

# Appendix E (1): Terrestrial Biodiversity Assessment



**Terrestrial Biodiversity Specialist Assessment:  
Proposed Botterblom Wind Energy Facility  
North of Loeriesfontein  
Northern Cape Province**

**JULY 2021**

**For  
FE Botterblom (Pty) Ltd**

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## Specialist Declaration

We declare that the work presented in this report is our own and has not been influenced in any way by the developer or the EAP. At no point has the developer asked us as specialists to manipulate the results in order to make it more favourable for the proposed development. We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP) and the EIA Regulations (2014, as amended). We have the necessary qualifications and expertise in conducting this specialist report.



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## Glossary

**Critical Biodiversity Area (CBA):** an area that must be maintained in a good ecological condition (natural or semi-natural state) in order to meet biodiversity targets. CBAs collectively meet biodiversity targets for all ecosystem types, as well as for species and ecological processes that depend on natural or semi-natural habitat that have not already been met in the protected area network. CBAs are identified through a systematic biodiversity planning process in a configuration that is complementary, efficient and avoids conflict with other land uses where possible.

**Conservation Importance (CI):** The importance of a site for supporting biodiversity features of conservation concern present, e.g. populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.

**Cumulative impact:** in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

**Endemic:** a species that is naturally restricted to a particular, well-defined region. This is not the same as the medical definition, which is 'occurring naturally in a region.

**Extent of occurrence (EOO):** the area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy; and in short is the species' contemporary distribution range.

**Functional integrity (FI):** A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts.

**IUCN Red List Categories and Criteria:** the threatened species categories used in Red Data Books and Red Lists have been in place for almost 30 years. The IUCN Red List Categories and Criteria provide an easily and widely understood system for classifying species at high risks of global extinction, so as to focus attention on conservation measures designed to protect them.

**IUCN Red List status:** the conservation status of species, based on the IUCN Red List categories and criteria.

**Mitigation:** means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

**Receptor Resilience (RR):** The intrinsic capacity of the receptor to resist major damage from disturbance and/or to

recover to its original state with limited or no human intervention.

**Species of conservation concern (SCC):** includes all species that are assessed according the IUCN Red List Criteria as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Data Deficient (DD) or Near Threatened (NT), as well as range-restricted species which are not declining and are nationally listed as Rare or Extremely Rare [also referred to in some Red Lists as Critically Rare].

**Threatened species** – species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered, Endangered or Vulnerable is a threatened species. In terms of section 56(1) of NEMBA, ‘threatened species’ means indigenous species listed under the Act as critically endangered, endangered or vulnerable species.

## 1 INTRODUCTION

### 1.1 PROJECT DESCRIPTION

Enviro-Insight CC was commissioned by FE Botterblom (Pty) Ltd to perform a Terrestrial Biodiversity Assessment for the proposed Botterblom Wind Energy Facility (WEF) located near Loeriesfontein in the Northern Cape Province, South Africa.

The Botterblom WEF will consist of up to 35 wind turbines, with a generation capacity of up to 7.5 MW per turbine. Each turbine will have a hub height of up to 150m and a rotor diameter of up to 175 m. The final turbine model to be utilised will only be determined closer to the time of construction, depending on the technology available at the time.

### 1.2 STUDY AREA

The proposed study area for the WEF development is located approximately 53km north of Loeriesfontein, 87 km west of Brandvlei and 146 km south of Pofadder in the Northern Cape. The site can be reached via a gravel Granaatboskolk / Zout Dwaggas Road, which branches off the R357 (Figure 1-1). The Botterblom WEF footprint is approximately 5 736 hectares (ha) and will be located on a Portion of the Remainder of the Farm Sous 226. The existing Khobab WEF is located directly north while Loeriesfontein2 WEF is located north-east of the study area.

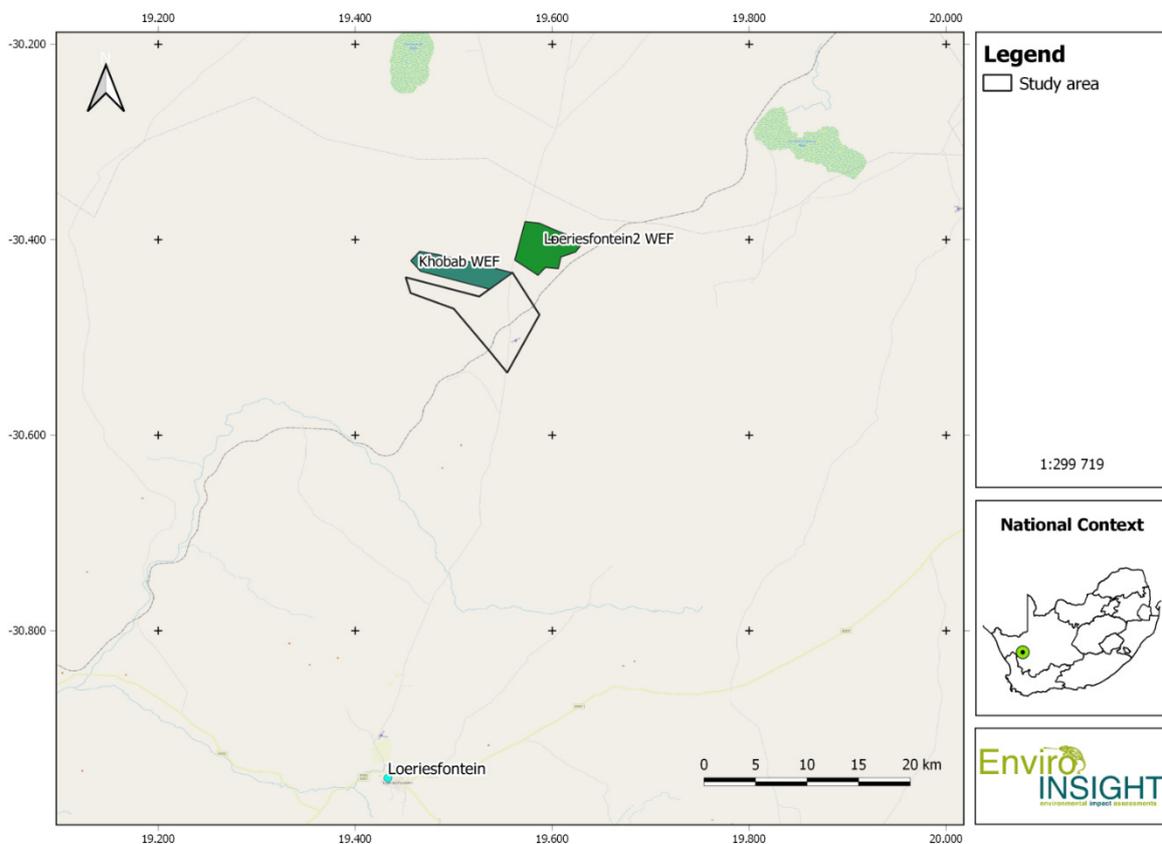


Figure 1-1: Location of the proposed Botterblom Wind Farm.

### 1.3 STUDY AIMS & LEGAL CONTEXT

- This report contains the Terrestrial Biodiversity as well as Sensitive Animal and Plant Species Themes of the Environmental Impact Assessment report (EIAR) required for the environmental authorisation process for a proposed development;
- The terrestrial animal and plant species protocol published on 30 October 2020 for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal and plant species in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)<sup>1</sup>, hereafter referred to as “species protocol”;
- Guidance for the implementation of the above-mentioned species protocols is followed according to SANBI (2020), hereafter referred to as “the terrestrial animal species protocol guidelines”.

### 1.4 PROJECT AREA OF INFLUENCE (PAOI)

The direct (primary) influence from the proposed Botterblom WEF is considered to be confined to the project area (5859 ha) as shown in Figure 1-1. However, only a proportion of the project area is anticipated to be cleared habitat for infrastructure. The footprint is expected to be less than 5 % of the project area based on required infrastructure which translates to approximately 293 ha.

## 2 METHODS

### 2.1 NATIONAL WEB BASED ENVIRONMENTAL SCREENING TOOL

The assessment and minimum reporting requirements of this protocol are associated with a level of environmental sensitivity identified by the national web based environmental screening tool (screening tool). The requirements for terrestrial biodiversity are for landscapes or sites which support various levels of biodiversity. An initial screening report was generated in October 2020, and again in February 2021 as data updates were made and confirmation was required. For this report, the February 2021 screening report will be applicable.

Based on the screening report generated on 03/02/2021, the Terrestrial Biodiversity Combined Sensitivity Theme is indicated as **Very High** sensitivity (Figure 2-1). The sensitive features which trigger the Very High sensitivity include:

- Freshwater ecosystem priority area quinary catchments;
- Critical Biodiversity Area 1; and
- Ecological Support Area.

Accordingly, a Terrestrial Biodiversity Specialist Assessment must be conducted based on the Protocols (published on 20 March 2020), and the site sensitivity verification (see below).

The Animal species theme is indicated as High sensitive due to the presence of sensitive avifauna species, while the remaining taxa groups are considered to be low (Figure 2-2). The avifauna component is addressed in a separate report based on the specific protocol and guidelines. Accordingly only a compliance statement is required.

