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Kareekloof PVSEF

Terrestrial Biodiversity

Scoping Report

31 August 2023

for

Cape EAPrac

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Disclaimer by specialists

We,

		
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declare, that the work presented in this report is our own and has not been influenced in any way by the developer or the Environmental Assessment Practitioner (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 (*Pr. Sci. Nat. Zoological Science)* for developing this specialist report.

EXECUTIVE SUMMARY

To be provided in the final EIA 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.

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.

Ecosystem: a dynamic complex of animal, plant and micro-organism communities and their non-living environment interacting as a functional unit

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.

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.

Rehabilitation: in the context of EIA, this means the repairing of a habitat/ecosystem so that processes and productivity remain functional, but it does not specifically imply that the original condition of the habitat/ecosystem will be restored.

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].

Taxon: (plural taxa) a taxonomic group of any rank, such as a species, family, or class.

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

The proposed Kareekloof Photovoltaic Solar Energy Facility (PVSEF) and associated infrastructure which includes the BESS, covers an area of ~3720 ha, has a proposed generation capacity of up to 800 MW, is located ~14 km southeast of Potfontein in the Northern Cape Province (Figure 1-1) and is not situated within a Renewable Energy Development Zone (REDZ). Enviro-Insight was commissioned to perform the required pre-construction terrestrial biodiversity studies as part of the Environmental Authorisation (EA) application process. This document is the Scoping Report for the terrestrial biodiversity component of the Environmental Impact Assessment (EIA) required as part of the process to obtain environmental authorisation (EA) for the proposed development.

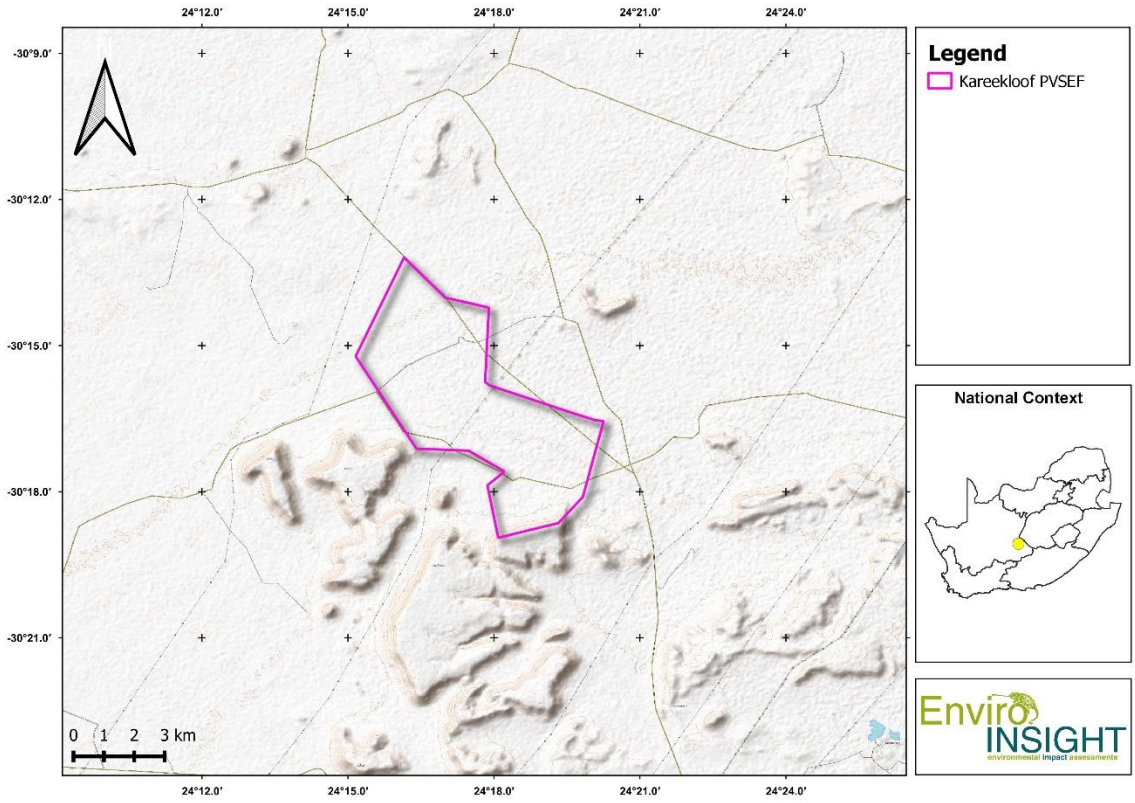

Figure 1-1. Location of the proposed Kareekloof PVSEF to be developed.

1.2 LEGAL CONTEXT & STUDY GUIDANCE

- This report addresses the Terrestrial Biodiversity Theme of the Scoping Phase of the Environmental Impact Assessment report (EIAr) required for the environmental authorisation process for a proposed development;

- General guidance for the implementation of the above-mentioned protocol is drawn from SANBI (2020).

1.3 SCREENING TOOL REPORT

The Screening Tool Report (STR) produced by the National Environmental Screening Tool[1] (generated on 10 August 2023) indicated a **Very High** Terrestrial Biodiversity Theme Sensitivity for the Kareekloof PVSEF project area, due to the presence of an Ecological Support Area (ESA) (Figure 1-2).

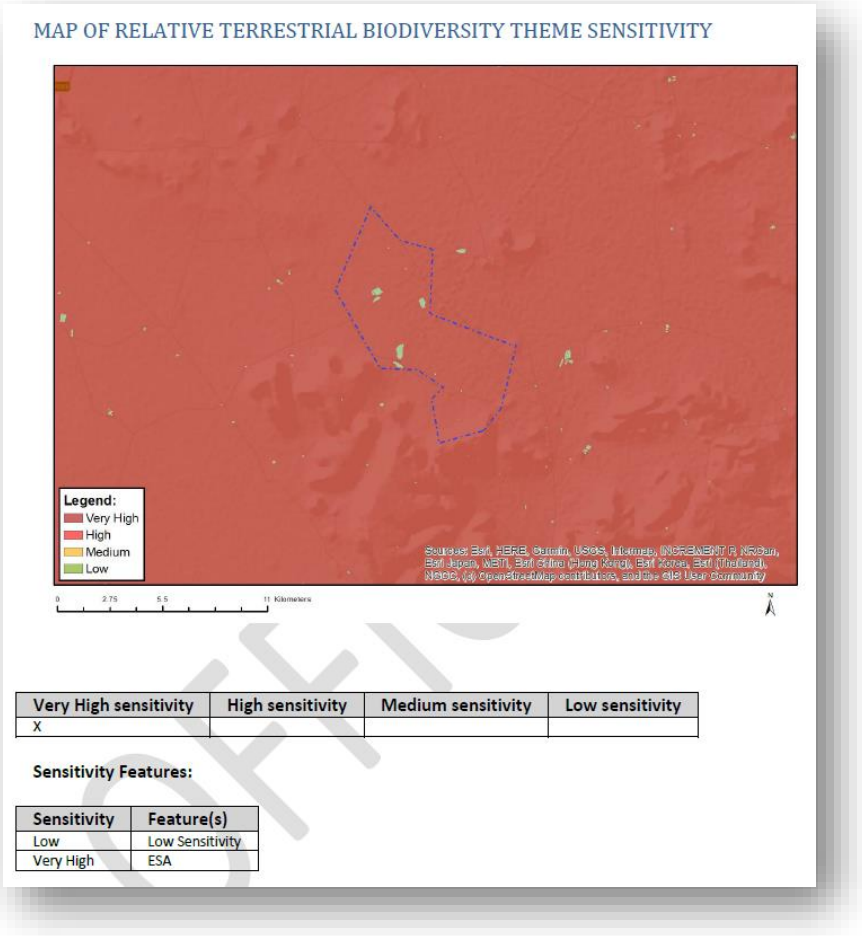

Figure 1-2. Terrestrial Biodiversity Theme Sensitivities of the Kareekloof PVSEF project area indicated by the National Screening Tool.

[1] https://screening.environment.gov.za/screeningtool/

2 METHODS

2.1 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. 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.

Site verification was undertaken in August 2023. The peak rain period for this area is from December to April. However, much rain had fallen just prior to the site visit. Habitat inspections and georeferenced photography was coupled with existing knowledge bases to evaluate the sensitivity assigned to the Terrestrial Biodiversity Theme.

2.2 DESKTOP SURVEY

2.2.1 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[a]);
- Northern Cape Critical Biodiversity Areas Reason (Northern Cape Department of Environment and Nature Conservation, 2016[b]);
- Protected and Conservation areas of South Africa (South Africa Protected Areas Database-SAPAD; South Africa Conservation Areas Database-SACAD)[2]; and
- Red List of Ecosystems (RLE) for terrestrial realm (SANBI, 2022).

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

2.2.2 Habitat mapping

The existing national landcover classification was used to assist with the identification of habitat types during the initial surveys. Furthermore, a drainage and aquatic habitat map was obtained from the aquatic specialist. These were pre-emptively buffered by 100 m to include the more prominent marginal vegetation. Finally, a digital elevation model (DEM) was obtained for the area and a slope analysis was performed to delineate sensitive rocky habitats. Slopes of > 7° were considered steep enough in this region to constitute potentially sensitive rocky habitats and these were buffered by 30 m.

2.3 FIELD SURVEYS

A single site visit was undertaken in August 2023. The timing of the survey represented winter conditions following recent rains. During the field surveys performed, the habitats were evaluated while driving and on foot and a series of georeferenced

[2] http://dea.maps.arcgis.com/apps/MapTools/index.html?appid=2367540dd75148e8b6eaeab178a19d3a
[3] http://qgis.osgeo.org/en/site/

photographs were taken of the habitat attributes. The field surveys focused on a classification of the observed flora, habitats as well as the actual and potential presence of species of conservation concern (either classified as Threatened by the IUCN (2022), protected by NEMBA (2007, as amended) or indeed other legislations applicable provincially or nationally). The coverage of the Kareekloof PVSEF project area was excellent and all habitats could be accessed (Figure 2-1).

