

Terrestrial Biodiversity Assessment

prepared in accordance with the
*"Protocol for the Specialist Assessment and minimum report content requirements for
environmental impacts on Terrestrial Biodiversity"*

Leeuwbosch Pv 3 Solar Photovoltaic (PV)
Plant and Associated Infrastructure near
Leeudoringstad in North West Province



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Terrestrial Biodiversity Assessment report for the proposed Leeuwbosch Pv 3 Solar Photovoltaic (PV) Plant and associated infrastructure near Leeudoringstad in North West Province.

for

21 November 2022

Report version: 1st draft

TABLE OF CONTENTS

TABLE OF CONTENTS	2
LIST OF FIGURES	3
SPECIALIST DETAILS & DECLARATION	4
DECLARATION OF INDEPENDENCE:.....	4
DISCLOSURE:	4
TERMS OF REFERENCE	5
LIMITATIONS, ASSUMPTIONS & UNCERTAINTIES	8
INTRODUCTION	9
PROJECT DESCRIPTION	9
SENSITIVITIES IDENTIFIED FROM DFFE ONLINE SCREENING TOOL	11
TERRESTRIAL BIODIVERSITY THEME.....	11
<i>Terrestrial Biodiversity theme</i>	11
METHODOLOGY	12
PROJECT AREA OF INFLUENCE (PAOI)	12
SURVEY TIMING.....	13
FIELD SURVEYS	14
SOURCES OF INFORMATION	15
<i>Regional Vegetation</i>	15
<i>Threatened Ecosystems</i>	15
<i>Regional plans</i>	15
<i>Aerial imagery</i>	15
HABITAT SENSITIVITY	15
RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS	17
CONVENTION ON BIODIVERSITY (CBD)	17
NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT NO. 107 OF 1998 (NEMA)	17
NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (ACT NO 10 OF 2004) (NEMBA).....	17
<i>Alien and Invasive Species</i>	18
<i>Government Notice No. 1002 of 2011: National List of Ecosystems that are Threatened and in need of protection</i>	19
<i>GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List</i>	19
<i>GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List</i>	19
<i>Government Notice No. 40733 of 2017: Draft National Biodiversity Offset Policy</i>	19
NATIONAL FORESTS ACT (ACT NO 84 OF 1998)	20
NATIONAL WATER ACT (ACT 36 OF 1998)	20
CONSERVATION OF AGRICULTURAL RESOURCES (ACT NO. 43 OF 1983) AS AMENDED IN 2001	20
NATIONAL VELD AND FOREST FIRE ACT (ACT NO. 101 OF 1998).....	20
MPUMALANGA NATURE CONSERVATION ACT, NO. 10 OF 1998	20
NATIONAL ENVIRONMENTAL MANAGEMENT PROTECTED AREAS ACT, NO. 57 OF 2003	21
DESCRIPTION OF STUDY AREA	22
LOCATION	22
SITE CONDITIONS.....	22
REGIONAL VEGETATION PATTERNS	23
<i>Vaal-Vet Sandy Grassland</i>	23
CONSERVATION STATUS OF REGIONAL VEGETATION TYPES.....	24
BIODIVERSITY CONSERVATION PLANS	25

HABITATS ON SITE.....	26
HABITAT SENSITIVITY	28
SITE ECOLOGICAL IMPORTANCE	1
ASSESSMENT OF SIGNIFICANCE OF ECOLOGICAL IMPACTS.....	3
ANTICIPATED IMPACTS.....	3
PLANNING PHASE IMPACTS.....	3
CONSTRUCTION PHASE IMPACTS.....	3
<i>Impact 1: Impacts on indigenous natural vegetation</i>	<i>3</i>
OPERATIONAL PHASE IMPACTS.....	3
<i>Impact 2: Establishment and spread of declared weeds and alien invader plants</i>	<i>3</i>
DECOMMISSIONING PHASE IMPACTS	3
<i>Impact 3: Impacts on indigenous natural vegetation</i>	<i>4</i>
<i>Impact 4: Continued establishment and spread of declared weeds and alien invader plants</i>	<i>4</i>
CUMULATIVE IMPACTS.....	4
<i>Cumulative impacts on indigenous natural vegetation</i>	<i>5</i>
<i>Cumulative impacts due to spread of declared weeds and alien invader plants</i>	<i>5</i>
SUMMARY OF MITIGATION MEASURES	5
SUMMARY OF MONITORING RECOMMENDATIONS	5
COMPARATIVE ASSESSMENT OF ALTERNATIVES	11
NO-GO ALTERNATIVE.....	11
DISCUSSION	12
BIBLIOGRAPHY AND REFERENCES:	13
APPENDICES:	14
APPENDIX 1: CURRICULUM VITAE: DR DAVID HOARE	14

LIST OF FIGURES

Figure 1: DFFE Screening Tool extract: terrestrial biodiversity theme.....	11
Figure 2: Recommended survey periods for different biomes (Species Environmental Assessment Guidelines).	Error! Bookmark not defined.
Figure 3: Location of the study area to the south of Ermelo in Mpumalanga Province.....	22
Figure 4: Regional vegetation types of the study area.....	23
Figure 5: Distribution of listed ecosystems relative to the study area.....	Error! Bookmark not defined.
Figure 6: Mpumalanga CBA map for the study area.	25
Figure 7: Mpumalanga Protected Area Expansion Strategy (Lotter 2015) arrow points to site.	Error! Bookmark not defined.
Figure 8: Main habitats of the study area.	27
Figure 9: Habitat sensitivity of the study area, including consideration of CBAs.....	29
Figure 10: Proposed infrastructure in relation to habitat sensitivity on site.	Error! Bookmark not defined.
Figure 11: Proposed infrastructure in relation to CBAs on site.....	Error! Bookmark not defined.

SPECIALIST DETAILS & DECLARATION

This report has been prepared in accordance with the "Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species, terrestrial plant species and terrestrial biodiversity", as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020. It has been prepared independently of influence or prejudice by any parties.

The details of Specialists are as follows:

Specialist	Qualification and accreditation
Dr David Hoare	<ul style="list-style-type: none">• PhD Botany• Pr.Sci.Nat. 400221/05 (Ecological Science, Botanical Science)

Declaration of independence:

David Hoare Consulting (Pty) Ltd is an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by David Hoare Consulting (Pty) Ltd is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

Disclosure:

David Hoare Consulting (Pty) Ltd undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

Based on information provided to David Hoare Consulting (Pty) Ltd by the client and in addition to information obtained during the course of this study, David Hoare Consulting (Pty) Ltd present the results and conclusion within the associated document to the best of the author's professional judgement and in accordance with best practice.



Dr David Hoare

21 November 2022

Date

TERMS OF REFERENCE

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Biodiversity. Note that the Protocols require determination of the level of sensitivity, which then determines the level of assessment required, either a full assessment, or a Compliance Statement.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL BIODIVERSITY

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020.

General information

1.1. An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified on the screening tool as being of “**very high sensitivity**” for terrestrial biodiversity, must submit a Terrestrial Biodiversity Specialist Assessment.

1.2. An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being “**low sensitivity**” for terrestrial biodiversity, must submit a Terrestrial Biodiversity Compliance Statement.

1.3. However, where the information gathered from the site sensitivity verification differs from the designation of “very high” terrestrial biodiversity sensitivity on the screening tool and it is found to be of a “low” sensitivity, then a Terrestrial Biodiversity Compliance Statement must be submitted.

1.4. Similarly, where the information gathered from the site sensitivity verification differs from that identified as having a “low” terrestrial biodiversity sensitivity on the screening tool, a Terrestrial Biodiversity Specialist Assessment must be conducted.

1.5. If any part of the proposed development footprint falls within an area of “very high” sensitivity, the assessment and reporting requirements prescribed for the “very high” sensitivity apply to the entire footprint, **excluding linear activities** for which impacts on terrestrial biodiversity are temporary and the land in the opinion of the terrestrial biodiversity specialist, based on the mitigation and remedial measures, can be returned to the current state within two years of the completion of the construction phase, in which case a compliance statement applies. Development footprint in the context of this protocol means the area on which the proposed development will take place and includes any area that will be disturbed.

Terrestrial Biodiversity Specialist Assessment

2.1. The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.

2.2. The assessment must be undertaken on the preferred site and within the proposed development footprint.

2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:

2.3.1. a description of the ecological drivers or processes of the system and how the proposed development will impact these;

2.3.2. ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the preferred site;

2.3.3. the ecological corridors that the proposed development would impede including migration and movement of flora and fauna;

2.3.4. the description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments;

2.3.5. a description of terrestrial biodiversity and ecosystems on the preferred site, including:

- (a) main vegetation types;
- (b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;
- (c) ecological connectivity, habitat fragmentation, ecological processes and fine-scale habitats; and
- (d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;

2.3.6. the assessment must identify any alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification; and

2.3.7. the assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:

2.3.7.1. terrestrial critical biodiversity areas (CBAs), including:

- (a) the reasons why an area has been identified as a CBA;
- (b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;
- (c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);
- (d) the impact on ecosystem threat status;
- (e) the impact on explicit subtypes in the vegetation;
- (f) the impact on overall species and ecosystem diversity of the site; and
- (g) the impact on any changes to threat status of populations of species of conservation concern in the CBA;

2.3.7.2. terrestrial ecological support areas (ESAs), including:

- (a) the impact on the ecological processes that operate within or across the site;
- (b) the extent the proposed development will impact on the functionality of the ESA; and
- (c) loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;

2.3.7.3. protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including-

- (a) an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;

2.3.7.4. priority areas for protected area expansion, including-

- (a) the way in which the proposed development will compromise or contribute to the expansion of the protected area network;

2.3.7.5. SWSAs including:

- (a) the impact(s) on the terrestrial habitat of a SWSA; and
- (b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);

2.3.7.6. FEPA subcatchments, including-

- (a) the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;

2.3.7.7 indigenous forests, including:

- (a) impact on the ecological integrity of the forest; and
- (b) percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.

2.4. The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.

Terrestrial Biodiversity Specialist Assessment Report

- 3.1. The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:
- 3.1.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;
 - 3.1.2. a signed statement of independence by the specialist;
 - 3.1.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
 - 3.1.4. a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;
 - 3.1.5. a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;
 - 3.1.6. a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);
 - 3.1.7. additional environmental impacts expected from the proposed development;
 - 3.1.8. any direct, indirect and cumulative impacts of the proposed development;
 - 3.1.9. the degree to which impacts and risks can be mitigated;
 - 3.1.10. the degree to which the impacts and risks can be reversed;
 - 3.1.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;
 - 3.1.12. proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);
 - 3.1.13. a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a “low” terrestrial biodiversity sensitivity and that were not considered appropriate;
 - 3.1.14. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and
 - 3.1.15. any conditions to which this statement is subjected.
- 3.2. The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.
- 3.3. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

LIMITATIONS, ASSUMPTIONS & UNCERTAINTIES

The following assumptions, limitations, uncertainties are listed regarding the ecological assessment of the Camden site:

- The assessment is based on a field survey conducted on 13 September 2016 and on 15 May 2017. The current study is based on an extensive site visit as well as a desktop study of the available information. The time spent on site was adequate for understanding general patterns across affected areas. The seasons in which the fieldwork (peak summer flowering period) was conducted was ideal for assessing the composition and condition of the vegetation.
- The vegetation was in good condition for sampling at the time of the field assessment, and the species lists obtained are considered reliable and relatively comprehensive.
- Compiling the list of species that could potentially occur on site is limited by the paucity of collection records for the area. The list of plant species that could potentially occur on site was therefore taken from a wider area and from literature sources that may include species that do not occur on site and may miss species that do occur on site. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons, be undertaken over a number of years and include extensive sampling. Due to time constraints inherent in the EIA process, this was not possible for this study. However the comprehensive field survey is sufficient for the purposes of this report and towards sufficiently informing the decision making process by the Competent Authority.

INTRODUCTION

Leeuwbosch PV Generation (Pty) Ltd (hereafter referred to as “Leeuwbosch PV Generation”) is proposing to construct a solar photovoltaic (PV) plant and associated infrastructure on Portion 37 of the Farm Leeuwbosch No. 44, approximately 6km north-east of the town of Leeudoringstad in the North West Province. The proposed development will have a maximum export capacity of up to 15 megawatt (MW) and will be known as the Leeuwbosch 3 Solar PV Plant. The proposed development is located within the Maquassi Hills Local Municipality in the Dr Kenneth Kaunda District Municipality.

The proposed solar PV plant development does not fall within any of the Renewable Energy Development Zones (REDZs) which were formally gazetted on 16 February 2018 (Government Notice 114) for the purpose of development of solar and wind energy generation facilities.

No layout alternatives are being considered and assessed as part of the current BA process. The “No-go” alternative is the option of not implementing the proposed development.

Project description

It is anticipated that the proposed Solar PV energy facility will include PV fields (arrays) comprising of multiple PV panels. In summary, the proposed SEF development will include the following components:

- The proposed solar PV plant will include PV fields (arrays) comprising multiple PV modules;
- PV panels will be single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology;
- Each PV module will be approximately 2274mm (≈2.3m) long and 1134mm (≈1.1m) wide and mounted on supporting structures above ground;
- The foundations will most likely be either concrete or rammed piles;
- Generation capacity of up to 15MWac;
- The dimension of the PV panels will be approximately 2.3 m wide by 1.1 m long;
- One (1) new 33/132kV on-site substation (facility substation) occupying an area of up to approximately 0.2003ha (2 003m²);
- Site and internal access roads, up to 4m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary;
- One (1) guard house approximately 0.0876 ha (876m²) in size;
- One (1) temporary building zone 0.2944 ha (2 944m²);
- Galvanized steel fencing with electrification approximately 2.1m in height;
- Existing boreholes will be used where possible. Water will potentially be stored in water storage tanks;

Component	Description / Dimensions
Location of site (centre point)	Latitude: 27°12'24.03" S Longitude: 26°18'2.64" E
Technology	<ul style="list-style-type: none"> • The proposed solar PV plant will include PV fields (arrays) comprising multiple PV modules. • PV panel mountings. PV panels will be single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. • Each PV module will be approximately 2274mm (≈2.3 m) long and 1134 mm (≈1.1 m) wide and mounted on supporting structures above

Component	Description / Dimensions
	<p>ground. At this stage it is anticipated that the structures will be mono-facial modules. The final design details will become available during the detailed design phase of the proposed development, prior to the start of construction.</p> <ul style="list-style-type: none"> The foundations will most likely be either concrete or rammed piles. The final foundation design will be determined at the detailed design phase of the proposed development.
SG codes	T0HP00000000004400037
Generation Capacity of Solar PV Plant	Maximum of up to \pm 15MW ac
Capacity of Switching Substation	More than 33 kV but less than 275 kV. Exact capacity of the proposed on-site switching substation will be determined and confirmed at a later stage.
Dimensions of PV Panels	<ul style="list-style-type: none"> Width: up to \pm 2274mm (\approx2.3m) Length: up to \pm 1134mm (\approx1.1m)
On-site Switching Substation	<ul style="list-style-type: none"> One (1) new on-site switching substation with a capacity of more than 33 but less than 275 kV. Total footprint: up to \pm 0.2003 ha (2 003 m²). To contain transformers for voltage, step up from medium voltage to high voltage. DC power from the PV modules will be converted into AC power in the inverters and the voltage will be stepped up to medium voltage in the inverter transformers.
Guard House	One (1) permanent guard house of \pm 0.0876ha (876 m ²).
Temporary Building Zone	One (1) temporary building zone of \pm 0.2944ha (2 944 m ²).
Area Occupied by Buildings	Up to \pm 1.3807 ha (13 807 m ²)
Width of Existing Internal Gravel Roads	<ul style="list-style-type: none"> Up to \pm 4 m; Existing internal gravel site roads will be used wherever possible. However, where required, new internal gravel roads may be constructed.
Length of existing internal roads (to be potentially upgraded)	<ul style="list-style-type: none"> Up to \pm 1.57 km
Site Access	Access to the proposed development will be via an existing gravel road which connects to the tarred R502 road.
Proximity to grid connection	<ul style="list-style-type: none"> Grid connection is to the 132/11kV Leeudoringstad Solar Plant Substation, which has been applied for as part of a separate BA process; and The 132/11kV Leeudoringstad Solar Plant Substation is located within the proposed Leeuwbosch 3 Solar PV Plant application site (namely Portion 37 of the Farm Leeuwbosch No. 44). Medium voltage cabling (anticipated to be \pm 0.8m x 0.6m wide at this stage) will link the various PV arrays to the switching substation, as well as the Leeudoringstad Solar Plant Substation. These cables will be laid underground, wherever technically feasible.
Height of fencing	<ul style="list-style-type: none"> \pm 2.1 m high Fencing will surround the entire proposed solar PV plant.
Type of fencing	Galvanised steel with electrification on top.
Area covered by fencing	Up to approximately 18 ha
Boreholes and storage tanks	<ul style="list-style-type: none"> At this stage it is anticipated that existing boreholes will be utilised; Water will potentially be stored in temporary water storage tanks.

SENSITIVITIES IDENTIFIED FROM DFFE ONLINE SCREENING TOOL

Terrestrial Biodiversity theme

The national web-based Environmental Screening Tool was queried in relation to the following infrastructure:

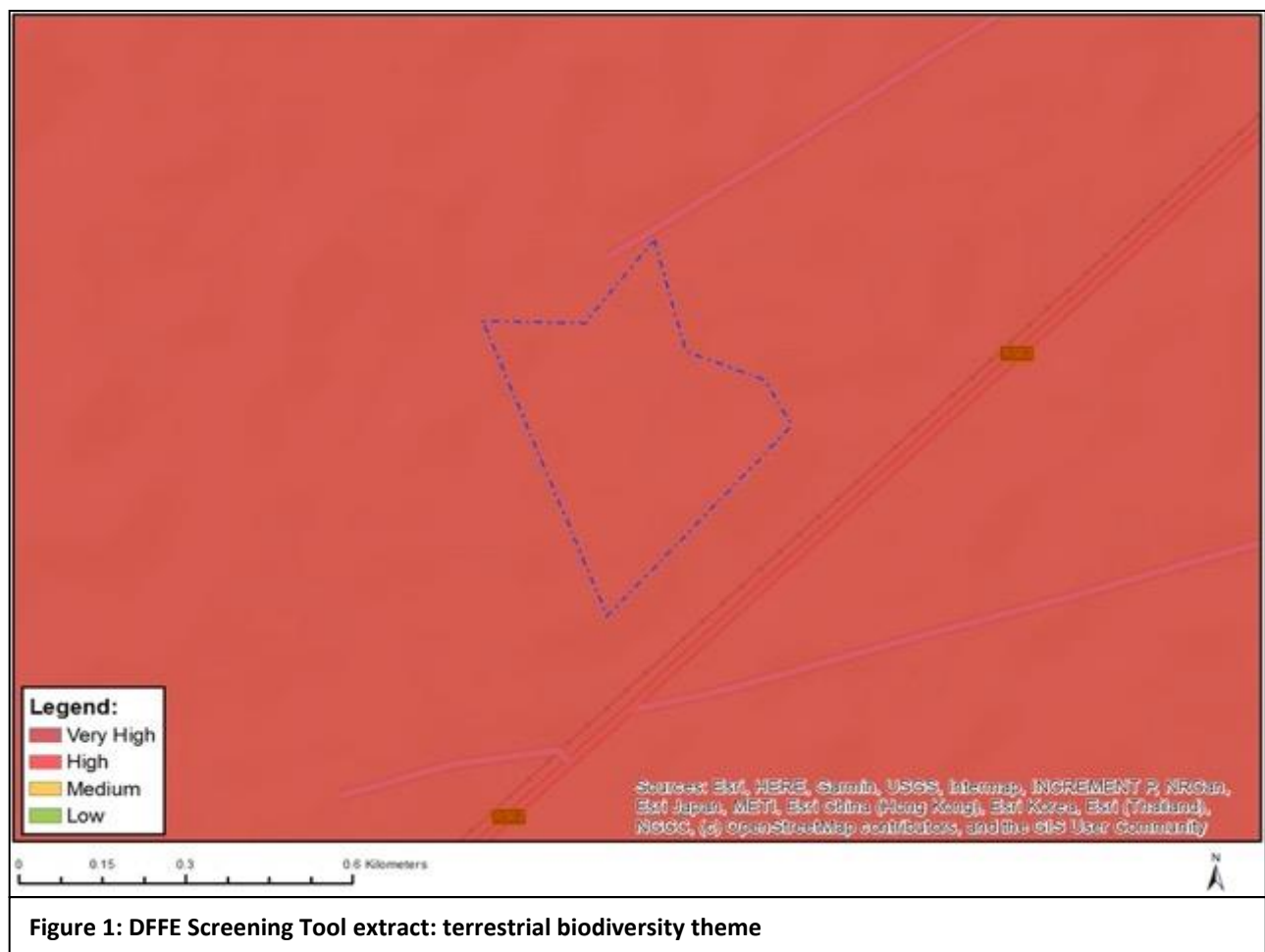
Utilities Infrastructure => Electricity => Generation => Renewable => Solar =>PV

The terrestrial biodiversity theme indicates that the site is within one sensitivity class, namely **VERY HIGH** (Figure 1).

Terrestrial Biodiversity theme

Sensitivity features are indicated as follows:

Sensitivity	Feature(s)
Very High	Ecological Support Area 1
Very High	Endangered ecosystem



METHODOLOGY

The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

Project Area of Influence (PAOI)

The proposal is to develop a solar PV facility on site, along with associated infrastructure. Anticipated impacts will mostly occur during the construction phase, with few discernible effects anticipated during operation. These impacts are not expected to extend beyond the boundaries of the study area. The PAOI is therefore treated here as the development footprint within which direct impacts will occur (Figure 2).

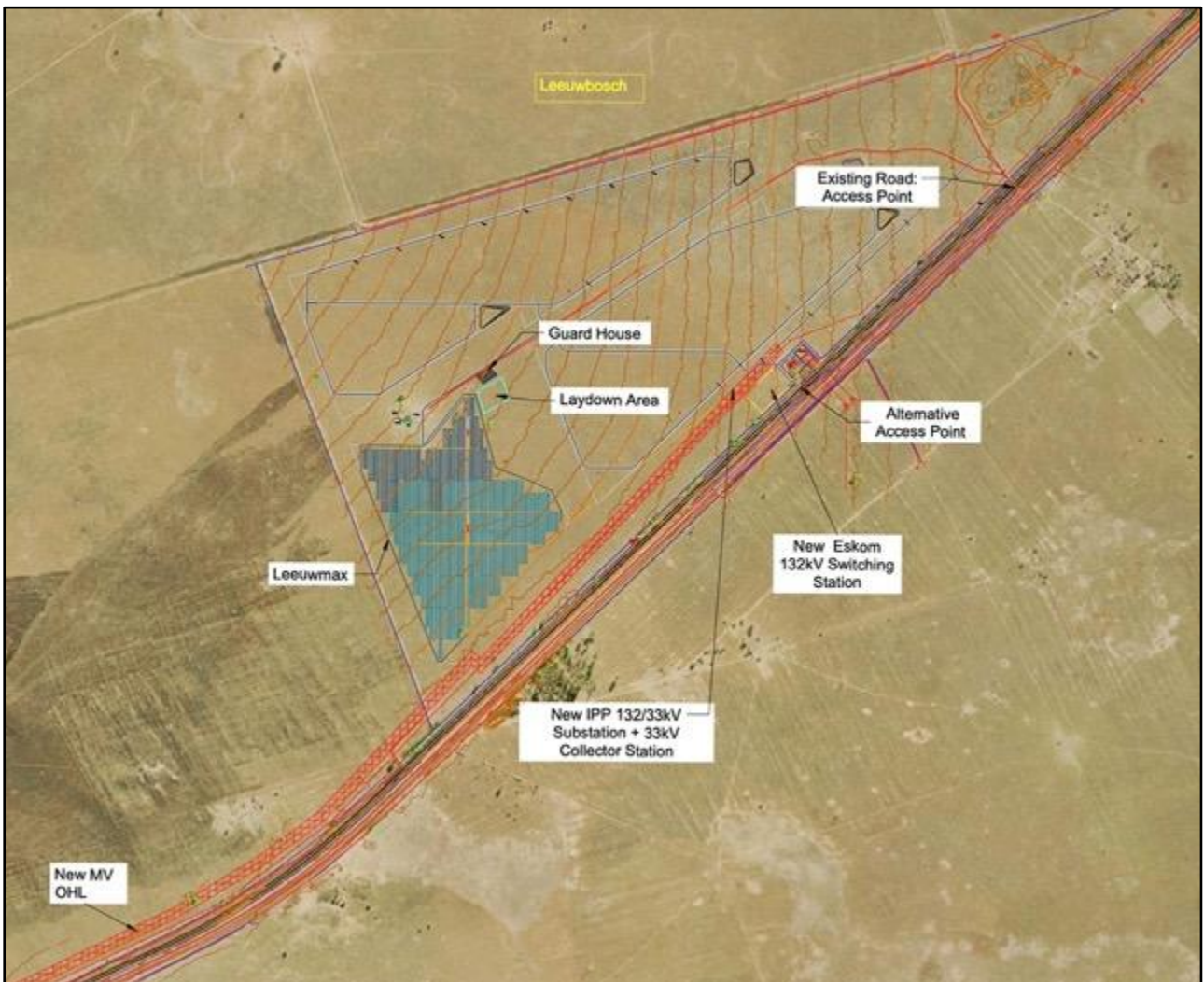


Figure 2: Proposed Project Area of Influence (PAOI).