<sup>1</sup> GOVERNMENT GAZETTE, No. 43855, 30 OCTOBER 2020. Available from: [http://www.gpwonline.co.za/Gazettes/Gazettes/43855\\_30-10\\_NationalGovernment.pdf](http://www.gpwonline.co.za/Gazettes/Gazettes/43855_30-10_NationalGovernment.pdf)

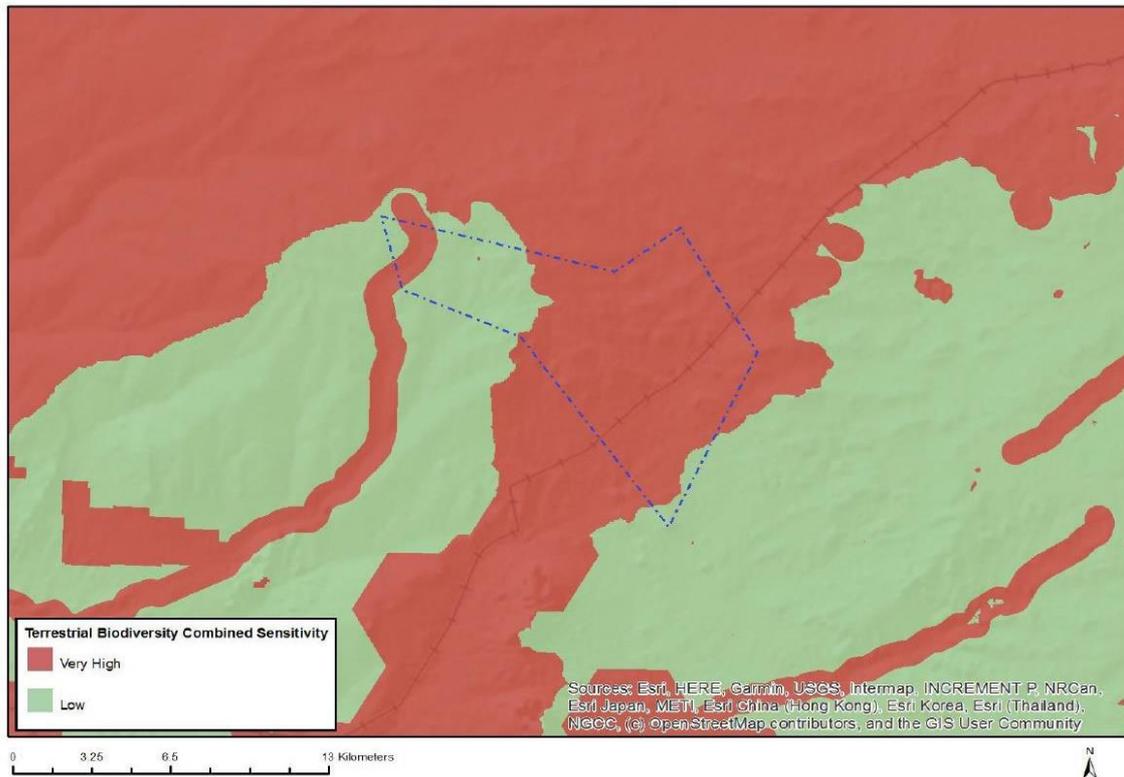


Figure 2-1: Screening Tool map of relative terrestrial biodiversity theme sensitivity.

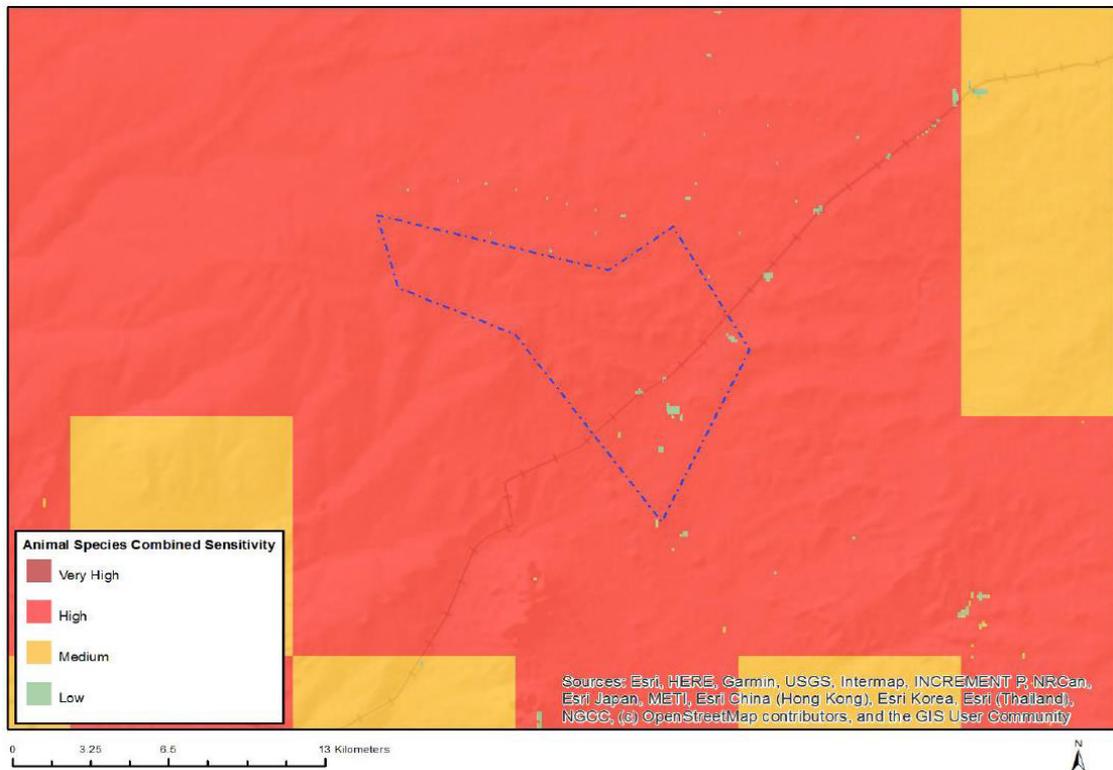
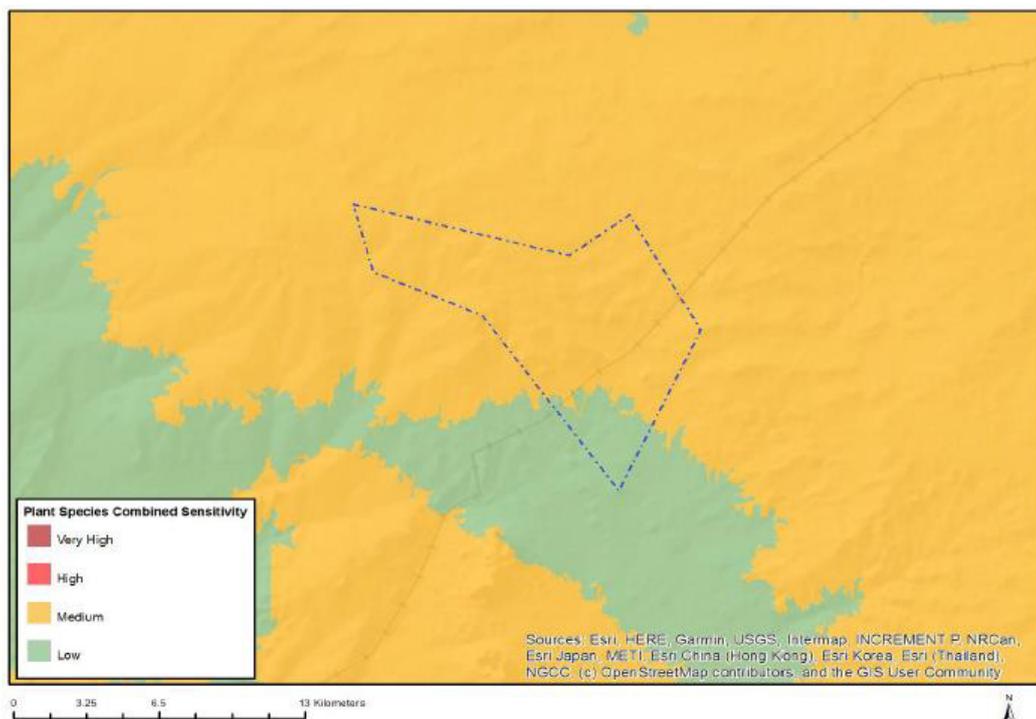


Figure 2-2: Screening Tool map of relative animal species theme sensitivity.

The plant species theme initially indicated Medium sensitive due to the presence of sensitive species 44, but in the updated screening report this species was no longer listed but *Dregeochloa calviniensis* was listed (Figure 2-3). Accordingly, a full assessment was incorporated for this theme to account for all possible sensitive species likely to occur on site (refer to section 4).



**Figure 2-3: Screening Tool map of relative plant species theme sensitivity.**

## 2.2 SITE SENSITIVITY VERIFICATION

Prior to commencing with a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration as identified by the screening tool must be confirmed by undertaking a site sensitivity verification.

Site verification was undertaken from 10-13 November 2021 by a SACNASP registered ecologist and zoologist. The purpose of this preliminary on-site inspection was to confirm the current use of the land and environmental sensitivities as identified by the screening tool. The findings of the site verification, which included a desktop assessment, confirmed the Very High environmental sensitivity of the Terrestrial Biodiversity theme and Low sensitivity for all other animal taxa groups, except for avifauna. The plant species theme indicated the possibility of both sensitive species to occur on site. The initial desktop review focused mainly on the BRAHMS Online BODATSA database, which proved to be of little relevance as less than 20 species were recorder for this area. The species lists generated from existing botanical reports for the surrounding wind farms were also scrutinised and included in the expected species list.

## 2.3 DESKTOP SURVEY

### 2.3.1 GIS

Existing data layers were incorporated into a GIS to establish how the proposed study areas and associated activities interact with important terrestrial entities. Emphasis was placed on the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018);
- Northern Cape Critical Biodiversity Areas (Northern Cape Department of Environment and Nature Conservation, 2016);
- Protected and Conservation areas of South Africa (South Africa Protected Areas Database-SAPAD; South Africa Conservation Areas Database-SACAD)<sup>2</sup>; and
- National List of Threatened Ecosystems (SANBI, 2011).

All mapping was performed using open source GIS software (QGIS<sup>3</sup>).

### 2.3.2 Habitat mapping

Habitats were manually mapped within the PAOI and surrounding areas as structural units that would be utilised differently by herpetofauna / mammals or represent distinct habitats to flora (geology, water-courses, vegetation density) as determined from satellite imagery and on the ground verification. This mapping exercise was achieved through a combination of:

- the habitat characterisation performed on the ground during fieldwork;
- vegetation communities identified by botany fieldwork;
- the digital elevation model (obtained from Shuttle Radar Topography Mission<sup>4</sup>); and
- the most recent satellite imagery (courtesy of Google Corporation).