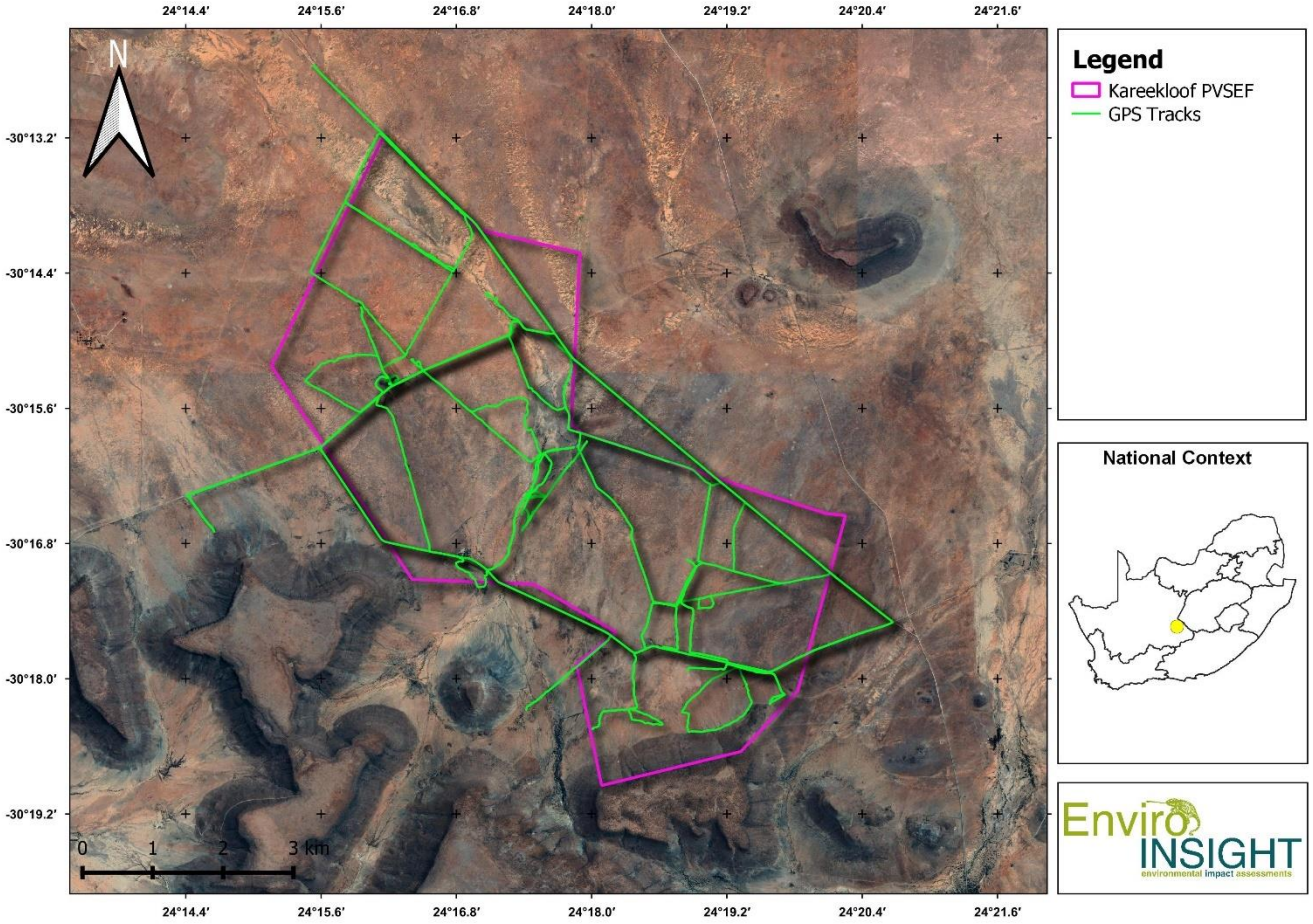

Figure 2-1: Specialist coverage of the Kareekloof PVSEF project area during August 2023.

2.4 SPECIES OF CONSERVATION CONCERN

The extinction risk status categories defined by the IUCN (Figure 2-2), 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).

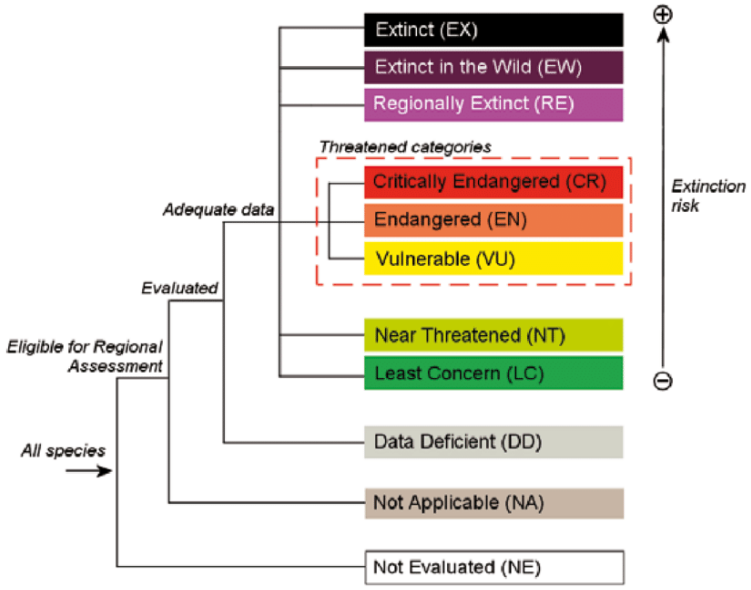

Figure 2-2: Schematic representation of the structure of the IUCN Red List Categories (IUCN 2012).

2.5 IMPACT ASSESSMENT

The following impact assessment methodology will be followed for the EIA phase of the project. SANBI (2020) cautions that assessing impacts by assigning numerical rankings that are then mathematically combined is not the preferred manner to evaluate impacts, and may frequently lead to erroneous evaluations. Care must therefore be taken when interpreting such evaluations. The Mitigation Hierarchy Guideline for South Africa which offers appropriate guidance to determine impact significance is still in development and therefore cannot be implemented here. As such, the "traditional" method of evaluating impacts is followed in lieu of an accepted published alternative.

2.5.1 Definitions of terminology

ITEM	DEFINITION
EXTENT	
Local	Extending only as far as the boundaries of the activity, limited to the site and its immediate surroundings
Regional	Impact on the broader region
National	Will have an impact on a national scale or across international borders

DURATION	
Short-term	0-5 years
Medium- Term	5-15 years
Long-Term	>15 years, where the impact will cease after the operational life of the activity
Permanent	Where mitigation, either by natural process or human intervention, will not occur in such a way or in such a time span that the impact can be considered transient.
MAGNITUDE OR INTENSITY	
Low	Where the receiving natural, cultural or social function/environment is negligibly affected or where the impact is so low that remedial action is not required.
Medium	Where the affected environment is altered, but not severely and the impact can be mitigated successfully and natural, cultural or social functions and processes can continue, albeit in a modified way.
High	Where natural, cultural or social functions or processes are substantially altered to a very large degree. If a negative impact then this could lead to unacceptable consequences for the cultural and/or social functions and/or irreplaceable loss of biodiversity to the extent that natural, cultural or social functions could temporarily or permanently cease.
PROBABILITY	
Improbable	Where the possibility of the impact materialising is very low, either because of design or historic experience
Probable	Where there is a distinct possibility that the impact will occur
Highly Probable	Where it is most likely that the impact will occur
Definite	Where the impact will undoubtedly occur, regardless of any prevention measures
SIGNIFICANCE	
Low	Where a potential impact will have a negligible effect on natural, cultural or social environments and the effect on the decision is negligible. This will not require special design considerations for the project
Medium	Where it would have, or there would be a moderate risk to natural, cultural or social environments and should influence the decision. The project will require modification or mitigation measures to be included in the design
High	Where it would have, or there would be a high risk of, a large effect on natural, cultural or social environments. These impacts should have a major influence on decision making.
Very High	Where it would have, or there would be a high risk of, an irreversible negative impact on biodiversity and irreplaceable loss of natural capital that could result in the project being environmentally unacceptable, even with mitigation. Alternatively, it could lead to a major positive effect. Impacts of this nature must be a central factor in decision making.
STATUS OF IMPACT	
Whether the impact is positive (a benefit), negative (a cost) or neutral (status quo maintained)	
DEGREE OF CONFIDENCE IN PREDICTIONS	

The degree of confidence in the predictions is based on the availability of information and specialist knowledge (e.g. low, medium or high)
MITIGATION
Mechanisms used to control, minimise and or eliminate negative impacts on the environment and to enhance project benefits Mitigation measures should be considered in terms of the following hierarchy: (1) avoidance, (2) minimisation, (3) restoration and (4) off-sets.

2.5.2 Scoring System for Impact Assessment Ratings

To comparatively rank the impacts, each impact has been assigned a score using the scoring system outlined in the Table below. This scoring system allows for a comparative, accountable assessment of the indicative cumulative positive or negative impacts of each aspect assessed.

IMPACT PARAMETER	SCORE	
Extent (A)	**Rating**	
Local	1	
Regional	2	
National	3	
Duration (B)	**Rating**	
Short term	1	
Medium Term	2	
Long Term	3	
Permanent	4	
Probability ©	**Rating**	
Improbable	1	
Probable	2	
Highly Probable	3	
Definite	4	
IMPACT PARAMETER	**NEGATIVE IMPACT SCORE**	**POSITIVE IMPACT SCORE**
Magnitude/Intensity (D)	**Rating**	**Rating**
Low	-1	1
Medium	-2	2
High	-3	3
SIGNIFICANCE RATING (F)	**Rating**	**Rating**
Low	0 –o - 40	0 to 40
Medium	- 41 –o - 80	41 to 80
High	- 81 –o - 120	81 to 120
Very High	> - 120	> 120

2.6 STUDY LIMITATIONS

- It is assumed that all third-party information acquired is correct (e.g. GIS data and scope of work).
- Avifauna assessments are not part of this assessment and is dealt with under the relevant theme.
- Due to the nature of most biophysical studies, it is not always possible to cover every square metre of a given study area.

3 TERRESTRIAL BIODIVERSITY RESULTS

The results are presented according to the requirements for undertaking SSV 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). To simplify this, each required aspect is indicated in Table 3-1 below, and where triggered it is discussed in more detail in the sections below.

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

Environmental Theme Aspect	Triggered for proposed activities	Section in report
Vegetation unit (SANBI 2018)	Yes – Besemkaree Koppies Shrubland, Eastern Upper Karoo and Northern Upper Karoo vegetation types.	Section 3.2
Threatened Ecosystems (SANBI 2022)	No – none of the vegetation types are considered as a threatened ecosystem, all are Least Concern	Section 3.2
Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA)	Yes. Project area intersects with an ESA as per the screening tool report. Sensitivity of ESA could not be confirmed during the SSV. CBAs not present within or nearby to the project area.	Section 3.1 Section 3.3
Protected Areas	No – not located in any current or future planned protected areas.	Section 3.4
Ecology of the system	Main landscape features, habitats and dominant species recorded.	Section 3.5

3.1 SITE SENSITIVITY VERIFICATION

The findings of the site verification, which included a desktop assessment and site survey, could not confirm the **Very High** environmental sensitivity of the Terrestrial Biodiversity Theme, which is based solely on the presence of an Ecological Support Area (ESA) on which the Kareekloof PVSEF project area is located (Figure 1-2). This ESA is an extremely large area (860,279 ha; Figure 3-1) of low intensity land use activities. There are no specific terrestrial features that are linked to the ESA (e.g. specific habitat types or fauna populations), and the vast majority of the ESA encompassed ecosystems that are considered to be of Least Concern (see below). The ESA has most likely been classified as a supporting ecological role to provide connectivity between the surrounding Critical Biodiversity Areas and Protected Areas and to maintain healthy populations of many species that are not of conservation concern. While this is an important ecological role, designation of the entire area as Very High

sensitivity for PVSEF developments seems unfounded. Detailed habitat descriptions and current impacts are discussed below to further substantiate this assertion.

