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Appendix D1:
Terrestrial Biodiversity Assessment

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

JANUARY 2022

For

FE Botterblom (Pty) Ltd

PREPARED BY

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Professional Team

The technical team responsible for the Terrestrial Biodiversity Impact Assessment reporting is presented below.

Team member	Qualification	SACNASP	Role on project
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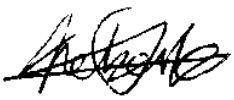
Specialist Declaration

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.

Sam Laurence *Pr. Sci. Nat.*

Corné Niemandt *Pr. Sci. Nat.*



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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 to 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.

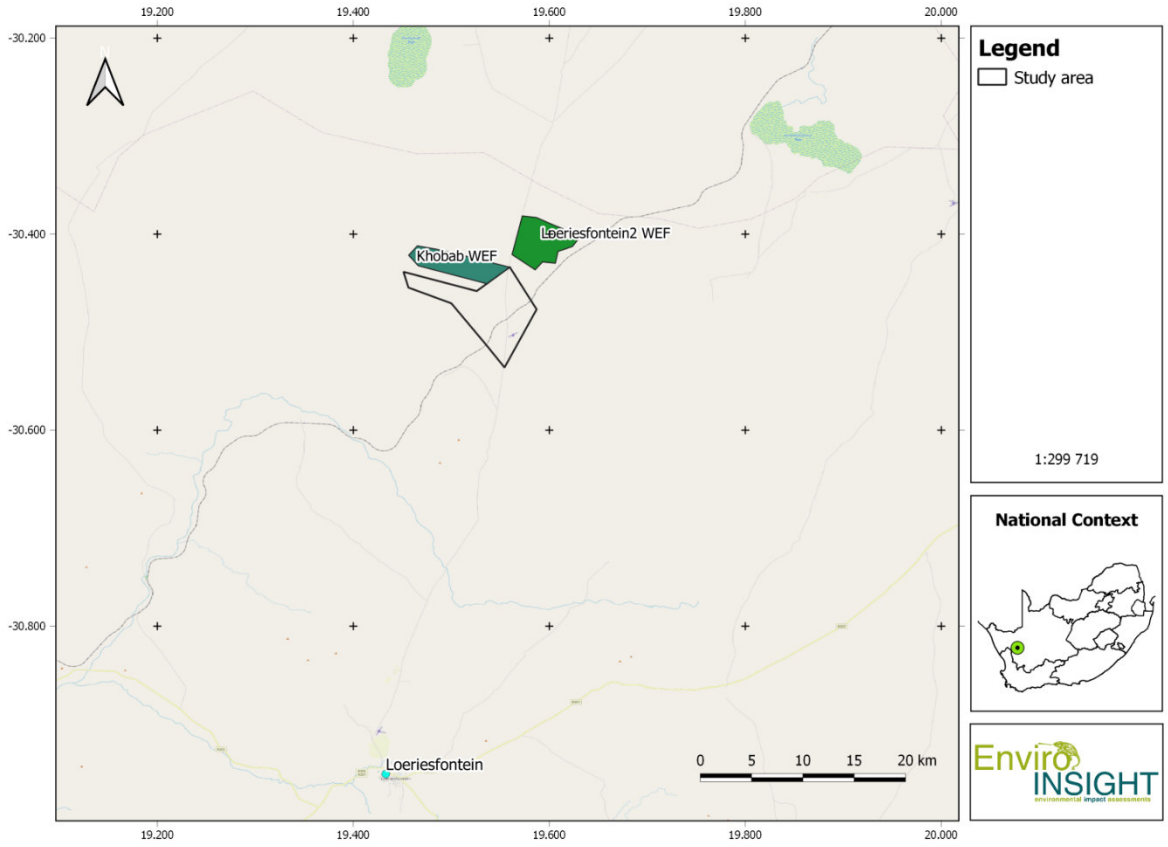

Figure 1-1: Location of the proposed Botterblom Wind Farm.

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)[1], 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.

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

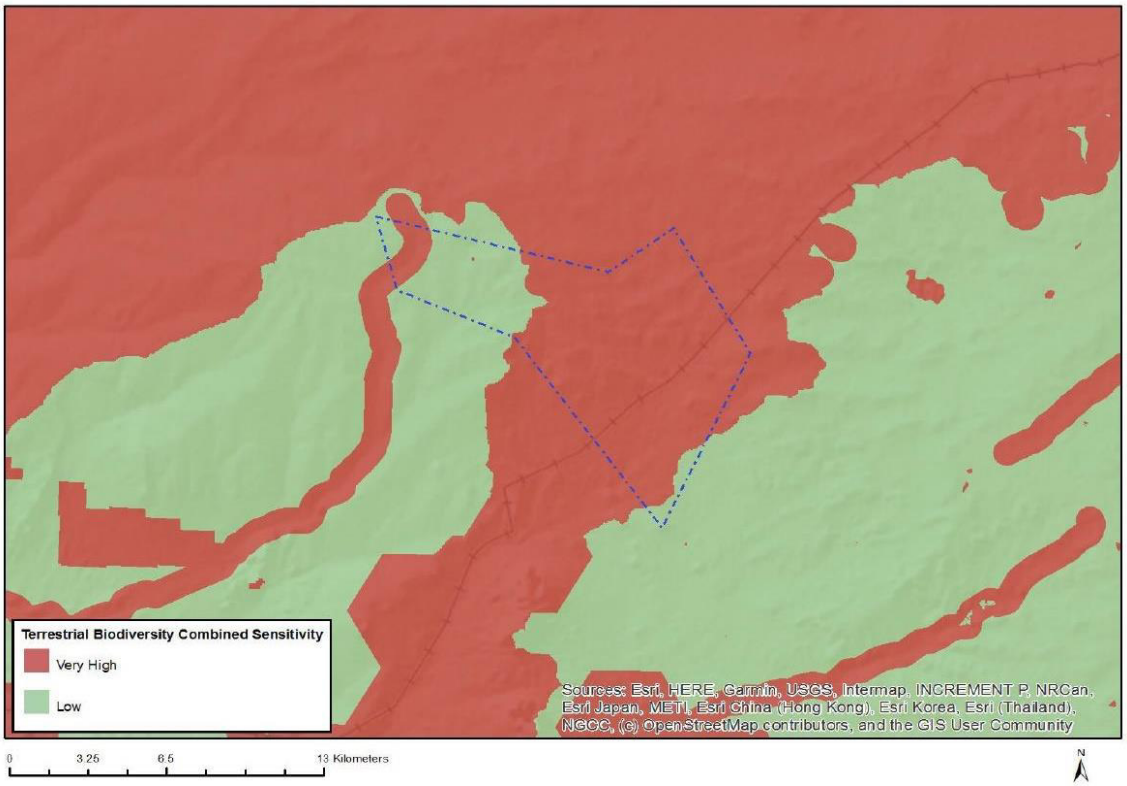

Figure 2-1: Screening Tool map of relative terrestrial biodiversity theme sensitivity.

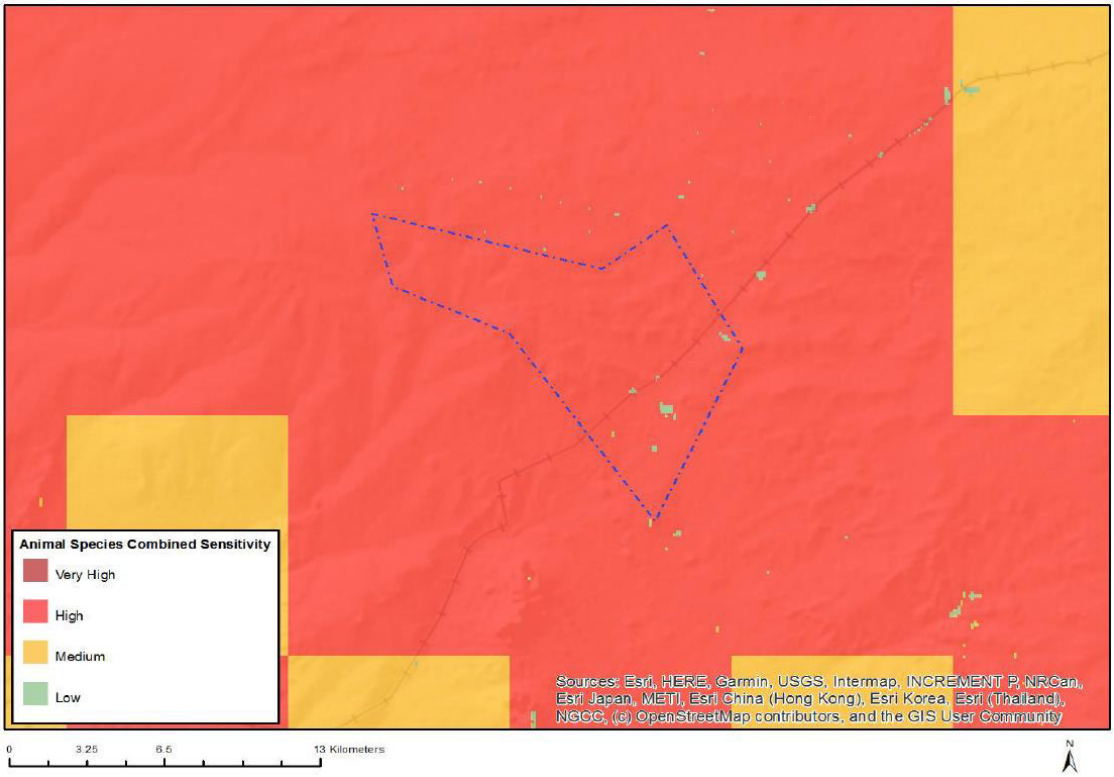

Figure 2-2: Screening Tool map of relative animal species theme sensitivity.