### 2.3.3 Flora Assessment

A literature review was conducted as part of the desktop study to identify the potential habitats and flora species of conservation concern (SCC) present within the study area. The South African National Biodiversity Institute (SANBI) provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA) (SANBI, 2016<sup>5</sup>), to access distribution records on southern African plants<sup>6</sup>. This is a new database which replaces the old Plants of Southern Africa (POSA) database. The POSA database provided distribution data of flora at the quarter degree grid cell (QDGC) resolution; however, the BODATSA database provides distribution data as point coordinates. The literature assessment, therefore, focussed on querying the database to generate species lists for the immediate study area and surroundings. Initially a list of 185 species were generated in October 2020, but when scrutinised there were several errors as three threatened species were included in the list which occur in the Western and Eastern Cape provinces. A query was submitted to SANBI and another list was generated in March 2021. This list however did not generate any species for the same area, and accordingly a larger list had to be generated for the xMin, yMin 18.80°, -29.70° : xMax, yMax 20.10°, -30.90° extent (WGS84 datum) in order to increase the likelihood of obtaining a representative species list for the proposed study area.

The Red List of South African Plants website (SANBI, 2021)<sup>7</sup> was utilized to provide the most current account of the national status of flora. Relevant field guides and texts consulted for identification purposes in the field during the surveys included the following:

- Guide to grasses of southern Africa (Van Oudtshoorn, 2014);

<sup>2</sup> <http://dea.maps.arcgis.com/apps/MapTools/index.html?appid=2367540dd75148e8b6eaeab178a19d3a>

<sup>3</sup> <http://qgis.osgeo.org/en/site/>

<sup>4</sup> <https://earthexplorer.usgs.gov/>

<sup>5</sup> <http://newposa.sanbi.org/>

<sup>6</sup> Data are obtained from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH)

<sup>7</sup> <http://redlist.sanbi.org/>

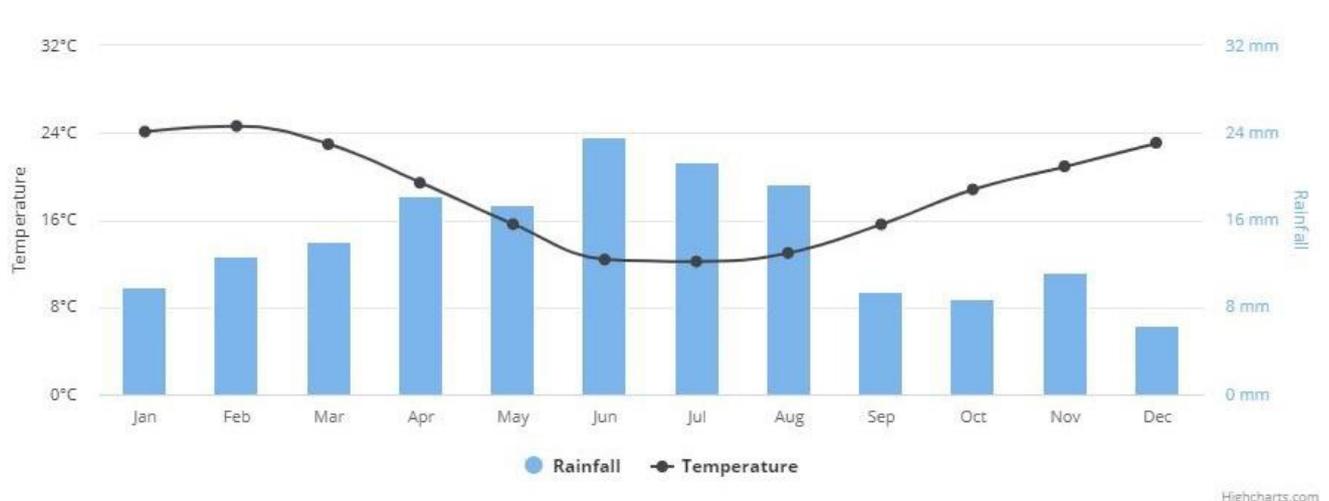
- Field guide to succulents of southern Africa (Smith *et al.* 2017);
- Field guide to wild flowers of South Africa (Manning, 2019);
- Problem plants and alien weeds of South Africa (Bromilow, 2019);
- Namaqualand Wildflower Guide (Le Roux & Schelpe 1988) and
- Field guide to trees of southern Africa (Van Wyk & Van Wyk, 2013).

Additional information regarding ecosystems, vegetation types, and SCC included the following sources:

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2006 as amended); and
- Red List of South African Plants (Raimondo *et al.*, 2009; SANBI, 2021).

## 2.4 FIELD SURVEYS

Site visits were undertaken in November 2020 (dry season) and March 2021 (early wet season) by a botanist and zoologist where the floral and the faunal aspects of the survey area were evaluated. The timing of the surveys represented both dry and wet season conditions in order to cover biophysical seasonal aspects. Many of the shrubs and other plant species were in flower during the March 2021 survey, but the optimal time, which will also be the final site visit for this assessment, is in July/August (Figure 2-4) after the winter rains.



**Figure 2-4: Average monthly temperature and rainfall for the watershed in which the study area is located for the period of 1991-2016<sup>8</sup>.**

During the field surveys performed, the habitats were evaluated on foot and a series of georeferenced photographs were taken of the habitat attributes. The field surveys focused on a classification of the observed fauna and flora, habitats as well as the actual and potential presence of species of conservation concern (either classified as Threatened by the IUCN (2021), protected by NEMBA (2007, as amended) or indeed other legislations applicable provincially or nationally). An analysis of the diversity and ecological integrity of the habitats present on site was also performed.

<sup>8</sup> The chart above shows mean historical monthly temperature and rainfall for Watershed #427 during the time period 1991-2016. The dataset was produced by the Climatic Research Unit (CRU) of University of East Anglia (UEA).

## 2.5 SPECIES OF CONSERVATION CONCERN

The Red List of threatened species generated by the IUCN (<http://www.iucnredlist.org/>) provided the global conservation status of terrestrial fauna and flora. However, regional conservation status assessments performed following the IUCN criteria were the most relevant and sourced for each group as follows:

- Plants: Red List of South African plants version 2021 and Raimondo *et al.* (2009);
- Reptiles: Bates *et al.* (2014);
- Amphibians: Du Preez & Carruthers (2017);
- Mammals: Child *et al.* (2016).

The conservation status categories defined by the IUCN (Figure 2-5), which are considered here to represent species of conservation concern, are the "threatened" categories defined as follows:

- **Critically Endangered (CR)** - Critically Endangered refers to species facing immediate threat of extinction in the wild.
- **Endangered (EN)** - Endangered species are those facing a very high risk of extinction in the wild within the foreseeable future.
- **Vulnerable (VU)** - Vulnerable species are those facing a high risk of extinction in the wild in the medium-term.

Other measures of conservation status include species listed under the following:

- Trade in Protected Species (TOPS; National)
- Convention on International Trade in Endangered Species (CITES; International).

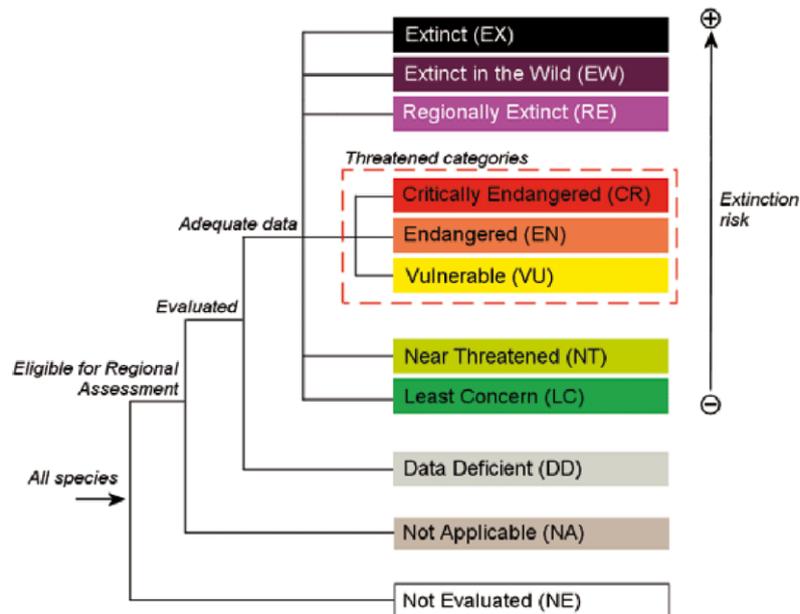


Figure 2-5: Schematic representation of the structure of the IUCN Red List Categories (IUCN 2012).

## 2.6 STUDY LIMITATIONS

- It is assumed that all third-party information acquired is correct (e.g. GIS data and scope of work).
- Avifauna and Bat assessment is not part of this assessment and is dealt with under the relevant theme which requires a 12-month pre-application monitoring assessment.
- Due to the nature of most biophysical studies, it is not always possible to cover every square metre of a given study area. Due to the large study area, it is possible that small individual plant species of conservation concern (SCC) may have been overlooked even though care has been taken to search for specific SCC.
- The literature review for plant species identified several limitations in the use of online data platforms, and for this specific area was not considered to be very reliable. Furthermore, as this is an extremely remote part of the country where limited surveys have been conducted, data is underrepresented for this area.

## 2.7 HABITAT MAPPING

Habitats were manually mapped within the PAOI and surrounding areas as structural units that would be utilised differently by herpetofauna / mammals or represent distinct habitats to flora (geology, water-courses, vegetation density) as determined from satellite imagery and on the ground verification. This mapping exercise was achieved through a combination of:

- the habitat characterisation performed on the ground during fieldwork;
- vegetation communities identified by botany fieldwork;
- the digital elevation model (obtained from Shuttle Radar Topography Mission<sup>9</sup>); and
- the most recent satellite imagery (courtesy of Google Corporation).