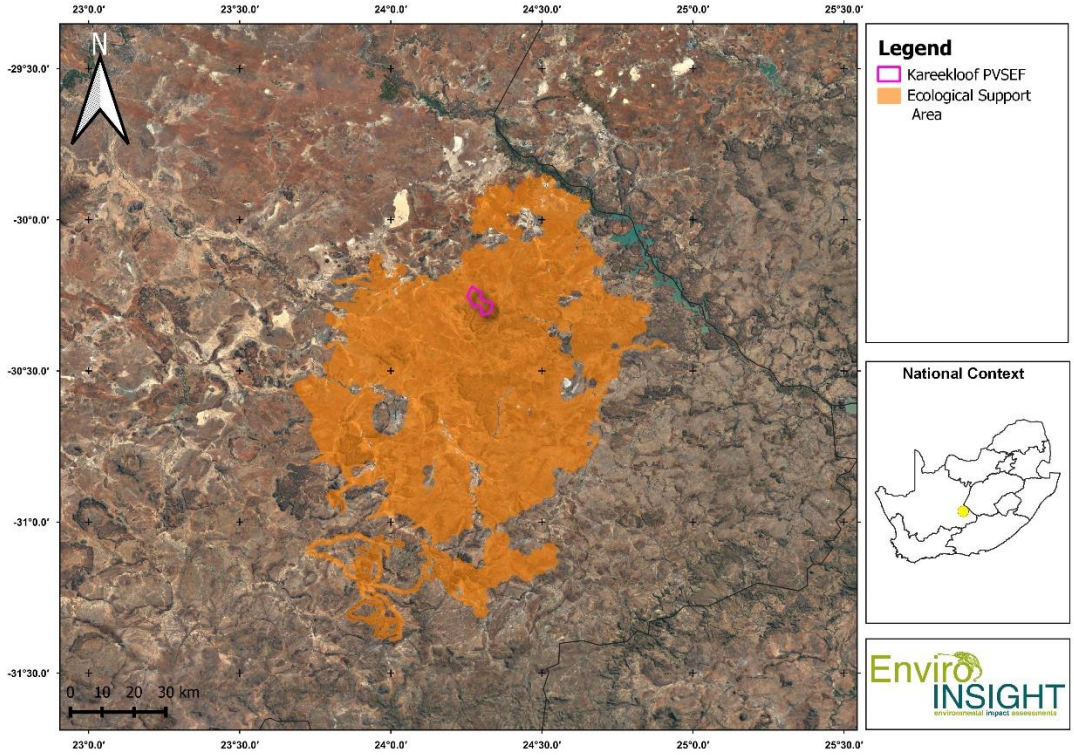

Figure 3-1: The extent of the Ecological Support Area on which the Kareekloof PVSEF project area is located.

3.2 REGIONAL VEGETATION

The study area is situated within the Nama-Karoo and Grassland Biomes. The Nama-Karoo is essentially a grassy, dwarf shrubland, dotted with characteristic koppies, most of which lies between 1,000 and 1,400 meters above sea level. Eastwards, the ratio of grasses to shrubs increases progressively, until the Nama Karoo eventually merges with the Grassland Biome, also present within the project area and represented by the Besemkaree Koppies Shrubland. On the northern fringes the dwarf shrubland often has an overstory of shrubs and trees.

Natural disturbance factors that drive many vegetation dynamics include many that are linked to human actions and many disturbances interact to modify effects. Factors include grazing by livestock and wild herbivores, fire, rainfall and runoff and other episodic events such as hailstorms. Very little of the NamaKaroo Biome in general and the Besemkaree Koppies Shrubland of the Grassland Biome has been transformed from natural vegetation to crops, dams, industry or other forms of land use that threaten natural diversity, mostly due to the arid conditions and/or rocky nature of the landscape. The dominant land use is the ranching of small stock, cattle and game farming with indigenous antelope.

The following vegetation types (Mucina & Rutherford, 2006, as amended) will be affected by the proposed development:

- Besemkaree Koppies Shrubland
- Eastern Upper Karoo

- Northern Upper Karoo

Information as indicated in the NBA (2018) is summarised in Table 3-2 for the three vegetation types accordingly.

Table 3-2: Vegetation types as per NBA (2018).

Vegetation type	Total area (ha) in South Africa	Total area (ha) and proportion (%) of Kareekloof PVSEF project area	Conservation status from NSBA	Remaining (percent of area) from NSBA	Conservation target	Protection Status from NSBA
Besemkaree Koppies Shrubland	967784.2	188.7 ha [5.1%]	Least threatened	95.7%	28%	Poorly protected
Eastern Upper Karoo	4983430.9	2566.5 ha [69%]	Least threatened	96.7%	21%	Poorly protected
Northern Upper Karoo	4227357.3	965.6 ha [26%]	Least threatened	94.5%	21%	Not protected

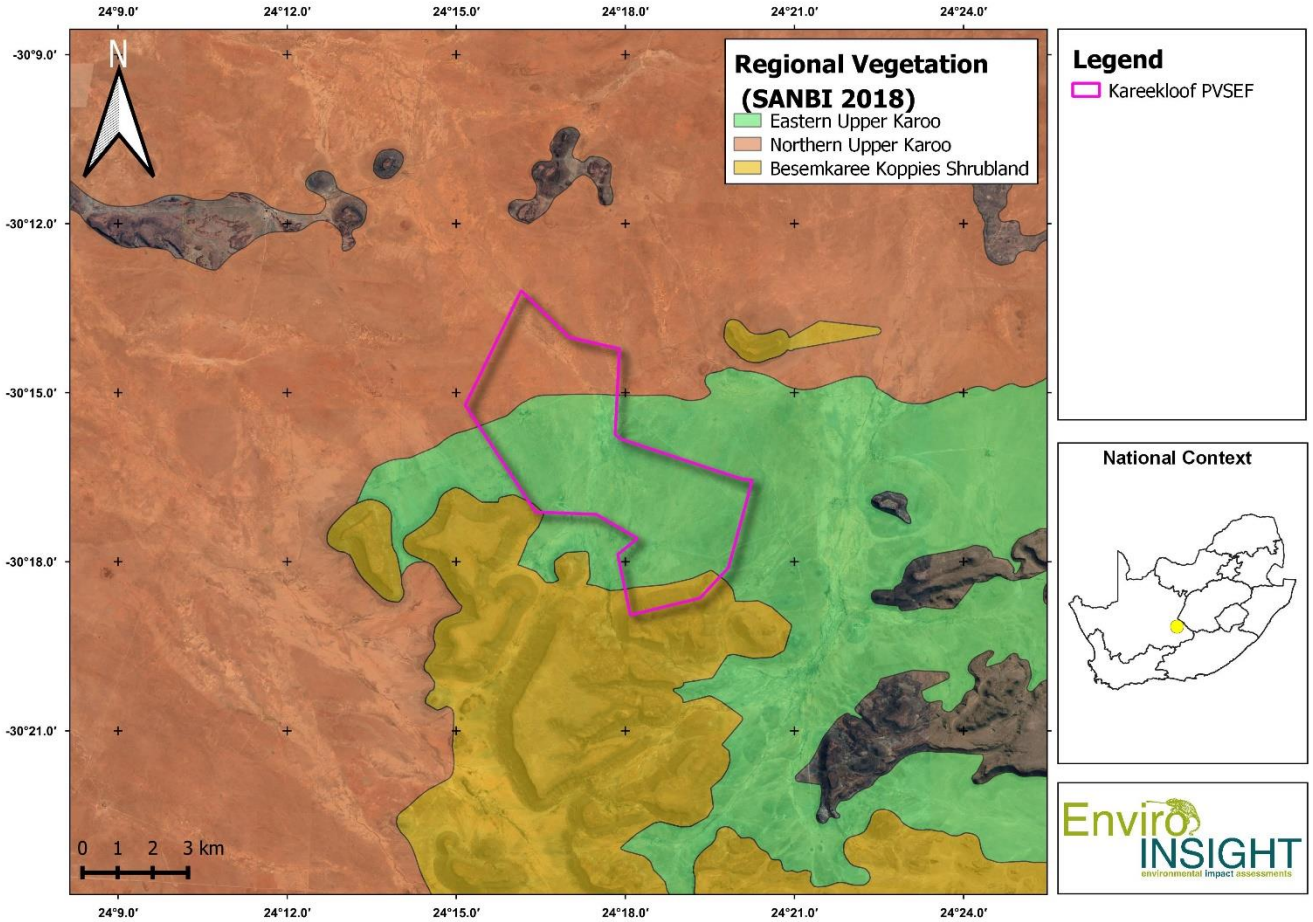

Figure 3-2: Regional vegetation types in relation to the Kareekloof PVSEF project area (SANBI, 2018).

Besemkaree Koppies Shrubland occurs in the Northern Cape, Free State and Eastern Cape provinces on the plains of the Eastern Upper Karoo, between Richmond and Middelburg in the south and the Orange River in the north (Mucina & Rutherford 2006). The vegetation occurs on the slopes of koppies, butts and tafelbergs and consists of a two-layered karroid shrubland (Mucina & Rutherford 2006). The lower layer of the vegetation is dominated by dwarf small-leaved shrubs and the upper layer is dominated by tall shrubs. The geology consists of dolerite koppies and sills embedded within Karoo Super Group sediments (Mucina & Rutherford, 2006). According to Mucina and Rutherford (2006), the vegetation is classified as Least Threatened with a conservation target of 28%; yet only 5% is formally conserved at present.

Table 3-3: Attributes of the Besemkaree Koppies Shrubland vegetation type (Mucina and Rutherford, 2006 as amended).

Name of vegetation type	Besemkaree Koppies Shrubland
Code as used in the Book	Gh4
Conservation Target (percent of area) from NSBA	28%
Protected (percent of area) from NSBA	5.3%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Poorly protected
Area (km^2) of the full extent of the Vegetation Type	9677.74
Name of the Biome	Grassland Biome
Name of Group and Bioregion	Dry Highveld Grassland Bioregion

The **Northern Upper Karoo** vegetation unit occupies the Northern regions of the Upper Karoo plateau from Prieska, Vosburg and Carnarvon in the west to Philipstown, Petrusville and Petrusburg in the east. Bordered in the north by Niekerkshoop, Douglas and Petrusburg and in the south by Carnarvon, Pampoenpoort and De Aar. A few patches occur in Griqualand West.