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).

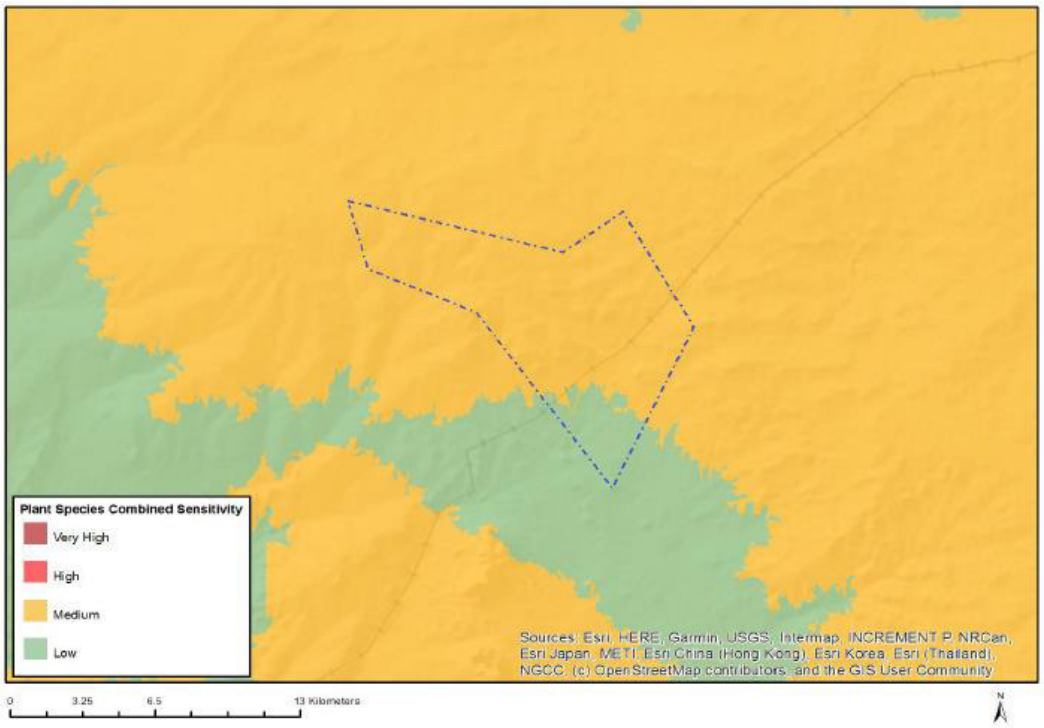

Figure 2-3: Screening Tool map of relative plant species theme sensitivity.

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)[2]; and
- National List of Threatened Ecosystems (SANBI, 2011).

All mapping was performed using open source GIS software (QGIS[3]).

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, watercourses, 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[4]); 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[5]), to access distribution records on southern African plants[6]. 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)[7] 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);
- Field guide to succulents of southern Africa (Smith *et al*. 2017);

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2 http://dea.maps.arcgis.com/apps/MapTools/index.html?appid=2367540dd75148e8b6eaeab178a19d3a
3 http://qgis.osgeo.org/en/site/
4 https://earthexplorer.usgs.gov/
5 http://newposa.sanbi.org/
6 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)
7 http://redlist.sanbi.org/

- 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.

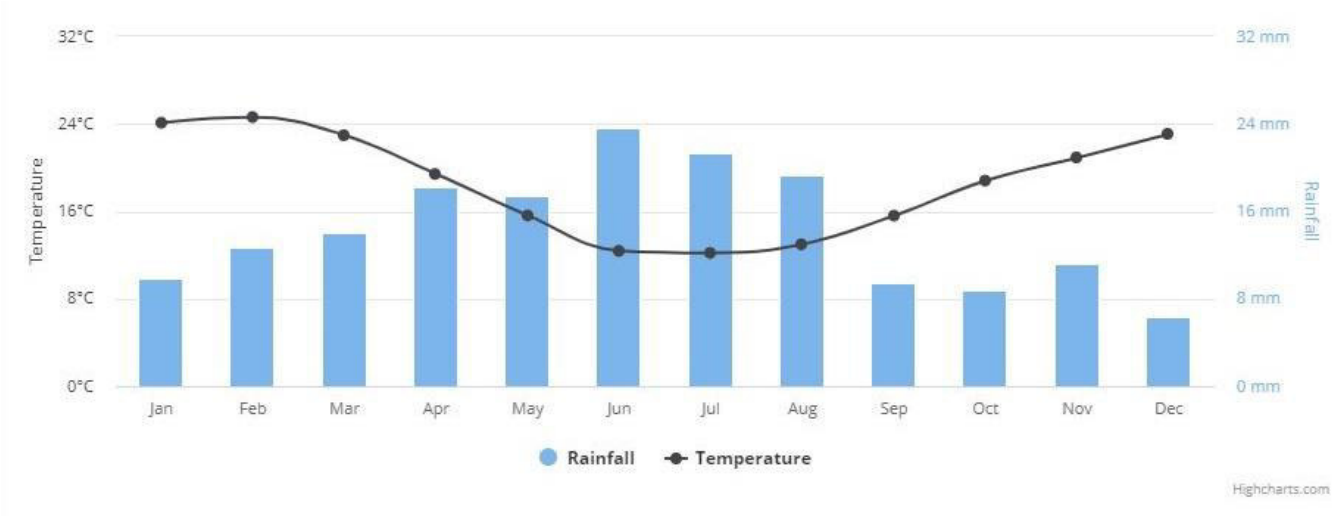

Figure 2-4: Average monthly temperature and rainfall for the watershed in which the study area is located for the period of 1991-2016 [8].

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.

[8] 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).

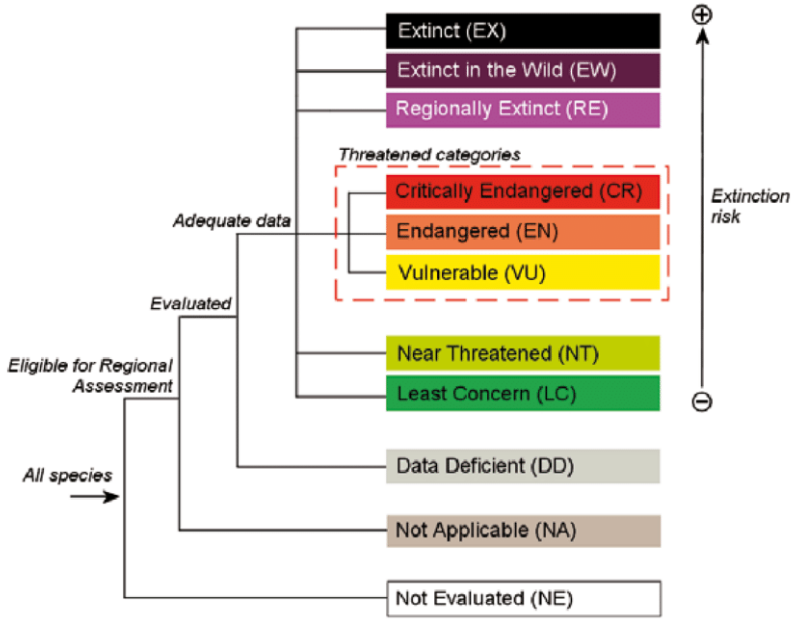

Figure 2-5: Schematic representation of the structure of the IUCN Red List Categories (IUCN 2012).