## 3 TERRESTRIAL BIODIVERSITY RESULTS

The results are presented according to the requirements for undertaking site sensitivity verification and for protocols for the assessment and minimum report content requirements of environmental impacts for environmental themes for activities requiring environmental authorisation dated 20 March 2020 (Government Gazette No. 43110, GN 320). In order to simply this, each required aspect is indicated in Table 3-1 below, and where triggered or relevant, it is discussed in more detail in the sections to follow.

*Table 3-1: Terrestrial Biodiversity theme aspects required to be assessed.*

Environmental Theme Aspect	Triggered for proposed activities	Section in report
Regional Vegetation according to Mucina and Rutherford (2006, as amended)	Yes – located in the Bushmanland Basin Shrubland vegetation type	Section 3.1
Threatened Ecosystems	No – not located within any listed threatened ecosystem	-
Protected Areas and Important Bird Areas	No – located in any protected area or important bird area, and none are located within a 20km radius from the study area	-

<sup>9</sup> <https://earthexplorer.usgs.gov/>

Provincial CBA	Yes – located in CBA and ESA	Section 3.2
Ecology of the system	Main landscape features, habitats, dominant species recorded	Section 3.3

### 3.1 REGIONAL VEGETATION

The study area is located in the Bushmanland Basin Shrubland vegetation type (Figure 3-1) (Table 3-2). Bushmanland Basin Shrubland occurs on the extensive basin centered on Brandvlei and Van Wyksvlei, spanning Granaatboskolk in the west to Copperton in the east, and Kenhardt in the north to around Williston in the south. The area is characterised by slightly irregular plains dominated by a dwarf shrubland, with succulent shrubs or perennial grasses in places. The geology consists largely of mudstones and shales of the Ecca group and Dwyka tillites with occasional dolerite intrusions. Soils are largely shallow to non-existent, with calcrete present in most areas. Rainfall ranges from 100-200 mm and falls mostly during the summer months as thunderstorms. As a result of the arid nature of the area, very little of this vegetation type has been affected by intensive agriculture and it is classified as Least Threatened. None of the unit is conserved in statutory conservation areas. According to Mucina and Rutherford no signs of serious transformation are present for the vegetation type, but scattered individuals of *Prosopis* sp. occur in some areas (e.g. in the vicinity of the Sak River drainage system), and some localised dense infestations form closed 'woodlands' along the eastern border of the unit with Northern Upper Karoo (east of Van Wyksvlei) (Mucina & Rutherford, 2006 as amended).

There are few endemic and biogeographically important species present at the site and only *Tridentea dwequensis* is listed by Mucina and Rutherford as biogeographically important while *Cromidon minimum*, *Ornithogalum bicornutum* and *O.ovatum* subsp *oliverorum* are listed as being endemic to the vegetation type (Mucina & Rutherford, 2006 as amended).

Other vegetation types which occur in the wider area include Hantam Karoo, some small pans in the area which fall within the Bushmanland Vloere and Namaqualand Riviere vegetation types. These are however outside of the study area and would not be affected directly by the proposed Botterblom WEF.

The study area is not located in a national threatened ecosystem.

**Table 3-2: Attributes of the Bushmanland Basin Shrubland vegetation type.**

Name of vegetation type	Bushmanland Basin Shrubland
Code as used in the Book	NKb6
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	%
Remaining (percent of area) from NSBA	99.5%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Not protected
Area (km <sup>2</sup> ) of the full extent of the Vegetation Type	34690.68
Name of the Biome	Nama-Karoo
Name of Bioregion	Bushmanland Bioregion

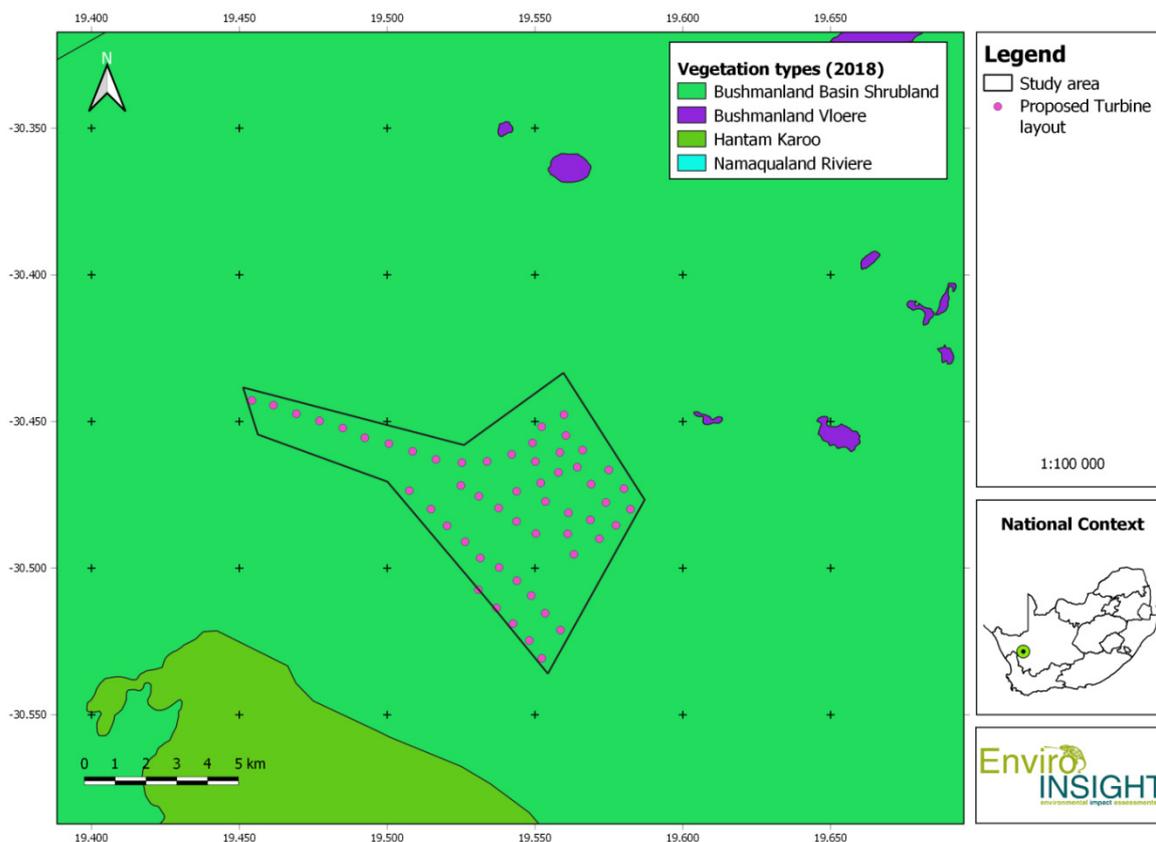


Figure 3-1: Regional vegetation types in relation to the study area (SANBI, 2018).

### 3.2 NORTHERN CAPE CRITICAL BIODIVERSITY AREAS

The Northern Cape CBA Map (2016) identifies biodiversity priority areas, called Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole (Holness & Oosthuysen, 2016). Priorities from existing plans such as the Namakwa District Biodiversity Plan, the Succulent Karoo Ecosystem Plan, National Estuary Priorities, and the National Freshwater Ecosystem Priority Areas were incorporated. Targets for terrestrial ecosystems were based on established national targets, while targets used for other features were aligned with those used in other provincial planning processes.

Critical biodiversity areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. The primary purpose of CBA's is to inform land-use planning in order to promote sustainable development and protection of important natural habitat and landscapes. Biodiversity priority areas are described as follows:

- *Critical biodiversity areas (CBA's)* are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses. For CBA's the impact on biodiversity of a change in land-use that results in a change from the desired ecological state is most significant locally at the point of impact through

the direct loss of a biodiversity feature (e.g. loss of a populations or habitat). All FEPA prioritized wetlands and rivers have a minimum category of CBA1, while all FEPA prioritised wetland clusters have a minimum category of CBA2.

- *Ecological support areas (ESA's)* are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas. For ESA's a change from the desired ecological state is most significant elsewhere in the landscape through the indirect loss of biodiversity due to a breakdown, interruption or loss of an ecological process pathway (e.g. removing a corridor results in a population going extinct elsewhere or a new plantation locally results in a reduction in stream flow at the exit to the catchment which affects downstream biodiversity). All natural non-FEPA wetlands and larger rivers have a minimum category of ESA.

According to the CBA Map, the study area is mainly located in the category "Other Natural Areas" with a CBA1 running through the study area and an ESA in the western and northern sections of the study area (Figure 3-2). The CBA1 is the NFEPA River, Klein-Rooiberg running through the site. The ESA towards the western section is the Leeuwborg River, while the smaller scattered ESAs throughout the site are pans (natural non-FEPA Wetlands) (Figure 3-4).

The proposed development layout will be amended to avoid all CBA1 and ESA areas.