The landscape typifying this vegetation type is flat to gently sloping plains with isolated Koppies of Upper Karoo Hardeveld in the south, Vaalbos Rocky Shrubland in the northeast and interspersed with many pans (Mucina & Rutherford 2006). The Shrubland is dominated by dwarf karoo shrubs, grasses and mainly *Senegalia mellifera subsp. detinens*. Bioregional important taxa and endemic species include: *Atriplex spongiosa, Convolvulus boedeckerianus, Galenia exigua, Lithops hookeri, Stomatium pluridens, Manulea deserticola.*

Shales of the Volksrust Formation and to a lesser extent the Prince Albert Formation (both of the Ecca Group) as well as Dwyka Group diamictites form the underlying geology. Jurassic Karoo Dolerite sills and sheets support this vegetation complex in places. Wide stretches of land are covered by superficial deposits including calcretes of the Kalahari Group.

The conservation target is 21% with no areas conserved in statutory conservation areas. About 4% has been cleared for cultivation (the highest proportion of any type in the Nama-Karoo) or irreversibly transformed by building of dams (for example, Houwater, Kalkfontein and Smart Syndicate Dams). Areas of human settlements are increasing in the north-eastern part of this

vegetation type. *Prosopis glandulosa*, regarded as one of the most important invasive alien plants in South Africa, is widely distributed in this vegetation type (Mucina & Rutherford 2006).

Table 3-4: Attributes of the Northern Upper Karoo vegetation type (Mucina and Rutherford, 2006, as amended).

Name of vegetation type	Northern Upper Karoo
Code as used in the Book	NKu3
Conservation Target (percent of area) from NSBA[4]	21%
Protected (percent of area) from NSBA	0%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (km^2) of the full extent of the Vegetation Type	41829.17
Name of the Biome	Nama-Karoo Biome
Name of Group and Bioregion	Nama-Karoo Biome

The **Eastern Upper Karoo** vegetation type is one of the largest vegetation types in the country and consists of flat and gently sloping plains vegetation dominated by dwarf microphyllous shrubs with 'white' grasses, especially *Aristida, Eragrostis* and *Stipagrostis* (Mucina & Rutherford 2006). Eastern Upper Karoo is found in the Northern, Western and Eastern Cape, between Carnarvon and Loxton in the west, De Aar, Petrusville and Venterstad in the north and Burgersdorp and Cradock in the east, and the Great Escarpment in the south (Mucina & Rutherford 2006). The Eastern Upper Karoo is classified as Least Threatened with a national conservation target set at 21%, but less than 1% is formally protected. About 2% of the original extent has been transformed, largely due to building of dams (Mucina & Rutherford 2006); however, this could have increased in the last 16 years. Its geology consists of mudstones and sandstones of the Beaufort Group supporting duplex soils, which are vulnerable to erosion.

Table 3-5: Attributes of the Eastern Upper Karoo vegetation type (Mucina and Rutherford, 2006, as amended).

Name of vegetation type	Eastern Upper Karoo
Code as used in the Book	NKu4
Conservation Target (percent of area) from NSBA	21%
Protected (percent of area) from NSBA	0.7%
Description of conservation status from NSBA	Least threatened
Description of the Protection Status from NSBA	Hardly protected
Area (km^2) of the full extent of the Vegetation Type	49821.32
Name of the Biome	Nama-Karoo Biome
Name of Group and Bioregion	Upper Karoo Bioregion

[4] National Spatial Biodiversity Assessment (NSBA)

3.2.1 Summary and additional notes of the vegetation types

- All three mentioned vegetation types are classified as either "Not Protected" or "Poorly Protected", however all three are listed as least threatened as the remaining extent of all four are more than 95% with conservation targets set at between 21-28%.
- Accordingly, none are close to reaching the thresholds where biodiversity loss will be significant and resources be irreplaceable.
- The extents of the three vegetation types that could be affected by the proposed development, assuming total habitat destruction of the entire project area, are not considered significant and are as follows:
    - Besemkaree Koppies Shrubland – 0.02%
    - Eastern Upper Karoo – 0.05%
    - Northern Upper Karoo – 0.02%
- In terms of permanent infrastructure (complete transformation of the vegetation type), the entire extent of the Kareekloof PVSEF project area will not be transformed as the PV solar panels will not remove the vegetation layer completely, the topsoil will not be removed and limited disturbance will take place, the seed bank will be protected, and plants can still grow between and to a lesser extent, underneath the panels.
- The fauna and flora species composition could likely change over time as the impact of solar panels above the vegetation has not been well assessed in South Africa. However, the viability of the seed bank is important for rehabilitation efforts and will still be intact to a large extent.
- The Kareekloof PVSEF project area does not represent irreplaceable habitat but nevertheless, best practice is recommended to apply avoidance mitigation for any sensitive habitats that are limited in their occurrence/extent in the landscape.

3.3 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 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 (NFEPA) were incorporated.

CBA's and ESA'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:

- 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.

- 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 migration corridor results in a population going extinct elsewhere). All natural non-FEPA wetlands and larger rivers have a minimum category of ESA.

The region surrounding the Kareekloof PVSEF project area has been classified as an Ecological Support Areas (ESA) due to it being located in the Platberg-Karoo Conservancy, the vegetation units and important wetland and river features (Northern Cape Department of Environment and Nature Conservation, 2016[b]). From a Terrestrial Biodiversity perspective, the Platberg-Karoo Conservancy and the vegetation units are important systems for grasslands and grassland-associated animals, as well as important areas for the conservation of avifauna. This section of the Karoo has the highest rainfall, and provides an ecotone between the Nama Karoo and Grassland biomes. Accordingly, all developments within this ESA must undergo EA processes, where impacts are assessed and appropriate mitigation measures provided to lower the significance of negative impacts and enhance positive impacts, where appropriate.

According to the CBA Map, the Kareekloof PVSEF project area is entirely located on an ESA as confirmed by the screening tool (Figure 1-2) and discussed above (Figure 3-1). The assignment of this ESA as "Very High Sensitivity" in the Kareekloof PVSEF project area by the screening tool is considered unjustified given that:

- No threatened ecosystems or vegetation types are present in the portion of the ESA that cover the proposed Kareekloof PVSEF;
- No specific habitat the Kareekloof PVSEF project area has any obvious key ecological role such as a migration corridor;
- No threatened plant species are expected to occur in the Kareekloof PVSEF project area (screening tool);
- Only two threatened fauna species of Medium sensitivity (modelled to occur, not known to occur) were flagged by the screening tool for the Kareekloof PVSEF project area (see avifauna report); and
- This ESA is an extremely large area (860,279 ha; Figure 3-1).

3.4 PROTECTED AREAS AND EXPANSION AREAS

The Kareekloof PVSEF project area does not intersect with any current or future planned protected areas. The nearest protected area is the Rolfontein Provincial Nature Reserve situated ~ 40 km away towards the northeast. The Kareekloof PVSEF project area is however situated entirely within the "Platberg-Karoo Conservancy" Important Bird Area (IBA) (Figure 3-3). The nearest future planned protected area is the "Senqu Caledon" area located ~ 23 km towards the south of the Kareekloof PVSEF project area (Figure 3-4).

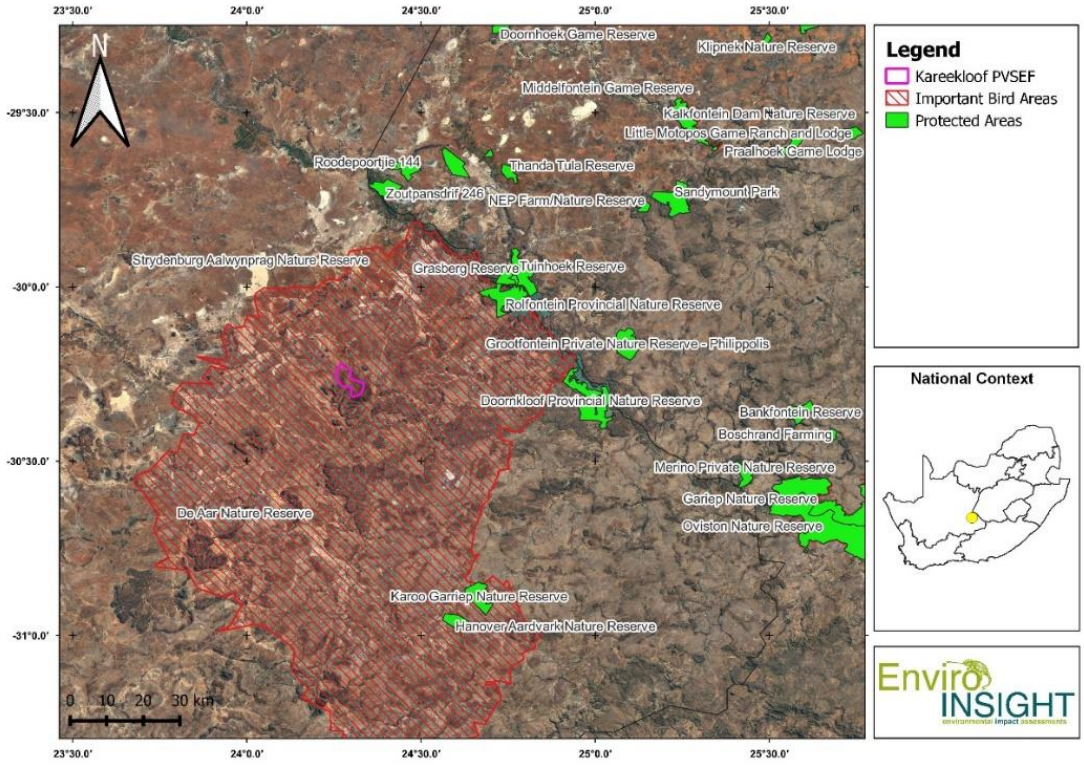

Figure 3-3.The Kareekloof PVSEF in relation to the nearest protected areas and IBAs.