2.6 IMPACT ASSESSMENT

Once a potential impact has been determined it is necessary to identify which project activity will cause the impact, the probability of occurrence of the impact, and its magnitude and extent (spatial and temporal). This information is important for evaluating the significance of the impact, and for defining mitigation and monitoring strategies. Direct and indirect implications of the impacts identified during the specialist investigations were assessed in terms of five standard rating scales to determine their significance.

The rating system used for assessing impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on six criteria, namely:

- **Status** of impacts (
- Table 2-1) – determines whether the potential impact is positive (positive gain to the environment), negative (negative impact on the environment), or neutral (i.e. no perceived cost or benefit to the environment). Take note that a positive impact will have a low score value as the impact is considered favourable to the environment;
- **Spatial extent** of impacts (Table 2-2) – determines the spatial scale of the impact on a scale of localised to global effect. Many impacts are significant only within the immediate vicinity of the site or within the surrounding community, whilst others may be significant at a local or regional level. Potential impact is expressed numerically on a scale of 1 (site-specific) to 5 (global);
- **Duration** of impacts (Table 2-2) – refers to the length of time that the aspect may cause a change either positively or negatively on the environment. Potential impact is expressed numerically on a scale of 1 (project duration) to 5 (permanent);
- **Frequency of the activity** (Table 2-2)– The frequency of the activity refers to how regularly the activity takes place. The more frequent an activity, the more potential there is for a related impact to occur.
- **Severity** of impacts (Table 2-2) – quantifies the impact in terms of the magnitude of the effect on the baseline environment, and includes consideration of the following factors:
    - The reversibility of the impact;
    - The sensitivity of the receptor to the stressor;
    - The impact duration, its permanency and whether it increases or decreases with time;
    - Whether the aspect is controversial or would set a precedent;
    - The threat to environmental and health standards and objectives;
- **Probability** of impacts (Table 2-2) –quantifies the impact in terms of the likelihood of the impact occurring on a percentage scale of <5% (improbable) to >95% (definite).
- **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge:
    - Low;
    - Medium; or
    - High.

In addition, each impact needs to be assessed in terms of reversibility and irreplaceability as indicated below:

- **Reversibility** of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):
    - High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);
    - Moderate reversibility of impacts;
    - Low reversibility of impacts; or

  - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).
- **Irreplaceability** of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):
  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Table 2-1: Status of Impacts

Rating	Description	Quantitative Rating
Positive	A benefit to the receiving environment (positive impact)	+
Neutral	No determined cost or benefit to the receiving environment	N
Negative	At cost to the receiving environment (negative impact)	-

Determination of Impact Significance

The information presented above in terms of identifying and describing the aspects and impacts is summarised below in Table 2-2 and significance is assigned with supporting rational.

Table 2-2: Consolidated Table of Aspects and Impacts Scoring

Spatial Scale	Rating	Duration	Rating	Severity	Rating
Activity specific	1	One day to one month	1	Insignificant/non-harmful	1
Area specific	2	One month to one year	2	Small/potentially harmful	2
Whole site/plant/mine	3	One year to ten years	3	Significant/slightly harmful	3
Regional/neighbouring areas	4	Life of operation	4	Great/harmful	4
National	5	Post closure	5	Disastrous/extremely harmful	5

Frequency of Activity	Rating	Probability of Impact	Rating
Annually / Once-off	1	Almost never/almost impossible	1
6 monthly	2	Very seldom/highly unlikely	2
Monthly	3	Infrequent/unlikely/seldom	3
Weekly	4	Often/regularly/likely/possible	4

Daily / Regularly	5	Daily/highly likely/definitely	5

Significance Rating of Impacts	Timing
Very Low (1-25)	
Low (26-50)	Pre-construction
Low – Medium (51-75)	Construction
Medium – High (76-100)	Operation
High (101-125)	Decommissioning
Very High (126-150)	

The environmental significance rating is an attempt to evaluate the importance of a particular impact, the consequence and likelihood of which is assessed by the relevant specialist. The description and assessment of the aspects and impacts is presented in a consolidated table with the significance of the impact assigned using the process and matrix detailed below.

The sum of the first three criteria (spatial scope, duration and severity) provides a collective score for the consequence of each impact. The sum of the last two criteria (frequency of activity and frequency of impact) determines the likelihood of the impact occurring. The product of consequence and likelihood leads to the assessment of the significance of the impact (Significance = Consequence X Likelihood), shown in the significance matrix below in Table 2-3.

Table 2-3: Significance Assessment Matrix.

Consequence (Severity + Spatial Scope + Duration)															
Likelihood (Frequency of Activity + Probability of Impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	08	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 2-4: Positive and Negative Impact Mitigation Ratings.

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very High	126-150	Avoidance – consider alternatives	Optimal contribution from Project
	High	101-125	Avoidance as far as possible; implement strict mitigation measures to account for residual impacts	Positive contribution from Project with scope to improve
	Medium-High	76-100	Where avoidance is not possible, consider strict mitigation measures	Moderate contribution from Project with scope to improve
	Low-Medium	51-75	Mitigation measures to lower impacts and manage the project impacts appropriately	Improve on mitigation measures
	Low	26-50	Appropriate mitigation measures to manage the project impacts	Improve on mitigation measures; consider alternatives to improve on
	Very Low	1-25	Ensure impacts remain very low	Consider alternatives to improve on

The model outcome is then assessed in terms of impact certainty and consideration of available information. Where a particular variable rationally requires weighting or an additional variable requires consideration the model outcome is adjusted accordingly.

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 [9]); and
- the most recent satellite imagery (courtesy of Google Corporation).

2.8 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.

[9] https://earthexplorer.usgs.gov/

- 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 a extremely remote part of the country where limited surveys have been conducted, data is underrepresented for this area.

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	-
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^2) of the full extent of the Vegetation Type	34690.68
Name of the Biome	Nama-Karoo
Name of Bioregion	Bushmanland Bioregion

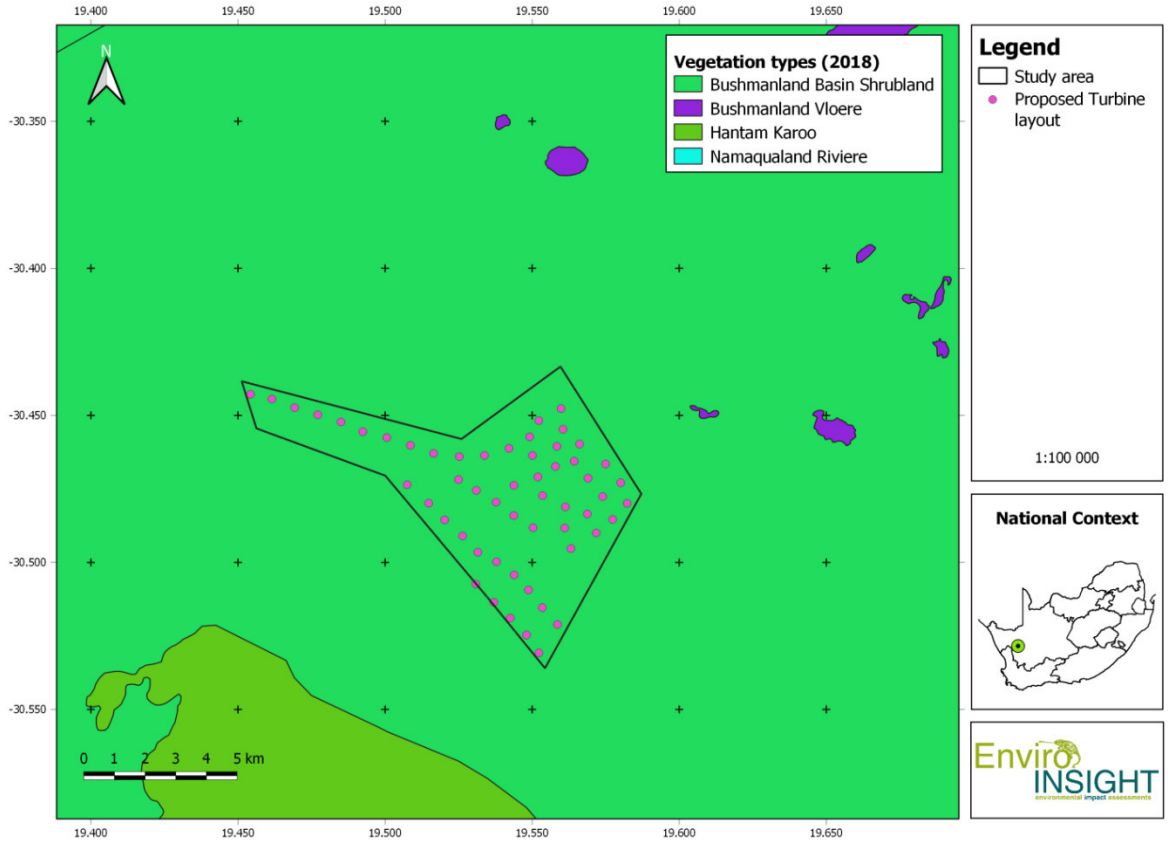

Figure 3-1: Regional vegetation types in relation to the study area (SANBI, 2018).