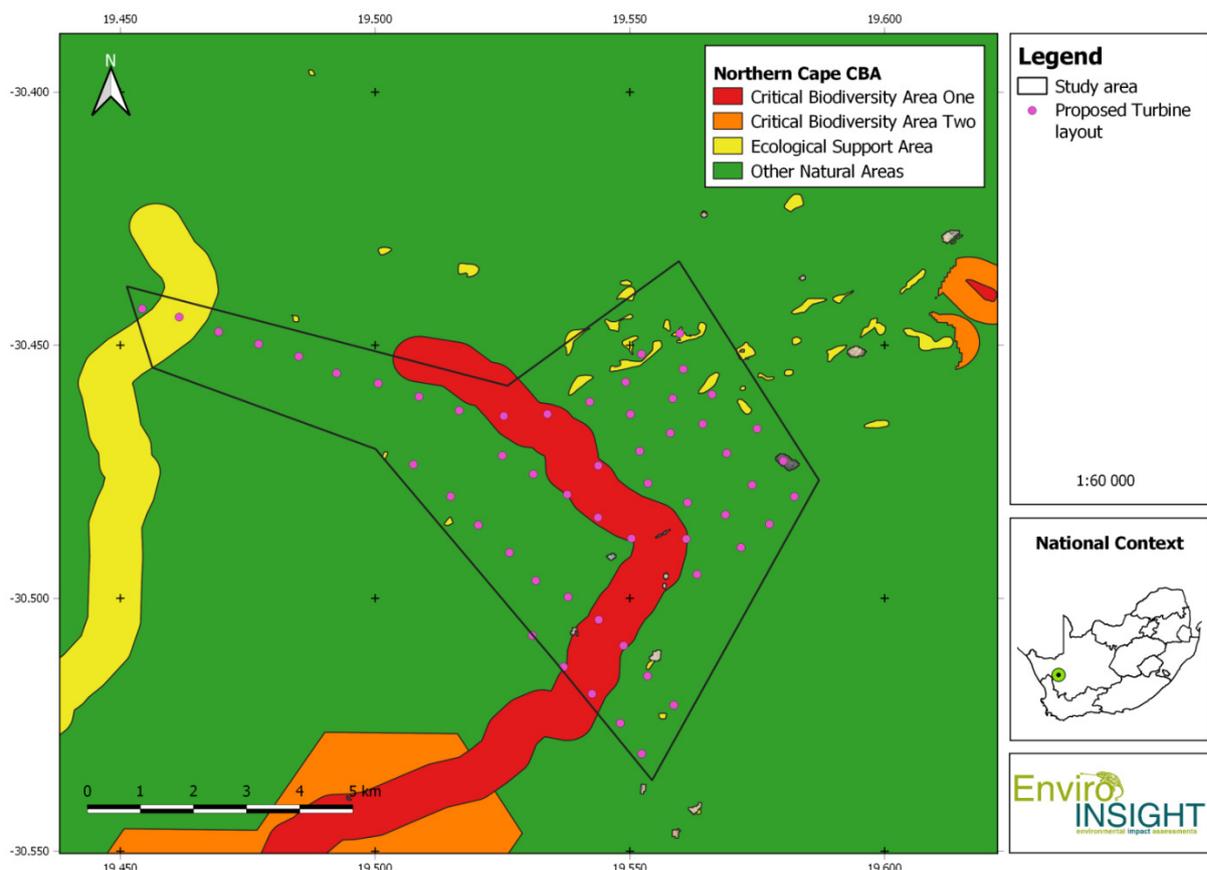


Figure 3-2: The study area in relation to the Northern Cape Critical Biodiversity Areas (2016).

### 3.3 ECOLOGY OF THE SYSTEM

#### 3.3.1 Ecological drivers and significant terrestrial landscape features

The study area is located in the E31C Quaternary catchment. Several important endorheic pans, wetlands clusters and rivers exist within this region which attracts several important bird species such as flamingoes.

Changes in vegetation structure and composition are mainly driven by overgrazing and the introduction of alien invasive species such as *Prosopis* sp. Transformation in the Bushmanland Basin Shrubland is minimal, and has increased mainly due to the construction of renewable energy facilities, both wind and solar.

The vegetation of the vegetation unit is mainly due to the high salt status of soil, which results in the increased presence of shrubs, especially succulents, and specialised species.

##### 3.3.1.1 National Freshwater Ecosystem Priority Areas (NFEPA), 2011

The National Freshwater Ecosystem Priority Areas (NFEPA) project provides strategic spatial priorities for conserving South Africa's freshwater ecosystems and supports sustainable use of water resources. These priority areas are called Freshwater Ecosystem Priority Areas, or 'FEPAs'.

FEPAs were identified based on:

- Representation of ecosystem types and flagship free-flowing rivers
- Maintenance of water supply areas in areas with high water yield
- Identification of connected ecosystems
- Representation of threatened and near-threatened fish species and associated migration corridors
- Preferential identification of FEPAs that overlapped with:
  - Any free-flowing river
  - Priority estuaries identified in the National Biodiversity Assessment 2011
  - Existing protected areas and focus areas for protected area expansion identified in the National Protected Area Expansion Strategy.

The largest section of the study area is located in a FEPA (Figure 3-3), with the Klein-Rooiberg FEPA river running through the study area, and a couple of FEPA wetlands classified as depressions, flats and seeps are located mainly in the northern section, bordering the Khobab WEF, and a few scattered throughout the site (Figure 3-4). A smaller section towards the south is classified as an Upstream Management Area (areas in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas).

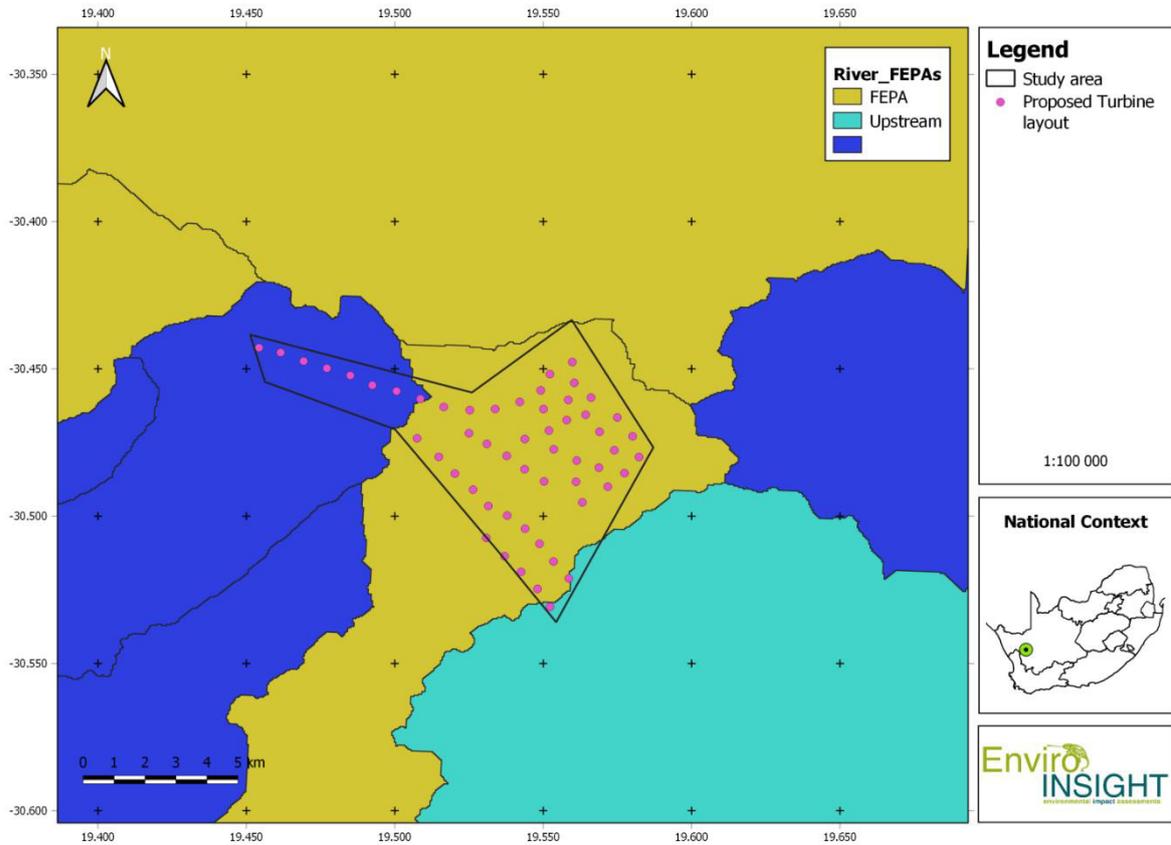


Figure 3-3: Freshwater Ecosystem Priority Areas

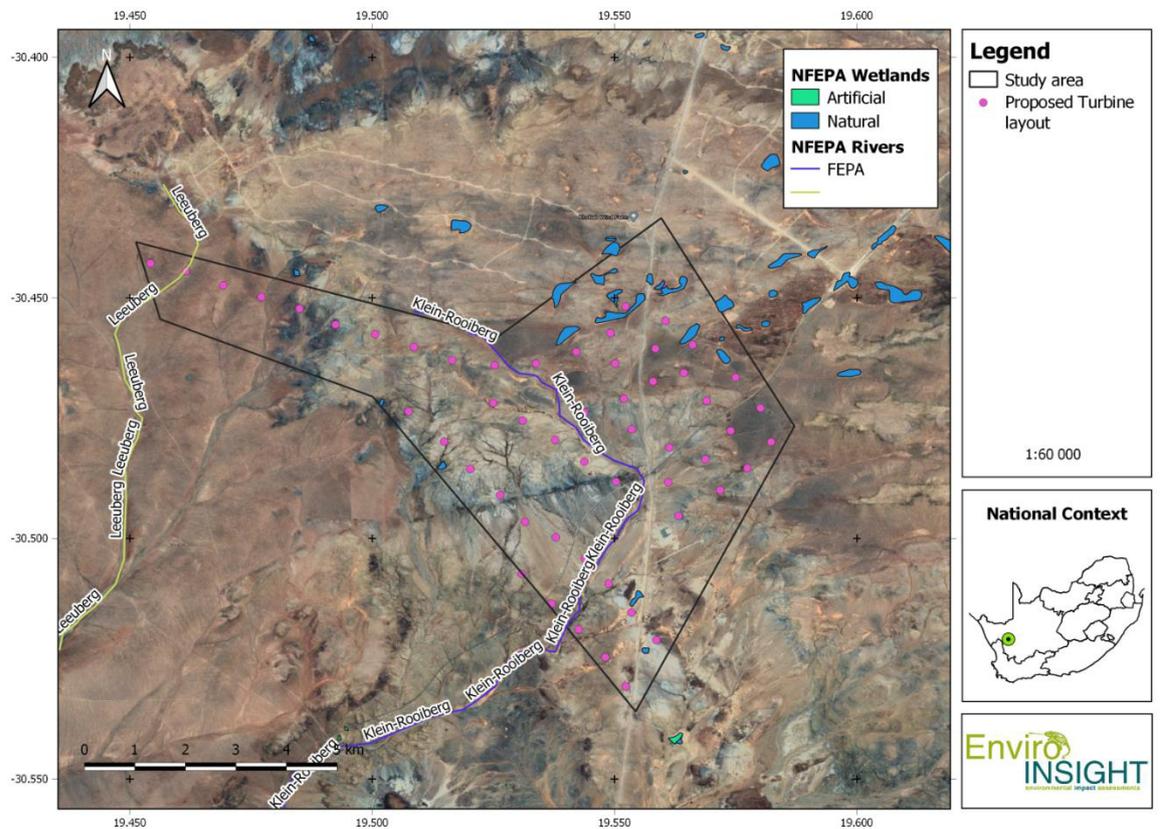


Figure 3-4: FEPA Rivers and wetlands.