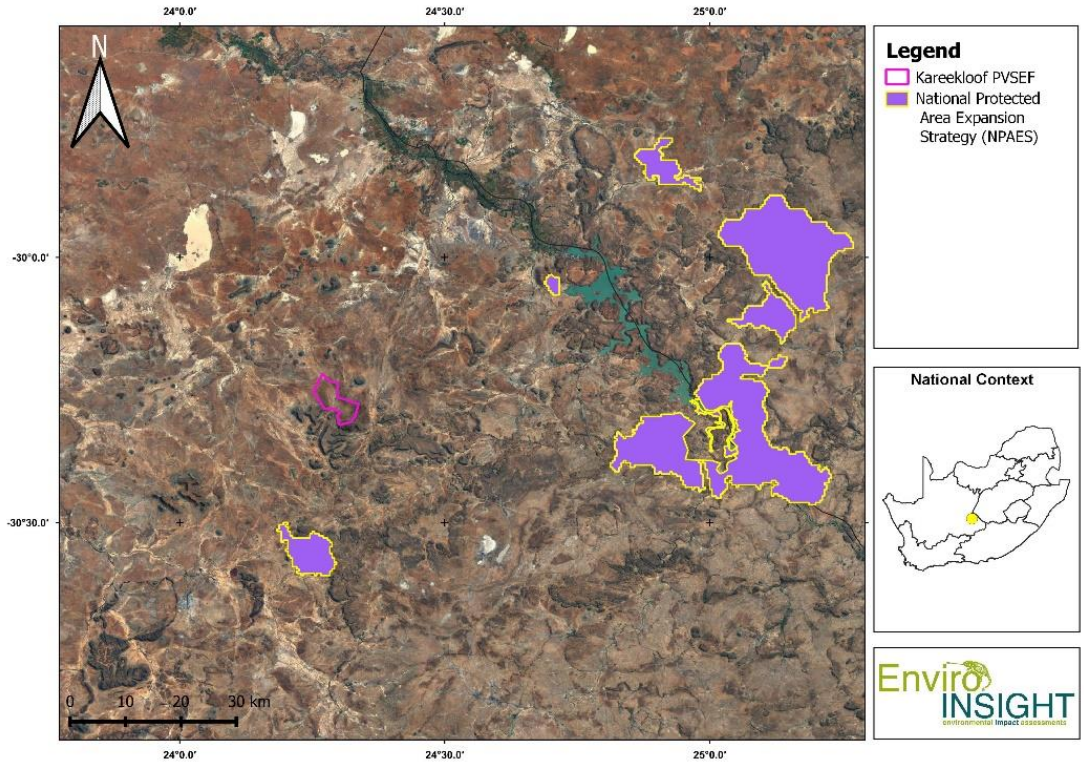

Figure 3-4.The Kareekloof PVSEF in relation to the National Protected Area Expansion Strategy (NPAES).

3.5 ECOLOGY OF THE SYSTEM

3.5.1 Ecological drivers and significant terrestrial landscape features

The Kareekloof PVSEF project area is predominantly located on relatively flat land, with elevated rocky ridges characterising the southern areas outside of the proposed PVSEF. There are few depression wetlands, scattered artificial dams and drainage areas present and no major rivers (Figure 3-5). The flat areas of Northern and Eastern Upper Karoo vegetation types are characterised by two major habitat types, namely Nama Karoo Low Shrubland and Natural Grassland according to the National Landcover Classification (NLC 2018[5]) (Figure 3-6).

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 vegetation types are minimal and has increased mainly due to the construction of renewable energy facilities, both wind and solar since 2012 (see below).

[5] https://www.dffe.gov.za/projectsprogrammes/egis_landcover_datasets

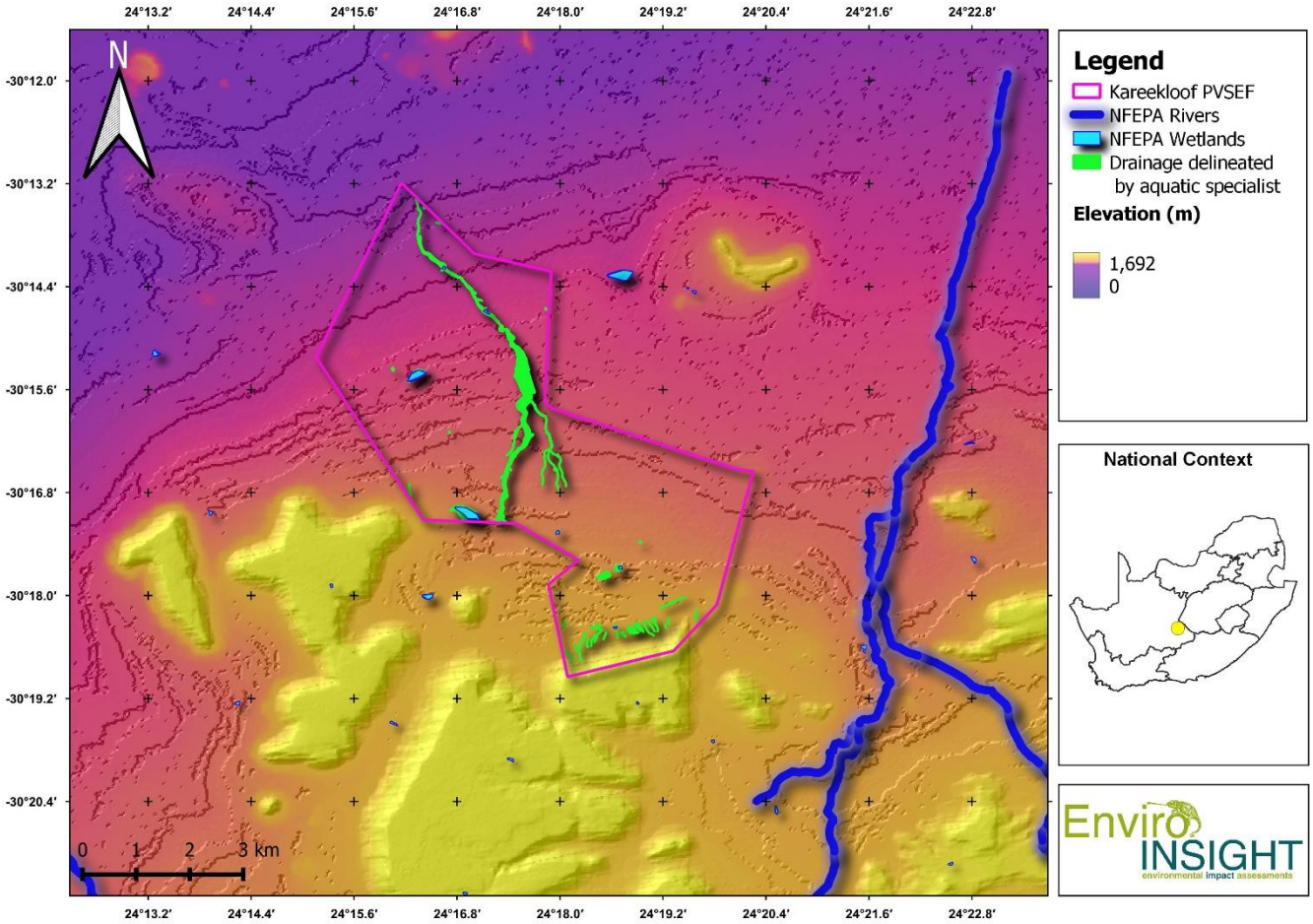

Figure 3-5. Major landscape features of the Kareekloof PVSEF project area.

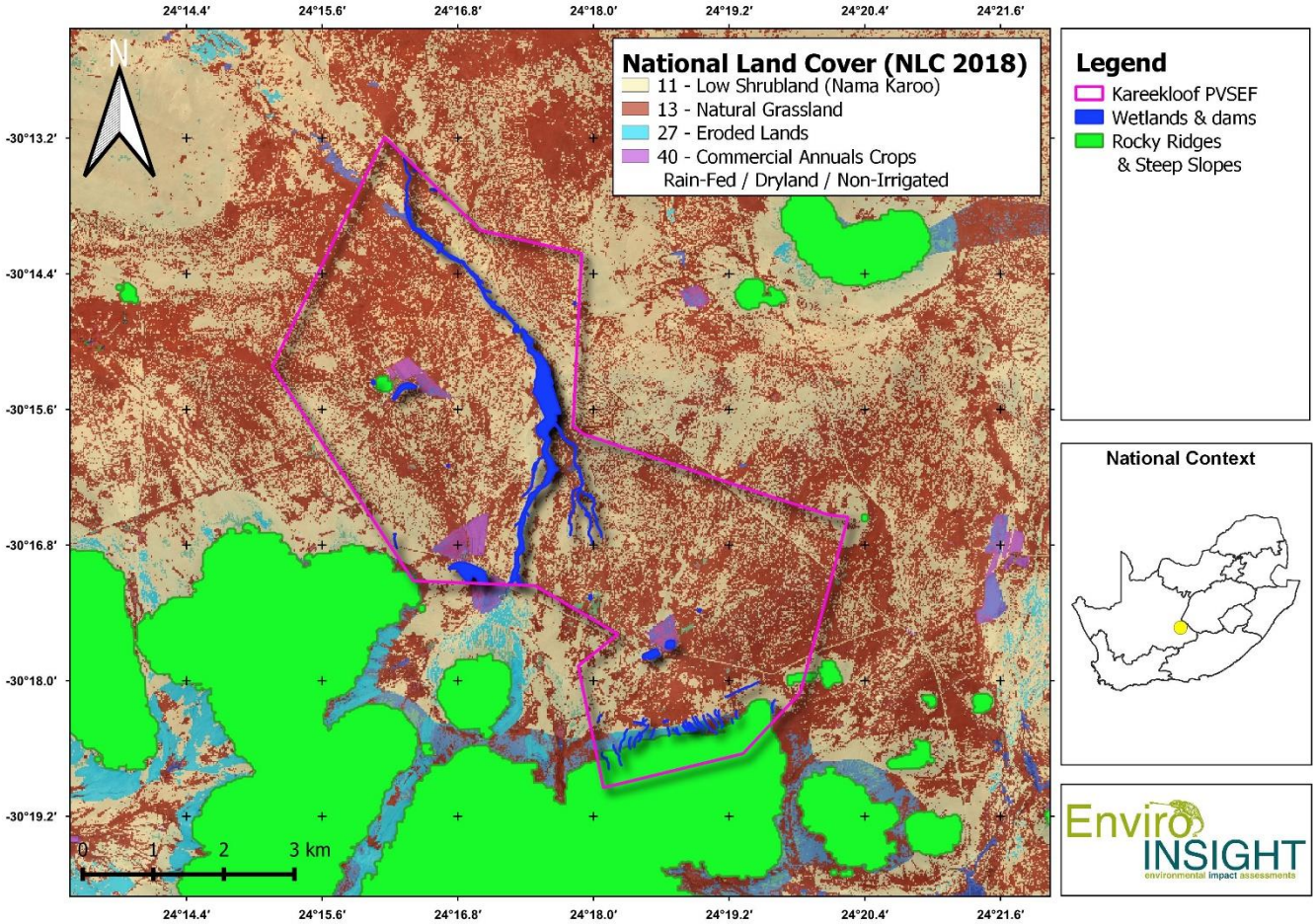

Figure 3-6.The major habitats and landscape features of the Kareekloof PVSEF project area.

3.5.1.1 National Freshwater Ecosystem Priority Areas (NFEPA), 2011

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

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 2018
  - Existing protected and focus areas for expansion identified in the NPAES.