Survey timing

The study commenced as a desktop-study followed by site-specific field study on 29 April 2021 and 27 October 2021. The site is within the grassland biome with a peak rainfall season in summer, which occurs from October to March. There is, however, a delay between rainfall and vegetation growth, which means the peak growing season is from November to May (Figure 3), with most perennial species characteristic of the vegetation being easily identifiable from January to March. The timing of the field survey was therefore ideal in terms of assessing the vegetation condition and flora composition of the site.

A more accurate indication of rainfall seasonality, which drives most ecological processes, is shown in Figure 4, which shows that the nearby Klerksdorp has peak rainfall from October to April. The timing of the survey in late summer and then in early summer is therefore optimal in terms of assessing the flora and vegetation of the site. The overall condition of the vegetation was therefore possible to be determined with a high degree of confidence.

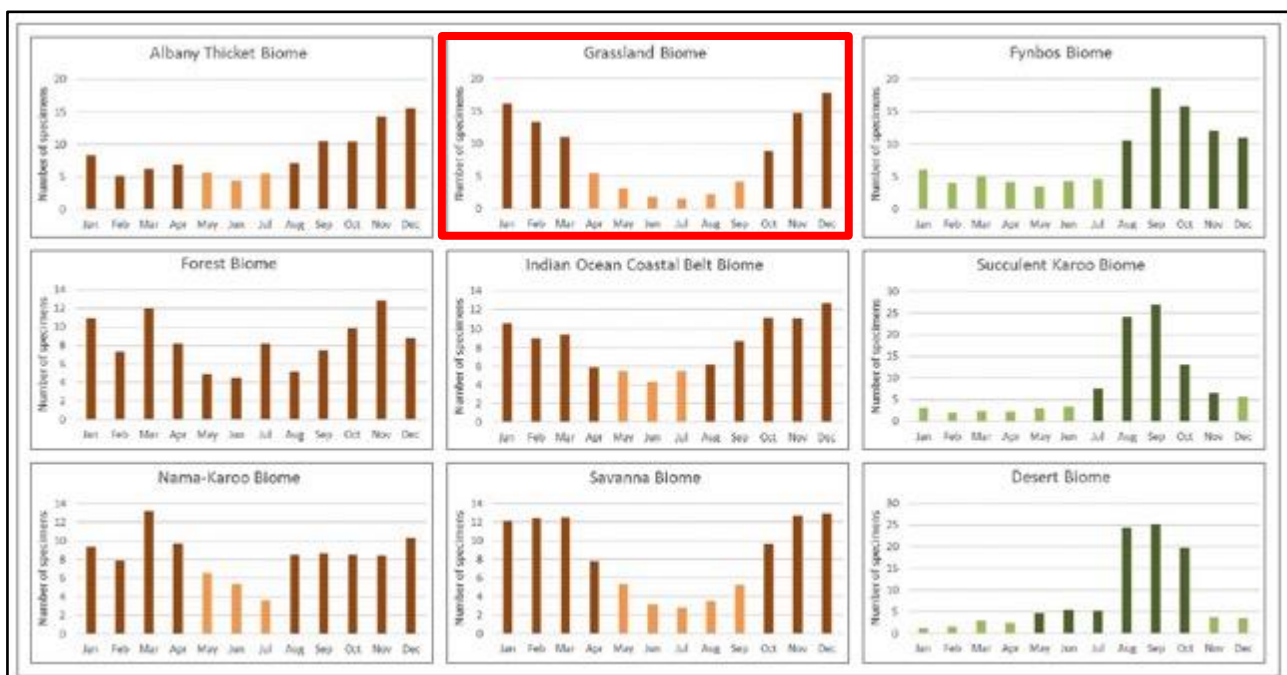


Figure 3: Recommended survey periods for different biomes (Species Environmental Assessment Guidelines). The site is within the Grassland Biome.

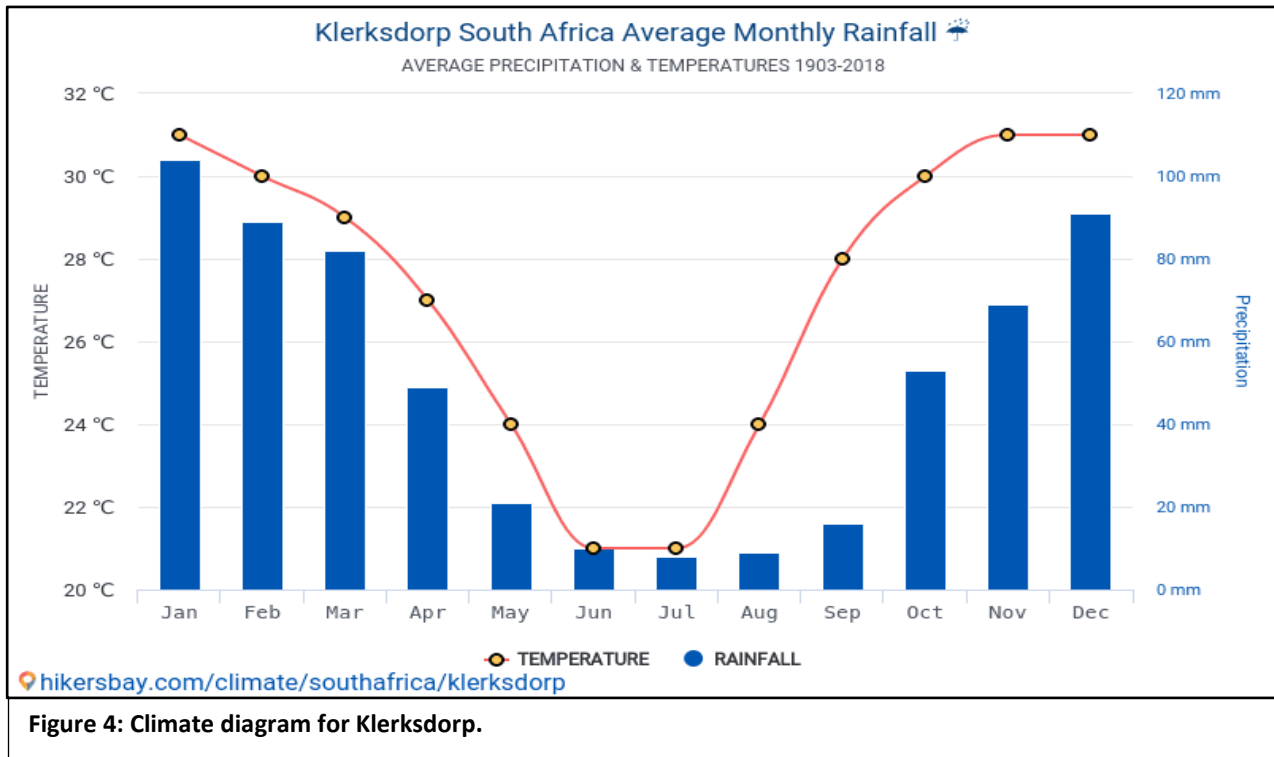


Figure 4: Climate diagram for Klerksdorp.

Field surveys

During the field survey, all major natural variation on site was assessed and select locations were traversed on foot. A meander approach was adopted with no time restrictions - the objective was to comprehensively examine all natural areas. A hand-held Garmin GPSMap 64s was used to record a track within which observations were made. Digital photographs were taken of features and habitats on site, as well as of all plant species that were seen. All plant species recorded were uploaded to the iNaturalist website.

Aerial imagery from Google Earth was used to identify and assess habitats on site. This included historical imagery that may show information not visible in any single dated image. Patterns identified from satellite imagery were verified on the ground. From this ground survey, as well as ad hoc observations on site, a checklist of plant species occurring on site was compiled. Digital photographs were taken at locations where features of interest were observed.

Specific features of potential concern were investigated in the field, including the following:

- General vegetation status, i.e. whether the vegetation was natural, disturbed/secondary or transformed;
- Presence of habitats of conservation concern in terms of high biodiversity, presence of species of conservation concern, specific sensitivities, e.g. wetlands, and any other factors that would indicate an elevated biodiversity or functional value that could not be determined from the desktop assessment;
- Presence of protected trees; and
- Potential presence of species of conservation concern, including observation of individual plants found on site or habitats that are suitable for any of the species identified from the desktop assessment.

Key parts of the development site were visited during the reconnaissance site visit in such a way as to ensure all major variation was covered and that any unusual habitats or features were observed. Plant and animal species observed were recorded. The season of the survey was favourable, and there is high confidence that many of species present on site were identifiable at the time of the survey. The survey was of adequate duration and intensity to characterise the flora of the development site as per the regulations.

Sources of information

Regional Vegetation

- Broad vegetation types occurring on site were obtained from Mucina and Rutherford (2006), with updates according to the SANBI BGIS website (<http://bgis.sanbi.org>) as follows:
 - Mucina, L. and Rutherford, M.C. (editors) 2006. Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. Strelitzia 19, South African National Biodiversity Institute, Pretoria.
 - South African National Biodiversity Institute 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 23 September 2021.

Threatened Ecosystems

- The conservation status of the vegetation types were obtained from Mucina and Rutherford (2006) and the National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004).
- The plant species checklist of species that could potentially occur on site was compiled from a plant species checklist extracted from the NewPosa database of the South African National biodiversity Institute (SANBI) for the quarter degree grid 2629BA.
- The IUCN Red List Category for plant species, as well as supplementary information on habitats and distribution, was obtained from the SANBI Threatened Species Programme (Red List of South African Plants, <http://redlist.sanbi.org>).

Regional plans

- The Mpumalanga Biodiversity Sector Plan (MBSP) retrieved from the SANBI BGIS website (<https://bgis.sanbi.org/MBCP>). Information on this map is found in Lötter & Ferrar (2006) and Ferrar & Lötter (2007).
- South Africa Protected Areas Database (SAPAD_OR_2021_Q2) retrieved from the Department of Forestry, Fisheries and the Environment website (https://egis.environment.gov.za/data_egis/data_download/current).
- Information from the National Protected Areas Expansion Strategy (NPAES) was consulted for possible inclusion of the site into a protected area in future (available on <http://bgis.sanbi.org>).

Aerial imagery

- Recent satellite imagery (courtesy of Google Earth Pro). Google Earth Pro also provides historical imagery for a period up to 15 years ago, which aided in the determination of certain vegetation types and land use historically and currently present on site.

Habitat sensitivity

The purpose of producing a habitat sensitivity map is to provide information on the location of potentially sensitive features in the study area. This was compiled by taking the following into consideration:

1. The general status of the vegetation of the study area was derived by compiling a landcover data layer for the study area (*sensu* Fairbanks *et al.*, 2000) using available satellite imagery and aerial photography. From this, it can be seen which areas are transformed versus those that are estimated as still being in a natural status.
2. Various provincial, regional or national level conservation planning studies have been undertaken in the area, e.g. the National Spatial Biodiversity Assessment (NSBA). The mapped results from these were taken into consideration in compiling the habitat sensitivity map.
3. Habitats in which various species of plants or animals occur that may be protected or are considered to have high conservation status are considered to be sensitive.

Sensitivity classes follow the approach for determining Site Ecological Importance (SEI) in the Species Environmental Assessment Guidelines. As per the Species Environmental Assessment Guidelines, Site Ecological Importance (SEI) is

calculated as a function of the Biodiversity Importance (BI) of the receptor and its resilience to impacts ($SEI = BI + RR$). The Biodiversity Importance (BI) in turn is a function of Conservation Importance (CI) and Functional Integrity (FI), i.e. $BI = CI + FI$. The full methodology is available in the Species Environmental Assessment Guidelines (pages 26 - 30).

RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

Relevant legislation is provided in this section to provide a description of the key legal considerations of importance to the proposed project. The applicable legislation is listed below.

Convention on Biodiversity (CBD)

South Africa became a signatory to the United Nations Convention on Biological Diversity (CBD) in 1993, which was ratified in 1995. The CBD requires signatory states to implement objectives of the Convention, which are the conservation of biodiversity; the sustainable use of biological resources and the fair and equitable sharing of benefits arising from the use of genetic resources. According to Article 14 (a) of the CBD, each Contracting Party, as far as possible and as appropriate, must introduce appropriate procedures, such as environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, to avoid or minimize these effects and, where appropriate, to allow for public participation in such procedures.

National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA is the framework environmental management legislation, enacted as part of the government's mandate to ensure every person's constitutional right to an environment that is not harmful to his or her health or wellbeing. It is administered by the Department of Forestry, Fisheries and the Environment (DFFE) but several functions have been delegated to the provincial environment departments. One of the purposes of NEMA is to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment. The Act further aims to provide for institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state and to provide for the administration and enforcement of other environmental management laws.

NEMA requires, inter alia, that:

- “development must be socially, environmentally, and economically sustainable”,
- “disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied”,
- “a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions”,

NEMA states that “the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.”

This report considers the Environmental Impact Assessment (EIA) Regulations of 2014 (NEMA, 2014) as amended. According to these Regulations under Listing Notice 1 (GRN No. 983, as amended), Listing Notice 2 (GRN No 984, as amended) and Listing Notice 3 (GRN No 985, as amended), the activities listed are identified as activities that require Environmental Authorisation prior to commencement of that activity and to identify competent authorities in terms of sections 24(2) and 24D of the Act.

National Environmental Management: Biodiversity Act (Act No 10 of 2004) (NEMBA)

As the principal national act regulating biodiversity protection, NEMBA, which is administered by DFFE, is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. The term biodiversity according to the Convention on Biodiversity (CBD) refers to the variability among living organisms from all sources including, inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity in genes, species and ecosystems.

In terms of NEMBA, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

Chapter 4 of the Act relates to threatened or protected ecosystems or species. According to Section 57 of the Act, "Restricted activities involving listed threatened or protected species":

- (1) A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7.

Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species".

Alien and Invasive Species

Chapter 5 of NEMBA relates to species and organisms posing a potential threat to biodiversity. The Act defines alien species and provides lists of invasive species in regulations. The Alien and Invasive Species (AIS) Regulations, in terms of Section 97(1) of NEMBA, was published in Government Notice R598 in Government Gazette 37885 in 2014 (NEMBA, 2014). The Alien and Invasive Species (AIS) lists were subsequently published in Government Notice R 864 of 29 July 2016 (NEMBA, 2016).

NEMBA regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. The purpose of Chapter 5 is:

- a) to prevent the unauthorized introduction and spread of alien species and invasive species to ecosystems and habitats where they do not naturally occur;
- b) to manage and control alien species and invasive species to prevent or minimize harm to the environment and to biodiversity in particular;
- c) to eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats;

According to Section 65 of the Act, "Restricted activities involving alien species":

- 1) A person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7. Restricted activities include the following:
 - a. Importing into the Republic, including introducing from the sea, any specimen of a listed invasive species.
 - b. Having in possession or exercising physical control over any specimen of a listed invasive species.
 - c. Growing, breeding or in any other way propagating any specimen of a listed invasive species, or causing it to multiply.
 - d. Conveying, moving or otherwise translocating any specimen of a listed invasive species.
 - e. Selling or otherwise trading in, buying, receiving, giving, donating or accepting as a gift, or in any other way acquiring or disposing of any specimen of a listed invasive species.
 - f. Spreading or allowing the spread of any specimen of a listed invasive species.
 - g. Releasing any specimen of a listed invasive species.
 - h. Additional activities that apply to aquatic species.
- 2) A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

An "**alien species**" is defined in the Act as:

- a) a species that is not an indigenous species; or
- b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by means of migration or dispersal without human intervention.

According to Section 71 of the Act, "Restricted activities involving listed invasive species":

- 1) A person may not carry out a restricted activity involving a specimen of a listed invasive species without a permit issued in terms of Chapter 7.
- 2) A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

An "**invasive species**" is defined in the Act as any species whose establishment and spread outside of its natural distribution range:

- a) threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and
- b) may result in economic or environmental harm or harm to human health.

A "**listed invasive species**" is defined in the Act as any invasive species listed in terms of section 70(1).

According to Section 73 of the Act, "Duty of care relating to listed invasive species":

- 2) A person who is the owner of land on which a listed invasive species occurs must-
 - a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
 - b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and
 - c) take all the required steps to prevent or minimize harm to biodiversity.

According to Section 75 of the Act, "Control and eradication of listed invasive species":

- (1) Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
- (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
- (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

Government Notice No. 1002 of 2011: National List of Ecosystems that are Threatened and in need of protection

This notice, published under Section 52(1)(a) of NEMBA, provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of NEMBA.

GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of NEMBA.

Government Notice No. 40733 of 2017: Draft National Biodiversity Offset Policy

Published under NEMA. The aim of the Policy is to ensure that significant residual impacts of developments are remedied as required by NEMA, thereby ensuring sustainable development as required by section 24 of the Constitution of the Republic of South Africa, 1996. This policy should be taken into consideration with every development application that still has significant residual impact after the Mitigation Sequence has been followed. The mitigation sequence entails the consecutive application of avoiding or preventing loss, then at minimizing or mitigating what cannot be avoided, rehabilitating where possible and, as a last resort, offsetting the residual impact. The Policy specifies that one impact that has come across consistently as unmitigatable is the rapid and consistent transformation of certain ecosystems and vegetation types, leading to the loss of ecosystems and extinction of species. The Policy specifically targets ecosystems where the ability to reach protected area targets is lost or close to being lost. However, the Policy states that "[w]here ecosystems remain largely untransformed, intact and functional, an offset would not be required for developments that lead to transformation, provided they have not been identified as a biodiversity priority". Biodiversity offsets should be considered to remedy residual negative impacts on biodiversity of 'medium' to 'high' significance. Residual impacts of 'very high' significance are a fatal flaw for development and residual biodiversity impacts of 'low' significance would usually not require offsets. The Policy indicates that impacts should preferably be

avoided in protected areas, Critical Biodiversity Areas (CBA), verified wetland and river features and areas earmarked for protected area expansion.

National Forests Act (Act no 84 of 1998)

Protected trees

According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any *protected tree*, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.

Forests

Prohibits the destruction of indigenous trees in any natural forest without a licence.

National Water Act (Act 36 of 1998)

Wetlands, riparian zones and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the water resource require authorisation (Section 21 of the National Water Act of 1998).

A "watercourse" in terms of the National Water Act (Act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.

National Veld and Forest Fire Act (Act No. 101 of 1998)

Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

Mpumalanga Nature Conservation Act, No. 10 of 1998

This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project:

- Various species are protected;
- The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species.

The Act provides lists of protected species for the Province. According to the Mpumalanga Nature Conservation Act, a permit is required for the removal of any species on this list.

National Environmental Management Protected Areas Act, No. 57 of 2003

The National Environmental Management: Protected Areas Act 57 of 2003 has the following objectives:

- to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes;
- to provide for the establishment of a national register of all national, provincial and local protected areas;
- to provide for the management of those areas in accordance with national norms and standards;
- to provide for intergovernmental co-operation and public consultation in matters concerning protected areas; and
- to provide for matters in connection therewith.

It has been amended several times:

- National Environmental Management: Protected Areas Amendment Act 21 of 2014
- National Environmental Management: Protected Areas Amendment Act 15 of 2009
- National Environmental Management: Protected Areas Amendment Act 15 of 2009
- National Environmental Laws Amendment Act 14 of 2009
- National Environmental Management: Protected Areas Amendment Act 31 of 2004

DESCRIPTION OF STUDY AREA

Location

The project is located on Portion 37 of the Farm Leeuwbosch No. 44, approximately 6km north-east of the town of Leeudoringstad in the North West Province (Figure 5). The site is just off the R502 (Orkney to Leeudoringstad) road.

Site conditions

The site is currently natural grassland that is used for grazing. There is no infrastructure on site, except for a small reservoir on the northern edge of the proposed project site.

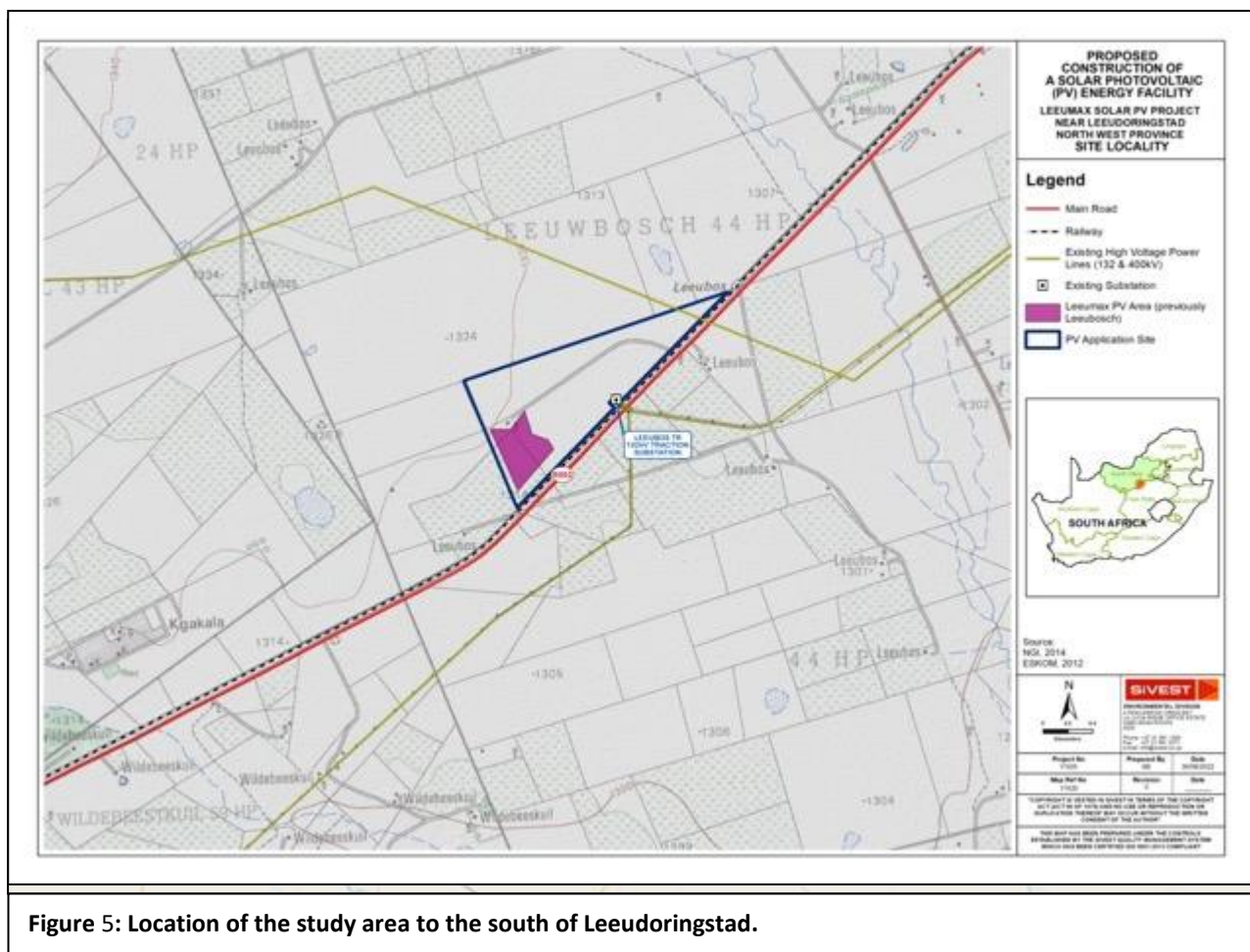


Figure 5: Location of the study area to the south of Leeudoringstad.

Regional vegetation patterns

There is one regional vegetation type occurring on site, namely Vaal-Vet Sandy Grassland (Figure 6). There are small patches of Highveld Salt Pans in nearby areas. These two vegetation types that occur on site and nearby are briefly described below according to published information. The description is from Mucina & Rutherford (2006), extracted from the SANBI BGIS website (<http://bgis.sanbi.org/vegmap>).

Vaal-Vet Sandy Grassland

This vegetation type occurs in the North-West and Free State Provinces in the area south of Lichtenburg and Ventersdorp, stretching southwards to Klerksdorp, Leeudoringstad, Bothaville and to the Brandfort area north of Bloemfontein. It occurs on plains-dominated landscapes with some scattered, slightly irregular undulating plains and hills.