The site consists of flat to gently undulating open plains dominated by low shrubs and arid tussock grasses. It is typical of southwestern Bushmanland and does contain some remarkable landscape features such as pans and large hills. Other landscape features include low ridges along the north-eastern boundary of the site, a low gravel hill in the centre of the site and some poorly developed drainage lines. The vegetation of the site is very homogenous and is dominated by shrub vegetation on gravelly soils.

### **3.3.2 Ecological functioning and processes**

The watercourses in the region represent the most important ecological processes, and if not protected it could lead to reduced ecosystem services and increased negative impacts could result in a cascading effect. The vegetation unit is not considered threatened and there are limited sensitive features or important landscape features that, if disturbed or transformed, will result in a catastrophic collapse of the system.

The proposed Botterblom WEF does not represent a significant impact on the ecosystem processes and services, except for the main river courses and wetland pans located on the study area which needs to be excluded from construction activities.

### **3.3.3 Ecological corridors and connectivity**

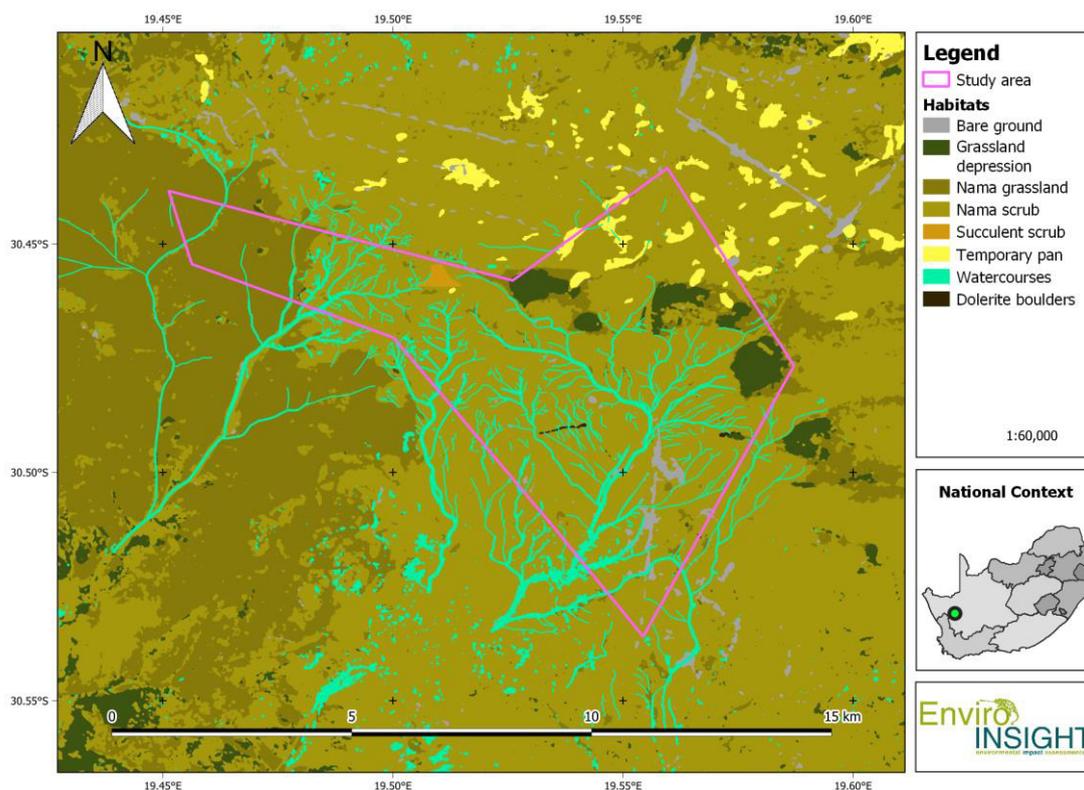
An ecological corridor is a clearly defined geographical space that is governed and managed over the long-term to maintain or restore effective ecological connectivity.

The main watercourses / rivers act as corridors for the movement of fauna across the landscape. The proposed turbine layout will not impact on connectivity within the landscape, if the turbines and associated infrastructure is located outside main watercourses. Where roads and powerlines cross watercourses, the necessary mitigation measures need to be implemented to reduce fauna mortality, and not restrict movement of fauna.

### **3.3.4 Species, distribution, and important habitats**

Plant diversity is generally low and the only areas with moderate levels of diversity are the ridges. Five main habitats were identified based on species composition and structure (Figure 3-5). The main driver of vegetation pattern in the area is substrate.

Georeferenced photographs (Appendix A) were taken to assist in both the site characterisation as well as the sensitivity analysis and provide lasting evidence for future queries. The specialist coverage is considered optimal as every habitat was surveyed, taking into consideration the large study area. Furthermore, all areas of the study area were clearly visible, but not completely accessible due to the extent of the study area and road access limitations.



**Figure 3-5: Habitats identified for the study area.**

### 3.3.4.1 Gravel Shrubland / Nama Scrub

This habitat occurs both on hills and plains (Figure 3-6). The Shrubland habitat is characterised by shrubs, forbs and succulent's characteristic of the Bushmanland Basin Shrubland, while tussock-grass-dominate areas on sandy soils. Overall diversity within this vegetation type at the site is considered medium, which can be ascribed to the aridity of the area and the poorly developed soils. Dominant species include *Aloe claviflora*, *Aptosimum indivisum*, *Drosanthemum schoenlandianum*, *Felicia clavipilosa*, *Gazania lichtensteinii*, *Leysera tenella*, *Lycium cinereum*, *Mesembryanthemum crystallinum*, *Oncosiphon grandiflorum*, *Oxalis furcillata*, *Plinthus karoocicus*, *Pteronia incana*, *Pteronia sordida*, *Ruschia intricata*, *Salsola tuberculata*, *Thesium lineatum*, *Titanopsis calcarean*, *Tribulus zeyheri* and *Zygophyllum lichtensteinianum*.

Protected species (for which a permit for removal will be required) include: *Aloidendron dichotomum*, *Hoodia gordonii*, *Pelargonium spp.*, *Anacampseros spp.*



Figure 3-6: Vegetation and landscape features of the shrubland.

#### 3.3.4.2 Watercourses

The drainage lines of the site are not very well developed and do not have a tall woody component. It is found along the small and narrow ephemeral drainage lines flowing in the landscape (Figure 3-7). Although the drainage lines are not well developed, which can be ascribed to aridity of the area, they are ecologically important because the higher cover and productivity of these areas is important for fauna forage and habitat availability and they also play an important hydrological role and regulate flow following occasional strong rainfall events. As such disturbance to these areas should be minimised as far as possible.

Dominant species recorded include *Augea capensis*, *Galenia sarcophylla*, *Melianthus comosus*, *Lessertia frutescens*, *Lycium pumilum*, *Osteospermum armatum*, *Parkinsonia africana*, *Prosopis glandulosa*, *Salsola aphylla*, *Salvia disermas*, *Sesamum capense*, *Stipagrostis namaquensis*, *Stipagrostis obtusa*.

Protected species (for which a permit for removal will be required) include: *Lessertia frutescens*.



Figure 3-7: Vegetation and landscape features of Drainage Lines.

### 3.3.4.3 Pans (Temporary)

The pans do not hold water regularly for extended periods and is only periodically filled with water after heavy rain (Figure 3-8). When filled with water it provides important ecosystem services which the fauna in the area rely on. Due to the nature of these pans and the important role they play in maintaining ecosystem services and functioning in the landscape, they are considered sensitive features which should be excluded from development. Dominant species include *Aptosimum indivisum*, *Gazania sp.*, *Lycium pumilum*, *Prosopis glandulosa*, *Salsola aphylla*, *Salsola glabrescens*, *Sesamum capense*, *Stipagrostis namaquensis*, *Stipagrostis obtuse*.



Figure 3-8: Vegetation and landscape features of pans.

### 3.3.4.4 Shrubby Grassland

Located imbedded in the shrubland are grassland patches which are dominated by grasses (Figure 3-9) such as *Stipagrostis ciliate*, *S. brevifolia*, *S. anomala* and *Aristida adscensionis*, shrubs including *Lycium pumilum*, *Aptosimum spinescence*, *Plinthus karooicus*, *Salsola tuberculata*, with occasional annuals such as *Leysera tenella*, *Osteospermum pinnatum*, and *Limeum africanum*.



Figure 3-9: Vegetation and landscape features of grasslands embedded in shrubland.

## 4 PLANT SPECIES THEME RESULTS

As per the screening reports, two sensitive species are likely to occur on the study area. Based on existing literature and surveys conducting, two more species of conservation concern were included in this assessment (Table 4-1). One species listed as Rare, *Cephalophyllum fulleri* L. Bolus was indicated as being observed east of the proposed study area (exact location and distance unknown as limited information was provided in the specialist report; Todd 2018). This is, however, highly unlikely as this is a habitat specialist known from only three subpopulations close to Pofadder and Aggeneys, further north of the study area. Accordingly, this species was omitted for the current assessment.