The assessment revealed the presence of a few depression systems, all of which have been converted into artificial dams. No major rivers are present within the project area but a prominent drainage line, delineated by the aquatic specialist, bisects the project area (Figure 3-5 & Figure 3-6).

3.5.2 Ecological functioning and processes

The aquatic habitats (drainage and dams) and the rocky ridges and steep slopes habitats (Figure 3-6) represent the most limited and therefore, most important ecological features in the region, and if not protected could lead to reduced ecosystem services and could impact negatively on important terrestrial biodiversity features. It is recommended that these habitats should be avoided when designing the placement of infrastructure. Where linear infrastructure such as roads and powerlines need to cross these habitats, the appropriate mitigation measures need to be applied.

3.5.3 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 drainage line and its associated marginal vegetation as well as the rocky ridges and steep slopes habitats function as migration corridors across the landscape for fauna. Where linear infrastructure such as roads and powerlines need to cross these habitats, the necessary mitigation measures need to be implemented to reduce potential fauna fatality, and not to restrict any movement of fauna.

3.5.4 Species, distribution, and important habitats

This area generally receives very limited and sporadic rainfall. Accordingly, plant diversity is relatively low. Four main habitats were identified based on species composition and structure. The main driver of vegetation pattern in the area is the substrate. Georeferenced photographs were taken to assist in both the site characterisation as well as the sensitivity analysis and to provide lasting evidence for future queries. Each of these habitats is briefly discussed below.

3.5.4.1 Grassland

This is the dominant habitat and is mostly present on softer, sandier soils. It is characterised by a dense grass sward with only few shrubs present. It is dominated by white grasses of the genera *Aristida* and *Eragrostis* interspersed with microphyllous shrubs such as *Lycium* spp. (Figure 3-7). This habitat is considered moderately sensitive due to moderate species diversity and the potential presence of provincially protected species (of the genera *Aloe, Ruschia, Jamesbrittenia, Crassula, Haemanthus, Oxalis).*

Figure 3-7. Major habitat of the Kareekloof PVSEF: Grassland on soft sandy soils.

3.5.4.2 Scrubland

This habitat is present as patches amongst the grassland, typically characterised by the near-absence of grasses (such as *Aristida* sp. and *Eragrostis* sp.) and the presence of large, woody shrubs (Figure 3-8). However, it often forms a habitat mosaic with the grassland, particularly on the ecotone of the two habitats. Similar to the grassland habitat, scrubland has a very expansive occurrence in the region and is therefore not considered to be highly sensitive. Provincially protected species of the genera *Aloe, Ruschia, Euphorbia, Haemanthus, Oxalis, Jamesbrittenia* and *Ammocharis* have been recorded in the area before.

Figure 3-8. Major habitat of the Kareekloof PVSEF: Scrubland.

3.5.4.3 Rocky Ridges & Steep Slopes

This structurally defined habitat (Figure 3-9) is limited in the region and has the potential to act a s a migration corridor for fauna. It is also not able to fully recover from any mechanical disturbances and has therefore been buffered from development by 30m.

The presence of the protected tree[6] *Boscia albitrunca* has been recorded on similar Koppies or their foot slopes within a 5 km radius from the Kareekloof PVSEF.


Figure 3-9. Major habitat of the Kareekloof PVSEF: Rocky ridges & steep slopes.

3.5.4.4 Drainage, wetlands & dams

This is a collection of aquatic habitats predominantly characterised by the ephemeral drainage lines and their marginal vegetation, but also the man-made impoundments (dams) in these drainage lines which retain surface water for longer (Figure 3-10). These habitats are very limited in this arid region and due to the periodic presence of water provide excellent foraging habitats for fauna, particularly in the dry months. The dense marginal vegetation is also often suitable for fauna breeding purposes. This habitat is considered to be sensitive as it functions as both foraging habitat and migration corridors for fauna and is limited in the landscape. It has therefore been buffered from development by 100 m.


Figure 3-10. Major habitat of the Kareekloof PVSEF: Drainage, wetlands & dams.

[6] National Forests Act No. 84 of 1998

4 OPPORTUNITIES & CONSTRAINTS

Following the appropriate buffering of the sensitive habitats defined above (100 m for aquatic habitats, 30 m for rocky habitats), a No-Go delineation was developed to indicate the areas where development of infrastructure should be avoided. By implication, the areas outside of the No-Go delineation and within the boundary of the Kareekloof PVSEF project area are considered developable. The opportunities (developable) and constraints (non-developable) map for the proposed Kareekloof PVSEF project area is provide in Figure 4-1.

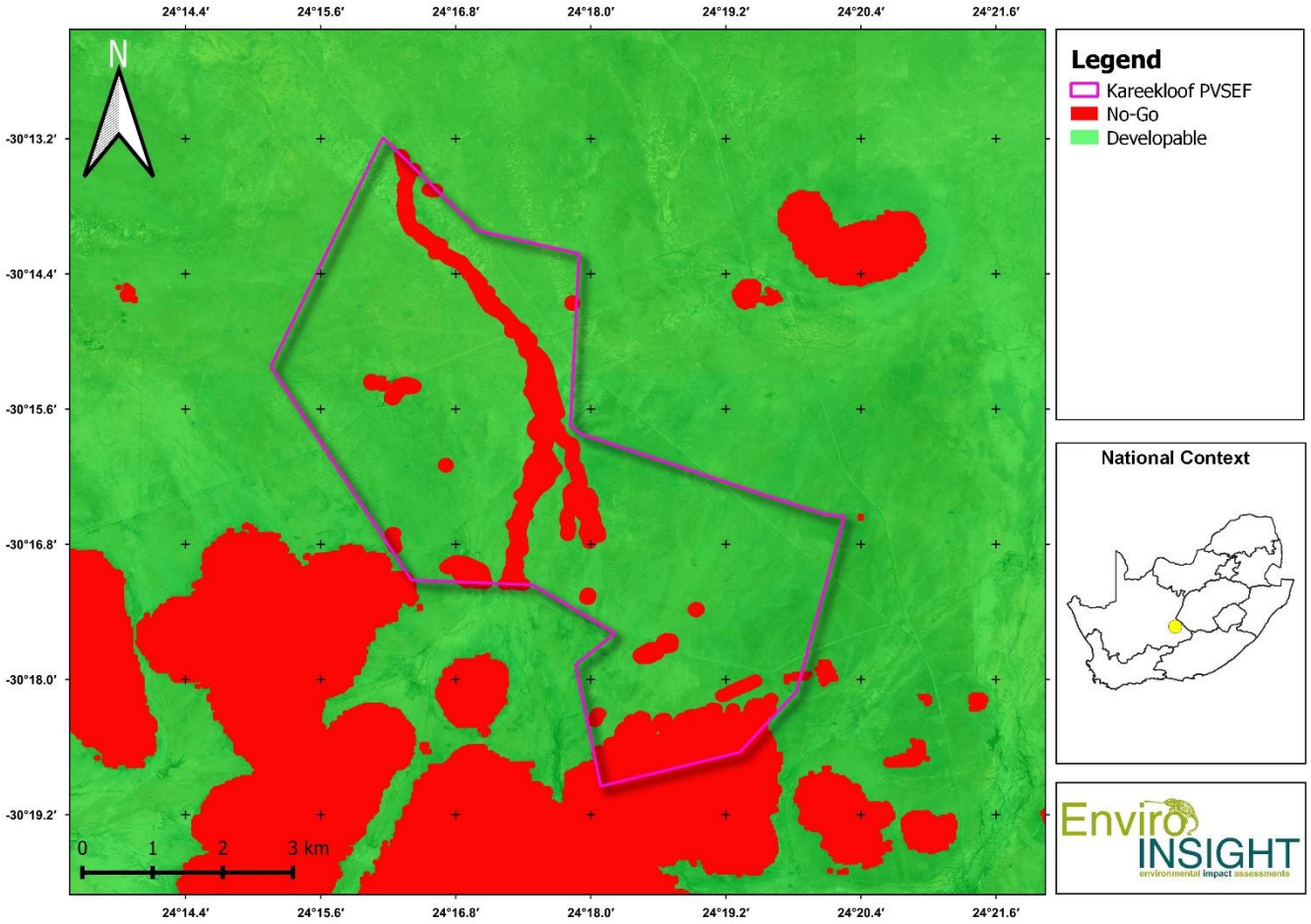

Figure 4-1. Terrestrial Biodiversity opportunities and constraints (No-Go areas) map for the proposed Kareekloof PVSEF.

5 IMPACT ASSESSMENT

The development of the Kareekloof PVSEF is likely to result in a variety of impacts to terrestrial biodiversity, associated largely with the disturbance and transformation of intact vegetation and faunal habitat to hard infrastructure such as PV solar panels and their stands, but also associated infrastructure such as the BESS, service areas, access roads, operations buildings, and laydown areas.

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;
- Increased presence of alien invasive plant species due to soil disturbance and movement during the construction phase;
- Soil erosion and compaction;
- Pollution.

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 briefly discussed below in more detail and will be fully assessed during the EIA phase.

The locality of renewable energy projects is based on agreements with landowners, basically where land is available for development in combination with suitable solar resource. Accordingly, the locality alternative needs to be assessed with these limitations in mind, and the developer generally seeks out suitable land. Potential flaws were highlighted to the developer from the onset regarding this chosen site, and the high sensitivity areas and protected species were avoided by the development footprint.

5.1.1 Habitat Loss and fragmentation

IMPACT NATURE	**Direct loss of habitat**		**STATUS**	**NEGATIVE**
Impact Description	Clearing of natural vegetation for the construction and establishment of the solar PV and associated infrastructure will result in the loss, degradation and fragmentation of foraging and breeding habitat for fauna. Optimal foraging habitat in and around drainage areas have been excluded from the development area by a buffer of 100 m. Provincially protected species as well as protected trees may be present on the rocky ridges and steep slopes and these have been excluded from the development area by a buffer of 30m. The shading effect from solar panels during the operation phase is likely to affect the flora species composition and diversity and may result in some bare patches. Numerous shrubs will be removed, where only the herbaceous and grass layers remain. Emerging seedlings of protected species may also be affected by the shading. Protected tree species and sensitive species may therefore not regenerate in the developed area. Large numbers of seedlings are not expected during the project cycle for protected trees.			
Impact Source(s)	Site clearing and preparation during the construction phase.			
PARAMETER	**WITHOUT MITIGATION**	**SCORE**	**WITH MITIGATION**	**SCORE**
EXTENT (A)	Preferred Alternative:		Preferred Alternative:	
DURATION (B)	Preferred Alternative:		Preferred Alternative:	
PROBABILITY (C)	Preferred Alternative:		Preferred Alternative:	

INTENSITY OR MAGNITUDE (D)	Preferred Alternative:		Preferred Alternative:	
SIGNIFICANCE RATING (F) = A*B*D*C	Preferred Alternative:		Preferred Alternative:	
CONFIDENCE	High			
MITIGATION MEASURES	• Limit the areas cleared for construction purposes (e.g. laydown areas). • Do not implement a bare earth policy for construction of solar panels, rather mow the vegetation. • Use the finalised Opportunities and Constraints spatial layers (to be developed) to appropriately position all surface infrastructure so as to minimise loss of high sensitivity habitat. • No construction related activities, such as the site camp, storage of materials, temporary roads or ablution facilities may be located in the high sensitivity areas. • Demarcate such areas on the ground during construction and sign post them as "Environmentally sensitive areas - keep out!". • Ensure that all non-solar panel infrastructure (usually permanent in nature) occurs in Low sensitivity portions of the project area. • Rehabilitate all areas disturbed immediately after construction based on approved plan. • Prioritise existing roads for access routes. • Where the approved layout designs impact on individuals, permit applications are required for either the relocation or destruction of provincially protected species (Northern Cape Nature Conservation Act No.9 of 2009) and for protected trees in terms of the National Forests Act (No. 84 of 1998).			