The vegetation is mainly a low-tussock grassland with an abundant karroid element (Mucina et al. 2006). The dominance of *Themeda triandra* is an important feature of this vegetation type. Locally low cover of *Themeda triandra* and the associated increase in *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* is attributed to heavy grazing and/or erratic rainfall.

Important taxa include the grasses, *Antheophora pubescens* (d), *Aristida congesta* (d), *Chloris virgata* (d), *Cymbopogon caesius* (d), *Cynodon dactylon* (d), *Digitaria argyrograpta* (d), *Elionurus muticus* (d), *Eragrostis chloromelas* (d), *E. lehmanniana* (d), *E. plana* (d), *E. trichophora* (d), *Heteropogon contortus* (d), *Panicum gilvum* (d), *Setaria sphacelata* (d),

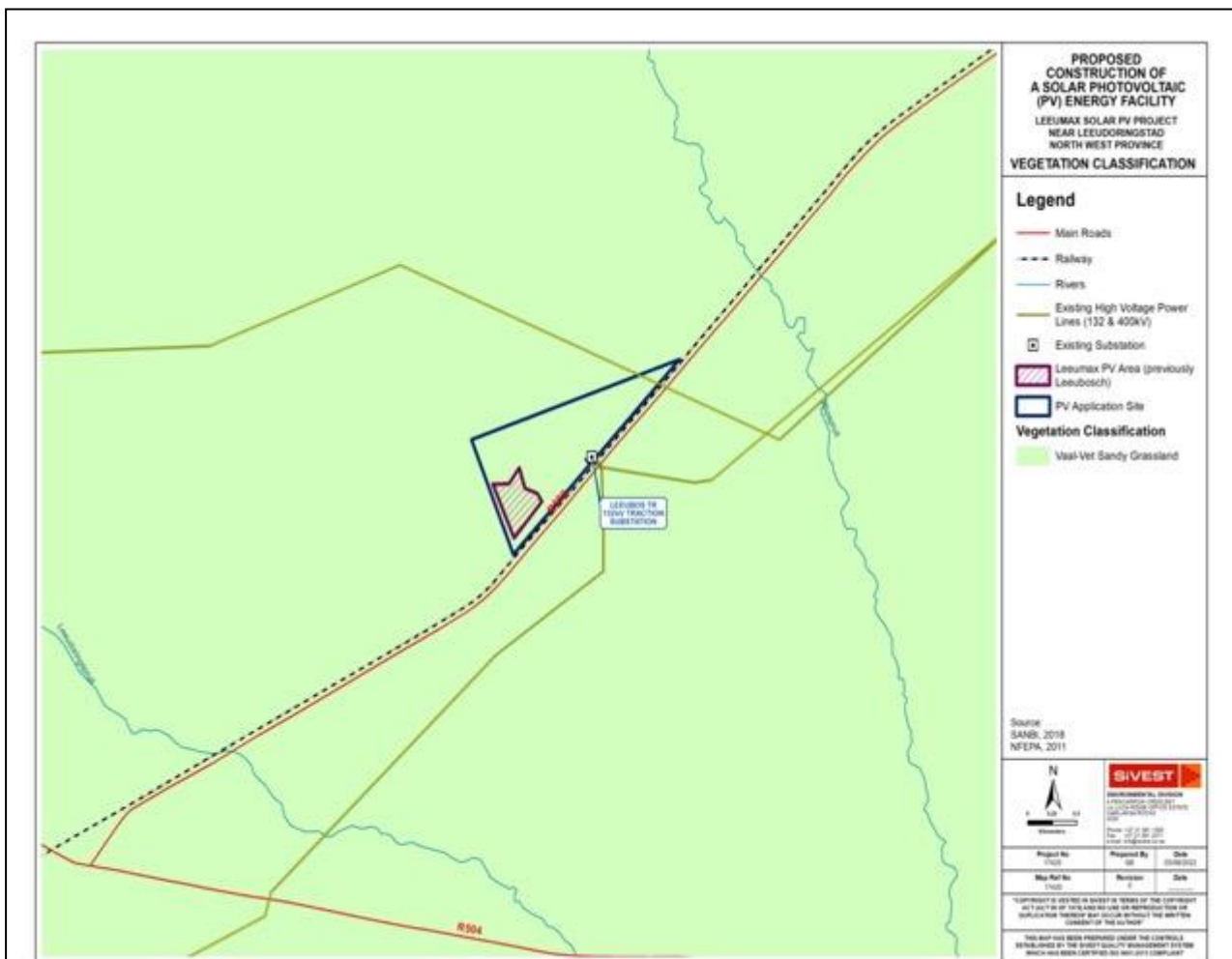


Figure 6: Regional vegetation types of the study area.

Themeda triandra (d), *Tragus berteronianus (d)*, *Brachiaria serrata*, *Cymbopogon pospischilii*, *Digitaria eriantha*, *Eragrostis curvula*, *E. obtusa*, *E. superba*, *Panicum coloratum*, *Pogonarthria squarrosa*, *Trichoneura grandiglumis* and *Triraphis andropogonoides*, the herbs, *Stachys spathulata (d)*, *Barleria macrostegia*, *Berkheya onopordifolia var. onopordifolia*, *Chamaesyce inaequilatera*, *Geigeria aspera var. aspera*, *Helichrysum caespititium*, *Hermannia depressa*, *Hibiscus pusillus*, *Monsonia burkeana*, *Rhynchosia adenodes*, *Selago densiflora*, *Vernonia oligocephala*, the geophytic herbs, *Bulbine narcissifolia* and *Ledebouria marginata*, the succulent Herb, *Tripteris aghillana var. integrifolia*, the low shrubs, *Felicia muricata (d)*, *Pentzia globosa (d)*, *Anthospermum rigidum subsp. pumilum*, *Helichrysum dregeanum*, *H. paronychioides* and *Ziziphus zeyheriana*.

Conservation status of regional vegetation types

On the basis of a scientific approach used at national level by SANBI (Driver *et al.*, 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 4 below, as determined by best available scientific approaches (Driver *et al.*, 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al.*, 2005).

Determining ecosystem status (Driver *et al.*, 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Conservation status of vegetation types occurring in the study area:

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver <i>et al.</i> 2005; Mucina <i>et al.</i> , 2006	National Ecosystem List (NEM:BA)
Vaal-Vet Sandy Grassland	24	0.3	63	Endangered	Endangered
Highveld Salt Pans	24	0.2	4	Least Threatened	Not listed

According to scientific literature (Driver *et al.*, 2005; Mucina *et al.*, 2006), Vaal-Vet Sandy Grassland is listed as Endangered.

The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types, and other ecosystems defined in the Act, that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature. Vaal-Vet Sandy Grassland is listed as Endangered in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011). Vaal-Vet Sandy Grassland covers the entire site (Figure 5).

Habitats on site

Natural habitats on site match the landcover map for the area (Figure 8). The majority of the solar PV area is within a previously cultivated area that currently contains secondary grassland. Remaining areas are natural grassland. A broad classification of the habitat units on site, which also reflects relatively uniform plant species compositional units, is as follows:

Natural habitats:

1. **Natural grassland** (open grassland on undulating plains – the condition is not indicated in the habitat map although there is a gradient from heavily grazed poor condition to moderate condition);

Transformed and degraded areas:

2. **Old lands** (secondary grasslands on previously cultivated areas);

NATURAL VERSUS SECONDARY GRASSLAND	
Natural grassland	Areas of original vegetation in which the soil has not been mechanically disturbed, including areas that are in poor condition due to overgrazing, trampling, invasion by weeds or alien invasive species, inappropriate fire regimes , or any other factor that drives natural change in species composition or vegetation structure. The key factor is that the original plants continue to exist, often resprouting after defoliation from sub-surface stems or other storage organs.
Secondary grassland	Areas of vegetation where the original grassland vegetation has been lost through direct disturbance of the soil that results in physical removal of the original plants, the most common cause of which is ploughing, but could be other mechanical factors. The vegetation that then develops is as a result of recolonization of the area through propagation.

The natural grassland on site is characterised by medium-height grassland that appears to be overgrazed at times. The presence of scattered termite mounds throughout the site indicates that the grassland is in a natural state (not ploughed). There were also no plough lines in these grasslands on the aerial imagery for the site. Significant parts of the site have been cultivated at some point in history, which is also clearly evident from the vegetation structure and species composition on site. The topography within these grassland areas is relatively flat. Common and dominant species in the natural areas include *Themeda triandra*, *Digitaria erianthe*, *Eragrostis chloromelas*, *Aristida congesta* subsp. *congesta*, *Cymbopogon pospischilii*, *Eragrostis superba*, *Setaria sphacelata* var. *torta*, *Eragrostis obtusa*, *Trichoneura grandiglumis*, *Cynodon dactylon*, *Felicia muricata*, *Hermannia depressa*, *Arctotis arctotoides*, *Anthospermum rigidum*, *Walafrida densiflora* and *Barleria* species. A total of 25 species per 100m² was recorded in these natural grasslands, which is moderately diverse relative to other Highveld grasslands. In comparison, the previously cultivated areas had only 17 species per 100m². Common and dominant species in the previously cultivated areas were *Aristida congesta* subsp. *congesta*, *Eragrostis lehmanniana*, *Themeda triandra*, *Eragrostis superba*, *Melinis repens*, *Trichoneura grandiglumis*, *Cynodon dactylon*, *Arctotis arctotoides*, *Anthospermum rigidum*, *Hermannia depressa* and *Pentzia* species.

Habitat sensitivity

A summary of sensitivities that occur on site are as follows:

1. Listed ecosystems: Vaal-Vet Sandy Grassland is listed as Endangered in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).
2. ESAs: The entire site is within an Ecological Support Area1.

This information was used in conjunction with methodology to calculate Site Ecological Importance, described below. A map of habitat sensitivity on site is provided in Figure 9.

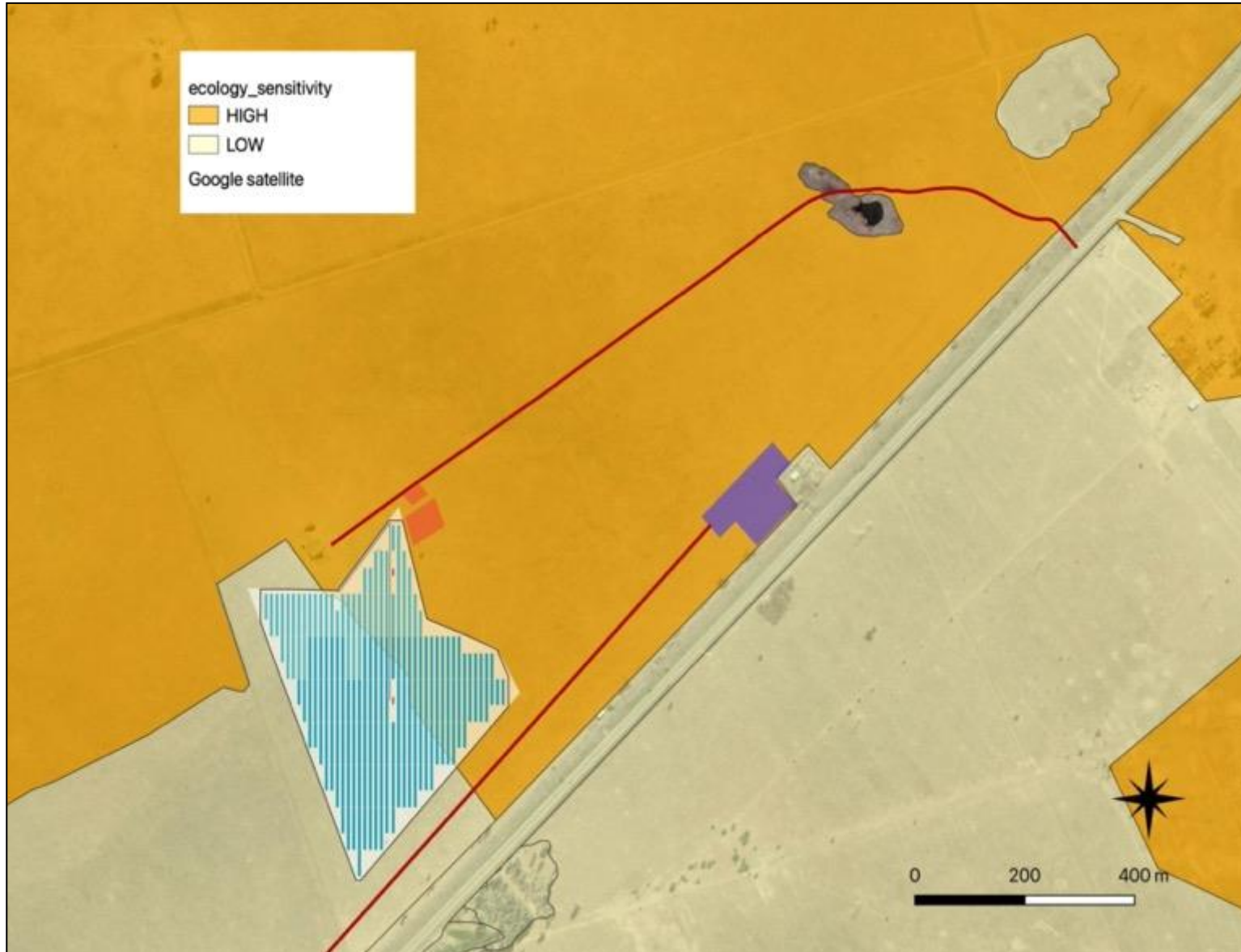


Figure 9: Habitat sensitivity of the study area, based on Site Ecological Index.

SITE ECOLOGICAL IMPORTANCE

The Species Environmental Assessment Guidelines (SANBI 2020) require that a Site Ecological Importance is calculated for each habitat on site, and provides methodology for making this calculation.

1. **Natural grassland** (open grassland on undulating plains, including moderately to heavily grazed areas);
2. **Old lands** (secondary grasslands on old lands);

As per the Species Environmental Assessment Guidelines (SANBI 2020), Site Ecological Importance (SEI) is calculated as a function of the Biodiversity Importance (BI) of the receptor and its resilience to impacts ($SEI = BI + RR$). The Biodiversity Importance (BI) in turn is a function of Conservation Importance (CI) and Functional Integrity (FI), i.e. $BI = CI + FI$.

Site ecological importance for habitats found on site:

Habitat	Conservation importance	Functional integrity	Receptor resilience	Site Ecological Importance (BI)
Natural grassland	High Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type.	Medium Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. (Chrissiesmeer Panveld is listed as EN) BUT Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.	Very low Habitat that is unable to recover from major impacts	High (BI = Medium)
Old lands	Low No natural habitat remaining.	Very low Several major current negative ecological impacts.	High Habitat that can recover relatively quickly (5-10 years) to restore >75% to restore the original species composition and functionality	Very low (BI = Very low)

The calculation of Site Ecological Importance matches the sensitivity classification given in the previous section of this report, but includes an explicit recognition of the ability of each ecosystem to tolerate and recover from disturbance. Guidelines for development activities within different importance levels are given in the Table below.

Guidelines for interpreting SEI in the context of the proposed development activities:

Site ecological importance	Interpretation in relation to proposed development activities
Very high	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/ not possible (i.e. last remaining populations of species, last

	remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities
Very low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

ASSESSMENT OF SIGNIFICANCE OF ECOLOGICAL IMPACTS

Anticipated impacts

The main impacts on Terrestrial Biodiversity associated with construction of the proposed infrastructure are anticipated to be as follows:

1. Direct loss of habitat within the footprint of the proposed infrastructure, and associated impacts on CBAs and threatened ecosystems.
2. Invasion by alien invasive plant species, leading to degradation of habitat. This could occur anywhere on site where disturbance is introduced and alien plants are not specifically controlled. The reason is that they already occur in the area and would opportunistically colonise any area of soil where they are not vigorously controlled.

The main mitigation measures, other than required Management Plans for plant rescue, rehabilitation, and alien plant management, are related to infrastructure location, which is a planning phase measure.

Planning Phase impacts

There are no negative impacts that are likely to be created as a result of project planning.

Construction Phase impacts

Impact 1: Impacts on indigenous natural vegetation

The regional terrestrial vegetation type in the broad study area is Vaal-Vet Sandy Grassland, listed as Endangered. It is also located within a CBA Node and Corridor area and a ESA Wetland area in the Provincial Conservation Plan and falls partly within an area identified for future conservation in the National Parks Area Expansion Strategy. The combination of these attributes indicates that any areas of natural habitat on site have high conservation value. However, some parts of the site are degraded or secondary, showing the existence of plough lines on the aerial image of the site, poor vegetation cover and relatively poor species diversity and composition.

Some loss of habitat will occur, but this will be insignificant in comparison to the total area of the vegetation types concerned. The assessment here is for all infrastructure components.

Operational Phase Impacts

Impact 2: Establishment and spread of declared weeds and alien invader plants

There is a moderate possibility that alien plants could be introduced to areas within the footprint of the proposed infrastructure from surrounding areas in the absence of control measures. The potential consequences may be of low seriousness for surrounding natural habitats due to the fact that little natural vegetation still remains on site. Control measures could prevent the impact from occurring.

Decommissioning Phase Impacts

It is expected that the project will operate for a minimum of twenty years or more (a typical planned life-span for a project of this nature). Decommissioning will probably require a series of steps resulting in the removal of equipment

Cumulative impacts on indigenous natural vegetation

The regional terrestrial vegetation types in the broad study area are listed as Endangered. This is the same vegetation type that will be affected by any other projects that would take place in the area. Loss of habitat will definitely occur, but this will be a small area in comparison to the total area of the vegetation type. The vegetation type occupies an area of 22 743 km², of which more than 63% has been altered, so approximately 8 400 km² remains. The total loss of habitat due to a number of projects together will be greater than for any single project, so a cumulative effect will occur. However, the area lost in total will be small compared to the total area of the vegetation type and will not result in a change in the conservation status of the vegetation type. The cumulative effect will therefore be low. In addition, the current project is located very close to an existing urban area. There will therefore be limited fragmentation of natural habitat, a factor that may be of concern if the project was located in a rural area with the no existing infrastructure nearby.

Cumulative impacts due to spread of declared weeds and alien invader plants

There is a moderate possibility that alien plants could be introduced to areas within the footprint of the proposed infrastructure from surrounding areas in the absence of control measures. The greater the number of projects, the more likely this effect will happen therefore the effect is cumulative. For the current site, the impact is predicted to be low due to existing impacts on site and the high ability to control any additional impact. The significance will therefore be low, especially if control measures are implemented.

Summary of mitigation measures

The following mitigation measures are recommended to address known potential impacts:

- Restrict impact to development footprint only and limit disturbance in surrounding areas.
- Prior to commencement of construction, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval.
- Prior to commencement of construction, compile an Alien Plant Management Plan, to be included into the EMPr during final approval.
- Prior to commencement of construction, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control, including monitoring specifications.
- Undertake regular monitoring to detect alien invasions early so that they can be controlled.
- Prior to commencement of construction, compile and implement a stormwater management plan including monitoring specifications.
- Monitor surfaces for erosion, repair and/or upgrade, where necessary.
- Prior to decommissioning commencing, compile a Rehabilitation Plan in compliance with the regulatory requirements at the time of decommissioning.

Summary of monitoring recommendations

Specific monitoring recommendations should be provided in the Alien Invasive Management Plan, and the Rehabilitation Plan. The following are broad recommendations:

Alien Invasive Species:

- Monitor for early detection, to find species when they first appear on site. This should be as per the frequency specified in the management plan, and should be conducted by an experienced botanist. Early detection should provide a list of species and locations where they have been detected. Summer (vegetation maximum growth period) is usually the most appropriate time, but monitoring can be adaptable, depending on local conditions – this must be specified in the management plan.
- Monitor for the effect of management actions on target species, which provides information on the effectiveness of management actions. Such monitoring depends on the management actions taking place. It should take place after each management action.

- Monitor for the effect of management actions on non-target species and habitats.

Rehabilitated areas:

- Rehabilitation Plan must be compiled by an approved ecologist prior to achieving COD and prior to the start of decommissioning.
- All management actions associated with rehabilitation must be recorded after each management action has taken place.
- All rehabilitated areas should be monitored to assess vegetation recovery. This should be for a minimum of three years after post-construction rehabilitation, but depends on the assessed trajectory of rehabilitation (whether it is following a favourable progression of vegetation establishment or not – this depends on the total vegetation cover present, and the proportion that consists of perennial growth of desired species). For each monitoring site, an equivalent comparative site in adjacent undisturbed vegetation should be similarly monitored. Monitoring data collection should include the following:
 - total vegetation cover and height, as well as for each major growth form;
 - species composition, including relative dominance;
 - soil stability and/or development of erosion features;
 - representative photographs should be taken at each monitoring period.
- Monitoring of rehabilitated areas should take place at the frequency and for the duration determined in the rehabilitation plan, or until vegetation stability has been achieved.

Table 1: Rating of impacts

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Indigenous natural vegetation	Loss, degradation or fragmentation of vegetation through direct clearing	1	4	4	2	4	2	30	-	Medium	Use existing road infrastructure for access roads. Avoid construction of infrastructure within sensitive habitats. Minimise vegetation clearing and disturbance to footprint areas only. Compile a rehabilitation programme and rehabilitate disturbed areas. Compile and implement Alien Invasive Management Plan. Limit access to sensitive areas during construction. Undertake monitoring to evaluate whether further measures are required.	1	4	3	2	4	2	28	-	Medium
Operational Phase																				

Vegetation	Establishment and spread of alien invasive plant species due to the presence of migration corridors and disturbance vectors	1	3	2	3	3	2	24	-	Medium	Compile and implement Alien Invasive Management Plan. Rehabilitate disturbed areas.	1	2	2	2	3	1	10	-	Low
Decommissioning Phase																				
Vegetation	Loss and disturbance of natural vegetation due to the removal of infrastructure and need for working sites	1	3	2	2	2	2	20	-	Low	No additional clearing of vegetation should take place without a proper assessment of the environmental impacts and authorization from relevant authorities. If any additional infrastructure needs to be constructed, for example overhead powerlines, communication cables, etc., then these must be located next to existing infrastructure, and clustered to avoid dispersed impacts. No driving of vehicles off-road. Implement Alien Plant Management Plan, including monitoring, to ensure minimal impacts on surrounding areas. Access to sensitive areas outside of development footprint should not be permitted during operation. Surface	1	3	2	2	2	1	10	-	Low

Indigenous natural vegetation	Loss, degradation or fragmentation of vegetation through direct clearing	2	4	4	2	4	2	32	-	Medium	Limit development within conservation zones, especially CBA1 areas.	2	4	4	2	4	1	16	-	low
Vegetation, ecosystems and habitats	General increase in the spread and invasion of new habitats by alien invasive plant species	2	3	2	3	3	2	26	-	Medium	Implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control. Undertake regular monitoring to detect alien invasions early so that they can be controlled. Post-decommissioning monitoring should continue for an appropriate length of time to ensure that future problems are avoided. Do NOT use any alien plants during any rehabilitation that may be required.	2	2	2	2	3	1	11	-	Low

COMPARATIVE ASSESSMENT OF ALTERNATIVES

No alternatives are being considered for this project.

No-Go Alternative

The “no-go” option assumes that the site remains in its current state, i.e. there is no construction of a Solar PV and associated infrastructure in the proposed project area and the status quo would proceed. The current land use is livestock grazing, which has the potential to lead to long-term degradation under overgrazing or could potentially benefit the land under ideal grazing. The local effect of the “no-go” alternative would therefore be beneficial in the long-term because it would entail no loss of grassland habitat.

DISCUSSION

In general, the site is considered to have potentially high sensitivity or biodiversity value, based on the location of the site within a listed ecosystem as well as being within an Ecological Support Area.

The project study area consists of natural grassland habitat, and degraded areas associated with previous cultivation. The site is within an area where the remaining natural habitat has been assessed as having high conservation value. Existing impacts on natural habitat are related to possible previous cultivation on site. The extent of previous cultivation can be determined from the combination of local species composition and patterns from aerial imagery. The proposed project will therefore have some effects on areas of natural habitat that may possibly have important biodiversity value.

The vegetation on site is part of a threatened ecosystem and has been assessed as being of high conservation value due to rates of transformation. The regional vegetation type that occurs on site, Vaal-Vet Sandy Grassland, is listed as Endangered in the National Ecosystem List, is part of an area earmarked for future National Park expansion and is part of a Provincial Ecological Support Area. Any remaining natural habitat on site therefore has high terrestrial biodiversity value.

The most significant impact associated with the project is due to clearing of indigenous natural vegetation. This impact was evaluated as having a significance of MEDIUM after mitigation. All other assessed impacts had a significance of LOW after mitigation. One potential impact with the most significant risk in the absence of any management is due to the potential spread and growth of alien invasive plant species, which is facilitated by disturbance.