**Table 4-1: Expected and Observed list of Sensitive Plant Species for Botterblom WEF.**

Species	National Status	Provincially Protected	Endemic to (1) South Africa or (2) Northern Cape	Observed or likely to occur within the study area
<i>Aloidendron dichotomum</i> (Masson) Klopper & Gideon.F.Sm.	Vulnerable A3ce	Yes	No	One individual observed within the study area, two individuals observed on neighbouring properties to the west.
<i>Dregeochloa calviniensis</i> Conert	Rare		1 and 2	Low probability – was recorded approximately 52km SE of the study area
<i>Hoodia gordonii</i> (Masson) Sweet ex Decne.	Data Deficient - Insufficient Information	Yes	No	Observed within the study area and on neighbouring properties.
<i>Wahlenbergia divergens</i> A.DC.	Data Deficient - Taxonomically Problematic		1 and 2	Unlikely – currently there is not enough information available for this species, but it is unlikely to be present on the study area. Based on historical records, this species was recorded approximately 19km south of the study area, within the Hantam Karoo vegetation type.

*Aloidendron dichotomum* (Masson) Klopper & Gideon.F.Sm. – Vulnerable A3ce

This species occurs from Nieuwoudtville east to Olifantsfontein and northwards to the Brandberg in Namibia and is therefore not endemic to South Africa. It is known to occur on north-facing rocky slopes (particularly dolomite) in the south, and any slopes and sandy flats in the central and northern parts of its range. The main threats to this species include climate change, harvesting and trampling by livestock. Damage by baboons, scale insects and fungus has been observed, but none of these seem to cause mortality. Some social birds make large nest on the species, sometimes causing it to fall over due to the weight of the nests and its owners. Climate change models project a 36% decline in its range in 100 years, assuming dispersal into newly suitable areas. Patterns of modelled declines have been supported by field and repeat photo studies. However, no colonization of newly suitable areas has yet happened (Foden 2018). Without dispersal, the models predict a 73% decline in 100 years, qualifying the species as EN.

Only one individual was recorded within the PAOI (Figure 4-1) and will not be impacted on by the current layout design.



**Figure 4-1: *Aloidendron dichotomum* recorded within the PAOI.**

*Dregeochloa calviniensis* Conert – Rare

This endemic species is known to occur in limestone outcrops in arid succulent karoo shrubland. The type collection is from Handelskraal, ENE of Loeriesfontein. It is a habitat specialist, occurring as localised subpopulations. It is a relatively unknown species from a poorly collected area where livestock grazing is abundant. There are no known threats to the species, although overgrazing could be considered. The species only flowers in October, thereby making identification out of season extremely difficult. The species was not recorded on site, but this is mainly due to seasonality and might not reflect a true absence.

*Hoodia gordonii* (Masson) Sweet ex Decne.

The species occurs in a wide variety of arid habitats from coastal to mountainous, also on gentle to steep shale ridges, found from dry, rocky places to sandy spots in riverbeds. It is a widespread species (EOO 850,000 km<sup>2</sup>) but has undergone decline since 2001 as a result of indiscriminate harvesting for its appetite suppressant properties. International and national demand was particularly high between 2004 and 2006 and as a result of the high economic value of this species (price range between R500 and R1200 per kilogram at this time); even remote areas of its distribution range are suspected to have been harvested. Unfortunately, data do not exist to quantify the degree of decline to the population and as this species is widespread and can be locally common it is not possible to estimate overall population decline. Research on population recovery post harvesting and degree of impact of the harvesting over the past 10 years is required before this species can be accurately assessed. As a result of a decrease in demand for Hoodia internationally and the strict enforcement of new legislation to protect this species wild harvesting has declined in South Africa (Raimondo *et al.*, 2008).

Within the study area, the species is not abundant, as less than five individuals have been recorded on site, with about another five individuals recorded in the surrounding area (Figure 4-2).



Figure 4-2: *Hoodia gordonii* recorded within the PAOI.

## 5 SENSITIVITY MAP

A preliminary sensitivity map was generated for the study area, where low sensitivity is considered ideal for development and high sensitive areas should be avoided (Figure 5-1). Only the watercourse habitat is considered highly sensitive. A small patch of unique species is also regarded as high sensitivity along with the location of *A. dichotomum* and a 200m buffer area around it, where no development should take place as the species should ideally be protected *in situ*. Some of the smaller tributaries may still be downgraded to lower sensitivity after mitigation measures have been implemented. This will also be done based on the findings of the aquatic biodiversity assessment. The final sensitivity map will be presented in the EIA phase of the project.

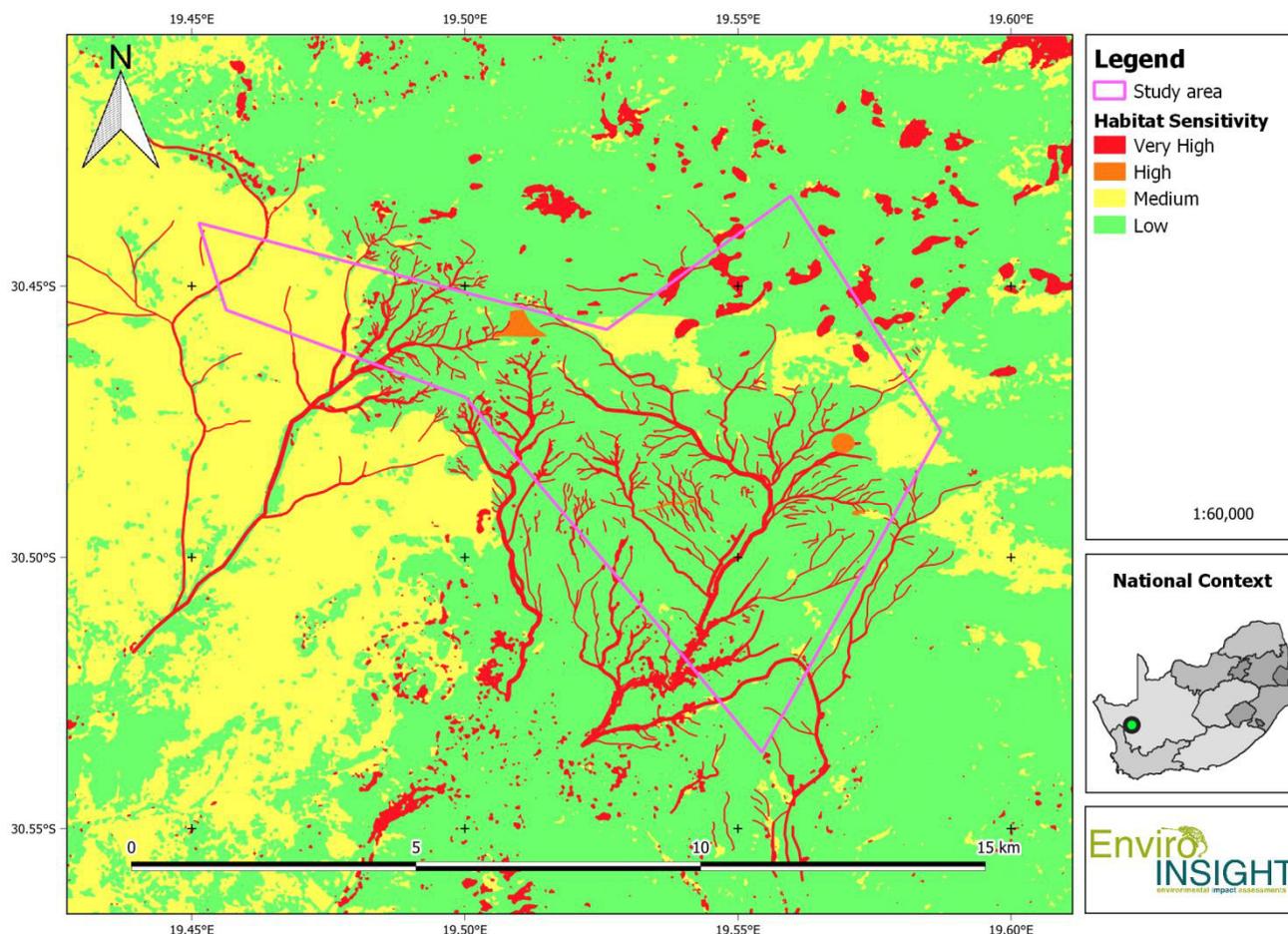


Figure 5-1: Preliminary Habitat sensitivity of the study area.

