact of the PV2 facility on birds in order to determine the efficiency of recommended mitigation measures and to assess if additional mitigation is required. As such the BMP can trigger an adaptive management process.

Who: An ornithologist with suitable experience should be appointed as the BMP manager.

What: As a minimum the BMP should assess the following three aspects:

- Development-induced changes in bird community composition;
- Utilisation of project infrastructure by birds;
- Bird injuries and fatalities resulting from project infrastructure including PV arrays, fences and power lines. The findings should be documented in annual post-construction monitoring reports compiled by the BMP manager.

When: The BMP manager should be appointed at least six months before the first section(s) of the PV2 facility becomes operational. The BMP should commence as soon as the first section of the solar field becomes operational. Initially, surveys should be conducted during the first two years. The results from these surveys will determine the need for, and frequency of, subsequent surveys. The timing of surveys during each year will in part depend on the findings of previous surveys. In addition, at least one of the surveys should coincide with a period when migrant species are present.

Methods: The methods recommended below represent a compromise between what might be theoretically desirable or ideal and what is practicable. The BMP manager must constantly strive to improve these methods in the light of field experience and other relevant information that may become available, for example from studies at other solar energy facilities. It is imperative that the manager understand what data is to be collected and why, and the limitations and biases inherent of the methods used. In order to aid this understanding the BMP manager should review the relevant information and literature during the planning phase and update it subsequently at least once a year. In order to gain insight into the interaction between birds and project infrastructure, all observed interactions including perching, shading and nesting, should be recorded.

- Bird community composition: Constructing the PV2 facility will transform local habitat into a PV array forest, potentially altering the resident bird community. To evaluate this impact, surveys based on those used in the Avifaunal Impact Assessment (see Section 4) should identify resident species within the development area and compare them to this report's findings, paying special attention to species at high risk of disturbance, as listed in Table 1.

- Bird injuries and fatalities: Before embarking on carcass related studies the BMP manager should review the relevant literature and take the many potential sources of error and bias into consideration when designing and planning the study. The Section on mortality rates in the main report will provide a good starting point (page 25 onwards).
 - PV solar field: The limited information available suggests that collision-related fatalities involving PV structures is likely to occur, but it is not yet possible to accurately predict which species will be most affected by this. It is imperative that the incidence of this should be assessed at the proposed PV2 facility. As will be clear from the Section on mortality rates in the main report (page 25 onwards), it is not feasible to conduct the required research to establish accurate fatality rates. Nevertheless, it is recommended that during each BMP survey a set of carcass searches should be conducted covering representative sections of the solar field. If observations indicate that a specific part of the solar field not covered by the carcass surveys is frequently visited by birds, this area should also be included in the carcass searches.
 - Power lines: Concurrently with the PV2 solar field surveys, the entire length of power lines within the development area should also be surveyed for dead birds.
 - Fences: The entire length of the perimeter fence of the PV2 facility should be checked for collision victims at least twice during each BMP survey.
- Bird incident register: The BMP manager must maintain a bird incident register wherein all avifaunal fatalities and nesting attempts directly associated with the PV2 facility are recorded in. Financial and time constraints will probably limit the BMP manager in terms of the number of times the PV2 facility can be visited. In order to maximise the data collection effort and promote environmental awareness among the staff, it is recommended that the manager also train one or more of the permanent staff working at the PV2 complex to use the Bird Incident Form (see example below) to record bird related incidents at the PV2 facility during routine maintenance activities. Trainees should be encouraged to take photographs of each incident and include it in the forms. Depending on the circumstances the bird incident forms can be a physical paper form or in electronic format, in which case it may be possible to send it electronically directly to the ornithologist who will have the responsibility of curating all the bird incident forms of the project. These forms are meant to supplement the data collected by the BMP manager during the formal BMP surveys.

Bird Incident Form	
Facility name:	
Observer name:	
Date:	Time (e.g. 7h15; 16h54):
The incident	Type (e.g. dead bird, nest):
	Likely cause:
The animal	Species:
	Age class:
	Sex:
	Condition of remains:
Location	GPS:
	Nearest PV hardware
Remarks:	
Photos:	

Appendix C Specialist declaration of independence

Specialist investigator: Dr. D. J. van Niekerk

djvnemail@gmail.com

PhD in Zoology. University of the Free State (2009).
Curriculum Vitae is included in Appendix E, page 213.