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 e 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 though the site. The ESA towards the western section is the Leeuwberg 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.

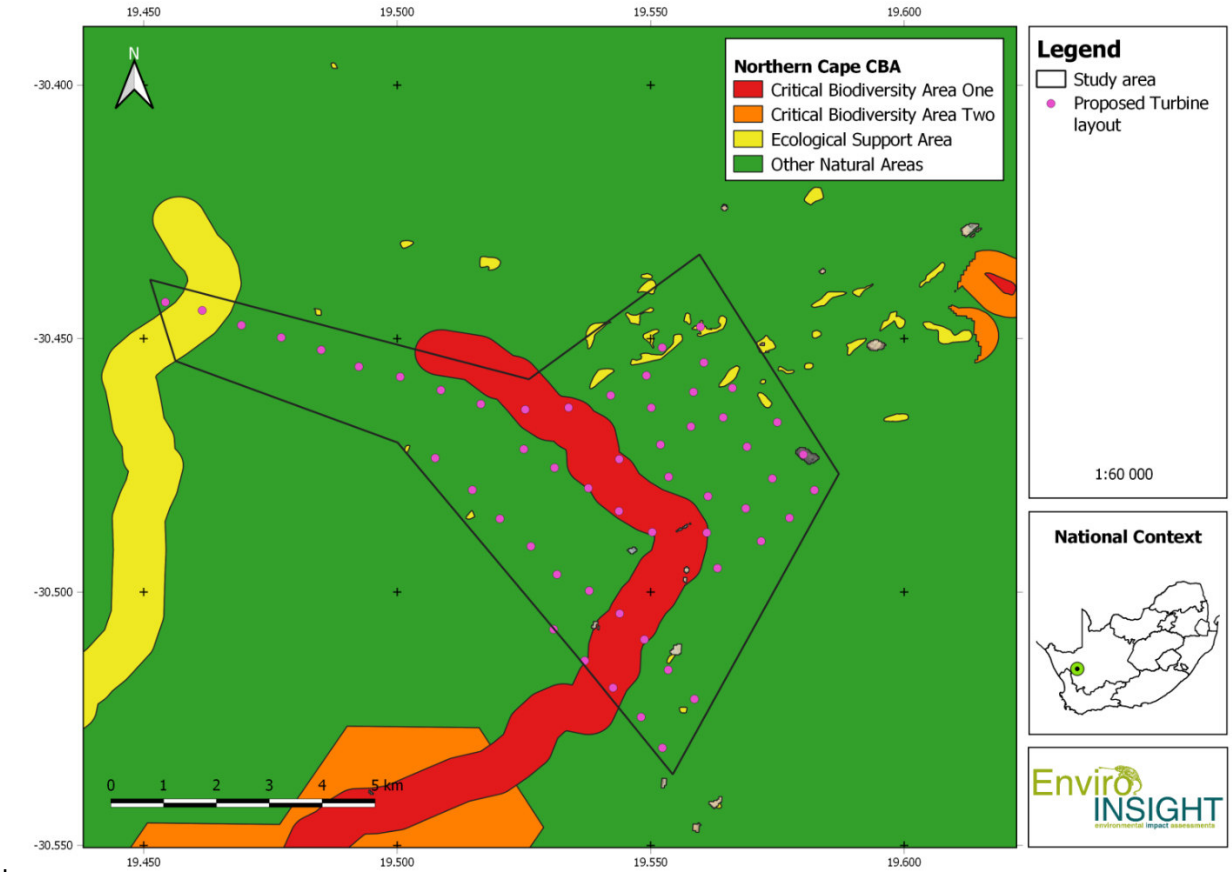

Figure 3-2: The study area in relation to the Northern Cape Critical Biodiversity Areas (2016).

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 flamingos.

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).