On the basis of the relatively limited extent that will be disturbed, and the general absence of any species of concern, the proposed development can be authorised.

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APPENDICES:

Appendix 1: Curriculum vitae: Dr David Hoare

Education

Matric - Graeme College, Grahamstown, 1984
B.Sc (majors: Botany, Zoology) - Rhodes University, 1991-1993
B.Sc (Hons) (Botany) - Rhodes University, 1994 with distinction
M.Sc (Botany) - University of Pretoria, 1995-1997 with distinction
PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Main areas of specialisation

- Vegetation ecology, primarily in grasslands, thicket, coastal systems, wetlands.
- Plant biodiversity and threatened plant species specialist.
- Alien plant identification and control / management plans.
- Remote sensing, analysis and mapping of vegetation.
- Specialist consultant for environmental management projects.

Membership

Professional Natural Scientist, South African Council for Natural Scientific Professions, 16 August 2005 – present. Reg. no. 400221/05 (Ecology, Botany)
Member, International Association of Vegetation Scientists (IAVS)
Member, Ecological Society of America (ESA)
Member, International Association for Impact Assessment (IAIA)
Member, Herpetological Association of Africa (HAA)

Employment history

1 December 2004 – present, Director, David Hoare Consulting (Pty) Ltd. Consultant, specialist consultant contracted to various companies and organisations.
1 January 2009 – 30 June 2009, Lecturer, University of Pretoria, Botany Dept.
1 January 2013 – 30 June 2013, Lecturer, University of Pretoria, Botany Dept.
1 February 1998 – 30 November 2004, Researcher, Agricultural Research Council, Range and Forage Institute, Private Bag X05, Lynn East, 0039. Duties: project management, general vegetation ecology, remote sensing image processing.

Experience as consultant

Ecological consultant since 1995. Author of over 380 specialist ecological consulting reports. Wide experience in ecological studies within grassland, savanna and fynbos, as well as riparian, coastal and wetland vegetation.

Publication record:**Refereed scientific articles (in chronological order):****Journal articles:**

- HOARE, D.B.** & BREDENKAMP, G.J. 1999. Grassland communities of the Amatola / Winterberg mountain region of the Eastern Cape, South Africa. *South African Journal of Botany* 64: 44-61.
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Consulting reports:

Total of over 380 specialist consulting reports for various environmental projects from 1995 – present.

Workshops / symposia attended:

- International Association for Impact Assessment Annual Congress, Durban, 16 – 19 May 2018.
- Workshop on remote sensing of rangelands presented by Paul Tueller, University of Nevada Reno, USA, VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- BioMap workshop, Stellenbosch, March 2002 to develop strategies for studying vegetation dynamics of Namaqualand using remote sensing techniques
- South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- 28th International Symposium on Remote Sensing of Environment, Somerset West, 27-31 March 2000.
- Workshop on Vegetation Structural Characterisation: Tree Cover, Height and Biomass, 28th International Symposium on Remote Sensing of Environment, Strand, 26 March 2000.
- South African Association of Botanists Annual Congress, Potchefstroom, January 2000
- National Botanical Institute Vegmap Workshop, Kirstenbosch, Cape Town, 30 September-1 October 1999.
- Sustainable Land Management – Guidelines for Impact Monitoring, Orientation Workshop: Sharing Impact Monitoring Experience, Zithabiseni, 27-29 September 1999.
- WWF Macro Economic Reforms and Sustainable Development in Southern Africa, Environmental Economic Training Workshop, development Bank, Midrand, 13-14 September 1999.
- 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999
- Expert Workshop on National Indicators of Environmental Sustainable Development, Dept. of Environmental Affairs and Tourism, Roodevallei Country Lodge, Roodeplaat Dam, Pretoria, 20-21 October 1998.
- South African Association of Botanists Annual Congress, Cape Town, January 1998
- Randse Afrikaanse Universiteit postgraduate symposium, 1997.
- South African Association of Botanists Annual Congress, Bloemfontein, January 1995.

Animal Species Compliance Statement

prepared in accordance with the
*"Protocol for the Specialist Assessment and minimum report content
requirements for environmental impacts on Terrestrial Biodiversity"*

Leeuwbosch PV3 Solar Photovoltaic (PV) Plant and Associated
Infrastructure near Leeudoringstad in North West Province



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Terrestrial Animal Species Compliance Statement Report for the Leeuwbosch PV3 Solar Photovoltaic (PV) Plant and Associated Infrastructure near Leeudoringstad in North West Province

22 November 2022

TABLE OF CONTENTS

TABLE OF CONTENTS	2
SPECIALIST DETAILS & DECLARATION	3
DECLARATION OF INDEPENDENCE:.....	3
DISCLOSURE:.....	3
TERMS OF REFERENCE	4
PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL ANIMAL SPECIES	4
INTRODUCTION	8
SITE LOCATION	8
IDENTIFIED THEME SENSITIVITIES	9
<i>Animal Species theme</i>	9
ASSESSMENT METHODOLOGY	11
PROJECT AREA OF INFLUENCE (PAOI)	11
SURVEY TIMING	12
FIELD SURVEY APPROACH	13
SOURCES OF INFORMATION.....	14
<i>Fauna</i>	14
LIMITATIONS	14
OUTCOME OF THE ASSESSMENT	15
NATURAL HABITATS ON SITE.....	15
ANIMAL SPECIES FLAGGED FOR THE STUDY AREA	18
<i>Mammals</i>	18
<i>Reptiles</i>	19
<i>Amphibians</i>	19
<i>Protected animals</i>	19
CONCLUSION	20
REFERENCES & BIBLIOGRAPHY	21
APPENDICES:	22
APPENDIX 1: ANIMAL SPECIES WITH A GEOGRAPHICAL DISTRIBUTION THAT INCLUDES THE STUDY AREA.....	22
APPENDIX 2: VERTEBRATE ANIMAL SPECIES (EXCLUDING BIRDS AND BATS) PROTECTED UNDER THE NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT 10 OF 2004)	24
APPENDIX 3: CURRICULUM VITAE: DR DAVID HOARE.....	26

SPECIALIST DETAILS & DECLARATION

This report has been prepared in accordance with the "Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity", as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020. It has been prepared independently of influence or prejudice by any parties.

The details of Specialists are as follows –

Table 1: Details of Specialist

Specialist	Qualification and accreditation
Dr David Hoare	<ul style="list-style-type: none">• PhD Botany• Pr.Sci.Nat. 400221/05 (Ecological Science, Botanical Science)

Declaration of independence:

David Hoare Consulting (Pty) Ltd in an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by David Hoare Consulting (Pty) Ltd is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

Disclosure:

David Hoare Consulting (Pty) Ltd undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

Based on information provided to David Hoare Consulting (Pty) Ltd by the client and in addition to information obtained during the course of this study, David Hoare Consulting (Pty) Ltd present the results and conclusion within the associated document to the best of the author's professional judgement and in accordance with best practise.



Dr David Hoare

22 November 2022
Date

TERMS OF REFERENCE

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL ANIMAL SPECIES

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Biodiversity, on Animal Species, and on Plant Species. Note that the Protocols require determination of the level of sensitivity, which then determines the level of assessment required, either a full assessment, or a Compliance Statement.

Protocol For The Specialist Assessment And Minimum Report Content Requirements For Environmental Impacts On Terrestrial Animal Species

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020.

General information

1.1 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "**very high**" or "**high**" sensitivity for terrestrial animal species, must submit a **Terrestrial Animal Species Specialist Assessment Report**.

1.2 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "**medium** sensitivity" for terrestrial animal species, must submit either a **Terrestrial Animal Species Specialist Assessment Report** or a **Terrestrial Animal Species Compliance Statement**, depending on the outcome of a site inspection undertaken in accordance with paragraph 4.

1.3 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "**low**" sensitivity for terrestrial animal species, must submit a **Terrestrial Animal Species Compliance Statement**.

1.4 Where the information gathered from the site sensitivity verification differs from the screening tool designation of "very high" or "high" for terrestrial animal species sensitivity on the screening tool, and it is found to be of a "low" sensitivity, then a **Terrestrial Animal Species Compliance Statement** must be submitted.

1.5 Where the information gathered from the site sensitivity verification differs from the screening tool designation of "low" terrestrial animal species sensitivity and it is found to be of a "very high" or "high" terrestrial animal species sensitivity, a **Terrestrial Animal Species Specialist Assessment** must be conducted.

1.6 If any part of the development falls within an area of confirmed "very high" or "high" sensitivity, the assessment and reporting requirements prescribed for the "very high" or "high" sensitivity, apply to the entire development footprint. Development footprint in the context of this protocol, means the area on which the proposed development will take place and includes the area that will be disturbed or impacted.

1.7 The **Terrestrial Animal Species Specialist Assessment** and the **Terrestrial Animal Species Compliance Statement** must be undertaken within the study area.

1.8 Where the nature of the activity is not expected to have an impact on species of conservation concern (SCC) beyond the boundary of the preferred site, the study area means the proposed development footprint within the preferred site.

1.9 Where the nature of the activity is expected to have an impact on SCC beyond boundary of the preferred site, the project areas of influence (PAOI) must be determined by the specialist in accordance with Species Environmental Assessment Guideline, and the study area must include the PAOI, as determined.

Terrestrial Animal Species Specialist Assessment

2.1 The assessment must be undertaken by a specialist registered with the South African Council for Natural Scientific Professions (SACNASP), within a field of practice relevant to the taxonomic groups ("taxa") for which the assessment is being undertaken.

2.2 The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline and must:

2.2.1 Identify the SCC which were found, observed or are likely to occur within the study area;

2.2.2 provide evidence (photographs) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3);

2.2.3 identify the distribution, location, viability and detailed description of population size of the SCC identified within the study area;

2.2.4 identify the nature and the extent of the potential impact of the proposed development to the population of the SCC located within the study area;

2.2.5 determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases including the IUCN Red List of Threatened Species, South African Red List of Species, and/or other relevant databases;

2.2.6 determine the potential impact of the proposed development on the habitat of the SCC located within the study area;

2.2.7 include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, a motivation for the deviation;

2.2.8 identify any dynamic ecological processes occurring within the broader landscape, that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fire-prone systems;

2.2.9 identify any potential impact on ecological connectivity in relation to the broader landscape, resulting in impacts on the identified SCC and its long term viability;

2.2.10 determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC; and

2.2.11 discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species, or roosting and breeding or foraging areas used by migratory species where these species show significant congregations, occurring in the vicinity; and

2.2.12 identify any alternative development footprints within the preferred development site which would be of "low" or "medium" sensitivity as identified by the screening tool and verified through the site sensitivity verification.

2.3 The findings of the assessment must be written up in a **Terrestrial Animal Species Specialist Assessment Report**.

Terrestrial Animal Species Specialist Assessment Report

3.1 This report must include as a minimum the following information:

3.1.1 contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae;

3.1.2 a signed statement of independence by the specialist;

3.1.3 a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

3.1.4 a description of the methodology used to undertake the site sensitivity verification and impact assessment and site inspection, including equipment and modelling used where relevant;

3.1.5 a description of the mean density of observations/number of samples sites per unit area of site inspection observations;

3.1.6 a description of the assumptions made and any uncertainties or gaps in knowledge or data;

3.1.7 details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;

3.1.8 the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;

3.1.9 the location of areas not suitable for development and to be avoided during construction where relevant;

3.1.10 a discussion on the cumulative impacts;

3.1.11 impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);

3.1.12 a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to the specific theme considered, and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and

3.1.13 a motivation must be provided if there were any development footprints identified as per paragraph 2.2.12 above that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate.

3.2 A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

INTRODUCTION

Site location

The project is located on Portion 37 of the Farm Leeuwbosch No. 44, approximately 6km north-east of the town of Leeudoringstad in the North West Province (Figure 5). The site is just off the R502 (Orkney to Leeudoringstad) road. Refer to Figure 1 below for the general location.

The site is currently natural grassland that is used for grazing. There is no infrastructure on site, except for a small reservoir on the northern edge of the proposed project site..

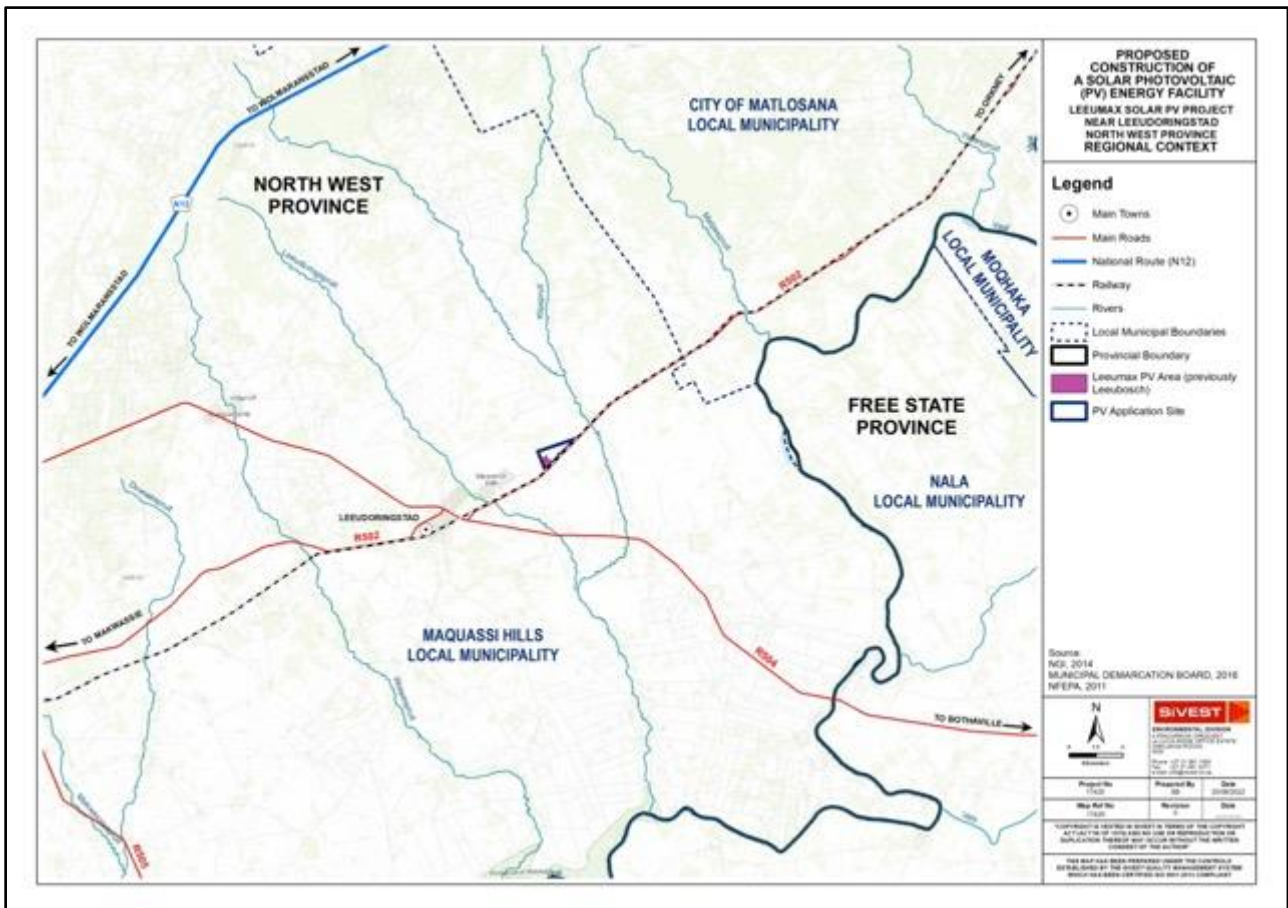


Figure 1: Location of the site.

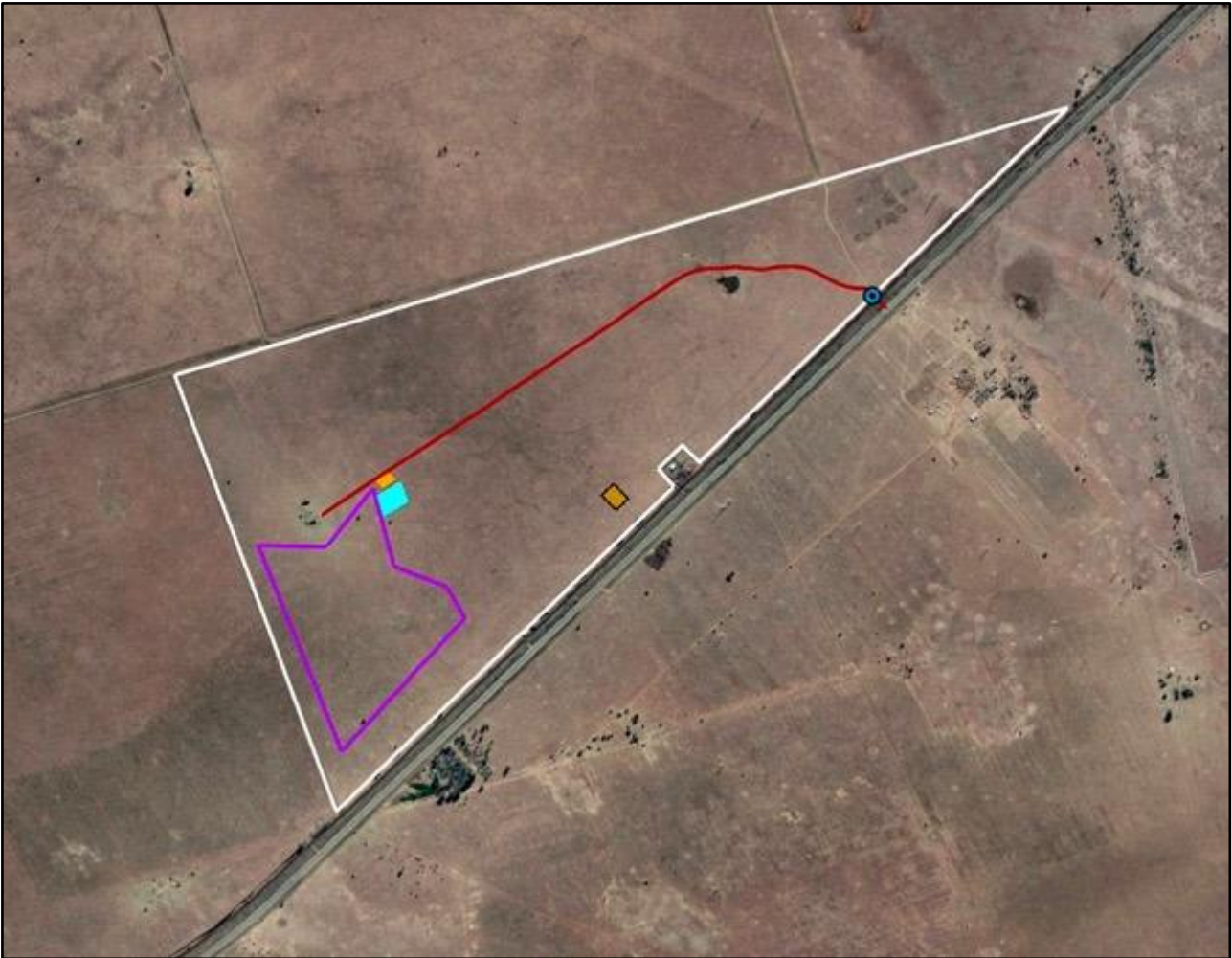


Figure 2: Aerial image of the site and surrounding areas.

Identified Theme Sensitivities

A sensitivity screening report from the DEA Online Screening Tool was requested in the application category: Transformation of land | Indigenous vegetation. The DEA Screening Tool report for the area, dated 02/11/2021, indicates the following sensitivities (see Figure 3):

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Animal Species Theme				X

Animal Species theme

Sensitivity features are indicated as follows:

Sensitivity	Feature(s)
Low	Subject to confirmation



Figure 3: Map of relative animal species theme sensitivity.

Survey timing

The study commenced as a desktop-study followed by site-specific field study on 29 April 2021 and 27 October 2021. The site is within the Grassland Biome with with a peak rainfall season in summer, which occurs from October to March. There is, however, a delay between rainfall and vegetation growth, which means the peak growing season is from November to May (Figure 5). A more accurate indication of rainfall seasonality, which drives most ecological processes, is shown in Figure 6, which shows that Klerksdorp has peak rainfall from October to April. The timing of the survey in is therefore suitable in terms of assessing the habitat of the site. The overall condition of animal habitat was possible to be determined with a high degree of confidence.

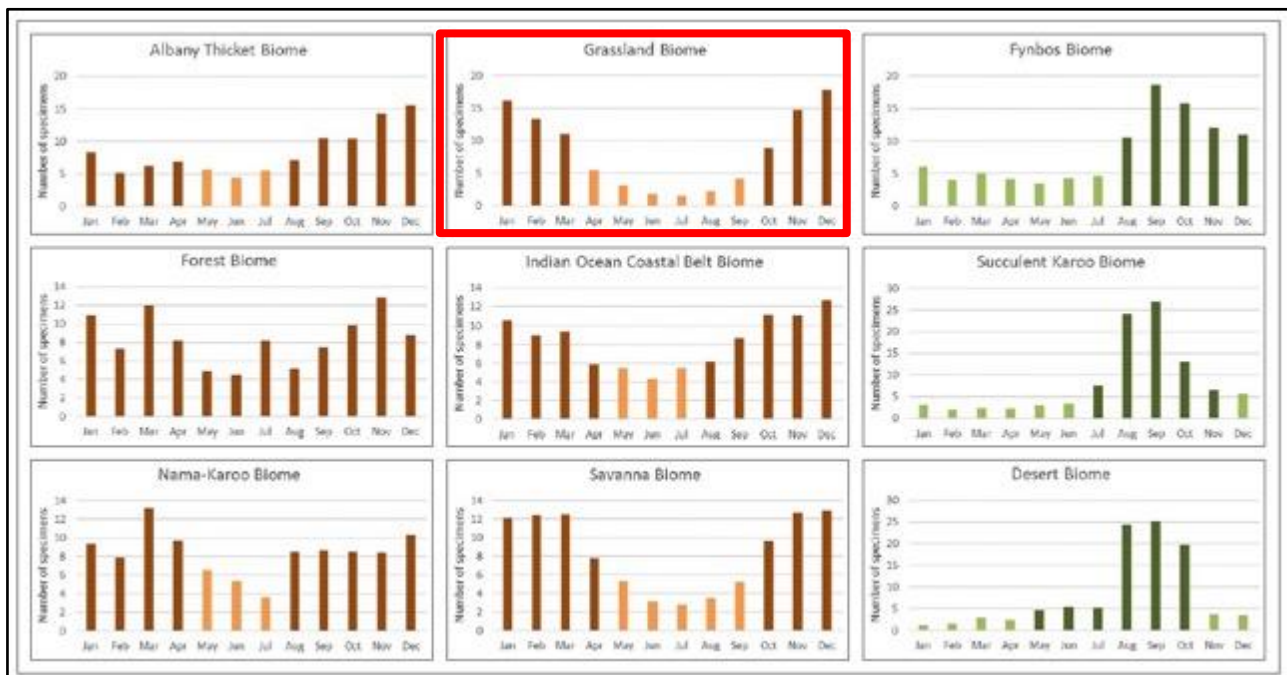


Figure 5: Recommended survey periods for different biomes (Species Environmental Assessment Guidelines). The site is within the Fynbos Biome.

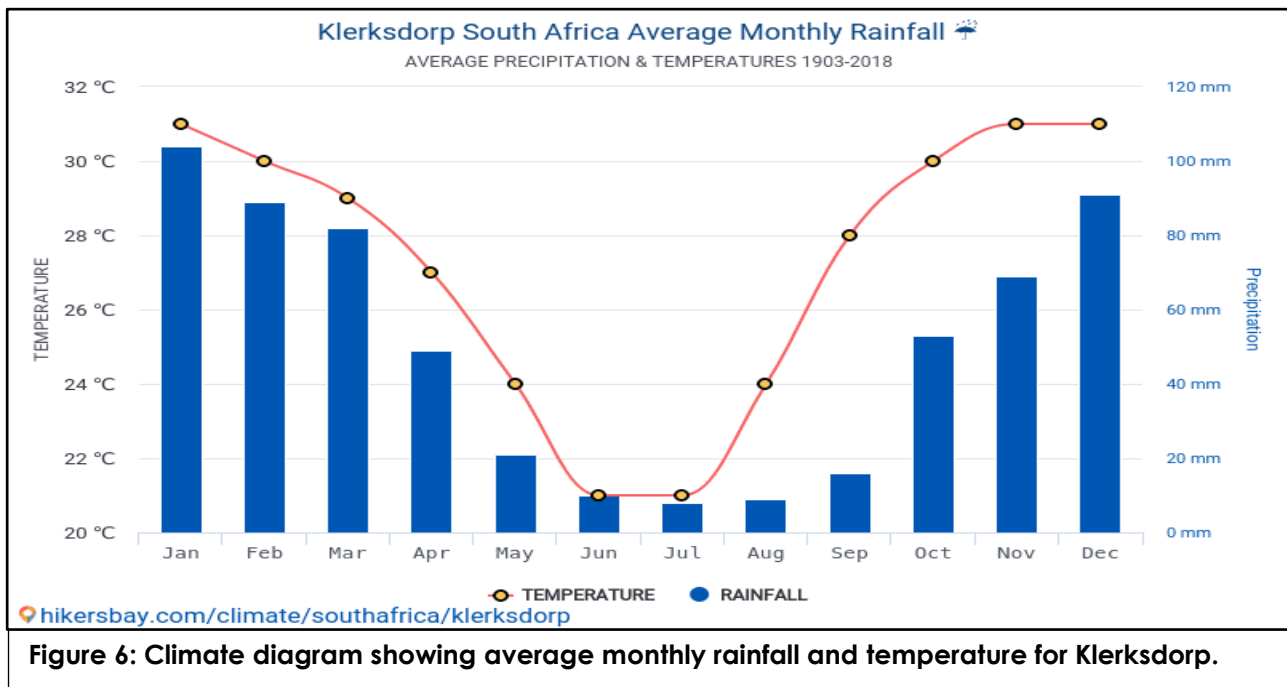


Figure 6: Climate diagram showing average monthly rainfall and temperature for Klerksdorp.