5.1.2 Alien and Invasive Species

IMPACT NATURE	**Establishment and spread of Alien and Invasive Species**		**STATUS**	**NEGATIVE**
Impact Description	Alien and invasive species are more likely to establish in disturbed areas due to construction activities. Currently, alien invasive species are dominant in the watercourse and drainage habitats and where existing infrastructure is located, such as homesteads and livestock pens. Vehicles can also transport seeds from other areas and introduce new species previously unknown to the area.			
Impact Source(s)	Site clearing and transportation of equipment during construction phase. Normal daily operation of vehicles in operation phase			
PARAMETER	**WITHOUT MITIGATION**	**SCORE**	**WITH MITIGATION**	**SCORE**
EXTENT (A)	Preferred Alternative:		Preferred Alternative:	
DURATION (B)	Preferred Alternative:		Preferred Alternative:	
PROBABILITY (C)	Preferred Alternative:		Preferred Alternative:	
INTENSITY OR MAGNITUDE (D)	Preferred Alternative:		Preferred Alternative:	

SIGNIFICANCE RATING (F) = A*B*D*C	Preferred Alternative:		Preferred Alternative:	
CONFIDENCE	High			
MITIGATION MEASURES	• Implement an alien and invasive species (AIS) control and monitoring plan in terms of NEMBA. Alien invasive species establishment and spreading should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with such plants. • The site-specific AIS control and monitoring 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. • Soil should not be brought in from outside the study area, or if absolutely necessary, should be sourced from an area with no alien plant species which may contain seeds. • 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.			

5.1.3 Increased erosion and soil compaction

IMPACT NATURE	**Erosion and soil compaction**		**STATUS**	**NEGATIVE**
Impact Description	Erosion is likely to occur where vegetation has been cleared. Heavy machinery and vehicles operated during the construction phase will lead to soil compaction. Plants cannot readily establish in compacted soil since the soil is too hard for root penetration. Water infiltration is less efficient in compacted areas and the runoff is higher, which could lead to increased erosion. It is expected that internal roads may cross watercourses. This may result in damage to the habitat, including changes in flow patterns, functionality and erosion. Erosion increases the sediment load in the watercourses, resulting in increased sedimentation downstream of the disturbance. Sedimentation may cause a blockage and alter the characteristics of the watercourse. This could impact on the vegetation and species structure which could reduce suitable habitat for water-dependent species.			
Impact Source(s)	Site clearing and preparation during the construction phase as well as hard surfaces causing increased runoff during the operational phase.			
PARAMETER	**WITHOUT MITIGATION**	**SCORE**	**WITH MITIGATION**	**SCORE**
EXTENT (A)	Preferred Alternative:		Preferred Alternative:	
DURATION (B)	Preferred Alternative:		Preferred Alternative:	
PROBABILITY (C)	Preferred Alternative:		Preferred Alternative:	

INTENSITY OR MAGNITUDE (D)	Preferred Alternative:		Preferred Alternative:	
SIGNIFICANCE RATING (F) = A*B*D*C	Preferred Alternative:		Preferred Alternative:	
CONFIDENCE	High			
MITIGATION MEASURES	• Utilise existing access routes as far as possible. • Confine the movement of vehicles to the access routes to and from the site and to the construction areas. • Do not drive off road. • Rehabilitate new vehicle tracks and areas where the soil has been compacted as soon as possible. • Monitor the entire site for signs of erosion throughout the construction phase of the project and apply adaptive mitigation.			

5.1.4 Chemical Use

IMPACT NATURE	**Ecotoxicity**		**STATUS**	**NEGATIVE**
Impact Description	The surfactants, dust suppressants and other chemicals that may be used to keep the PV panels clean may cause poisoning and or exacerbate habitat loss.			
Impact Source(s)	Chemicals running off from panels and entering natural areas			
PARAMETER	**WITHOUT MITIGATION**	**SCORE**	**WITH MITIGATION**	**SCORE**
EXTENT (A)	Preferred Alternative:		Preferred Alternative:	
DURATION (B)	Preferred Alternative:		Preferred Alternative:	
PROBABILITY (C)	Preferred Alternative:		Preferred Alternative:	
INTENSITY OR MAGNITUDE (D)	Preferred Alternative:		Preferred Alternative:	
SIGNIFICANCE RATING (F) = A*B*D*C	Preferred Alternative:		Preferred Alternative:	
CONFIDENCE	Medium			
MITIGATION MEASURES	• Avoid or minimise the use of chemical surfactants and dust suppressants on site; • Ensure that none of the cleaning water enters nearby watercourses through runoff; • Do not clean before an imminent rainstorm.			

5.2 DECOMISSIONING PHASE

When the PVSEF 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 solar farm and repowering the site, that the panels need to be replaced. As decommissioning of large-scale solar 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 solar 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 issues are the physical removal and the disposal of the used parts. Where possible, all recyclable materials must be repurposed in an environmentally friendly way. Active restoration will be required since it will be a large area filled with mostly weedy grasses.

It is expected that the dismantling of the PV arrays 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.

5.3 ANTICIPATED CUMULATIVE IMPACTS

Cumulative impacts are notoriously difficult to assess accurately. However, the evaluation of cumulative impacts from PVSEFs can largely be considered as a spatial analysis, because the most obvious impact to terrestrial biodiversity from these developments in arid areas is the loss of habitat.

There are 4 known PVSEFs and seven known WEFs within a 30 km radius of the proposed Kareekloof PVSEF project area (REEA Q1 2023[7]) (Figure 5-1). Assuming that the total areas represented by all of these renewable energy developments shown in Figure 5-1 will be transformed, Table 5-1 shows that the maximum transformed area from renewable energy development boundaries within a 30 km radius of the proposed development cluster currently amounts to only 7.17% of the total land area. The proposed Kareekloof PVSEF itself only represents 1.01% of the 30 km radius area, indicating an insignificant proportion of transformation in the regional context that can be expected from this development alone. It is important to note that not all of these areas will be transformed by the proposed developments and mitigation recommendations made above and implemented by the existing developments will ensure that the most sensitive habitats remain undisturbed in the region. The cumulative impact of habitat loss is therefore considered negligible.

Table 5-1: Cumulative impact from renewable energy developments in the region.

Elements	Area (ha)	Proportion of total area
Total area of 30 km buffer surrounding (and including) the proposed Kareekloof PVSEF.	369908.7	100.00%
Total area of known renewable energy developments within a 30 km buffer surrounding the proposed Kareekloof PVSEF.	26510.3	7.17%

[7] Renewable Energy EIA Application Database Quarter 1 2023 - https://egis.environment.gov.za/data_egis/data_download/current

Total area of known WIND energy developments within a 30 km buffer surrounding the proposed Kareekloof PVSEF.	18288.0	4.94%
Total area of known PV energy developments within a 30 km buffer surrounding the proposed Kareekloof PVSEF.	8222.3	2.22%
Total area of the proposed Kareekloof PVSEF.	3720.8	1.01%

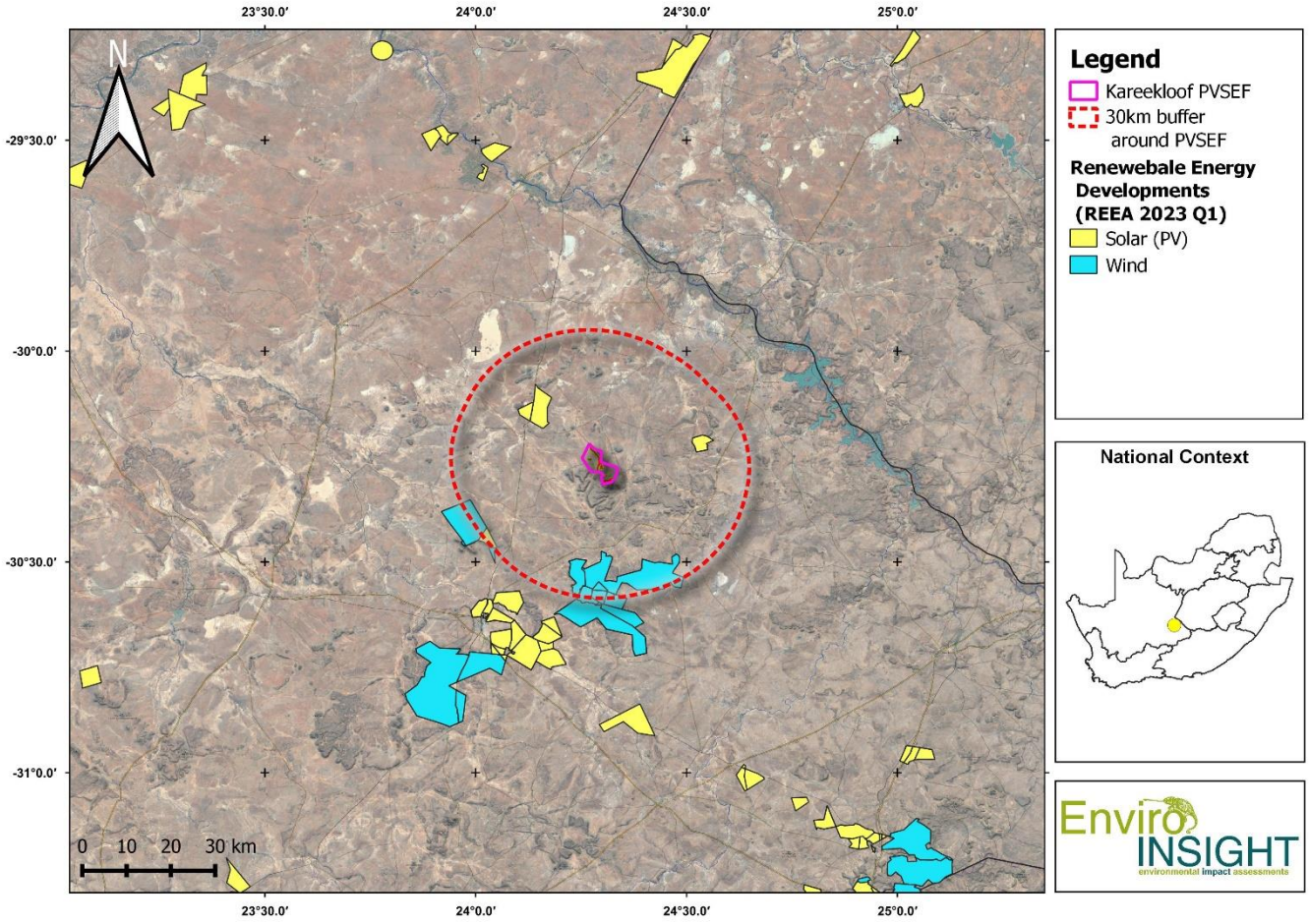

Figure 5-1. Location of known regional renewable energy projects (Quarter 1, 2023[8]) in relation to the Kareekloof PVSEF.