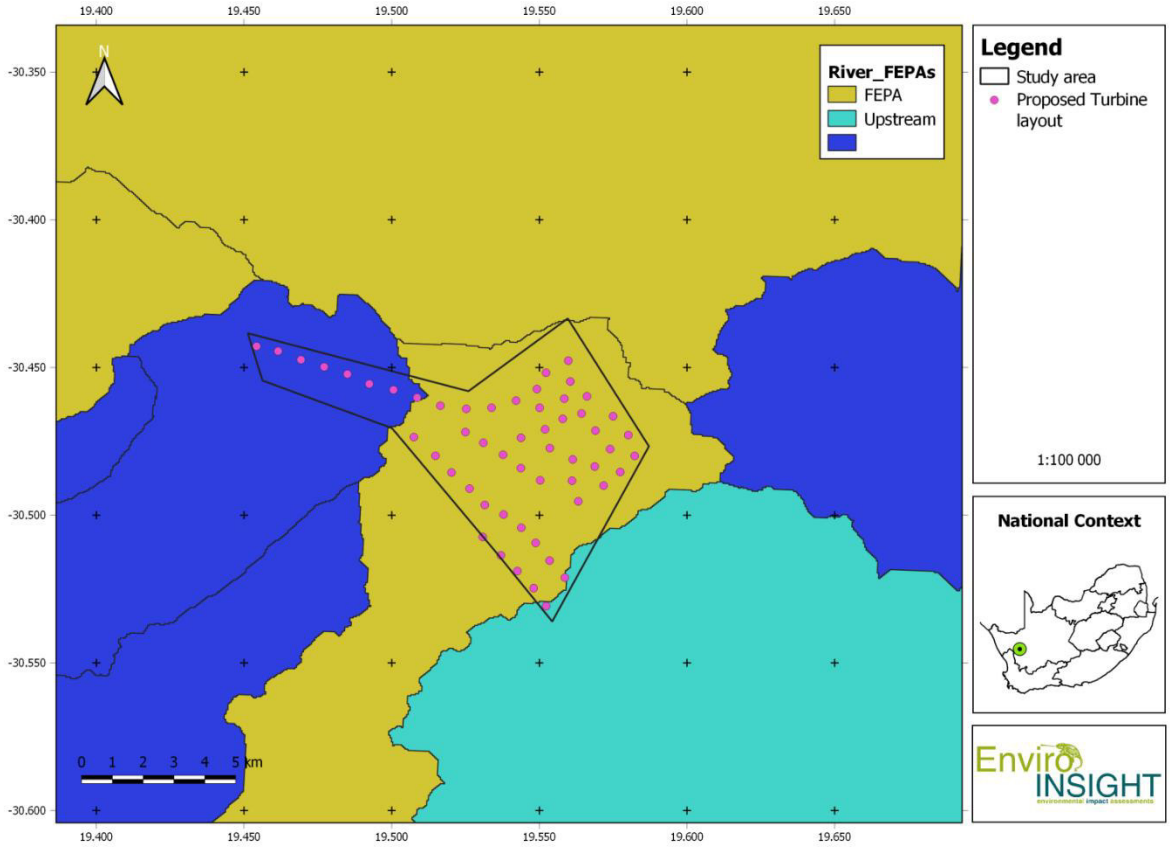

Figure 3-3: Freshwater Ecosystem Priority Areas

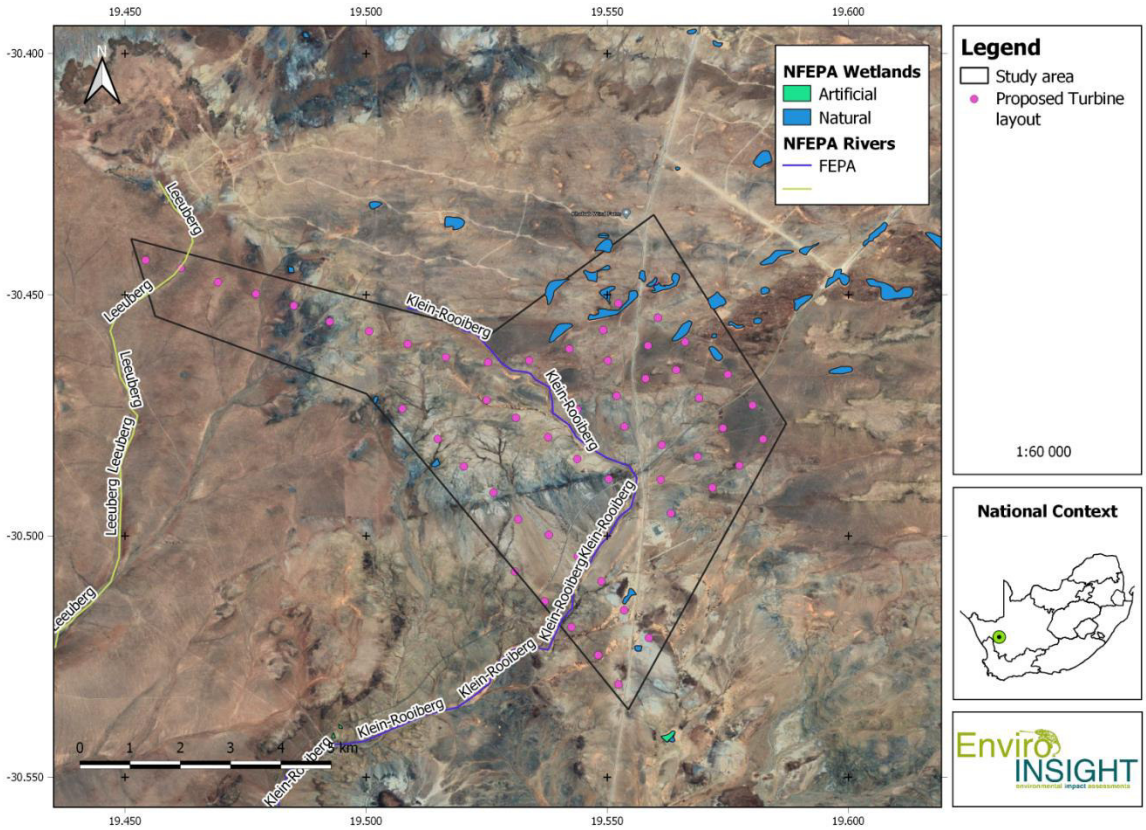

Figure 3-4: FEPA Rivers and wetlands.

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.

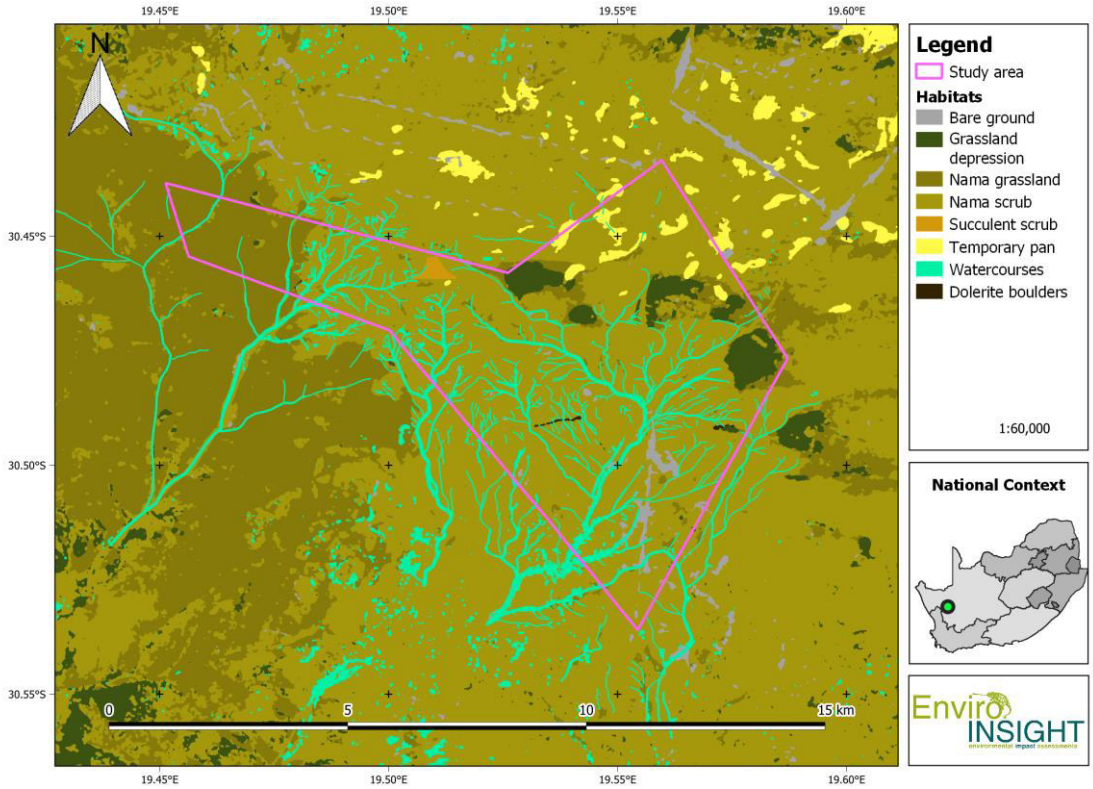

Figure 3-5: Habitats identified for the study area.

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 karooicus, 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 the 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 relies 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 adscenionis*, shrubs including *Lycium pumilum, Aptosimum spinescence, Plinthus karooicus, Salsola tuberculate,* 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

4.1 NATIONAL SENSITIVE SPECIES

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 highlighted in bold were recorded during this survey.

Species	National Status	Provincially Protected	Endemic to (1) South Africa or (2) Northern Cape	Observed or likely to occur within the study area
***Aloidendron dichotomum* (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.**
Dregeochloa calviniensis Conert	Rare		1 and 2	Low probability – was recorded approximately 52km SE of the study area
***Hoodia gordonii* (Masson) Sweet ex Decne.**	**Data Deficient - Insufficient Information**	**Yes**	**No**	**Observed within the study area and on neighbouring properties.**
Wahlenbergia divergens 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) which is not impacted on by the proposed layout. The species will be protected *in situ* as per the Provincial gazette No 968 of 1 April 2005 in terms of the Nature and Environmental Conservation Ordinance, 1974 (Ordinance No. 19 of 1974) which prohibits the harvesting of this species.

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 km²) 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, and less than five individuals have been recorded on site, with about another five individuals recorded in the surrounding area (Figure 4-2). Where the proposed development requires the removal or destruction of the species, the necessary permit from the Provincial Department for its relocation is required.

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

4.2 PROVINCIALLY PROTECTED SPECIES

In addition to the above species, there are several provincially protected species under the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) that occur on the study area which require permits for their removal from the Provincial Department. Prior to construction activities, all individuals of these species that will be directly impacted on by the proposed development, needs to be enumerated and marked with a GPS. A permit application for their relocation needs to be submitted to the Northern Cape Department Agriculture, Environmental Affairs, Rural Development and Land Reform and the necessary species needs to be removed or relocated prior to the commencement of construction activities.

Provincially protected species include:

Schedule 1 species:

- *Hoodia gordonii*
- *Aloidendron dichotomum*
- *Sutherlandia spp.*
- *Pelargonium spp.*

Schedule 2 species:

- All species within the Aizoaceae family, which includes *Ruschia, Mesembryanthemum crystallinum, Drosanthemum spp., Stomatium mustelinum,*
- All species within the Amaryllidaceae family, including *Boophone haemanthoides*
- All species within the Anacampserotaceae family, including *Anacampseros* spp., Avonia spp.
- All species within the Oxalidaceae family, including *Oxalis* spp.,
- All species within the Apocynaceae family, including *Larryleachia cactiformis, Microloma sagittatum*, *Tridentea jucunda*,
- All species within the Asphodelaceae family, including all *Aloe* spp. (except those listed in Schedule 1), *Gonialoe variegata*.

5 IMPACT ASSESSMENT

The development of the Botterblom WEF is likely to result in a variety of impacts, associated largely with the disturbance and transformation of intact vegetation and faunal habitat to hard infrastructure such as turbine foundations and associated infrastructure such as service areas, access roads, operations buildings, and laydown areas.

The overall impacts associated with the current layout of the proposed Botterblom WEF as well as the "no-go alternative" will be assessed to evaluate the significance of the "as predicted" ecological impacts (prior to mitigation) and the "residual" ecological impacts (that remain after mitigation measures are considered). The following impacts are identified as the major impacts that are likely to be associated with the development and which will be assessed during the EIA phase for the construction and operational phases of the development.

5.1 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. Theses impacts are assessed and discussed in more detail below.

5.2 PLANNING AND DESIGN PHASE:

No direct, indirect or cumulative ecological impacts have been identified for the Planning and Design Phase of the proposed Botterblom WEF because no tangible alterations to the environment will occur within the proposed site during this phase, although the current layout plan shows turbines and infrastructure within Critical Biodiversity Areas and is therefore not entirely consistent with the land use guidelines. The CBA classification is triggered by the presence of NFEPA watercourses.