Field survey approach

The study commenced as a desktop-study followed by a site-specific field study. During the field survey of habitats on site, the entire site was assessed on foot. Field surveys included both meander searches of general areas, and active searching in habitats that were considered to be suitable for specific groups or species. Meander surveys were undertaken with no time restrictions - the objective was to comprehensively examine all natural areas. A hand-held Garmin GPSMap 64s was used to record a track within which observations were made. Digital photographs were taken of features and habitats on site, as well as of any animal species that were seen. Any animal species recorded were uploaded to the iNaturalist website (<https://www.inaturalist.org>) and are accessible by viewing the observations for the site (use the Explore menu, zoom and pan until the desired study area is within the browser window, click the button "Redo search in map", and all observations for that area will be shown and listed).

Aerial imagery from Google Earth was used to identify and assess habitats on site. This included historical imagery that may show information not visible in any single dated image. Patterns identified from satellite imagery were verified on the ground. Digital photographs were taken at locations where features of interest were observed. During the field survey, particular attention was paid to ensuring that all habitat variability was covered physically on the ground.

Sources of information

Fauna

- Lists of animal species that have a geographical range that includes the study area were obtained from literature sources (Bates et al., 2014 for reptiles, du Preez & Carruthers 2009 for frogs, Mills & Hes 1997 and Friedmann and Daly, 2004 for mammals). This was supplemented with information from the Animal Demography Unit website (adu.uct.ac.za) and literature searches for specific animals, where necessary.
- Appendix 2 is a summary (for the QDS3422AA) of amphibians, mammals and reptiles that may occur on the study site.

Limitations

The following assumptions, limitations, uncertainties are listed regarding the assessment of the site:

- The assessment is based on a single site visit. The current study is based on an extensive site visit as well as a desktop study of the available information. The time spent on site was adequate for understanding general patterns across affected areas.
- Compiling the list of species that could potentially occur on site is limited by the paucity of collection records for the area. The list of animal species that could potentially occur on site was therefore taken from a wider area and from literature sources that may include species that do not occur on site and may miss species that do occur on site. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons, be undertaken over a number of years and include extensive sampling. Due to legislated time constraints for environmental authorisation processes, this is not possible.
- Rare and threatened animal species are, by their nature, usually very difficult to locate and can be easily missed.

OUTCOME OF THE ASSESSMENT

Natural habitats on site

Natural habitats on site match the landcover map for the area (Figure 8). The majority of the solar PV area is within a previously cultivated area that currently contains secondary grassland. Remaining areas are natural grassland. A broad classification of the habitat units on site, which also reflects relatively uniform plant species compositional units, is as follows:

Natural habitats:

1. **Natural grassland** (open grassland on undulating plains – the condition is not indicated in the habitat map although there is a gradient from heavily grazed poor condition to moderate condition);

Transformed and degraded areas:

2. **Old lands** (secondary grasslands on previously cultivated areas);

NATURAL VERSUS SECONDARY GRASSLAND	
Natural grassland	Areas of original vegetation in which the soil has not been mechanically disturbed, including areas that are in poor condition due to overgrazing, trampling, invasion by weeds or alien invasive species, inappropriate fire regimes , or any other factor that drives natural change in species composition or vegetation structure. The key factor is that the original plants continue to exist, often resprouting after defoliation from sub-surface stems or other storage organs.
Secondary grassland	Areas of vegetation where the original grassland vegetation has been lost through direct disturbance of the soil that results in physical removal of the original plants, the most common cause of which is ploughing, but could be other mechanical factors. The vegetation that then develops is as a result of recolonization of the area through propagation.

The natural grassland on site is characterised by medium-height grassland that appears to be overgrazed at times. The presence of scattered termite mounds throughout the site indicates that the grassland is in a natural state (not ploughed). There were also no plough lines in these grasslands on the aerial imagery for the site. Significant parts of the site have been cultivated at some point in history, which is also clearly evident from the vegetation structure and species composition on site. The topography within these grassland areas is relatively flat. Common and dominant species in the natural areas include *Themeda triandra*, *Digitaria erianthe*, *Eragrostis chloromelas*, *Aristida congesta* subsp. *congesta*, *Cymbopogon pospischilii*, *Eragrostis superba*, *Setaria sphacelata* var. *torta*, *Eragrostis obtusa*, *Trichoneura grandiglumis*, *Cynodon dactylon*, *Felicia muricata*, *Hermannia depressa*, *Arctotis arctotoides*, *Anthospermum rigidum*, *Walafrida densiflora* and *Barleria* species. A total of 25 species per 100m² was recorded in these natural grasslands, which is moderately diverse relative to other Highveld grasslands. In comparison, the previously cultivated areas had only 17 species per 100m². Common and dominant species in the previously cultivated areas were *Aristida congesta* subsp. *congesta*, *Eragrostis lehmanniana*, *Themeda triandra*, *Eragrostis superba*, *Melinis repens*, *Trichoneura grandiglumis*, *Cynodon dactylon*, *Arctotis arctotoides*, *Anthospermum rigidum*, *Hermannia depressa* and *Pentzia* species.



Figure 9: View of the site at the existing small reservoir (northern edge of solar array).



Figure 8: Grassland on site.

Animal species flagged for the study area

According to the National Web-Based Environmental Screening Tool (DFFE), there are no animal species that have been flagged as of concern for the current project (see previous section of this report).

Vertebrate species (mammals (except bats), reptiles, amphibians) with a geographical distribution that includes the study area are listed in Appendix 1. All threatened (Critically Endangered, Endangered or Vulnerable) or near threatened vertebrate animals that could occur in the study area and have habitat preference that includes habitats available in the study area are discussed further.

In all cases, the site does not constitute important habitat for any of these species, but there is still a possibility that they may occur there. Development of the site is unlikely to cause a significant loss of habitat for any of these species, but care should still be taken to avoid or minimize impacts on them.

Mammals

There are 82 mammal species that have a geographical distribution that includes the study area, of which nine are listed in a conservation category of some level (see Appendix 3). Of the listed species, there are three of low conservation concern that could occur in available habitats in the study area. These are the Brown Hyaena, the Honey Badger and Southern African Hedgehog. All of these species are classified nationally as near threatened (NT), but globally as Least Concern. They are, therefore, of relatively low conservation concern in comparison to more threatened species found in other parts of the country. The Honey Badger and the Hedgehog are protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. Listed species with a geographical range that includes the site are discussed in more detail below to evaluate the potential for them to occur on site.

Black Rhinoceros

The Black Rhinoceros (*Diceros bicornis minor*), listed as Vulnerable, has a geographical extent of occurrence that just includes the study area. It is a browser occurring in bushveld habitat where it requires dense cover, sufficient browsing and permanent water. The species is only found in protected areas and on some private properties. It would not occur on site unless introduced deliberately. The habitat on site is not suitable.

Brown Hyaena

The Brown Hyaena (*Hyaena brunnea*), listed as Near Threatened, is found in dryer parts of the country, primarily savanna, grassland, shrubland and in urban areas. It is a solitary carnivorous scavenger that travels large distances every night (Mills & Hes 1997). It could potentially forage across the site, but is unlikely to be restricted to such a small area.

Spotted-necked Otter

The Spotted-necked Otter (*Lutra maculicollis*), listed as Near Threatened, is found in permanent, unsilted and unpolluted rivers, streams and freshwater lakes in the well-watered eastern parts of the country (Mills & Hes 1997). There is no suitable habitat on site or nearby.

Honey Badger

The Honey Badger (*Mellivora capensis*), listed as Near Threatened, is found in a wide variety of habitats. It is found over most of Africa, including most of South Africa. It could potentially occur on site, but is a mobile animal that forages over wide areas.

Southern African Hedgehog

The Southern African Hedgehog (*Atelerix frontalis*), listed as Near Threatened, is found in a wide variety of terrestrial habitats where there is adequate ground cover, avoiding mesic habitats (Mills & Hes 1997). The study area is well within the core extent of occurrence of this species and habitat on site is potentially suitable, at least in places. There is therefore the possibility that it occurs on site.

White-tailed Rat

The White-tailed Rat (*Mystromus albicaudatus*), listed as Endangered, is found mainly in highveld and montane grassland where it lives in holes in the ground or shelters in cracks in the soil (Mills & Hes 1997). It apparently requires sandy soils with good cover (Friedmann & Daly 2004). It occurs at a low density throughout its range. The study area is within the core extent of occurrence of this species and habitat on site is potentially suitable, at least in places. There is therefore the possibility that it occurs on site.

Reptiles

There are a total of 52 reptile species with a geographical distribution that includes the study area (Bates et al. 2014). These are listed in Appendix 1. There are no reptile species of conservation concern that have a distribution that includes the study area.

Amphibians

There are a total of 17 frog species with a geographical distribution that includes the study area (see Appendix 3). The Giant Bullfrog is the only listed amphibian species with a distribution that includes the study area and which could occur on site. This species is listed as Least Concern globally and Near threatened in South Africa. It is, however, protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit.

Giant Bullfrog

The Giant Bullfrog (*Pyxicephalus adspersus*) was previously listed as Near Threatened, but according to the IUCN Red List, is currently listed as Least Concern. It is, however, protected under National legislation (see Appendix 4). The species is widely distributed in southern Africa, mainly at higher elevations and inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas. It also utilises non-permanent vleis and shallow water on margins of waterholes and dams. They prefer sandy substrates although they sometimes inhabit clay soils. Based on habitat requirements, this species could potentially occur on site.

Protected animals

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). According to this Act, "a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7". Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution that includes the site are listed in Appendix 2, marked with the letter "N". This includes the following species: Black Rhinoceros, Cape Clawless Otter, Brown Hyaena, Spotted-necked Otter, Honey Badger, Leopard, Cape Fox South African Hedgehog, and Giant Bullfrog.

Due to habitat and forage requirements and the fact that some species are restricted to game farms and/or conservation areas, only the Brown Hyaena, Honey Badger, Leopard, Cape Fox South African Hedgehog, and Giant Bullfrog have a likelihood of occurring on site. All of these species are mobile animals that are likely to move away in the event of any activities on site disturbing them. They are also not dependent on a small patch of habitat within their range that has already been

disturbed by existing quarrying. They are therefore unlikely to be affected by the proposed development of the quarry.

It is therefore verified that the Animal Species Theme has LOW sensitivity for the site.

CONCLUSION

Desktop information, field data collection and mapping from aerial imagery provides the following verifications of patterns for various themes:

1. The site consists of a combination of Grassland and Secondary Grassland (old fields).
2. The site has been assessed as having low sensitivity in terms of the Animal Species Theme.
3. There are no animal species flagged for the site. Further research indicates that there are no animal species of concern or protected animal species that are likely to occur on site or be reliant on the site.
4. The proposed development will not affect any animal species of concern. The development is therefore supported.

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APPENDICES:

Appendix 1: Animal species with a geographical distribution that includes the study area.

Notes:

1. Species of conservation concern are in red lettering.
2. Species protected according to the National Environmental Management: Biodiversity Act of 2004 (Act 10 of 2000) marked with "N"

Mammals:

Red hartebeest
Springbok
Black wildebeest
Blue wildebeest
Blesbok
NBlack rhinoceros VU
Klipspringer
Gemsbok
Warthog
Steenbok
Common duiker
Eland
Kudu
Rock hyrax
NCape clawless otter
Water mongoose
Black-backed jackal
Caracal
Yellow mongoose
NBlack-footed cat
African wild cat
Slender mongoose
Small-spotted genet
Large-spotted genet
NBrown hyaena NT
White-tailed mongoose
Striped polecat
NSpotted-necked otter NT
NHoney badger NT
Bat-eared fox
NLeopard
African weasel
Aardwolf
Suricate
NCape fox
African straw-coloured fruit bat
Percival's short-eared trident bat VU
Geoffroy's horseshoe bat **NT/LC**
Egyptian slit-faced bat
Egyptian free-tailed bat
Natal long-fingered bat NT
Long-tailed serotine bat
Temminck's myotis
Welwitsch's myotis
Cape serotine bat
NSouth African hedgehog NT
Reddish-grey musk shrew

Tiny musk shrew
Lesser red musk shrew
Swamp musk shrew
Least dwarf shrew
Lesser dwarf shrew
Cape/desert hare
Scrub/savannah hare
Vervet monkey
Chacma baboon
Red veld rat
Tete veld rat
Namaqua rock mouse
Common mole rat
Grey climbing mouse
Short-tailed gerbil
Woodland dormouse
Porcupine
Single-striped mouse
Large-eared mouse
Multimammate mouse
Desert pygmy mouse
White-tailed rat EN
Angoni vlei rat
Vlei rat
Springhare
Striped mouse
Pouched mouse
Kreb's fat mouse
Highveld gerbil
Bushveld gerbil
Tree rat
Greater cane rat
Cape ground squirrel
Rock elephant shrew
Aardvark

Reptiles:

Pelomedusidae:

Marsh terrapin

Testudinidae:

Serrated tent tortoise

Leopard tortoise

Gekkonidae:

Common dwarf gecko

Cape gecko

Amphisbaenidae

Cape worm lizard

Lacertidae:

Savanna lizard
 Holub's sandveld lizard
 Spotted sandveld lizard
 Spotted sand lizard

Cordylidae:

Common girdled lizard
 Southern karusa lizard

Gerrhosauridae:

Yellow-throated plated lizard

Scincidae:

Thin-tailed legless skink
 Wahlberg's snake-eyed skink
 Cape skink
 Speckled rock skink
 Speckled sand skink
 Variable skink

Varanidae:

Southern rock monitor
 Nile monitor

Chamaeleonidae:

Common flap-necked chameleon

Agamidae:

Eastern ground agama
 Southern rock agama

Typhlopidae:

Bibron's blind snake
 Delelande's beaked blind snake
 Leptotyphlopidae
 Peter's thread snake

Viperidae:

Puff adder
 Rhombic night adder

Lamprophiidae:

Black-headed centipede eater
 Bibron's stiletto snake
 Common house snake
 Aurora snake
 Brown water snake
 Cape wolf snake
 Short-snouted grass snake

Cross-marked grass snake
 Fork-marked sand snake
 Spotted grass snake
 Striped grass snake
 South African slug eater
 Two-striped shovel-snout
 Sundevall's shovel-snout
 Mole snake

Elapidae:

Sundevall's garter snake
 Rinkhals
 Cape cobra

Colubridae:

Red-lipped snake
 Rhombic egg eater
 Boomslang
 Spotted bush snake

Amphibians

Bushveld rain frog
 Eastern olive toad
 Guttural toad
 Raucous toad
 Southern pygmy toad
 Red toad
 Bubbling kassina
 Snoring puddle frog
 Common platanna
 Boettger's caco
 Common river frog
 Cape river frog
^NGiant bullfrog NT
 Striped stream frog
 Tremolo sand frog
 Natal sand frog
 Tandy's sand frog

Appendix 2: Vertebrate animal species (excluding birds and bats) protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

(as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Reptilia

Loggerhead sea turtle
Leatherback sea turtle
Hawksbill sea turtle

Mammalia

Riverine rabbit
Rough-haired golden mole

ENDANGERED SPECIES

Reptilia

Green turtle
Giant girdled lizard
Olive ridley turtle
Geometric tortoise

Mammalia

Robust golden mole
Tsessebe
Black rhinoceros
Mountain zebra
African wild dog
Gunning's golden mole
Oribi
Red squirrel
Four-toed elephant-shrew

VULNERABLE SPECIES

Mammalia

Cheetah
Samango monkey
Giant golden mole
Giant rat
Bontebok
Tree hyrax
Roan antelope
Pangolin
Juliana's golden mole
Suni
Lion
Leopard
Blue duiker

PROTECTED SPECIES

Amphibia

Giant bullfrog
African bullfrog

Reptilia

Gaboon adder
Namaqua dwarf adder
Smith's dwarf chameleon
Armadillo girdled lizard
Nile crocodile
African rock python

Mammalia

Cape clawless otter
South African hedgehog
White rhinoceros
Black wildebeest
Spotted hyaena
Black-footed cat
Brown hyaena
Serval
African elephant
Spotted-necked otter
Honey badger
Sharpe's grysbok
Reedbuck
Cape fox

Appendix 3: Curriculum vitae: Dr David Hoare

Education

Matric - Graeme College, Grahamstown, 1984

B.Sc (majors: Botany, Zoology) - Rhodes University, 1991-1993

B.Sc (Hons) (Botany) - Rhodes University, 1994 with distinction

M.Sc (Botany) - University of Pretoria, 1995-1997 with distinction

PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Main areas of specialisation

- Vegetation ecology, primarily in grasslands, thicket, coastal systems, wetlands.
- Plant biodiversity and threatened plant species specialist.
- Alien plant identification and control / management plans.
- Remote sensing, analysis and mapping of vegetation.
- Specialist consultant for environmental management projects.

Membership

Professional Natural Scientist, South African Council for Natural Scientific Professions, 16 August 2005
– present. Reg. no. 400221/05 (Ecology, Botany)

Member, International Association of Vegetation Scientists (IAVS)

Member, Ecological Society of America (ESA)

Member, International Association for Impact Assessment (IAIA)

Member, Herpetological Association of Africa (HAA)

Employment history

1 December 2004 – present, Director, David Hoare Consulting (Pty) Ltd. Consultant, specialist consultant contracted to various companies and organisations.

1 January 2009 – 30 June 2009, Lecturer, University of Pretoria, Botany Dept.

1 January 2013 – 30 June 2013, Lecturer, University of Pretoria, Botany Dept.

1 February 1998 – 30 November 2004, Researcher, Agricultural Research Council, Range and Forage Institute, Private Bag X05, Lynn East, 0039. Duties: project management, general vegetation ecology, remote sensing image processing.

Experience as consultant

Ecological consultant since 1995. Author of over 380 specialist ecological consulting reports. Wide experience in ecological studies within grassland, savanna and fynbos, as well as riparian, coastal and wetland vegetation.

Publication record:**Refereed scientific articles (in chronological order):****Journal articles:**

- HOARE, D.B.** & BREDENKAMP, G.J. 1999. Grassland communities of the Amatola / Winterberg mountain region of the Eastern Cape, South Africa. *South African Journal of Botany* 64: 44-61.
- HOARE, D.B.**, VICTOR, J.E., LUBKE, R.A. & MUCINA, L., 2000. Vegetation of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 87-96.
- VICTOR, J.E., **HOARE, D.B.** & LUBKE, R.A., 2000. Checklist of plant species of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 97-101.
- MUCINA, L, BREDENKAMP, G.J., **HOARE, D.B** & MCDONALD, D.J. 2000. A National Vegetation Database for South Africa *South African Journal of Science* 96: 1-2.
- HOARE, D.B.** & BREDENKAMP, G.J. 2001. Syntaxonomy and environmental gradients of the grasslands of the Stormberg / Drakensberg mountain region of the Eastern Cape, South Africa.. *South African Journal of Botany* 67: 595 – 608.
- LUBKE, R.A., **HOARE, D.B.**, VICTOR, J.E. & KETELAAR, R. 2003. The vegetation of the habitat of the Brenton blue butterfly, *Orachrysops niobe* (Trimen), in the Western Cape, South Africa. *South African Journal of Science* 99: 201–206.
- HOARE, D.B** & FROST, P. 2004. Phenological classification of natural vegetation in southern Africa using AVHRR vegetation index data. *Applied Vegetation Science* 7: 19-28.
- FOX, S.C., HOFFMANN, M.T. and HOARE, D. 2005. The phenological pattern of vegetation in Namaqualand, South Africa and its climatic correlates using NOAA-AVHRR NDVI data. *South African Geographic Journal*, 87: 85–94.
- Pfab, M.F., Compaan, P.C., Whittington-Jones, C.A., Engelbrecht, I., Dumalisile, L., Mills, L., West, S.D., Muller, P., Masterson, G.P.R., Nevhutalu, L.S., Holness, S.D., **Hoare, D.B.** 2017. The Gauteng Conservation Plan: Planning for biodiversity in a rapidly urbanising province. *Bothalia*, Vol. 47:1. a2182. <https://doi.org/10.4102/abc.v47i1.2182>.

Book chapters and conference proceedings:

- HOARE, D.B.** 2002. Biodiversity and performance of grassland ecosystems in communal and commercial farming systems in South Africa. Proceedings of the FAO's Biodiversity and Ecosystem Approach in Agriculture, Forestry and Fisheries Event: 12–13 October, 2002. Food and Agriculture Organisation of the United Nations, Viale delle Terme di Caracalla, Rome, Italy. pp. 10 - 27.
- STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. In: Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) *Hotspots revisited*. CEMEX, pp.218–229. ISBN 968-6397-77-9
- STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. **Error! Hyperlink reference not valid..**
- HOARE, D.B.**, MUCINA, L., RUTHERFORD, M.C., VLOK, J., EUSTON-BROWN, D., PALMER, A.R., POWRIE, L.W., LECHMERE-OERTEL, R.G., PROCHES, S.M., DOLD, T. and WARD, R.A. *Albany Thickets*. in Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.
- MUCINA, L., **HOARE, D.B.**, LÖTTER, M.C., DU PREEZ, P.J., RUTHERFORD, M.C., SCOTT-SHAW, C.R., BREDENKAMP, G.J., POWRIE, L.W., SCOTT, L., CAMP, K.G.T., CILLIERS, S.S., BEZUIDENHOUT, H., MOSTERT, T.H., SIEBERT, S.J., WINTER, P.J.D., BURROWS, J.E., DOBSON, L., WARD, R.A., STALMANS, M., OLIVER, E.G.H., SIEBERT, F., SCHMIDT, E., KOBISI, K., KOSE, L. 2006. *Grassland Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- RUTHERFORD, M.C., MUCINA, L., LÖTTER, M.C., BREDENKAMP, G.J., SMIT, J.H.L., SCOTT-SHAW, C.R., **HOARE, D.B.**, GOODMAN, P.S., BEZUIDENHOUT, H., SCOTT, L. & ELLIS, F., POWRIE, L.W., SIEBERT, F., MOSTERT, T.H., HENNING, B.J., VENTER, C.E., CAMP, K.G.T., SIEBERT, S.J., MATTHEWS, W.S., BURROWS, J.E., DOBSON, L., VAN ROOYEN, N., SCHMIDT, E., WINTER, P.J.D., DU PREEZ, P.J., WARD, R.A., WILLIAMSON, S. and HURTER, P.J.H. 2006. *Savanna Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

- MUCINA, L., RUTHERFORD, M.C., PALMER, A.R., MILTON, S.J., SCOTT, L., VAN DER MERWE, B., **HOARE, D.B.**, BEZUIDENHOUT, H., VLOK, J.H.J., EUSTON-BROWN, D.I.W., POWRIE, L.W. & DOLD, A.P. 2006. *Nama-Karoo Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- MUCINA, L., SCOTT-SHAW, C.R., RUTHERFORD, M.C., CAMP, K.G.T., MATTHEWS, W.S., POWRIE, L.W. and **HOARE, D.B.** 2006. *Indian Ocean Coastal Belt*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

Conference Presentations:

- HOARE, D.B. & LUBKE, R.A. *Management effects on diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994
- HOARE, D.B., VICTOR, J.E. & LUBKE, R.A. *Description of the coastal fynbos south of George, southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994
- HOARE, D.B. & LUBKE, R.A. *Management effects on fynbos diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995
- HOARE, D.B. & BOTHA, C.E.J. *Anatomy and ecophysiology of the dunegrass *Ehrharta villosa* var. *maxima**; Poster presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995
- HOARE, D.B., PALMER, A.R. & BREDENKAMP, G.J. 1996. *Modelling grassland community distributions in the Eastern Cape using annual rainfall and elevation*; Poster presentation, South African Association of Botanists Annual Congress, Stellenbosch, January 1996
- HOARE, D.B. *Modelling vegetation on a past climate as a test for palaeontological hypotheses on vegetation distributions*; Paper presentation, Randse Afrikaanse Universiteit postgraduate symposium, 1997
- HOARE, D.B., VICTOR, J.E. & BREDENKAMP, G.J. *Historical and ecological links between grassy fynbos and afro-montane fynbos in the Eastern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998
- LUBKE, R.A., HOARE, D.B., VICTOR, J.E. & KETELAAR, R. *The habitat of the Brenton Blue Butterfly*. Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998
- HOARE, D.B. & PANAGOS, M.D. *Satellite stratification of vegetation – structure or floristic composition?* Poster presentation at the 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999.
- HOARE, D.B. & WESSELS, K. *Conservation status and threats to grasslands of the northern regions of South Africa*, Poster presentation at the South African Association of Botanists Annual Congress, Potchefstroom, January 2000.
- HOARE, D.B. *Phenological dynamics of Eastern Cape vegetation*. Oral paper presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- HOARE, D.B., MUCINA, L., VAN DER MERWE, J.P.H. & PALMER, A.R. *Classification and digital mapping of grasslands of the Eastern Cape* Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- HOARE, D.B. *Deriving phenological variables for Eastern Cape vegetation using satellite data* Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- MUCINA, L., RUTHERFORD, M.C., HOARE, D.B. & POWRIE, L.W. 2003. *VegMap: The new vegetation map of South Africa, Lesotho and Swaziland*. In: Pedrotti, F. (ed.) *Abstracts: Water Resources and Vegetation, 46th Symposium of the International Association for Vegetation Science*, June 8 to 14 – Napoli, Italy.
- HOARE, D.B. 2003. *Species diversity patterns in moist temperate grasslands of South Africa*. *Proceedings of the VIIth International Rangeland Congress*, 26 July – 1 August 2003, Durban South Africa. *African Journal of Range and Forage Science*. 20: 84.