6 CONCLUSION AND PROFESSIONAL OPINION

The proposed Kareekloof PVSEF is located within three vegetation types, all listed as Least Threatened but poorly protected. None of the facilities are located in a threatened ecosystem or national protected expansion area. The Terrestrial Biodiversity theme of the screening tool report was rated as Very High sensitivity. However, based on the SSV, this could not be confirmed

[8] https://egis.environment.gov.za/data_egis/data_download/current

and is rather considered to be of low-medium sensitivity in relation to the proposed development. The project is located in an ESA and no plant SCC are expected to occur on site. The ESAs are mainly due to watercourses on site which should be avoided as far as possible and the appropriate mitigation measures should be in place to reduce impacts to acceptable levels. A buffer of 100 m is considered sufficient to achieve this outcome, and this has been applied to generate the No-Go delineation in Figure 4-1 .

Most of the project is located in grasslands on flat plains and gently sloping hills that are considered to be moderately sensitive. The drainage areas, wetlands and rocky ridges with associated steep slopes are considered to be sensitive and should be avoided during the construction period for placement of PV arrays, laydown areas and associated infrastructure. Roads and cables should not cross watercourses as far as possible, and the impacts can be mitigated by reducing it to acceptable levels since avoidance may not be possible.

Considering the above-mentioned information, no fatal flaws are evident for the proposed project should the layout incorporate the final habitat sensitivities which will be included in the EIA phase. It is the opinion of the specialists that the project, may be considered for authorisation, on condition that all prescribed mitigation measures and supporting recommendations are implemented. Should the layout be amended and significant changes occur which impacts on sensitive features, all necessary protocols need to be followed to ensure all highly sensitive areas are avoided.

7 REFERENCES

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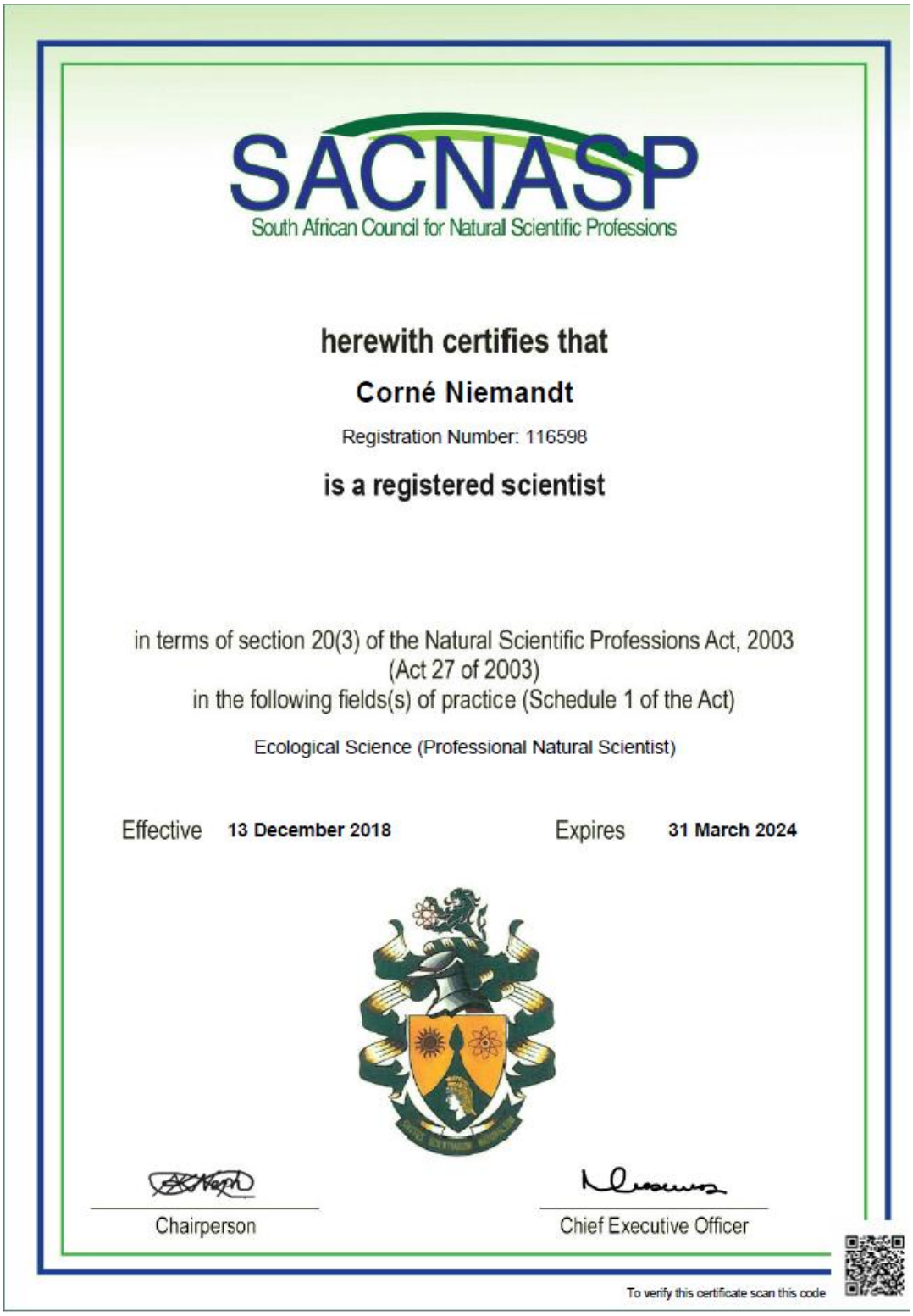
APPENDIX A: SACNASP PROFESSIONAL CERTIFICATES



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)

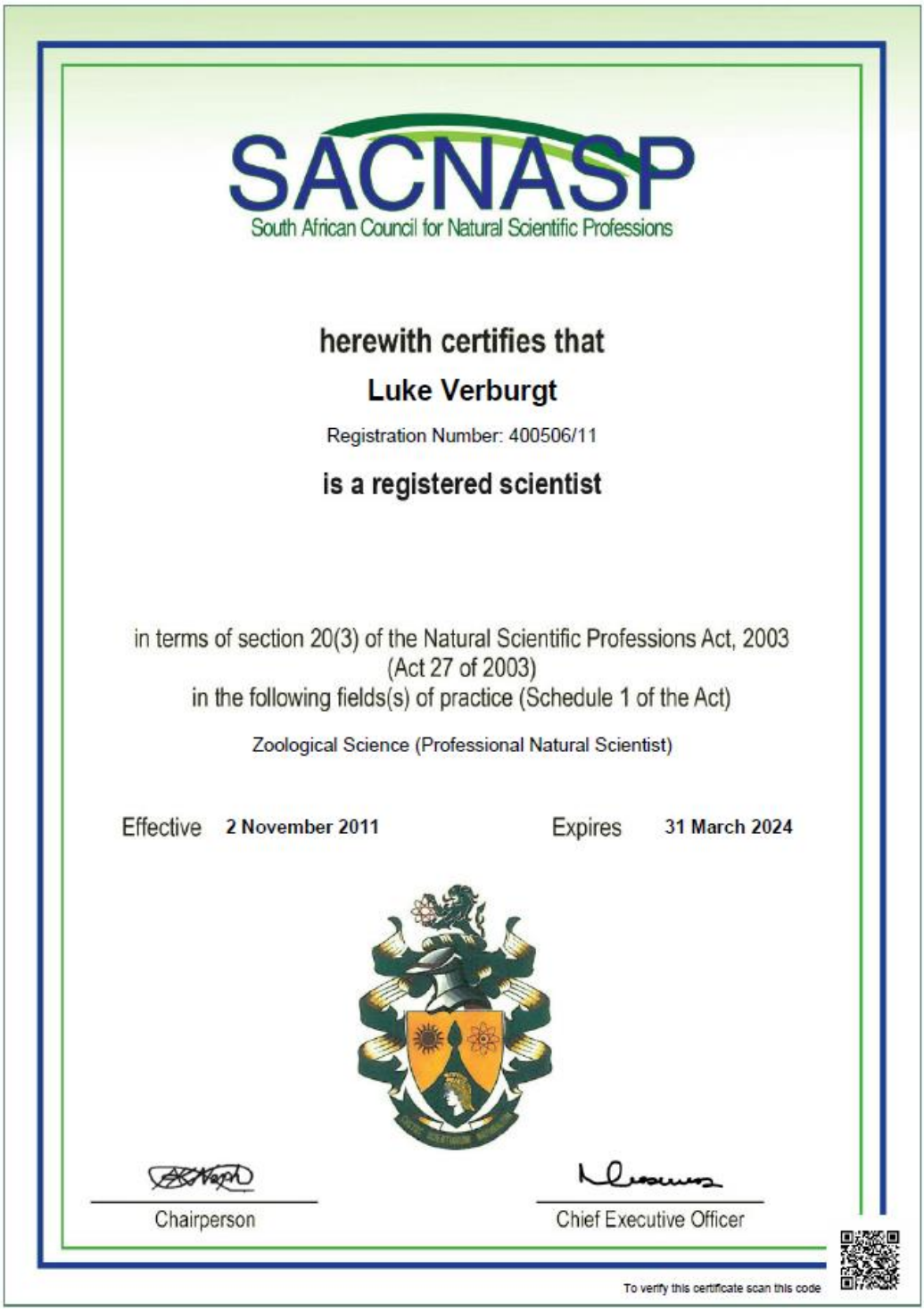
Ecological Science (Professional Natural Scientist)

Effective **13 December 2018** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code



SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Luke Verburgt

Registration Number: 400506/11

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 (Professional Natural Scientist)

Effective **2 November 2011** Expires **31 March 2024**

Chairperson

Chief Executive Officer

To verify this certificate scan this code