Furthermore, the placement of turbines in sensitive areas such as the location of the quiver tree and associated buffer area must be excluded from development.

5.3 CONSTRUCTION PHASE:

Impact 1: Habitat Loss and Fragmentation

The habitats within the proposed study area and those of the surrounding areas form part of a functional ecosystem. An ecosystem can be defined as “a dynamic complex of animal, plant and micro-organism communities and their non-living environment interacting as a functional unit” (Ecosystem Environmental Assessment Guideline Draft, 5 July 2021). The functional component or ecological functioning can be defined as “the roles, or functions, that species (of plants, animals, and microbes) and the effects of their activities (e.g., feeding, growing, moving, excreting waste etc.) play in the community or ecosystem in which they occur. In this approach, physiological, anatomical, and life history characteristics of the species are emphasised. The term "function" is used to emphasize certain physiological processes rather than discrete properties, describe an organism's role in a trophic system, or illustrate the effects of natural selective processes on an organism” (Ecosystem Environmental Assessment Guideline Draft, 5 July 2021). Considering the interactions between living and the non-living component of the environment requires an understanding of the processes that drive these interactions. These processes are crucial for maintaining healthy ecosystems and supporting the long-term persistence of biodiversity. Ecological processes include, amongst others, population abundance, range shifts (e.g. season or long-term migration), community structure and species turnover, trophic interactions, pollination, invasive species, shrub expansion/loss, forest expansion/loss, fire (frequency, severity, timing, extent), pathogens, pest outbreaks, acidification, succession, nutrient cycling, herbivory, phenology, and primary productivity/biomass. Various anthropological, atmospheric, biogeochemical, geomorphic, hydrological, and oceanographic processes also exist, but these are not ecological in nature.

The proposed Botterblom WEF is not located in a threatened ecosystem and is located in the Bushmanland Basin Shrubland vegetation type which has a status of least concern. There is a CBA1 and ESA located on the property which should be excluded from development, where possible. This will not be possible for all linear activities (roads and grid connections), but the turbine placement, laydown areas and other permanent structures must not be placed within these areas.

The proposed development will require vegetation clearing for turbines, roads and other hard infrastructure, which will also impact on faunal habitat. This is usually accompanied by the loss of food sources and/or shelter but may also include the loss of sensitive features including wetlands, breeding habitat and rocky outcrops. It must be noted that only portions of vegetation on the study area will be transformed and not the entire property. Accordingly, habitat fragmentation will be higher compared to habitat loss. Furthermore, the cumulative impacts for this vegetation unit will be high due to existing wind farms in the area (two existing, one approved for construction and another four who has approved environmental authorisations but not yet received preferred bidder status). In addition, there is a solar farm being constructed and several mines within the area which increases the cumulative impact on vegetation clearing.

Sensitive features must be avoided during the construction phase. In order to minimise the loss of vegetation and faunal habitat, several mitigation measures are proposed. Prior to mitigation the impact is considered High, which can be reduced to low-medium after the application of appropriate mitigation.

Table 5-1: Impacts associated with Habitat Loss and Fragmentation.

Nature: Habitat Loss and Fragmentation during construction phase.

	Without mitigation	With mitigation
Spatial Scale	3	2
Duration	4	2
Severity	5	4
Probability	5	4
Frequency of Activity	4	3
Significance	**108 (High)**	**56 (Low – Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially	Partially
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	To an extent - vegetation loss will have to occur for the development to proceed.	
Residual Impacts: Minor. Once the construction ceases and the mitigation measures are implemented limited residual impacts are expected as the loss of vegetation can only be restored through rehabilitation efforts, and even then, the species composition and richness could be altered.		

Proposed mitigation measures:

- Placement of turbines within the High Sensitivity areas and drainage lines should be avoided.
- Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.
- Minimise the development footprint as far as possible.
- Rehabilitate disturbed areas that are no longer required by the operational phase of the development. Inadequate rehabilitation could result in limited revegetation and/or an invasion of alien vegetation which will result in long term ecological degradation and damage.
- A Rehabilitation Management Plan must be developed and implemented during the construction phase as construction is complete at each site.
- The number of roads should be reduced to the minimum possible and routes should also be adjusted to avoid areas of high sensitivity as far as possible. Where possible, existing roads must be used to avoid additional habitat loss and fragmentation.
- Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However, caution should be exercised to avoid using material that might entangle fauna.
- An Environmental Control Officer (ECO) must be employed to monitor the clearing of vegetation for the construction of roads and hardstands.

Impact 2: Loss of species of conservation concern (SCC), including national and provincial protected species and protected trees.

Apart from the direct loss of vegetation within the development footprint, listed SCC will be impacted on. The nationally protected *Aloidendron dichotomum* was recorded on site, as well as several provincially protected species. The development must avoid *A. dichotomum,* and where the turbines and associated infrastructure are located the necessary permits for their removal or relocation is required prior to the commencement of construction activities.

Prior to mitigation the impact is considered high, which can be reduced to low-medium after the application of appropriate mitigation.

Table 5-2: Loss of species of conservation concern.

***Nature:* Loss of species of conservation concern.**		
	Without mitigation	**With mitigation**
Spatial Scale	3	3
Duration	4	4
Severity	5	3
Probability	5	3
Frequency of Activity	4	3
Significance	**High (108)**	**Low - Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	No	Yes
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes - avoidance is the best approach.	
Residual Impacts: If areas are avoided and the necessary permits are obtained for species removal, there should be no residual impacts.		

Proposed mitigation measures:

- A comprehensive Plant Search and Rescue must be undertaken by a suitably qualified botanical specialist prior to vegetation clearance.
- All relevant plant permits must be obtained from the provincial authority prior to the removal or relocation of SCC, including provincially protected species.
- Plant SCC (excluding *A. dichotomum* which must be protected *in situ*) found within the proposed site must either be housed in an onsite nursery for use during rehabilitation or be relocated to suitable areas where vegetation clearance will not occur.
- Demarcate sensitive species with the appropriate buffers which must be excluded from development activities. A 200m buffer is applied to *A. dichotomum.*

Impact 3: Alien and invasive plant species

The disturbance associated with the construction phase of the project could see an increase of alien invasive plant species at disturbed areas. Some alien plant invasion is inevitable and regular alien plant clearing activities would be required to limit

the extent of this problem. Once the natural vegetation has returned to the disturbed areas through rehabilitation efforts post-construction, the site will be less susceptible to alien plant invasion. Roadsides and turbine service areas will remain focal points of alien plant invasion for the project's operational duration, and likely during the decommissioning phase. This impact would manifest towards the end of the construction phase, and accordingly the required measures to reduce this impact are required early on.

Prosopis sp. are the only dominant alien invasive plant in the study area which is confined to watercourses. A few individuals may occur in the larger study area. The removal of these individuals will have a positive outcome by improving the indigenous biodiversity as there will be less competition and more favourable habitat for indigenous fauna.

Table 5-3: Alien and invasive plant species.

Nature: **Alien and invasive plant species.**		
	Without mitigation	**With mitigation**
Spatial Scale	3	3
Duration	5	5
Severity	4	2
Probability	4	3
Frequency of Activity	4	2
Significance	**High (96)**	**Low (50)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Possibly	Unlikely
Can impacts be mitigated?	Yes	
Residual Impacts: Minor - some residual impact is likely as the containment of alien invasive species are never 100% possible.		

Proposed mitigation measures:

- A site-specific Alien Invasive Species (AIS) Management Plan must be implemented during the construction phase and continued monitoring and eradication needs to take place throughout the life of the project.
- Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site.
- The development footprints and immediate surroundings should be monitored for the growth/regrowth of alien vegetation throughout the construction and operation phases of the project.

Impact 4: Increased risk of erosion and flash floods

Disturbance created during construction would leave the site vulnerable to wind and water erosion. Soil disturbance associated with the development such as earth works, laying foundations, and expansion of roads, will render the impacted

areas vulnerable to soil erosion, especially when crossing watercourses. Appropriate measures to limit erosion will need to be implemented. This impact is mainly limited to the construction phase and could persist into the operational phase.

Table 5-4: Increased risk of erosion and flash floods.

Nature: **Increased risk of erosion and flash floods.**		
	Without mitigation	**With mitigation**
Spatial Scale	3	3
Duration	3	2
Severity	4	2
Probability	4	3
Frequency of Activity	4	2
Significance	**Medium – High (80)**	**Low (35)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially	With appropriate mitigation the impact can be ameliorated
Irreplaceable loss of resources?	Possible	No
Can impacts be mitigated?	Yes	
Residual Impacts: *Some level of erosion is currently visible on site. Accordingly, only impacts from the development should be mitigated and rehabilitated.*		

Proposed mitigation measures:

- Soil erosion and Rehabilitation Plan to be part of the EMPr.
- The clearance of vegetation, at any given time, must be kept to a minimum to reduce the possibility of soil erosion.
- Rehabilitation of eroded areas on a regular basis during the construction period.
- All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.