Unpublished technical reports:

- PALMER, A.R., HOARE, D.B. & HINTSA, M.D., 1999. Using satellite imagery to map veld condition in Mpumalanga: A preliminary report. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Grahamstown.
- HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: methodology for mapping the vegetation communities of the South African savanna at a scale of 1:250 000. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.
- HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: size and coverage of field data that exists on the database of vegetation data for South African savanna. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.
- THOMPSON, M.W., VAN DEN BERG, H.M., NEWBY, T.S. & HOARE, D.B. 2001. Guideline procedures for national land-cover mapping and change monitoring. Report no. ENV/P/C 2001-006 produced for Department of Water Affairs and Forestry, National Department of Agriculture and Department of Environment Affairs and Tourism. Copyright: Council for Scientific and Industrial Research (CSIR) and Agricultural Research Council (ARC).
- HOARE, D.B. 2003. Natural resource survey of node O R Tambo, using remote sensing techniques, Unpublished report and database of field data for ARC Institute for Soil, Climate & Water, ARC Range and Forage Institute, Grahamstown.
- HOARE, D.B. 2003. Short-term changes in vegetation of Suikerbosrand Nature Reserve, South Africa, on the basis of resampled vegetation sites. Gauteng Department of Agriculture, Conservation, Environment and Land Affairs, Conservation Division.
- BRITTON, D., SILBERBAUER, L., ROBERTSON, H., LUBKE, R., HOARE, D., VICTOR, J., EDGE, D. & BALL, J. 1997. The Life-history, ecology and conservation of the Brenton Blue Butterfly (*Orachrysops niobe*) (Trimen) (*Lycaenidea*) at Brenton-on-Sea. Unpublished report for the Endangered Wildlife Trust of Southern Africa, Johannesburg. 38pp.
- HOARE, D.B., VICTOR, J.E. & MARNEWIC, G. 2005. Vegetation and flora of the wetlands of Nylsvley River catchment as component of a project to develop a framework for the sustainable management of wetlands in Limpopo Province.

Consulting reports:

Total of over 380 specialist consulting reports for various environmental projects from 1995 – present.

Workshops / symposia attended:

- International Association for Impact Assessment Annual Congress, Durban, 16 – 19 May 2018.
- Workshop on remote sensing of rangelands presented by Paul Tueller, University of Nevada Reno, USA, VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- BioMap workshop, Stellenbosch, March 2002 to develop strategies for studying vegetation dynamics of Namaqualand using remote sensing techniques
- South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- 28th International Symposium on Remote Sensing of Environment, Somerset West, 27-31 March 2000.
- Workshop on Vegetation Structural Characterisation: Tree Cover, Height and Biomass, 28th International Symposium on Remote Sensing of Environment, Strand, 26 March 2000.
- South African Association of Botanists Annual Congress, Potchefstroom, January 2000
- National Botanical Institute Vegmap Workshop, Kirstenbosch, Cape Town, 30 September-1 October 1999.
- Sustainable Land Management – Guidelines for Impact Monitoring, Orientation Workshop: Sharing Impact Monitoring Experience, Zithabiseni, 27-29 September 1999.
- WWF Macro Economic Reforms and Sustainable Development in Southern Africa, Environmental Economic Training Workshop, development Bank, Midrand, 13-14 September 1999.
- 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999
- Expert Workshop on National Indicators of Environmental Sustainable Development, Dept. of Environmental Affairs and Tourism, Roodevallei Country Lodge, Roodeplaat Dam, Pretoria, 20-21 October 1998.
- South African Association of Botanists Annual Congress, Cape Town, January 1998

Randse Afrikaanse Universiteit postgraduate symposium, 1997.
South African Association of Botanists Annual Congress, Bloemfontein, January 1995.

Plant Species Compliance Statement

prepared in accordance with the
"Protocol for the Specialist Assessment and minimum report content requirements for environmental impacts on Terrestrial Plant Species"

Leeuwbosch Pv 3 Solar Photovoltaic (PV) Plant and Associated Infrastructure near Leeudoringstad in North West Province



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Terrestrial Plant Species Compliance Statement Report for Leeuwbosch Pv 3 Solar Photovoltaic (PV) Plant and Associated Infrastructure near Leeudoringstad in North West Province

22 November 2022

TABLE OF CONTENTS

TABLE OF CONTENTS	2
SPECIALIST DETAILS & DECLARATION	3
DECLARATION OF INDEPENDENCE:.....	3
DISCLOSURE:.....	3
TERMS OF REFERENCE	4
PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL PLANT SPECIES.....	4
INTRODUCTION	8
SITE LOCATION	8
IDENTIFIED THEME SENSITIVITIES	9
<i>Plant Species theme</i>	9
ASSESSMENT METHODOLOGY	11
PROJECT AREA OF INFLUENCE (PAOI)	11
SURVEY TIMING	12
FIELD SURVEY APPROACH	13
SOURCES OF INFORMATION.....	14
<i>Vegetation and plant species</i>	14
LIMITATIONS	14
OUTCOME OF THE ASSESSMENT	15
REGIONAL VEGETATION PATTERNS	15
<i>Vaal-Vet Sandy Grassland</i>	15
NATURAL HABITATS ON SITE.....	16
RED LIST PLANT SPECIES OF THE STUDY AREA.....	19
PROTECTED PLANTS (NEMBA)	19
<i>Crinum bulbispermum</i>	19
<i>Harpagophytum procumbens</i>	19
SUMMARY.....	19
SITE ECOLOGICAL IMPORTANCE	20
CONCLUSION	22
REFERENCES	23
APPENDICES:	24
APPENDIX 1: PLANT SPECIES OF CONSERVATION IMPORTANCE (THREATENED, NEAR THREATENED AND DECLINING) THAT HAVE HISTORICALLY BEEN RECORDED IN THE STUDY AREA.	24
APPENDIX 2: LIST OF PROTECTED TREE SPECIES (NATIONAL FORESTS ACT).	25
APPENDIX 3: PLANT SPECIES PREVIOUSLY RECORDED IN THE GENERAL AREA. THOSE RECORDED ON SITE ARE HIGHLIGHTED IN GREEN.	26
APPENDIX 4: FLORA SPECIES PROTECTED UNDER THE NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT, 2004 (ACT 10 OF 2004)	30
APPENDIX 5: FLORA SPECIES PROTECTED UNDER THE NORTH WEST BIODIVERSITY MANAGEMENT ACT, NO. 4 OF 2004.....	32
APPENDIX 6: CURRICULUM VITAE: DR DAVID HOARE.....	33

SPECIALIST DETAILS & DECLARATION

This report has been prepared in accordance with the "Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity", as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020. It has been prepared independently of influence or prejudice by any parties.

The details of Specialists are as follows –

Table 1: Details of Specialist

Specialist	Qualification and accreditation
Dr David Hoare (Pr.Sci.Nat.)	<ul style="list-style-type: none">• PhD Botany• SACNASP Reg. no. 400221/05 (Ecology, Botany)

Declaration of independence:

David Hoare Consulting (Pty) Ltd in an independent consultant and hereby declare that it does not have any financial or other vested interest in the undertaking of the proposed activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998). In addition, remuneration for services provided by David Hoare Consulting (Pty) Ltd is not subjected to or based on approval of the proposed project by the relevant authorities responsible for authorising this proposed project.

Disclosure:

David Hoare Consulting (Pty) Ltd undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and will provide the competent authority with access to all information at its disposal regarding the application, whether such information is favourable to the applicant or not.

Based on information provided to David Hoare Consulting (Pty) Ltd by the client and in addition to information obtained during the course of this study, David Hoare Consulting (Pty) Ltd present the results and conclusion within the associated document to the best of the author's professional judgement and in accordance with best practise.



Dr David Hoare

22 November 2022
Date

TERMS OF REFERENCE

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL PLANT SPECIES

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Plant Species. Note that the Protocols require determination of the level of sensitivity, which then determines the level of assessment required, either a full assessment, or a Compliance Statement.

Protocol For The Specialist Assessment And Minimum Report Content Requirements For Environmental Impacts On Terrestrial Plant Species

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020.

General information

1.1 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "**very high**" or "**high**" sensitivity for terrestrial plant species, must submit a Terrestrial Plant Species Specialist Assessment Report.

1.2 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "**medium** sensitivity" for terrestrial plant species, must submit either a Terrestrial Plant Species Specialist Assessment Report or a Terrestrial Plant Species Compliance Statement, depending on the outcome of a site inspection undertaken in accordance with paragraph 4.

1.3 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of "**low**" sensitivity for terrestrial plant species, must submit a Terrestrial Plant Species Compliance Statement.

1.4 Where the information gathered from the site sensitivity verification differs from the screening tool designation of "very high" or "high" for terrestrial plant species sensitivity on the screening tool, and it is found to be of a "low" sensitivity, then a Terrestrial Plant Species Compliance Statement must be submitted.

1.5 Where the information gathered from the site sensitivity verification differs from the screening tool designation of "low" terrestrial plant species sensitivity and it is found to be of a "very high" or "high" terrestrial plant species sensitivity, a Terrestrial Plant Species Specialist Assessment must be conducted.

1.6 If any part of the development falls within an area of confirmed "very high" or "high" sensitivity, the assessment and reporting requirements prescribed for the "very high" or "high" sensitivity, apply to the entire development footprint. Development footprint in the context of this protocol, means the area on which the proposed development will take place and includes the area that will be disturbed or impacted.

1.7 The Terrestrial Plant Species Specialist Assessment and the Terrestrial Plant Species Compliance Statement must be undertaken within the study area.

1.8 Where the nature of the activity is not expected to have an impact on species of conservation concern (SCC) beyond the boundary of the preferred site, the study area means the proposed development footprint within the preferred site.

1.9 Where the nature of the activity is expected to have an impact on SCC beyond boundary of the preferred site, the project areas of influence (PAOI) must be determined by the specialist in accordance with Species Environmental Assessment Guideline, and the study area must include the PAOI, as determined.

Terrestrial Plant Species Specialist Assessment

2.1 The assessment must be undertaken by a specialist registered with the South African Council for Natural Scientific Professions (SACNASP), within a field of practice relevant to the taxonomic groups ("taxa") for which the assessment is being undertaken.

2.2 The assessment must be undertaken within the study area.

2.3 The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline and must:

2.3.1 Identify the SCC which were found, observed or are likely to occur within the study area;

2.3.2 provide evidence (photographs) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3);

2.3.3 identify the distribution, location, viability and detailed description of population size of the SCC identified within the study area;

2.3.4 identify the nature and the extent of the potential impact of the proposed development to the population of the SCC located within the study area;

2.3.5 determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases including the IUCN Red List of Threatened Species, Red List of South African Plants, and/or other relevant databases;

2.3.6 determine the potential impact of the proposed development on the habitat of the SCC located within the study area;

2.3.7 include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, a motivation for the deviation;

2.3.8 identify any dynamic ecological processes occurring within the broader landscape, that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fire-prone systems;

2.3.9 identify any potential impact on ecological connectivity within the broader landscape, and resulting impacts on the identified SCC and its long term viability;

2.3.10 determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC; and

2.3.11 discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species; and

2.3.12 identify any alternative development footprints within the preferred development site which would be of "low" sensitivity" or "medium" sensitivity as identified by the screening tool and verified through the site sensitivity verification.

2.4 The findings of the assessment must be written up in a Terrestrial Plant Species Specialist Assessment Report.

Terrestrial Plant Species Specialist Assessment Report

3.1 This report must include as a minimum the following information:

3.1.1 contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae;

3.1.2 a signed statement of independence by the specialist;

3.1.3 a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

3.1.4 a description of the methodology used to undertake the site sensitivity verification and impact assessment and site inspection, including equipment and modelling used where relevant;

3.1.5 a description of the assumptions made and any uncertainties or gaps in knowledge or data;

3.1.6 a description of the mean density of observations/number of samples sites per unit area of site inspection observations;

3.1.7 details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;

3.1.8 the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;

3.1.9 the location of areas not suitable for development and to be avoided during construction where relevant;

3.1.10 a discussion on the cumulative impacts;

3.1.11 impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);

3.1.12 a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to the specific theme considered, and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and

3.1.13 a motivation must be provided if there were any development footprints identified as per paragraph 2.3.12 above that were identified as having "low" or "medium" terrestrial plant species sensitivity and were not considered appropriate.

3.2 A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

Terrestrial plant species compliance statement

Where the sensitivity in the Screening Report from the web-based Online Screening Tool has been confirmed to be LOW, a Plant Species Compliance Statement is required, either (1) for areas where no natural habitat remains, or (2) in natural areas where there is no suspected occurrence of SCC.

The compliance statement must be prepared by a SACNASP registered specialist under one of the two fields of practice (Botanical Science or Ecological Science).

The compliance statement must:

1. be applicable within the study area
2. confirm that the study area is of "low" sensitivity for terrestrial plant species; and
3. indicate whether or not the proposed development will have any impact on SCC.

The compliance statement must contain, as a minimum, the following information:

1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;
2. a signed statement of independence by the specialist;
3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;
4. a baseline profile description of biodiversity and ecosystems of the site;
5. the methodology used to verify the sensitivities of the terrestrial biodiversity and plant species features on the site including the equipment and modelling used where relevant;
6. in the case of a linear activity, confirmation from the terrestrial biodiversity specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase;
7. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr;
8. a description of the assumptions made as well as any uncertainties or gaps in knowledge or data; and
9. any conditions to which this statement is subjected.

A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

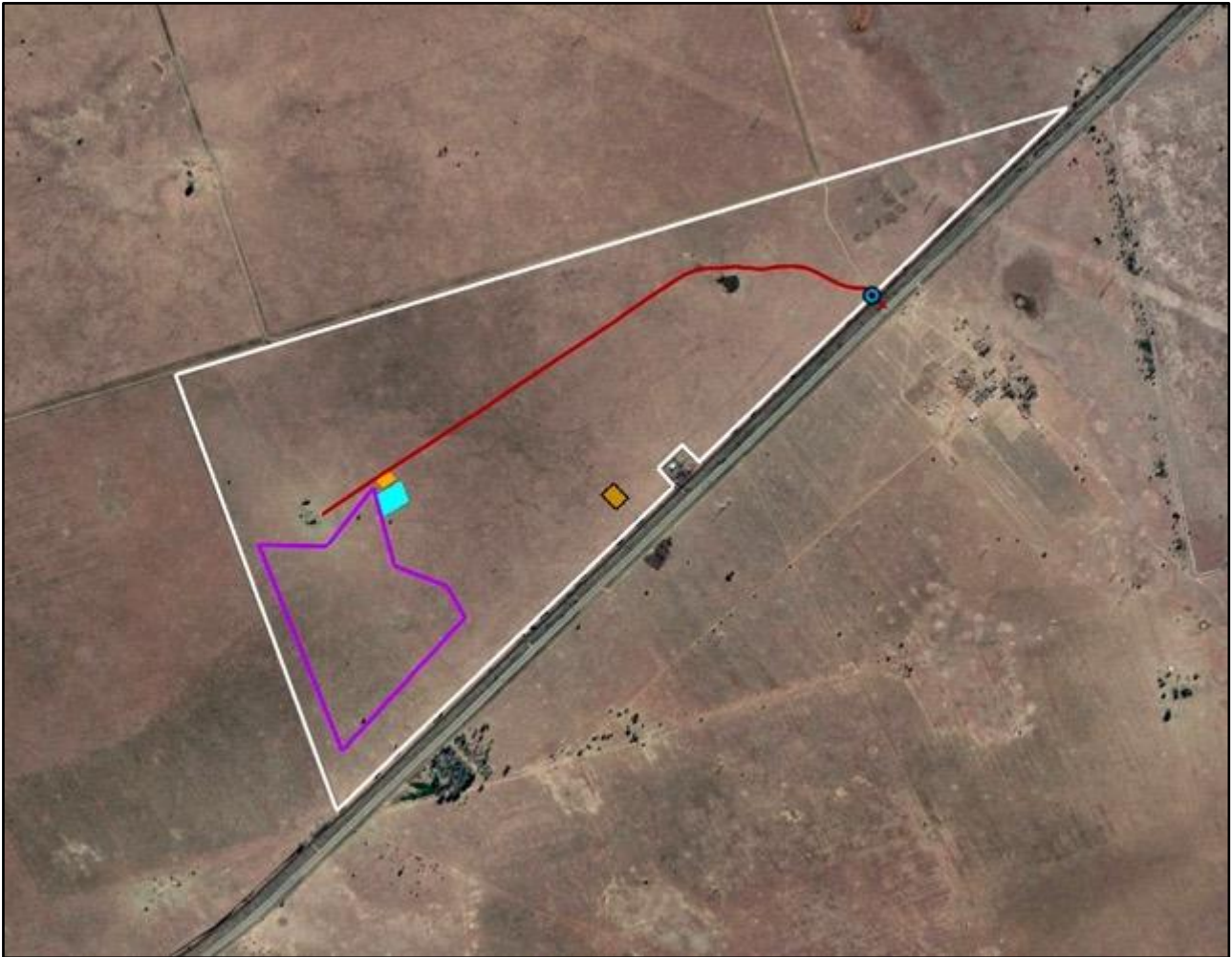


Figure 2: Aerial image of the site and surrounding areas.

Identified Theme Sensitivities

A sensitivity screening report from the DEA Online Screening Tool was requested in the application category: Transformation of land | Indigenous vegetation. The DEA Screening Tool report for the area, dated 30/05/2022, indicates the following sensitivities (see Figure 3):

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Plant Species Theme			X	

Plant Species theme

Sensitivity features are indicated as follows:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Sensitive species 1261



Figure 3: Map of relative plant species theme sensitivity.

ASSESSMENT METHODOLOGY

The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

Project Area of Influence (PAOI)

The proposal is to develop a solar PV facility on site, along with associated infrastructure. Anticipated impacts will mostly occur during the construction phase, with few discernible effects anticipated during operation. These impacts are not expected to extend beyond the boundaries of the study area. The PAOI is therefore treated here as the development footprint within which direct impacts will occur (Figure 4).

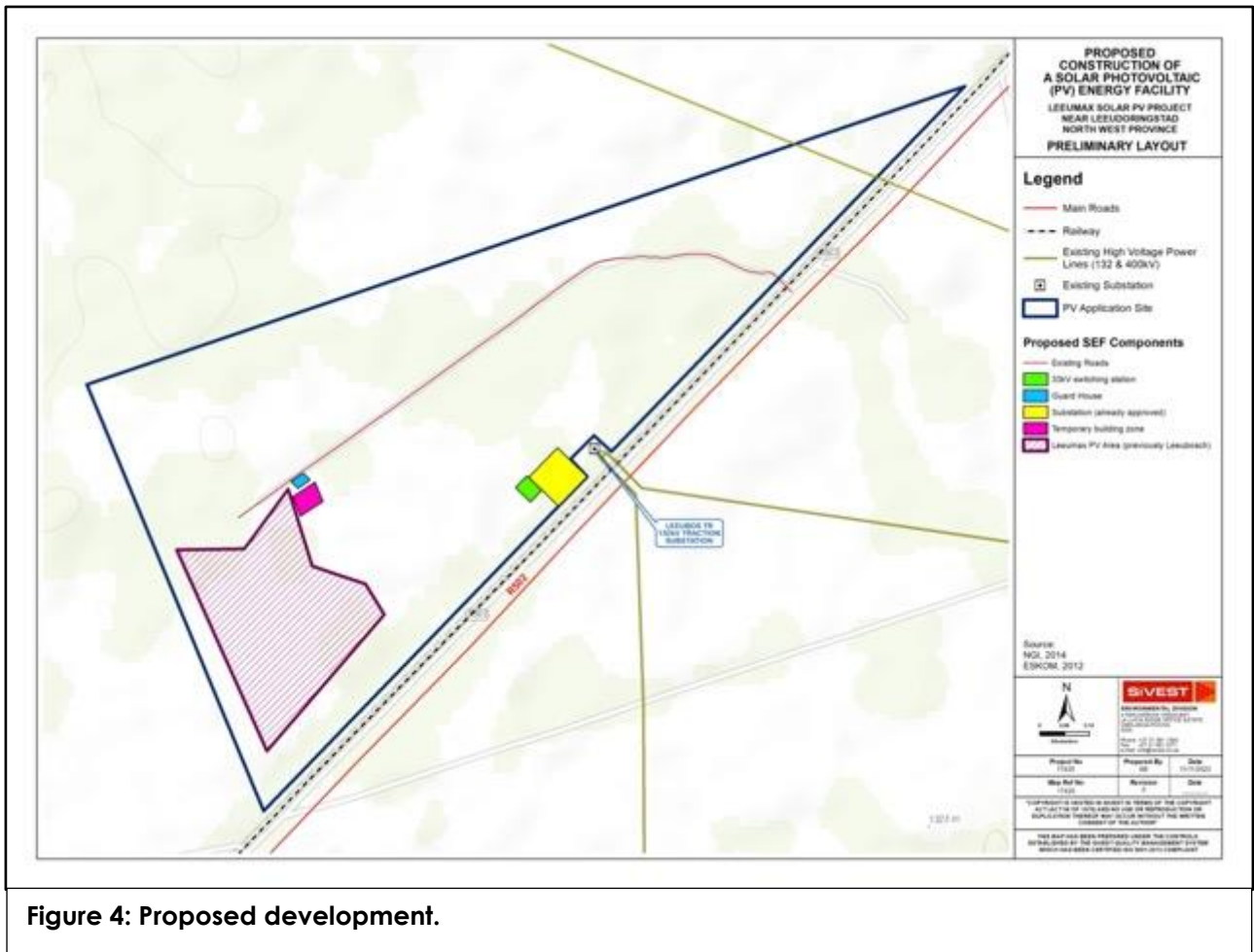


Figure 4: Proposed development.

Survey timing

The study commenced as a desktop-study followed by site-specific field study on 29 April 2021 and 27 October 2021. The site is within the Grassland Biome with a peak rainfall season in summer, which occurs from October to March. There is, however, a delay between rainfall and vegetation growth, which means the peak growing season is from November to May (Figure 5). A more accurate indication of rainfall seasonality, which drives most ecological processes, is shown in Figure 6, which shows that Klerksdorp has peak rainfall from October to April. The timing of the survey is therefore suitable in terms of assessing the habitat of the site. The overall condition of animal habitat was possible to be determined with a high degree of confidence.