## 6 IMPACT ASSESSMENT

### 6.1 POTENTIAL IMPACTS

Potential impacts associated with the proposed development include:

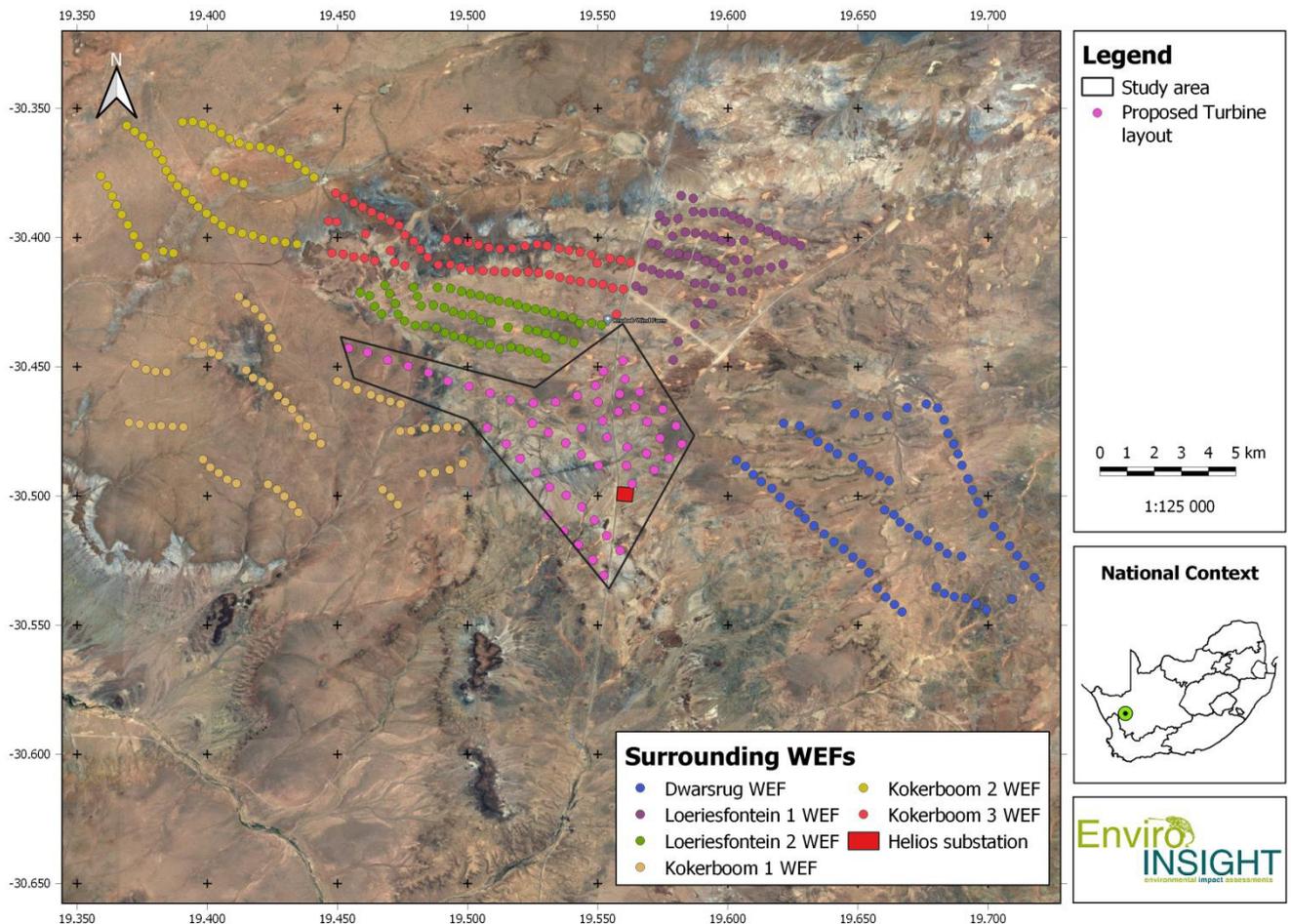
- Habitat loss due to placement of infrastructure,
- Habitat fragmentation,
- Reduced connectivity within the landscape,
- Loss of sensitive flora,
- Increased alien invasive plant species due to soil disturbance and movement during the construction phase,
- Reduced ecosystem functioning due to construction within watercourse, pans and other sensitive features,
- Animal mortality due to construction phase activities, and
- Increased erosion due to removal of vegetation.

Currently, no anticipated fatal flaws exist as avoidance is possible and where not, appropriate mitigation measures can reduce impacts to low levels. These impacts will be assessed in more detail during the EIA phase of the project.

## 6.2 CUMULATIVE IMPACTS

Where other renewable energy developments occur within the surrounding area of the proposed development, a cumulative impact assessment is required. This includes a general assessment of cumulative impact as well as an assessment of different potential cumulative impact sources and an indication of the size or extent of the identified cumulative impact. There is a large amount of existing and planned WEFs within the area, which raises the possibility of significant cumulative impacts (Figure 6-1). From this, a node of renewable energy development is developing around the Helios Substation. The large amount of development in the area would potentially generate significant cumulative impact in terms of habitat loss and potential disruption of landscape connectivity.

There are two existing WEFs towards the north and north-east of the study area, and one Solar Facility. The total extent of habitat loss from these developments is approximately 500ha. Another four WEFs and four solar PV projects have already obtained environmental authorisation and await the necessary approval as preferred bidders before construction can commence.



**Figure 6-1: DEA Renewable Energy Development (RED) registered projects for the area as at March 2021. The proposed Botterblom WEF is located between either existing or proposed renewable energy projects.**

Some of the main cumulative impacts of renewable energy developments in the region will include:

- Vegetation and habitat loss,
- Increased habitat fragmentation,
- Loss of critical habitat for flora SCC as well as endemic species,
- Loss of provincially protected species which require a permit,
- Surface water impacts and associated ecological processes,
- Increased erosion due to flooding (not a yearly event but longer term),
- Increased alien flora and fauna species.

A detailed assessment of cumulative impacts will be done during the EIA phase of the project.

## 7 CONCLUSION AND PROFESSIONAL OPINION

The study area is located within Bushmanland Basin Shrubland vegetation type, listed as Least Threatened, and intersects a CBA2 and ESA according to the Northern Cape CBA Map. This is mainly due to Freshwater ecosystem priority area quinary catchments, main rivers and FEPA Rivers and wetlands. These habitats should be avoided as far as possible and the appropriate mitigation measures should be in place to reduce impacts to acceptable levels.

The majority of the Botterblom WEF consist of shrubland with grassland patches on flat plains and gently sloping hills that are not considered sensitive. The watercourses and pans are considered sensitive and should be avoided during the construction period for placement of turbines, laydown areas and associated infrastructure. Roads and cables will cross watercourses, and the impacts can be mitigated by reducing it to acceptable levels since avoidance is not possible.

Large sections of the affected area are not considered sensitive and there are no specific features of the affected area which would indicate that it is of broad-scale significance for faunal movement or landscape connectivity. One individual of a sensitive species was recorded on site which should be protected *in situ* as it can be avoided by the proposed development. A 200m buffer has been placed around its location. For other provincially listed species which are affected by the proposed development, a permit application for their removal must be applied for with the provincial authority prior to development.

The impacts of the proposed development will be assessed in the EIA phase, and will follow the mitigation hierarchy where avoidance will be considered first. As there are limited sensitive features and only a few SCC, the study area is not considered a core area for protection of these, and by implementing the necessary measures large sections of the study area still remain suitable for development for the wind farm. The conditions to be included in the EMPr will also be addressed in the EIA report as well as the final sensitivity map overlaid with the final layout.

## 8 REFERENCES

- Fish, L., Mashau, A.C., Moeaha, M.J. and Nembudani, M.T. 2015. Identification guide to southern African grasses. Strelitzia 36. South African National Biodiversity Institute, Pretoria.
- Foden, W. 2018. *Aloidendron dichotomum* (Masson) Klopper & Gideon.F.Sm. National Assessment: Red List of South African Plants version 2020.1. Accessed on 2021/07/06.
- Foden, W., Midgley, G.F., Hughes, G., Bond, W.J., Thuiller, W., Hoffman, M.T., Kaleme, P., Underhill, L.G., Rebelo, A.G. and Hannah, L. 2007. A changing climate is eroding the geographical range of the Namib Desert tree Aloe through population declines and dispersal lags. Diversity and Distributions 13:645-653.
- Holness, S., & Oosthuysen, E. (2016). Critical Biodiversity Areas of the Northern Cape: Technical Report.
- Northern Cape Department of Environment and Nature Conservation. (2016). Northern Cape Critical Biodiversity Areas [Vector] 0. Available from the Biodiversity GIS [website](#).
- Northern Cape Department of Environment and Nature Conservation. 2016 Northern Cape Critical Biodiversity Areas Reason [Vector] 2016. Available from the Biodiversity GIS [website](#).
- Raimondo, D., Wynberg, R., Newton, D. & Victor, J.E. 2008. *Hoodia gordonii* (Masson) Sweet ex Decne. National Assessment: Red List of South African Plants version 2020.1. Accessed on 2021/07/06
- Raimondo, D., von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A. and Manyama, P.A. 2009. Red List of South African Plants. Strelitzia 25. South African National Biodiversity Institute, Pretoria.
- ReptileMAP. 2021. The Southern African Reptile Conservation Assessment (SARCA, now ReptileMAP). <http://vmus.adu.org.za/>.
- SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE (SANBI). 2020. *Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa*. South African National Biodiversity Institute, Pretoria. Version 1.2020.
- TODD, S. 2018 Fauna and Flora Specialist Basic Assessment Report: Acces road for the Dwarsrug WEF located Near to Loeriesfontein in the Northern Cape.
- Van Wyk, B.-E. and Smith, G. 2003. Guide to aloes of South Africa. (2nd ed.). Briza Publications, Pretoria.
- Victor, J.E., Ellis, R.P. & Fish, L. 2005. *Dregeochloa calviniensis* Conert. National Assessment: Red List of South African Plants version 2020.1. Accessed on 2021/07/06.

## APPENDIX A: GEOREFERENCED PHOTOGRAPHS



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## APPENDIX B: QUALIFICATIONS AND CV

### SACNASP professional certificate



# SACNASP

South African Council for Natural Scientific Professions

**herewith certifies that**

**Corné Niemandt**

Registration Number: 116598

**is a registered scientist**

in terms of section 20(3) of the Natural Scientific Professions Act, 2003  
(Act 27 of 2003)

in the following field(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)

Effective 13 December 2018

Expires 31 March 2022



*Botha*

Chairperson

*R. Prinsloo*

Chief Executive Officer



To verify this certificate scan this code

**SACNASP**  
South African Council for Natural Scientific Professions

herewith certifies that  
**Alexander Douglas Rebelo**

Registration Number: 124030

**is a registered scientist**

in terms of section 20(3) of the Natural Scientific Professions Act, 2003  
(Act 27 of 2003)

in the following field(s) of practice (Schedule 1 of the Act)

Zoological Science (Candidate Natural Scientist)

Effective 11 September 2019

Expires 31 March 2022



*Botha*

Chairperson

*M. J. ...*

Chief Executive Officer



To verify this certificate scan this code