Impact 5: Disturbances or displacement impacts on fauna including traffic, noise and dust

The construction of the proposed Botterblom WEF and associated infrastructure will result in an increase in noise and dust within the proposed site and surrounds. Roads are known to alter the physical characteristics of the environment and it is possible that numerous species within the proposed site will be affected by the increase in noise and dust to some extent.

Species which is most likely to be impacted by the increase in noise and dust levels water associated. Increased dust levels alter wetlands and watercourses which could affect the feeding and breeding of species within these areas.

Fauna vary in the degree to which they can tolerate such disturbances and the increase in noise and dust could potentially have adverse impacts on various faunal groups. Increased noise and motor vibrations in wetland areas could also impact amphibian breeding choruses, but these impacts will be localised and many amphibian species are surprisingly tolerant of vehicle noise. Noise pollution will occur during all phases of development (construction, operational, and de-commissioning/closure).

Table 5-5: Disturbances or displacement impacts on fauna including traffic, noise and dust

Nature: Disturbances or displacement impacts on fauna including traffic, noise and dust.		
	Without mitigation	**With mitigation**
Spatial Scale	3	2
Duration	4	3
Severity	4	2
Probability	5	3
Frequency of Activity	4	2
Significance	**Medium-High (99)**	**Low (35)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Possible	No
Can impacts be mitigated?	Yes	
Residual Impacts: Minor - collision with animals are likely, but the number of collisions can be significantly reduced.		

Proposed mitigation measures:

- Ground clearing and the digging of trenches should ideally take place at the end of the dry season, prior to the first rains in order to minimise the impacts of dust.
- Newly cleared and exposed areas must be managed for dust and landscaped with indigenous vegetation to avoid soil erosion. Where necessary, temporary stabilisation measures must be used until vegetation establishes.
- Speed restrictions (40 km per hour is recommended) should be in place to reduce the amount of dust caused by vehicle movement along the roads, and to reduce possible fauna fatalities with vehicle collisions.
- Driving around in the area as well as noise levels at night should be limited, as should the use of harsh lights which could cause light pollution for nocturnal species.
- Where appropriate, sound dampeners must be used.
- Avoid the presence of people and vehicles in highly sensitive areas as far as possible.
- Fences should be constructed in such a way so that burrowing animals can still gain access.

- Strict measures should be put into place to prevent workers from poaching and hunting naturally occurring fauna.

5.4 OPERATIONAL PHASE:

Impact 1: Direct faunal impacts due to operation

Operational phase has a longer duration (approximately 15 years) in comparison to the construction phase (approximately 12-18 months). The most negative and significant impacts will likely be the displacement and/or disturbance of fauna communities. Fences around the proposed WEF, if not fauna-friendly, may limit fauna movement and dispersal. Importantly, mitigation measures should be put in place to assure that ecological flow and genetic exchange is not interrupted or fragmented by the infrastructure.

Additionally, the presence of human and vehicle-movements through the area (associated with maintenance movements) has the potential to negatively affect the fauna community, especially during the night-time when most fauna species are active and can get killed by moving vehicles. However due to the short duration of these impacts and especially if mitigation measures are implemented, this is considered to be a low-significance impact.

Table 5-6: Direct faunal impacts due to operation.

Nature: Direct faunal impacts due to operation.		
	Without mitigation	**With mitigation**
Spatial Scale	2	2
Duration	4	4
Severity	3	2
Probability	4	2
Frequency of Activity	3	2
Significance	**Low-Medium (63)**	**Low (32)**
Status (positive or negative)	Negative	Negative
Reversibility	The impact will persist for the lifespan of the facility	The impact will persist for the lifespan of the facility
Irreplaceable loss of resources?	Possible	No
Can impacts be mitigated?	Yes	
Residual Impacts: Minor. Residual impact from the wind turbines and general disturbance will persist		

Proposed mitigation measures:

- reduce the presence of human activity on the project area as far as possible by only focusing on the areas where operational tasks are required,
- avoid the presence of people and vehicles in highly sensitive areas as far as possible,
- no unauthorised persons should be allowed onto the site,

- any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location,
- lower the levels of noise whenever possible and avoid the destruction or disturbance of identified important features,
- The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except by individuals with the appropriate permits,
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill,
- fences should be constructed in such a way so that burrowing animals can still gain access, which will allow other animals to also utilise the holes dug under fences to increase connectivity in the area.

Impact 2: Alien and invasive plant species

The clearance of vegetation associated with the development of the Botterblom WEF and associated infrastructure will create open patches which are likely to be colonised by pioneer plant species. While this is partly a natural revegetation/regeneration process, which would ultimately lead to the re-establishment of secondary vegetation cover, it also favours the establishment of alien species.

Table 5-7: Alien and invasive plant species.

***Nature:* Alien and invasive plant species.**		
	Without mitigation	**With mitigation**
Spatial Scale	3	3
Duration	4	4
Severity	4	2
Probability	4	2
Frequency of Activity	4	2
Significance	**Medium - High (88)**	**Low (36)**
Status (positive or negative)	Negative	Negative
Reversibility	With appropriate mitigation the impact can be ameliorated	With appropriate mitigation the impact can be ameliorated
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	Yes	
Residual Impacts: *Minor - the impact can be successfully controlled and managed, but it is not always 100% effective.*		

Proposed mitigation measures:

- The site-specific AIS Management Plan must be implemented for the first year of the operational phase. Thereafter, alien vegetation must continue to be monitored and eradicated annually throughout the life of the project.
- Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as Prosopis are already present in the area and are likely to increase rapidly if not controlled.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.
- Alien vegetation, within the development footprints, should be removed from the site and disposed of at a registered waste disposal site.

5.5 DECOMISSIONING PHASE

When the wind farm reaches the end of its lifespan, all machinery and related installations must be dismantled and removed, and the site should, as far as is reasonably possible, be restored to its original condition. It is only if the developer decides to extend the life of the wind farm and repowering the site, that only the top section of the turbines (mainly the blades and operating mechanism) must be replaced. As decommissioning of large-scale wind farms in South Africa are new, the regulatory framework and impacts associated with this phase are based on assumptions. Perhaps the most important assumption is that decommissioning a wind farm is straight forward and simple, compared to the problems associated with decommissioning a nuclear power station, or a coal or gas fired plant. The major issue is not the physical removal but rather the disposal of the used parts. Where possible, all recyclable materials must be repurposed in an environmentally friendly way.

It is expected that the dismantling of turbines and associated infrastructure can lead to disturbance of fauna community, in all ways similar to that resulting from the construction phase. The ecological impacts associated with the decommissioning phase will be similar to those listed in the construction phase and the associated mitigations measures must be updated and implemented to reduce potential adverse impacts.

The dismantling of the project will eventually contribute to the removal of all the implemented structures; accordingly, this may be considered a positive impact.

5.6 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 5-1). From this, a node of renewable energy development is developing around the Helios Substation. The large amount of renewable energy developments 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.

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.