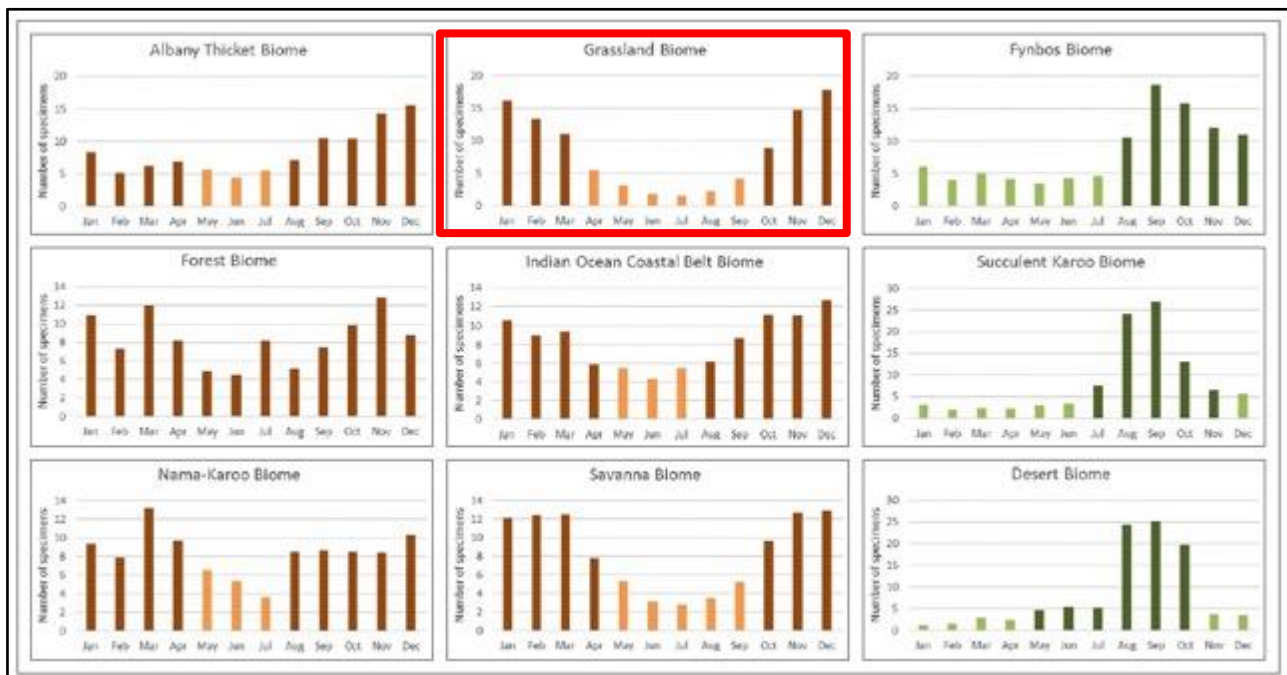


Figure 5: Recommended survey periods for different biomes (Species Environmental Assessment Guidelines). The site is within the Fynbos Biome.

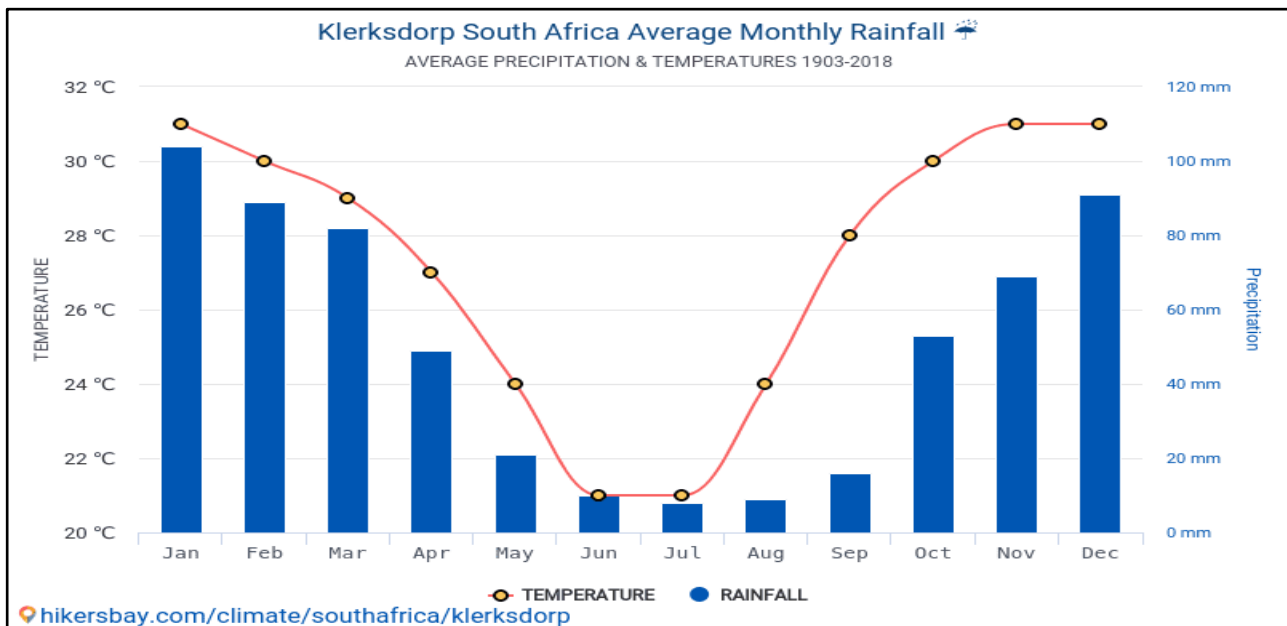


Figure 6: Climate diagram showing average monthly rainfall and temperature for Klerksdorp.

Field survey approach

The study commenced as a desktop-study followed by a site-specific field study. During the field survey of habitats on site, the entire site was assessed on foot. Field surveys included both meander searches of general areas, and active searching in habitats that were considered to be suitable for specific groups or species. Meander surveys were undertaken with no time restrictions - the objective was to comprehensively examine all natural areas. A hand-held Garmin GPSMap 64s was used to record a track within which observations were made (Figure 7). Digital photographs were taken of features and habitats on site, as well as of all plant species that were seen. All plant and animal species recorded were uploaded to the iNaturalist website (<https://www.inaturalist.org>) and are accessible by viewing the observations for the site (use the Explore menu, zoom and pan until the desired study area is within the browser window, click the button "Redo search in map", and all observations for that area will be shown and listed).

Aerial imagery from Google Earth was used to identify and assess habitats on site. This included historical imagery that may show information not visible in any single dated image. Patterns identified from satellite imagery were verified on the ground. Digital photographs were taken at locations where features of interest were observed. During the field survey, particular attention was paid to ensuring that all habitat variability was covered physically on the ground.

Sources of information

Vegetation and plant species

- Plant species that could potentially occur on in the general area was extracted from the NewPosa database of the South African National biodiversity Institute (SANBI) for the quarter degree grid/s in which the site is located.
- The IUCN Red List Category for plant species, as well as supplementary information on habitats and distribution, was obtained from the SANBI Threatened Species Programme (Red List of South African Plants, <http://redlist.sanbi.org>).
- Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (<http://posa.sanbi.org>) for the quarter degree square/s within which the study area is situated. Habitat information for each species was obtained from various published sources. The probability of finding any of these species was then assessed by comparing the habitat requirements with those habitats that were found, during the field survey of the site, to occur there.
- Regulations published for the National Forests Act (Act 84 of 1998) (NFA) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI Biodiversity Information System website (<http://sibis.sanbi.org/>) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed and were considered as being at risk of occurring there.

Limitations

The following assumptions, limitations, uncertainties are listed regarding the assessment of the site:

- The assessment is based on a single site visit. The current study is based on an extensive site visit as well as a desktop study of the available information. The time spent on site was adequate for understanding general patterns across affected areas.
- Compiling the list of species that could potentially occur on site is limited by the paucity of collection records for the area. The list of plant species that could potentially occur on site was therefore taken from a wider area and from literature sources that may include species that do not occur on site and may miss species that do occur on site. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons, be undertaken over a number of years and include extensive sampling. Due to legislated time constraints for environmental authorisation processes, this is not possible.
- Rare and threatened plant species are, by their nature, usually very difficult to locate and can be easily missed.

OUTCOME OF THE ASSESSMENT

Regional vegetation patterns

There is one regional vegetation type occurring on site, namely Vaal-Vet Sandy Grassland (Figure 6). There are small patches of Highveld Salt Pans in nearby areas. These two vegetation types that occur on site and nearby are briefly described below according to published information. The description is from Mucina & Rutherford (2006), extracted from the SANBI BGIS website (<http://bgis.sanbi.org/vegmap>).

Vaal-Vet Sandy Grassland

This vegetation type occurs in the North-West and Free State Provinces in the area south of Lichtenburg and Ventersdorp, stretching southwards to Klerksdorp, Leeudoringstad, Bothaville and to the Brandfort area north of Bloemfontein. It occurs on plains-dominated landscapes with some scattered, slightly irregular undulating plains and hills.

The vegetation is mainly a low-tussock grassland with an abundant karroid element (Mucina et al. 2006). The dominance of *Themeda triandra* is an important feature of this vegetation type. Locally low cover of *Themeda triandra* and the associated increase in *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* is attributed to heavy grazing and/or erratic rainfall.

Important taxa include the grasses, *Antheophora pubescens* (d), *Aristida congesta* (d), *Chloris virgata* (d), *Cymbopogon caesius* (d), *Cynodon dactylon* (d), *Digitaria argyrograpta* (d), *Elionurus muticus* (d), *Eragrostis chloromelas* (d), *E. lehmanniana* (d), *E. plana* (d), *E. trichophora* (d), *Heteropogon contortus* (d), *Panicum gilvum* (d), *Setaria sphacelata* (d), *Themeda triandra* (d), *Tragus berteronianus* (d), *Brachiaria serrata*, *Cymbopogon pospischilii*, *Digitaria eriantha*, *Eragrostis curvula*, *E. obtusa*, *E. superba*, *Panicum coloratum*, *Pogonarthria squarrosa*, *Trichoneura grandiglumis* and *Triraphis andropogonoides*, the herbs, *Stachys spathulata* (d), *Barleria macrostegia*, *Berkheya onopordifolia* var. *onopordifolia*, *Chamaesyce inaequilatera*, *Geigeria aspera* var. *aspera*, *Helichrysum caespititium*, *Hermannia depressa*, *Hibiscus pusillus*, *Monsonia burkeana*, *Rhynchosia adenodes*, *Selago densiflora*, *Vernonia oligocephala*, the geophytic herbs, *Bulbine narcissifolia* and *Ledebouria marginata*, the succulent Herb, *Tripteris aghillana* var. *integrifolia*, the low shrubs, *Felicia muricata* (d), *Pentzia globosa* (d), *Anthospermum rigidum* subsp. *pumilum*, *Helichrysum dregeanum*, *H. paronychioides* and *Ziziphus zeyheriana*.

Natural habitats on site

Natural habitats on site match the landcover map for the area (Figure 8). The majority of the solar PV area is within a previously cultivated area that currently contains secondary grassland. Remaining areas are natural grassland. A broad classification of the habitat units on site, which also reflects relatively uniform plant species compositional units, is as follows:

Natural habitats:

1. **Natural grassland** (open grassland on undulating plains – the condition is not indicated in the habitat map although there is a gradient from heavily grazed poor condition to moderate condition);

Transformed and degraded areas:

2. **Old lands** (secondary grasslands on previously cultivated areas);

NATURAL VERSUS SECONDARY GRASSLAND	
Natural grassland	Areas of original vegetation in which the soil has not been mechanically disturbed, including areas that are in poor condition due to overgrazing, trampling, invasion by weeds or alien invasive species, inappropriate fire regimes , or any other factor that drives natural change in species composition or vegetation structure. The key factor is that the original plants continue to exist, often resprouting after defoliation from sub-surface stems or other storage organs.
Secondary grassland	Areas of vegetation where the original grassland vegetation has been lost through direct disturbance of the soil that results in physical removal of the original plants, the most common cause of which is ploughing, but could be other mechanical factors. The vegetation that then develops is as a result of recolonization of the area through propagation.

The natural grassland on site is characterised by medium-height grassland that appears to be overgrazed at times. The presence of scattered termite mounds throughout the site indicates that the grassland is in a natural state (not ploughed). There were also no plough lines in these grasslands on the aerial imagery for the site. Significant parts of the site have been cultivated at some point in history, which is also clearly evident from the vegetation structure and species composition on site. The topography within these grassland areas is relatively flat. Common and dominant species in the natural areas include *Themeda triandra*, *Digitaria erianthe*, *Eragrostis chloromelas*, *Aristida congesta* subsp. *congesta*, *Cymbopogon pospischilii*, *Eragrostis superba*, *Setaria sphacelata* var. *torta*, *Eragrostis obtusa*, *Trichoneura grandiglumis*, *Cynodon dactylon*, *Felicia muricata*, *Hermannia depressa*, *Arctotis arctotoides*, *Anthospermum rigidum*, *Walafrida densiflora* and *Barleria* species. A total of 25 species per 100m² was recorded in these natural grasslands, which is moderately diverse relative to other Highveld grasslands. In comparison, the previously cultivated areas had only 17 species per 100m². Common and dominant species in the previously cultivated areas were *Aristida congesta* subsp. *congesta*, *Eragrostis lehmanniana*, *Themeda triandra*, *Eragrostis superba*, *Melinis repens*, *Trichoneura grandiglumis*, *Cynodon dactylon*, *Arctotis arctotoides*, *Anthospermum rigidum*, *Hermannia depressa* and *Pentzia* species.



Figure 9: View of the site at the existing small reservoir (northern edge of solar array).



Figure 8: Grassland on site.

Red List plant species of the study area

According to the National Web-Based Environmental Screening Tool (DFFE), there is one plant species of concern flagged for the site (see previous section of this report). This is a sensitive species for which the details are not allowed to be presented in a public document.

Lists of plant species previously recorded in the quarter degree grids in which the study area is situated as well as all surrounding grids were obtained from the South African National Biodiversity Institute. These are listed in Appendix 1. Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids are also listed.

There is one species that may occur in the study area, the geophyte, *Eucomis autumnalis* subsp. *clavata*, listed as Declining. *Eucomis autumnalis* subsp. *clavata* is found in damp, open grassland and sheltered places from the coast to 2450 m. The species has been recorded in the current grid near to the current site and the possibility of it occurring in the study area is therefore considered to be high. The habitat on site is potentially suitable, but no individuals were found there.

Protected plants (NEMBA)

Plant species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) are listed in Appendix 4. Two plant species that appear on this list that could potentially occur in the general region, although they have not previously been recorded in the grids of the study area, are *Crinum bulbispermum* and *Harpagophytum procumbens*.

Crinum bulbispermum

Crinum bulbispermum occurs from the Northern Cape eastwards to Mpumalanga and KwaZulu-Natal. It also occurs in Lesotho. It is found in grasslands and savanna near rivers, streams, seasonal pans and in damp depressions. There is a moderate to low probability that it occurs in the general study area, but it was not found on site, although habitat suitability suggests it could potentially occur there.

Harpagophytum procumbens

Harpagophytum procumbens occurs in Angola, Botswana, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe. Within South Africa this species occurs in the Northern Cape, North West, Free State, and Limpopo Provinces and the largest populations are found in the communally owned areas of the North West Province and the north eastern parts of the Northern Cape. The species is found in well drained sandy habitats in open savanna and woodlands. It has been previously recorded in this general area in which the site is located. It is considered possible that this species could occur on site, but it was not found there.

Summary

No flagged, sensitive or protected plant species were found on site, therefore none will be affected by the proposed development.

There are no threatened, near threatened or rare species that occur in or close to the proposed development area. It is therefore verified that the Plant Species Theme has LOW sensitivity for the development footprint.

SITE ECOLOGICAL IMPORTANCE

The Species Environmental Assessment Guidelines require that a Site Ecological Importance (SEI) is calculated for each habitat on site, and provides methodology for making this calculation. The SEI is assessed separately for each biodiversity theme and is assessed below specifically for the Terrestrial Plant Species theme.

As per the Species Environmental Assessment Guidelines, Site Ecological Importance (SEI) is calculated as a function of the Biodiversity Importance (BI) of the receptor and its resilience to impacts ($SEI = BI + RR$). The Biodiversity Importance (BI) in turn is a function of Conservation Importance (CI) and Functional Integrity (FI), i.e. $BI = CI + FI$.

An assessment of habitats on site is provided below (Table 2) specifically for the Plant Species Theme.

Table 2: Site ecological importance for habitats found on site

Habitat	Conservation importance	Functional integrity	Receptor resilience	Site Ecological Importance (BI)
Grassland	Low No confirmed or highly likely populations of SCC.	Medium Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types.	Low Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.	Medium (BI = Low)
Secondary vegetation	Low < 50% of receptor contains natural habitat with limited potential to support SCC.	Medium Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora)	Medium Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor	Low (BI = Low)

		and a few signs of minor past disturbance. Moderate rehabilitation potential..	functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.	
Degraded & transformed	Very low No natural habitat remaining.	Very low Several major current negative ecological impacts.	Very high Habitat that can recover rapidly	Very low (BI = Very low)

Guidelines for development activities within different importance levels are given in the Table below (Table 8).

Table 3: Guidelines for interpreting SEI in the context of the proposed development activities

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

CONCLUSION

Desktop information, field data collection and mapping from aerial imagery provides the following verifications of patterns for the plant species theme:

1. Large parts of the site consists of secondary grassland within previously cultivated areas. There are remnants of the original natural grassland vegetation in the area.
2. One sensitive plant species is flagged for the site but it was not found there. For all other plant SCC, based on the available habitat, it is considered unlikely that any occur there. The site is therefore confirmed to have low sensitivity for the plant species theme. The proposed development is therefore supported.

REFERENCES

- Germishuizen, G., Meyer, N.L., Steenkamp, Y And Keith, M. (eds.) (2006). A checklist of South African plants. Southern African Botanical Diversity Network Report No. 41, SABONET, Pretoria.
- IUCN (2001). *IUCN Red Data List categories and criteria: Version 3.1*. IUCN Species Survival Commission: Gland, Switzerland.

APPENDICES:

Appendix 1: Plant species of conservation importance (Threatened, Near Threatened and Declining) that have historically been recorded in the study area.

Sources: South African National Biodiversity Institute in Pretoria.

Family	Taxon	Status	Habitat	Likelihood of occurrence in study area
AMARYLLIDACEAE	<i>Crinum bulbispermum</i>	Declining	Near rivers, streams, seasonal pans and in damp depressions	MEDIUM
HYACINTHACEAE	<i>Eucomis autumnalis</i> subsp. <i>clavata</i>	Declining	Damp open grassland and sheltered places from the coast to 2450 m.	LOW
APOCYNACEAE	<i>Brachystelma incanum</i>	Vulnerable	Lichtenburg to Wolmaransstad and Sasolburg. Sandy loam soils in thornveld and themeda-grassland. Previously recorded near Wolmaransstad 25 km to west of site, and near Bakerville to the west of Lichtenburg.	HIGH
BRASSICACEAE	<i>Cleome conrathii</i>	Near Threatened	Kuruman to Pretoria. Stony, quartzite slopes, usually in red sandy soil, grassland or deciduous woodland, all aspects.	LOW
HYACINTHACEAE	<i>Drimia sanguinea</i>	Near threatened	Northern Cape to Limpopo and Mpumalanga. Open veld and scrubby woodland in a variety of soil types.	HIGH
ASTERACEAE	<i>Gnaphalium nelsonii</i>	Near threatened	Pretoria to Vereeniging and Wolmaransstad. Seasonally wet places in grassland and savanna, and along dry watercourses.	HIGH
AIZOACEAE	<i>Lithops leslei</i> subsp. <i>leslei</i>	Near threatened	From Douglas in the Northern Cape to central Limpopo Province and south-eastern Botswana. Primarily in arid grasslands, usually in rocky places, growing under the protection of forbs and grasses.	MEDIUM
AMARYLLIDACEAE	<i>Nerine gracilis</i>	Vulnerable	Belfast and Ermelo to Wolmaransstad. Undulating grasslands in damp areas.	HIGH

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria. *IUCN (3.1) Categories: VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NT = Near Threatened.

Appendix 2: List of protected tree species (National Forests Act).

<i>Vachellia erioloba</i>	<i>Acacia haematoxylon</i>
<i>Adansonia digitata</i>	<i>Azelia quanzensis</i>
<i>Balanites</i> subsp. <i>maughamii</i>	<i>Barringtonia racemosa</i>
<i>Boscia albitrunca</i>	<i>Brachystegia spiciformis</i>
<i>Breonadia salicina</i>	<i>Bruguiera gymnorhiza</i>
<i>Cassipourea swaziensis</i>	<i>Catha edulis</i>
<i>Ceriops tagal</i>	<i>Cleistanthus schlechteri</i> var. <i>schlechteri</i>
<i>Colubrina nicholsonii</i>	<i>Combretum imberbe</i>
<i>Curtisia dentata</i>	<i>Elaeodendron (Cassine) transvaalensis</i>
<i>Erythrophysa transvaalensis</i>	<i>Euclea pseudebenus</i>
<i>Ficus trichopoda</i>	<i>Leucadendron argenteum</i>
<i>Lumnitzera racemosa</i> var. <i>racemosa</i>	<i>Lydenburgia abottii</i>
<i>Lydenburgia cassinoides</i>	<i>Mimusops caffra</i>
<i>Newtonia hildebrandtii</i> var. <i>hildebrandtii</i>	<i>Ocotea bullata</i>
<i>Ozoroa namaensis</i>	<i>Philenoptera violacea (Lonchocarpus capassa)</i>
<i>Pittosporum viridiflorum</i>	<i>Podocarpus elongatus</i>
<i>Podocarpus falcatus</i>	<i>Podocarpus henkelii</i>
<i>Podocarpus latifolius</i>	<i>Protea comptonii</i>
<i>Protea curvata</i>	<i>Prunus africana</i>
<i>Pterocarpus angolensis</i>	<i>Rhizophora mucronata</i>
<i>Sclerocarya birrea</i> subsp. <i>caffra</i>	<i>Securidaca longependunculata</i>
<i>Sideroxylon inerme</i> subsp. <i>inerme</i>	<i>Tephrosia pondoensis</i>
<i>Warburgia salutaris</i>	<i>Widdringtonia cedarbergensis</i>
<i>Widdringtonia schwarzii</i>	

Vachellia erioloba and *Boscia albitrunca* have a geographical distribution that coincides with the study area.

Appendix 3: Plant species previously recorded in the general area. Those recorded on site are highlighted in green.