Declaration of independence:

I, the specialist investigator responsible for conducting this particular specialist study, declare that

- I have served as an independent specialist in this application;
- I will perform/performed 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. There are no circumstances that compromised 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 am aware that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Johan van Niekerk

Appendix D SACNASP registration



herewith certifies that
Daniël Johan van Niekerk

Registration Number: 147195

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)
Zoological Science (Professional Natural Scientist)

Effective **7 May 2025**

Expires **31 March 2026**



A handwritten signature in black ink, appearing to read 'S. V. N. P.', written over a horizontal line.

Chairperson

A handwritten signature in black ink, appearing to read 'N. J. van Niekerk', written over a horizontal line.

Chief Executive Officer



Appendix E Curriculum Vitae: Dr. D. J. van Niekerk

CURRICULUM VITAE

(Abridged)

Dr. D. Johan van Niekerk

Ornithologist

March 2026

I, Johan van Niekerk (PhD Zoology), am an ornithologist with 23 years of experience as an independent environmental consultant specialising in birds. During this period I successfully completed a numerous of environmental impact assessments, bird monitoring and risk assessment studies.

1 Tertiary qualifications

- B. Sc. (Biochemistry and Zoology). University of the Free State (1994)
- B. Sc. Honours in Zoology. University of the Free State (1995)
- M. Sc. in Zoology with distinction. University of the Free State (2000)
- Ph. D. in Zoology. University of the Free State (2009)

Additional courses

- Taxidermy course. National Museum, Bloemfontein. June 1988.
- EIA, Centre for Environmental Management, University of the Free State, January 2006

2 Professional registration

South African Council for Natural Scientific Professions (SACNASP): Zoological Science (Professional Natural Scientist): #147195

3 Work experience

Environmental Management
Group

Avifaunal specialist for impact
assessments

Since 2022

Green-Box Consulting	Avifaunal specialist for impact assessments	Since 2021
Greenmined Environmental	Avifaunal specialist for impact assessments	Since 2021
Spatial Solutions	Avifaunal specialist for impact assessments	Since 2020
Eco-Con Environmental	Avifaunal specialist for impact assessments	Since 2019
Savannah Environmental	Avifaunal specialist for impact assessments	Since 2015
Environamics Environmental Consultants	Avifaunal specialist for impact assessments	Since 2015
Tlokoeng Valley Biodiversity Conservation Project (Lesotho)	Project manager for the faunal component	2012–2015
Nare Sereto CC	Avifaunal specialist for impact assessments	Since 2012
Enviroworks	Avifaunal specialist for impact assessments	Since 2009
H2ON Environmental Specialists	Avifaunal specialist for International Cyanide Management Code	2008
Syngenta	Trainer of personnel in Brazil for conducting risk assessment studies	2010
	Project manager for risk assessment studies.	2006–2007; 2010–2011
Conserving Mountain Biodiversity in Southern Lesotho (UNDP project)	Project manager for bird component	2003-2004
Lesotho Highlands Development Authority	Project manager for bird component of monitoring and faunal rescue at Mohale Dam	2002–2003
University of the State	Research associate	2010–2012
	Temporary lecturer	2006-2007
	Laboratory assistant	1995-2005 & 2008-2009

Specialist reports:

- Van Niekerk, D. J. 2002. Birds. In: Biological Resource Monitoring Contract LHDA 1053: Annual Report 2001/2002 (ed. C. Mokuku). NUL-CONSULS, Maseru, Lesotho.
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- Van Niekerk, D.J. 2015. Avifaunal Impact Assessment report for the proposed extension of the Bokamoso Photovoltaic Solar Energy Facility near Leeudoringstad, North West Province. Report to Environamics Environmental Consultants.
- Van Niekerk, D.J. 2016. Feasibility study for the proposed construction of the Semonkong Wind Farm in Lesotho: Avifauna. Report to Savannah Environmental.
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