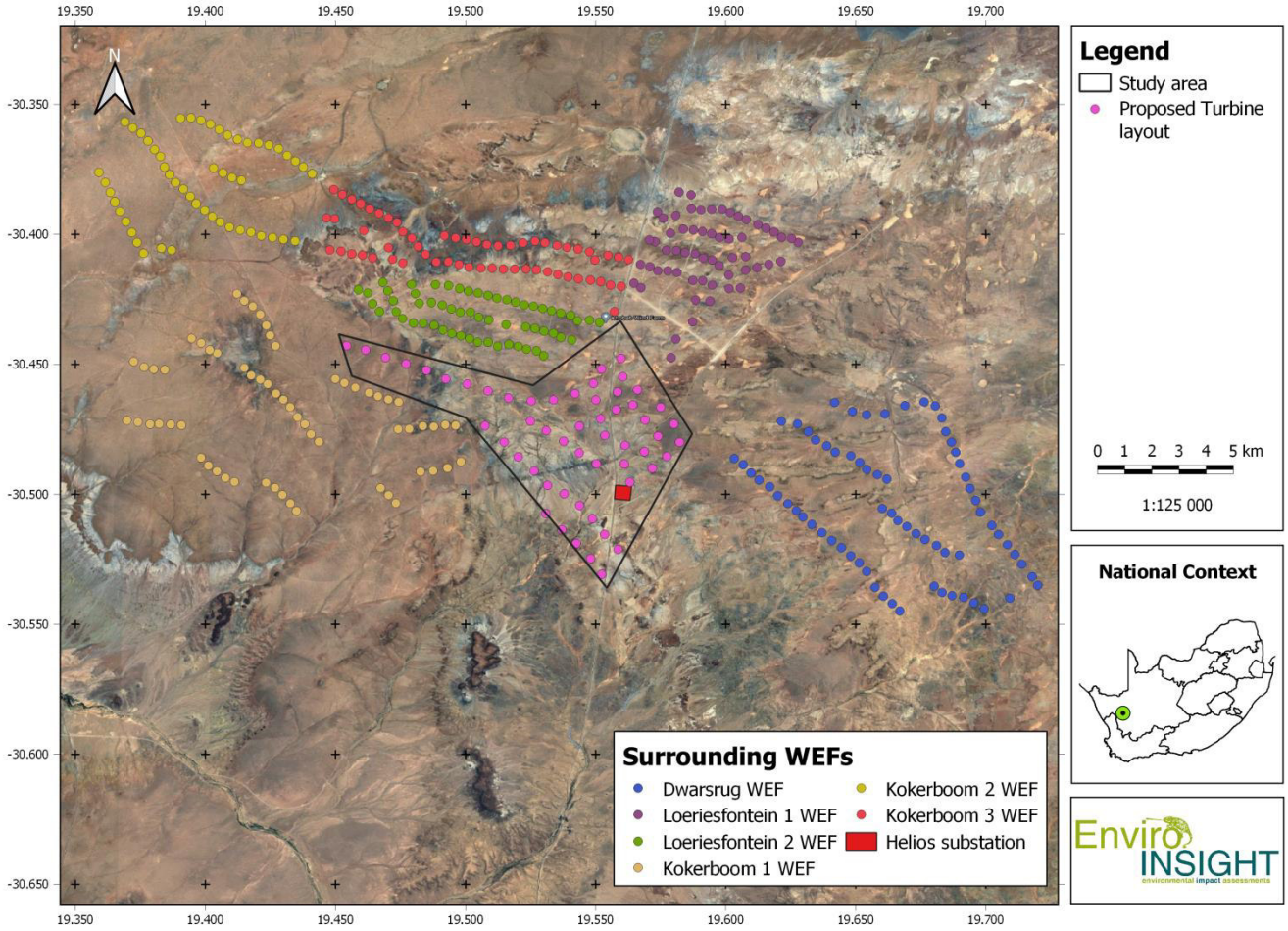

Figure 5-1: DEA Renewable Energy Development (RED) registered projects for the area as of 2021. The proposed Botterblom WEF is located between either existing or proposed renewable energy projects.

6 SENSITIVITY MAP

A sensitivity map was generated for the study area, where low sensitivity is considered ideal for development and highly sensitive areas should be avoided (Figure 6-1). 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.

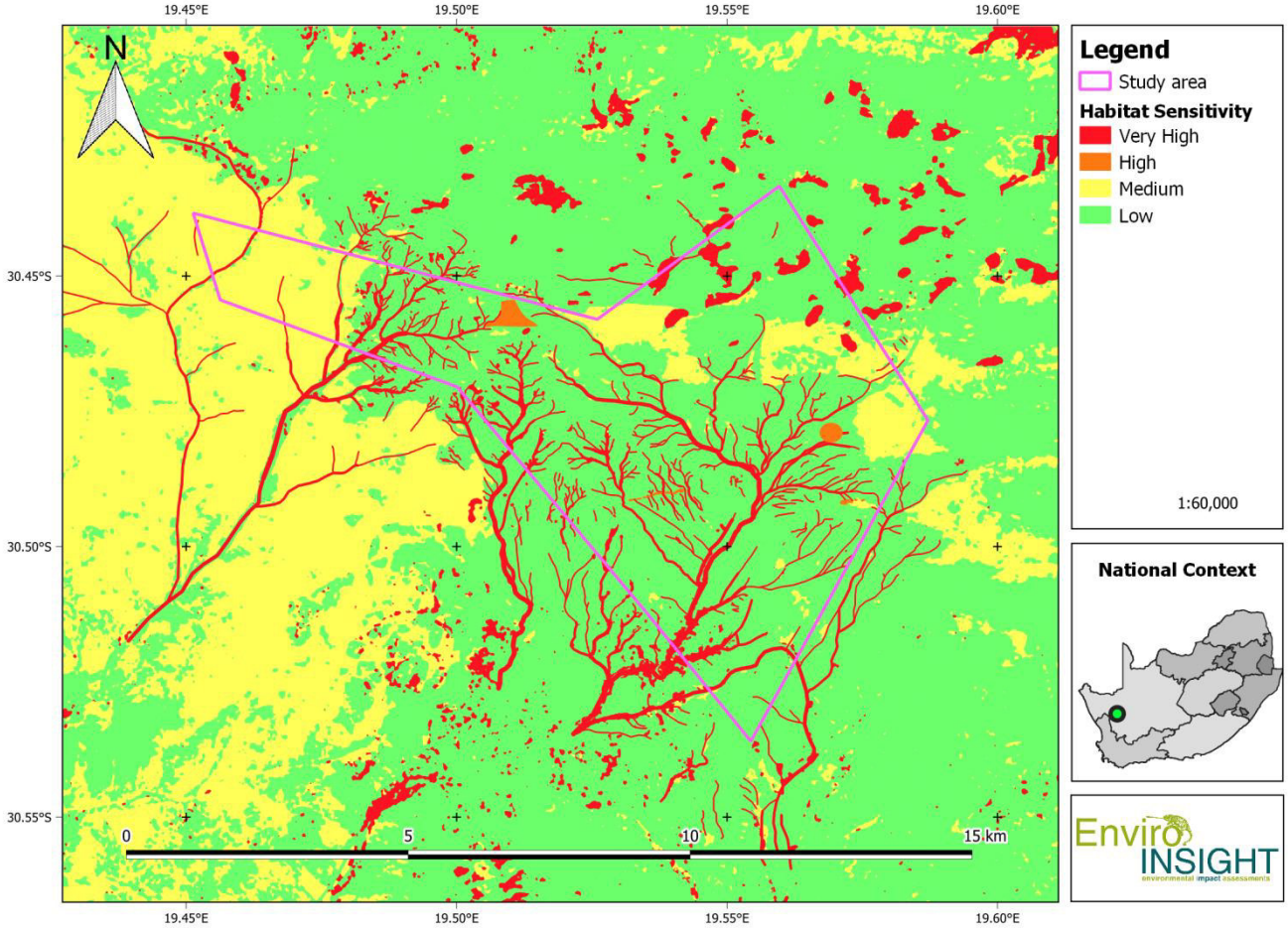

Figure 6-1: Habitat sensitivity of the study area.

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 the commencement of construction activities.

Several wind energy developments has and are being developed around the Helios Substation, the intensity of development in the wider area is still low. The affected area is 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. Although there are two existing wind farms and several more applications in the area, the total extent of habitat loss due to wind energy is currently less than 200ha and with all applications would still be less than 1000ha and this is not considered significant in context of the affected vegetation types, which are among the more extensive in the country.

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APPENDIX A: GEOREFERENCED PHOTOGRAPHS


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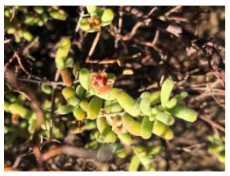
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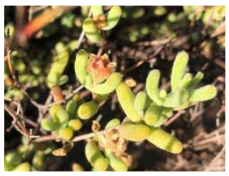
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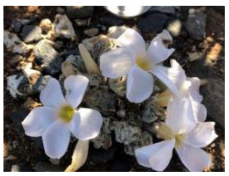
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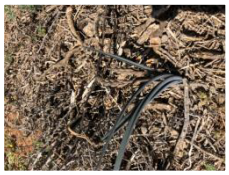

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APPENDIX B: QUALIFICATIONS AND CV

SACNASP professional certificate

SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Samuel David Laurence

Registration number: 400450/13

is registered as a

Professional Natural 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 I of the Act)

Zoological Science	20 November 2013
Ecological Science	20 November 2013

COPY

20 November 2013
Pretoria

President

Executive Director

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 fields(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)

Effective **13 December 2018** Expires **31 March 2022**

Chairperson

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 fields(s) of practice (Schedule 1 of the Act)

Zoological Science (Candidate Natural Scientist)

Effective **11 September 2019** Expires **31 March 2022**

Chairperson

Chief Executive Officer

To verify this certificate scan this code