Acanthosicyos naudinianus	Brachystelma stenophyllum
Achyranthes aspera var. sicula*	Bulbine abyssinica
Acrotome inflata	Bulbine capitata
Achyropsis leptostachya	Bulbine frutescens
Achyropsis sp.	Bulbine narcissifolia
Ornithogalum prasinum	Bulbostylis hispidula subsp. pyriformis
Albuca setosa	Cadaba aphylla
Albuca shawii	Celtis africana
Albuca virens subsp. arida	Chamaecrista blensis
Albuca virens subsp. virens	Chascanum adenostachyum
Alectra pumila	Chascanum pinnatifidum var. pinnatifidum
Aloe greatheadii	Chasmatophyllum musculinum
Amellus strigosus	Cheilanthes parviloba
Andropogon appendiculatus	Chenopodium album
Antheophora pubescens	Chenopodium carinatum
Anthospermum rigidum	Chloris gayana
Antizoma angustifolia	Chlorophytum angulicaule
Aponogeton rehmannii	Chlorophytum fasciculatum
Aptosimum indivisum	Ciclospermum leptophyllum*
Aptosimum elongatum	Clematis brachiata
Arctotis arctotoides	Coccinia sessilifolia
Arctotis venusta	Colchicum melanthoides subsp. melanthoides
Argemone ochroleuca* (Declared weed category 1)	Commelina africana var. krebsiana
Aristida canescens	Commelina livingstonii
Aristida congesta subsp. barbicollis	Commicarpus pilosus
Aristida congesta subsp. congesta	Convolvulus aschersonii
Aristida diffusa subsp. burkei	Convolvulus dregeanus
Aristida junciformis subsp. junciformis	Convolvulus sagittatus
Aristida stipitata subsp. graciliflora	Convolvulus sp.
Aristida stipitata subsp. stipitata	Conyza canadensis*
Asclepias aurea	Corchorus asplenifolius
Asclepias brevipes	Crabbea acaulis
Asclepias densiflora	Crassula capitella subsp. nodulosa
Asclepias gibba var. gibba	Crassula lanceolata subsp. lanceolata
Asclepias fruticosus	Crotalaria sphaerocarpa subsp. sphaerocarpa
Asclepias sp.	Crotalaria sp.
Asparagus larinicus	Croton gratissimus var. subgratissimus
Asparagus suaveolens	Cucumis zeyheri
Atriplex nummularia subsp. nummularia*	Cullen tomentosum
Atriplex semibaccata var. typica*	Cuscuta campestris
Berkheya heterophylla	Cymbopogon caesius
Bidens bipinnata	Cymbopogon dieterienii
Blepharis squarrosa	Cymbopogon pospischilli
Bolusia acuminata	Cynodon dactylon
Boscia albitrunca (Protected tree species)	Cyperus assimilis
Brachiaria eruciformis	Cyperus capensis
Brachiaria nigropedata	Cyperus decurvatus
Brachiaria serrata	Cyperus difformis
	Cyperus eragrostis*

Cyperus longus var. tenuiflorus
 Cyperus margaritaceus var. margaritaceus
 Cyperus rupestris var. rupestris
 Cyperus sphaerospermus
 Cyperus usitatus
 Cyphia assimilis
 Cyphia sp.
 Cyphia stenopetala
 Datura ferox* (Declared weed Cat 1)
 Delosperma sp.
 Denekia capensis
 Deverra burchellii
 Diandrochloa sp. (prob. namaquensis)
 Dianthus micropetalus
 Dianthus mooiensis subsp. kirkii
 Dicoma anomala subsp. gerrardii
 Dicoma zeyheri
 Digitalia erianthe
 Diheteropogon amplexens
 Diopsiros lycioides subsp. lycioides
 Diospyros austro-africana var. microphylla
 Dipcade viride
 Drimia elata (DDT)
 Duthieastrum linifolium
 Dyschoriste transvaalensis
 Echinochloa colona
 Echinochloa holubii
 Ehretia alba
 Elephantorrhiza elephantina
 Elionurus muticus
 Emex australis*
 Eragrostis biflora
 Eragrostis chloromelas
 Eragrostis curvula
 Eragrostis gummiflora
 Eragrostis lappula
 Eragrostis lehmanniana var. lehmanniana
 Eragrostis obtusa
 Eragrostis pallens
 Eragrostis plana
 Eragrostis pseudobtusa
 Eragrostis stapfii
 Eragrostis superba
 Eragrostis trichophora
 Eragrostis viscoa
 Eucalyptus camaldulensis* (Declared invader category 2)
 Euclea undulata
 Eucomis autumnalis subsp. clavata (Declining)
 Euphorbia inaequilatera var. inaequilatera
 Euphorbia pseudotuberosa
 Evolvulus alsinoides
 Falkia oblonga
 Felicia muricata
 Ficus carica*
 Flaveria bidentis*
 Fockia angustifolia
 Gazania krebsiana
 Geigeria burkei subsp. burkei var. burkei
 Gisekia pharnacoides var. pharnacoides
 Gladiolus permeabilis subsp. edulis
 Gnaphalium filagopsis
 Gnidia sericocephala
 Gomphocarpus fruticosus subsp. fruticosus
 Gomphostigma virgatum
 Gomphrena celosioides*
 Grewia flava
 Guilleminea densa*
 Gymnosporia buxifolia
 Gymnosporia tenuispina
 Haemanthus humilis subsp. hirsutus
 Harpagophytum procumbens subsp. procumbens
 (Protected)
 Helichrysum argyrosphaerum
 Helichrysum caespitium
 Helichrysum callicomum
 Helichrysum nudifolium
 Helichrysum sp.
 Helichrysum zeyheri
 Heliotropium ciliatum
 Heliotropium nelsonii
 Hemarthria altissima
 Hermannia depressa
 Hermannia stellulata
 Hermannia tomentosa
 Hermstaedtia odorata var. aurantiaca
 Hermstaedtia odorata var. odorata
 Heteropogon contortus
 Hibiscus microcarpus
 Hibiscus pusillus
 Hillardiella oligocephala
 Hypertelis salsoloides var. salsoloides
 Indigofera commixta
 Indigofera cryptantha
 Indigofera daleoides var. daleoides
 Indigofera heterotricha
 Indigofera rhytidocarpa subsp. rhytidocarpa
 Indigofera vicioides var. vicioides
 Ipomoea albivenia
 Ipomoea bathycolpos
 Ipomoea bolusiana
 Ipomoea oenotheroides
 Ipomoea ommaneyi
 Jamesbrittenia aurantiaca
 Jamesbrittenia sp.
 Juncus rigidus

Justicia orchioides subsp. glabrata
 Kalanchoe rotundifolia
 Kohautia amatymbica
 Kohautia caespitosa subsp. brachyloba
 Kyllinga alba
 Kyllinga erecta
 Kyphocarpa angustifolia
 Lactuca inermis
 Lantana rugosa
 Lasiosiphon burchellii
 Lasiosiphon capitatus
 Ledebouria sp.
 Leptochloa fusca
 Lippia javonica
 Lippia scaberrima
 Leobordea carinata
 Leobordea adpressa subsp. adpressa
 Listia heterophylla
 Lobelia flaccida
 Lobelia thermalis
 Lycium arenicola
 Lycium cinereum
 Lycium hirsutum
 Lycium horridum
 Malva parviflora
 Marsilea macrocarpa
 Melhania prostrata
 Melinis repens
 Mestoklema arboriforme
 Michrochloa caffra
 Momordica balsamina
 Monsonia angustifolia
 Nerine frithii
 Nerine laticoma
 Nicotiana glauca*
 Nidorella anomala
 Nidorella hottentotta
 Nidorella resedifolia subsp. resedifolia
 Ocimum angustifolium
 Ophioglossum polyphyllum var. polyphyllum
 Opuntia microdasys*
 Orbea sp.
 Ornithogalum juncifolium var. juncifolium
 Ornithogalum flexuosum
 Ornithoglossum vulgare
 Oropetium capense
 Orthanthera jasminiflora
 Oxalis corniculata*
 Oxygenum dregeanum subsp. canescens var. canescens
 Panicum kalahareense
 Panicum schinzii
 Papaver aculeatum
 Pappaea capensis
 Paspalum distichum
 Paspalum urvillei*
 Pavetta zeyheri subsp. zeyheri
 Pavonia burchellii
 Pellaea calomelanos var. calomelanos
 Pentzia globosa
 Persicaria lapathifolia*
 Pharmaceum brevicaule
 Phyllanthus parvulus var. parvulus
 Plumbago zeylanica*
 Pogonarthria squarrosa
 Polygala hottentotta
 Polygala uncinata
 Portulaca hereroensis
 Portulaca kermesina
 Portulaca quadrifida
 Potamogeton pectinatus
 Protea roupelliae subsp. roupelliae
 Pseudognaphium luteo-album
 Raphionacme hirsuta
 Requienia sphaerosperma
 Rhynchosia venulosa
 Richardia scabra*
 Ruelliopsis setosa
 Rumex lanceolatus*
 Ruschia sp.
 Salsola glabrescens
 Salvia disermas
 Salvia runcinata
 Salvia stenophylla
 Scabiosa columbaria
 Scizocarpus nervosus
 Schmidtia pappophoroides
 Schkuhria pinnata*
 Schoenoplectus corymbosus
 Schoenoplectus species
 Searsia ciliate
 Searsia lancea
 Searsia leptodictya forma leptodictya
 Searsia magalismsontana subsp. magalismsontana
 Searsia pyroides var. pyroides
 Searsia rigida var. margaretae
 Seddera capensis
 Selaginella dregei
 Selago densiflora
 Selago welwitschii var. australis
 Senecio inaequidens
 Senecio species
 Senegalia caffra
 Senna italica subsp. arachoides
 Sericorema remotiflora
 Seriphium plumosum

Sesbania bispinosa var. bispinosa*
Setaria incrassata
Setaria sphacelata var. torta
Sida chrysantha
Silene undulata
Solanum lichtensteinii
Solanum rubetorum
Solanum supinum var. supinum
Solanum tomentosum*
Sonchus dregeanus
Sporobolus discosporus
Sporobolus fimbriatus
Stachys spathulata
Stipagrostis uniplumis var. neesii
Stipagrostis uniplumis var. uniplumis
Tagetes minuta
Tarchonanthus camphoratus
Tephrosia lupinifolia
Teucrium trifidum
Themeda triandra
Thesium gracilarioides
Thunbergia neglecta
Thunbergia sp.
Trachyandra asperata var. asperata
Trachyandra laxa var. rigida
Trachyandra saltii var. saltii
Tragia rupestris

Tragia sp.
Tragus racemosus
Tribulus terrestris
Trichodesma angustifolium subsp. angustifolium
Trichoneura grandiglumis
Tristachya rehmannii
Tulbaghia acutiloba
Vachellia karroo
Vahlia capensis subsp. vulgaris var. linearis
Vachellia erioloba
Vachellia hebeclada subsp. hebeclada
Vachellia robusta subsp. robusta
Verbesina encelloides var. encelloides*
Verbena bonariensis*
Verbena officinalis*
Vernonia oligocephala
Viscum rotundifolium
Wahlenbergia androsacea
Wahlenbergia banksiana
Wahlenbergia denticulata var. denticulata
Wahlenbergia denticulata var. transvaalensis
Wahlenbergia undulata
Ziziphus mucronata subsp. mucronata
Ziziphus zeyheriana
Zornia milneana

Appendix 4: Flora species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

(as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Flora

Adenium swazicum
Aloe pillansii
Diaphanthe millarii
Dioscorea ebutsniorum
Encephalartos aemulans
Encephalartos brevifoliolatus
Encephalartos cerinus
Encephalartos dolomiticus
Encephalartos heenanii
Encephalartos hirsutus
Encephalartos inopinus
Encephalartos latifrons
Encephalartos middelburgensis
Encephalartos nubimontanus
Encephalartos woodii

ENDANGERED SPECIES

Flora

Angraecum africae
Encephalartos arenarius
Encephalartos cupidus
Encephalartos horridus
Encephalartos laevifolius
Encephalartos lebomboensis
Encephalartos msinganus
Jubaeopsis caffra
Siphonochilus aethiopicus
Warburgia salutaris
Newtonia hilderbrandi

VULNERABLE SPECIES

Flora

Aloe albida
Encephalartos cycadifolius
Encephalartos Eugene-maraisii
Encephalartos ngovanus
Merwillia plumbea
Zantedeschia jucunda

PROTECTED SPECIES

Flora

Adenia wilmsii
Aloe simii
Clivia mirabilis

Disa macrostachya
Disa nubigena
Disa physodes
Disa procera
Disa sabulosa
Encephelartos altensteinii
Encephelartos caffer
Encephelartos dyerianus
Encephelartos frederici-guilielmi
Encephelartos ghellinckii
Encephelartos humilis
Encephelartos lanatus
Encephelartos lehmannii
Encephelartos longifolius
Encephelartos natalensis
Encephelartos paucidentatus
Encephelartos princeps
Encephelartos senticosus
Encephelartos transvenosus
Encephelartos trispinosus
Encephelartos umbeluziensis
Encephelartos villosus
Euphorbia clivicola
Euphorbia meloformis
Euphorbia obesa
Harpagophytum procumbens
Harpagophytum zeyherii
Hoodia gordonii
Hoodia currorii
Protea odorata
Stangeria eriopus

Appendix 5: Flora species protected under the North West Biodiversity Management Act, No. 4 of 2004

(Published in Provincial Gazette No. 7721, 3 January 2017)

KINGDOM PLANTAE

Aloe braamvanwykii (CR)

Anacampseros decapitate (VU)

Barleria media (VU)

Blepharis angusta (endemic to NW)

Brachystelma (all species) – those recorded near to the site include the following: burchellii var. burchellii, circinatum, cupulatum, dimorphum subsp. gratum (CR), foetidum, **incanum** (VU), nanum, ramosissimum, stenophyllum

Ceropegia insignis (EN)

Ceropegia stentiae (EN)

Cineraria austrotransvaalensis (NT)

Cineraria exilis (DDT)

Cleome conrathii (NT)

Commelina bella (DDT)

Cynodon polevansii

Delosperma leendertziae (NT)

Dicliptera magaliesbergensis (VU)

Drimia sanguinea (NT)

Euphorbia (all species, except E. ingens) – those recorded near to the site include **davyi**, duseimata, **hirta**, **inaequilatera**, indica, **prostrata**, **serpens**, **spartaria**

Pteridophyta, all species except Pteridium aquilinum

Frithia pulchra (rare)

Gladiolus filiformis (NT)

Gnaphalium nelsonii (NT)

Indigofera commixta

Kniphofia typhoides (NT)

Ledebouria atrobrunnea

Ledebouria confusa

Lessertia phillipsiana (DDD)

Lithops leslei subsp. leslei (NT)

Lobelia cuneifolia var. ananda (critically rare)

Miraglossum laeve (CR PE)

Nerine gracilis (VU)

Nuxia glomerulata

Rennera stellata (now Pentzia stellata) (NT)

Searsia maricoana (VU)

Senecio holubii (CR PE)

Spirostachys africana

Sporobolus oxyphyllus

Stenostelma umbelluliferum (NT)

Appendix 6: Curriculum vitae: Dr David Hoare

Education

Matric - Graeme College, Grahamstown, 1984

B.Sc (majors: Botany, Zoology) - Rhodes University, 1991-1993

B.Sc (Hons) (Botany) - Rhodes University, 1994 with distinction

M.Sc (Botany) - University of Pretoria, 1995-1997 with distinction

PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Main areas of specialisation

- Vegetation ecology, primarily in grasslands, thicket, coastal systems, wetlands.
- Plant biodiversity and threatened plant species specialist.
- Alien plant identification and control / management plans.
- Remote sensing, analysis and mapping of vegetation.
- Specialist consultant for environmental management projects.

Membership

Professional Natural Scientist, South African Council for Natural Scientific Professions, 16 August 2005
– present. Reg. no. 400221/05 (Ecology, Botany)

Member, International Association of Vegetation Scientists (IAVS)

Member, Ecological Society of America (ESA)

Member, International Association for Impact Assessment (IAIA)

Member, Herpetological Association of Africa (HAA)

Employment history

1 December 2004 – present, Director, David Hoare Consulting (Pty) Ltd. Consultant, specialist consultant contracted to various companies and organisations.

1 January 2009 – 30 June 2009, Lecturer, University of Pretoria, Botany Dept.

1 January 2013 – 30 June 2013, Lecturer, University of Pretoria, Botany Dept.

1 February 1998 – 30 November 2004, Researcher, Agricultural Research Council, Range and Forage Institute, Private Bag X05, Lynn East, 0039. Duties: project management, general vegetation ecology, remote sensing image processing.

Experience as consultant

Ecological consultant since 1995. Author of over 380 specialist ecological consulting reports. Wide experience in ecological studies within grassland, savanna and fynbos, as well as riparian, coastal and wetland vegetation.

Publication record:**Refereed scientific articles (in chronological order):****Journal articles:**

- HOARE, D.B.** & BREDENKAMP, G.J. 1999. Grassland communities of the Amatola / Winterberg mountain region of the Eastern Cape, South Africa. *South African Journal of Botany* 64: 44-61.
- HOARE, D.B.**, VICTOR, J.E., LUBKE, R.A. & MUCINA, L., 2000. Vegetation of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 87-96.
- VICTOR, J.E., **HOARE, D.B.** & LUBKE, R.A., 2000. Checklist of plant species of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 97-101.
- MUCINA, L, BREDENKAMP, G.J., **HOARE, D.B** & MCDONALD, D.J. 2000. A National Vegetation Database for South Africa *South African Journal of Science* 96: 1-2.
- HOARE, D.B.** & BREDENKAMP, G.J. 2001. Syntaxonomy and environmental gradients of the grasslands of the Stormberg / Drakensberg mountain region of the Eastern Cape, South Africa.. *South African Journal of Botany* 67: 595 – 608.
- LUBKE, R.A., **HOARE, D.B.**, VICTOR, J.E. & KETELAAR, R. 2003. The vegetation of the habitat of the Brenton blue butterfly, *Orachrysops niobe* (Trimen), in the Western Cape, South Africa. *South African Journal of Science* 99: 201–206.
- HOARE, D.B** & FROST, P. 2004. Phenological classification of natural vegetation in southern Africa using AVHRR vegetation index data. *Applied Vegetation Science* 7: 19-28.
- FOX, S.C., HOFFMANN, M.T. and HOARE, D. 2005. The phenological pattern of vegetation in Namaqualand, South Africa and its climatic correlates using NOAA-AVHRR NDVI data. *South African Geographic Journal*, 87: 85–94.
- Pfab, M.F., Compaan, P.C., Whittington-Jones, C.A., Engelbrecht, I., Dumalisile, L., Mills, L., West, S.D., Muller, P., Masterson, G.P.R., Nevhutalu, L.S., Holness, S.D., **Hoare, D.B.** 2017. The Gauteng Conservation Plan: Planning for biodiversity in a rapidly urbanising province. *Bothalia*, Vol. 47:1. a2182. <https://doi.org/10.4102/abc.v47i1.2182>.

Book chapters and conference proceedings:

- HOARE, D.B.** 2002. Biodiversity and performance of grassland ecosystems in communal and commercial farming systems in South Africa. Proceedings of the FAO's Biodiversity and Ecosystem Approach in Agriculture, Forestry and Fisheries Event: 12–13 October, 2002. Food and Agriculture Organisation of the United Nations, Viale delle Terme di Caracalla, Rome, Italy. pp. 10 - 27.
- STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. In: Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) *Hotspots revisited*. CEMEX, pp.218–229. ISBN 968-6397-77-9
- STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. **Error! Hyperlink reference not valid..**
- HOARE, D.B.**, MUCINA, L., RUTHERFORD, M.C., VLOK, J., EUSTON-BROWN, D., PALMER, A.R., POWRIE, L.W., LECHMERE-OERTEL, R.G., PROCHES, S.M., DOLD, T. and WARD, R.A. *Albany Thickets*. in Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.
- MUCINA, L., **HOARE, D.B.**, LÖTTER, M.C., DU PREEZ, P.J., RUTHERFORD, M.C., SCOTT-SHAW, C.R., BREDENKAMP, G.J., POWRIE, L.W., SCOTT, L., CAMP, K.G.T., CILLIERS, S.S., BEZUIDENHOUT, H., MOSTERT, T.H., SIEBERT, S.J., WINTER, P.J.D., BURROWS, J.E., DOBSON, L., WARD, R.A., STALMANS, M., OLIVER, E.G.H., SIEBERT, F., SCHMIDT, E., KOBISI, K., KOSE, L. 2006. *Grassland Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- RUTHERFORD, M.C., MUCINA, L., LÖTTER, M.C., BREDENKAMP, G.J., SMIT, J.H.L., SCOTT-SHAW, C.R., **HOARE, D.B.**, GOODMAN, P.S., BEZUIDENHOUT, H., SCOTT, L. & ELLIS, F., POWRIE, L.W., SIEBERT, F., MOSTERT, T.H., HENNING, B.J., VENTER, C.E., CAMP, K.G.T., SIEBERT, S.J., MATTHEWS, W.S., BURROWS, J.E., DOBSON, L., VAN ROOYEN, N., SCHMIDT, E., WINTER, P.J.D., DU PREEZ, P.J., WARD, R.A., WILLIAMSON, S. and HURTER, P.J.H. 2006. *Savanna Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

- MUCINA, L., RUTHERFORD, M.C., PALMER, A.R., MILTON, S.J., SCOTT, L., VAN DER MERWE, B., **HOARE, D.B.**, BEZUIDENHOUT, H., VLOK, J.H.J., EUSTON-BROWN, D.I.W., POWRIE, L.W. & DOLD, A.P. 2006. *Nama-Karoo Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- MUCINA, L., SCOTT-SHAW, C.R., RUTHERFORD, M.C., CAMP, K.G.T., MATTHEWS, W.S., POWRIE, L.W. and **HOARE, D.B.** 2006. *Indian Ocean Coastal Belt*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

Conference Presentations:

- HOARE, D.B. & LUBKE, R.A. *Management effects on diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994
- HOARE, D.B., VICTOR, J.E. & LUBKE, R.A. *Description of the coastal fynbos south of George, southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994
- HOARE, D.B. & LUBKE, R.A. *Management effects on fynbos diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995
- HOARE, D.B. & BOTHA, C.E.J. *Anatomy and ecophysiology of the dunegrass Ehrharta villosa var. maxima*; Poster presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995
- HOARE, D.B., PALMER, A.R. & BREDENKAMP, G.J. 1996. *Modelling grassland community distributions in the Eastern Cape using annual rainfall and elevation*; Poster presentation, South African Association of Botanists Annual Congress, Stellenbosch, January 1996
- HOARE, D.B. *Modelling vegetation on a past climate as a test for palaeontological hypotheses on vegetation distributions*; Paper presentation, Randse Afrikaanse Universiteit postgraduate symposium, 1997
- HOARE, D.B., VICTOR, J.E. & BREDENKAMP, G.J. *Historical and ecological links between grassy fynbos and afro-montane fynbos in the Eastern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998
- LUBKE, R.A., HOARE, D.B., VICTOR, J.E. & KETELAAR, R. *The habitat of the Brenton Blue Butterfly*. Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998
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- HOARE, D.B. & WESSELS, K. *Conservation status and threats to grasslands of the northern regions of South Africa*, Poster presentation at the South African Association of Botanists Annual Congress, Potchefstroom, January 2000.
- HOARE, D.B. *Phenological dynamics of Eastern Cape vegetation*. Oral paper presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- HOARE, D.B., MUCINA, L., VAN DER MERWE, J.P.H. & PALMER, A.R. *Classification and digital mapping of grasslands of the Eastern Cape* Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- HOARE, D.B. *Deriving phenological variables for Eastern Cape vegetation using satellite data* Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- MUCINA, L., RUTHERFORD, M.C., HOARE, D.B. & POWRIE, L.W. 2003. *VegMap: The new vegetation map of South Africa, Lesotho and Swaziland*. In: Pedrotti, F. (ed.) Abstracts: Water Resources and Vegetation, 46th Symposium of the International Association for Vegetation Science, June 8 to 14 – Napoli, Italy.
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- PALMER, A.R., HOARE, D.B. & HINTSA, M.D., 1999. Using satellite imagery to map veld condition in Mpumalanga: A preliminary report. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Grahamstown.
- HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: methodology for mapping the vegetation communities of the South African savanna at a scale of 1:250 000. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.
- HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: size and coverage of field data that exists on the database of vegetation data for South African savanna. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.
- THOMPSON, M.W., VAN DEN BERG, H.M., NEWBY, T.S. & HOARE, D.B. 2001. Guideline procedures for national land-cover mapping and change monitoring. Report no. ENV/P/C 2001-006 produced for Department of Water Affairs and Forestry, National Department of Agriculture and Department of Environment Affairs and Tourism. Copyright: Council for Scientific and Industrial Research (CSIR) and Agricultural Research Council (ARC).
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- HOARE, D.B. 2003. Short-term changes in vegetation of Suikerbosrand Nature Reserve, South Africa, on the basis of resampled vegetation sites. Gauteng Department of Agriculture, Conservation, Environment and Land Affairs, Conservation Division.
- BRITTON, D., SILBERBAUER, L., ROBERTSON, H., LUBKE, R., HOARE, D., VICTOR, J., EDGE, D. & BALL, J. 1997. The Life-history, ecology and conservation of the Brenton Blue Butterfly (*Orachrysops niobe*) (Trimen) (*Lycaenidea*) at Brenton-on-Sea. Unpublished report for the Endangered Wildlife Trust of Southern Africa, Johannesburg. 38pp.
- HOARE, D.B., VICTOR, J.E. & MARNEWIC, G. 2005. Vegetation and flora of the wetlands of Nylsvley River catchment as component of a project to develop a framework for the sustainable management of wetlands in Limpopo Province.

Consulting reports:

Total of over 380 specialist consulting reports for various environmental projects from 1995 – present.

Workshops / symposia attended:

- International Association for Impact Assessment Annual Congress, Durban, 16 – 19 May 2018.
- Workshop on remote sensing of rangelands presented by Paul Tueller, University of Nevada Reno, USA, VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- BioMap workshop, Stellenbosch, March 2002 to develop strategies for studying vegetation dynamics of Namaqualand using remote sensing techniques
- South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- 28th International Symposium on Remote Sensing of Environment, Somerset West, 27-31 March 2000.
- Workshop on Vegetation Structural Characterisation: Tree Cover, Height and Biomass, 28th International Symposium on Remote Sensing of Environment, Strand, 26 March 2000.
- South African Association of Botanists Annual Congress, Potchefstroom, January 2000
- National Botanical Institute Vegmap Workshop, Kirstenbosch, Cape Town, 30 September-1 October 1999.
- Sustainable Land Management – Guidelines for Impact Monitoring, Orientation Workshop: Sharing Impact Monitoring Experience, Zithabiseni, 27-29 September 1999.
- WWF Macro Economic Reforms and Sustainable Development in Southern Africa, Environmental Economic Training Workshop, development Bank, Midrand, 13-14 September 1999.
- 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999
- Expert Workshop on National Indicators of Environmental Sustainable Development, Dept. of Environmental Affairs and Tourism, Roodevallei Country Lodge, Roodeplaat Dam, Pretoria, 20-21 October 1998.
- South African Association of Botanists Annual Congress, Cape Town, January 1998

Randse Afrikaanse Universiteit postgraduate symposium, 1997.
South African Association of Botanists Annual Congress, Bloemfontein, January 1995.