

ENVIRONMENTAL IMPACT REPORT:

Ecological study on the potential impacts of the proposed BioTherm  
Aletta Wind Energy Facility near Copperton in the Northern Cape

Prepared by

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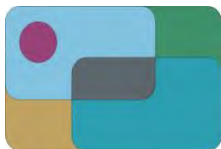
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David Hoare Consulting cc

Biodiversity Assessments, Vegetation Description /  
Mapping, Species Surveys

## DECLARATION OF INDEPENDENCE & SUMMARY OF EXPERTISE

### Appointment of specialist

David Hoare of David Hoare Consulting cc was commissioned by SiVEST Environmental Division to provide specialist consulting services for the Environmental Impact Assessment process for the proposed construction of the BioTherm Aletta Wind Energy Facility near Copperton in the Northern Cape Province. The consulting services comprise an assessment of potential impacts on the general ecology in the study area by the proposed project.

### Details of specialist

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### Summary of expertise

Dr David Hoare:

- Has majors in Botany and Zoology with distinction from Rhodes University, Grahamstown, an Honours Degree (with distinction) in Botany from Rhodes University, an MSc (cum laude) from the Department of Plant Science, University of Pretoria, and a PhD in Botany from the Nelson Mandela Metropolitan University, Port Elizabeth with a focus on species diversity.
- Registered professional member of The South African Council for Natural Scientific Professions (Ecological Science, Botanical Science), registration number 400221/05.
- Founded David Hoare Consulting cc, an independent consultancy, in 2001.
- Ecological consultant since 1995, with working experience in Gauteng, Mpumalanga, Limpopo, North West, Eastern Cape, Western Cape, Northern Cape and Free State Provinces, Tanzania, Kenya, Mozambique and Swaziland.
- Conducted, or co-conducted, over 350 specialist ecological surveys as an ecological consultant. Areas of specialization include general ecology, biodiversity assessments, vegetation description and mapping, plant species surveys and remote sensing of vegetation. Has undertaken work in grassland, thicket, forest, savannah, fynbos, coastal vegetation, wetlands and nama-karoo vegetation, but has a specific specialization in grasslands and wetland vegetation.
- Published six technical scientific reports, 15 scientific conference presentations, seven book chapters and eight refereed scientific papers.
- Attended 15 national and international congresses & 5 expert workshops, lectured vegetation science / ecology at 2 universities and referee for 2 international journals.

## Independence

David Hoare Consulting cc and its Directors have no connection with the proponent. David Hoare Consulting cc is not a subsidiary, legally or financially, of the proponent. Remuneration for services by the proponent in relation to this project is not linked to approval by decision-making authorities responsible for authorising this proposed project and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project. David Hoare is an independent consultant to SiVEST Environmental Division and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work.

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## EXECUTIVE SUMMARY

David Hoare Consulting cc was appointed by SIVEST Environmental Division to undertake a general ecology assessment of the study area. This report provides details of the results of the Scoping Phase study, based on a desktop assessment of the study area and mapping from aerial imagery. The study area is located in the Northern Cape Province approximately 30 km to the west-south-west of Prieska.

The vegetation types that occur on site (Bushmanland Arid Grassland and Lower Gariep Broken Veld and possibly floristic elements of Bushmanland Vloere, Bushmanland Basin Shrubland and Northern Upper Karoo) are classified as Least Threatened and also have a wide distribution and extent. The natural vegetation on the sites is therefore not considered to have high conservation status. The area is not within a Centre of Plant Endemism or in areas identified in Provincial Conservation Plans to be of concern, but it does occur within an area identified as part of the National Parks Area Expansion Strategy.

Local factors that may lead to parts of the sites having elevated ecological sensitivity are the potential presence of the following:

- Presence of natural vegetation on site, although of low conservation priority.
- Presence of a number of Provincially protected plant species.
- Presence of a number of individuals of one protected tree species, *Boscia albitrunca*.
- Presence of drainage areas and pans.
- Presence of low, rocky hills with higher biodiversity than surrounding areas.
- Potential presence of the following animals of potential conservation concern:
  - Honey badger (NT)
  - **Littledale's Whistling Rat (NT)**
  - Giant Bullfrog (NT/LC)
- Potential invasion of natural habitats by alien invasive plants, thus causing additional impacts on biodiversity features.

Potential risks (impacts) to the ecological receiving environment are as follows:

1. Loss of indigenous natural vegetation during construction;
2. Impacts on protected plant species;
3. Impacts on a protected tree species;
4. Impacts on sensitive habitats;
5. Mortality of populations of sedentary species during construction;
6. Displacement of populations of mobile species;
7. Introduction and/or spread of declared weeds and alien invasive plants in terrestrial habitats.

A summary and comparison between pre- and post-mitigation phases is provided below.

Environmental parameter	Issues	Rating prior to mitigation	Rating post mitigation
Indigenous natural vegetation	Loss, degradation or fragmentation	-38	-36
Listed or protected plant species	Loss of individuals	-11	-9
Protected trees	Loss of individuals	-12	-9
Sensitive habitats	Loss, degradation or fragmentation	-36	-10
Sedentary fauna	Mortality of individuals	-26	-11
Mobile fauna	Displacement	-8	-8
Natural habitat	Invasion by alien invasive plant species leading to habitat loss and/or degradation	-28	-11

Cumulative impacts of this project in combination with similar projects is likely to be of low significance.

Proposed mitigation measures include formalising a rehabilitation programme, restricting access to sensitive areas, locating internal roads judiciously to avoid sensitive areas, undertaking a botanical walk-through survey, obtaining permits for any protected species that may be affected, undertaking a search and rescue of plants that can be rescued, compiling an alien plant management plan and undertaking regular monitoring.

The two proposed sites for the combination of on-site substation and O&M buildings were evaluated and both sites were found to be favourable. No significant features of concern were found at either site.

The report concludes that the project is unlikely to have highly significant impacts on the ecological receiving environment and impacts that will occur can be controlled and reduced to low significance. Mitigation measures are provided to avoid or minimise these impacts. Some impacts require permits to be issued, either by National or Provincial authorities. If mitigation measures are applied then the potential impacts can be well-managed, in which case the project is supported and it is recommended that it may be authorised.

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## INTRODUCTION

### Terms of reference and approach

SiVEST Environmental Division was appointed to undertake an application for environmental authorisation through an Environmental Impact Assessment (EIA) for the proposed BioTherm Aletta Wind Energy Facility near Copperton in the Northern Cape Province. At this stage, it is proposed that the wind energy facility will consist of the following components:

- Between 80 and 125 wind turbines with a total generation capacity capacity of up to 140MW;
- The turbines will be connected via medium voltage cables to the proposed onsite Eureka East Substation;
- Internal access roads are proposed to be between 4 m and 6 m wide;
- A temporary construction lay down area;
- The operations and maintenance buildings, including an on-site spares storage building, a workshop an an operations building;
- Fencing (if required) will be up to 5m where required and will be either mesh or palisade.

The purpose of the EIA is to identify environmental impacts associated with the project.

On 19 February 2015 David Hoare Consulting cc was appointed by SiVEST Environmental Division to undertake a general ecology assessment of the study area. It was agreed that the study would include the following:

#### Scoping Phase:

- Conduct a desktop scoping study to broadly describe and characterise the study area in terms of:
  - Vegetation types and/or habitats;
  - National conservation status of major vegetation types;
  - Red Data (threatened and endangered) flora and fauna species;
  - The potential presence of trees protected according to the National Forests Act and fauna and flora protected under the National Environmental Management: Biodiversity Act;
  - Important Bird Areas (IBAs) and Critical Biodiversity Areas (CBAs);
  - The general status of vegetation on site; and
  - Potential impact on biodiversity, sensitive habitats and ecosystem functioning.
- Compile scoping level biodiversity report including (but not limited to) the following aspects:
  - Introduction;
  - Legislative background as applicable to the proposed activity;
  - High level description of the environmental baseline;
  - Identification of gaps in terms of the environmental baseline;
  - Methodology;
  - High level identification and mapping of biodiversity (fauna and flora) sensitive areas within the proposed application site (all sensitive areas within the development site must be provided to SiVest as shapefiles);
  - Potential anticipated impacts related to biodiversity (fauna and flora);
  - High level assessment of the significance of the proposed development on flora, fauna and ecology during the Pre-construction, Construction, Operation, Decommissioning Phases;
  - Preliminary Alternatives Assessment;

- o Recommendations for further assessment; and
- o Conclusion.

Impact Assessment Phase:

- Undertake field investigations to assess and confirm the patterns identified during the desktop assessment.
- Compile an impact level biodiversity report including (but not limited to) the following aspects:
  - o Introduction;
  - o Legislative background as applicable to the proposed activity;
  - o Updated environmental baseline;
  - o Methodology;
  - o Identification and mapping of biodiversity (fauna and flora) sensitive areas within the application site based on field investigation and findings (all sensitive areas within the development site must be provided to SiVEST as shapefiles);
  - o Assessment of the significance of the proposed development on flora, fauna and ecology during the Pre-construction, Construction, Operation, Decommissioning **Phases (using SiVEST's Impact Assessment Methodology)**;
  - o Findings (maps to be created and shapefiles submitted);
  - o Alternatives Assessment (alternatives will be provided);
  - o Implications of specialist findings for the proposed development (e.g. permits, licenses, etc.);
  - o Cumulative impact identification and assessment;
  - o Recommend mitigations measures and provide recommendations in order to minimize the impact of the proposed development on flora, fauna, ecology, etc.; and
  - o Conclusion.
- **Update and amend the draft report according to SiVEST's comments and resubmit final report for inclusion in the Environmental Impact Report.**

This report provides details of the results of the Impact Assessment stage assessment. The findings of the study are based on a desktop assessment of the study area, field data collection and mapping from aerial imagery.

## METHODOLOGY

The assessment is to be undertaken in two phases, a Scoping phase and an Impact Assessment phase. This report provides the Impact Assessment level description of the site and assessment of the activity.

### Assessment philosophy

Many parts of South Africa contain high levels of biodiversity at species and ecosystem level. At any single site there may be large numbers of species or high ecological complexity. Sites also vary in their natural character and uniqueness and the level to which they have been previously disturbed. Assessing the potential impacts of a proposed development often requires evaluating the conservation value of a site relative to other natural areas and relative to the national importance of the site in terms of biodiversity conservation. A simple approach to evaluating the relative importance of a site includes assessing the following:

- Is the site unique in terms of natural or biodiversity features?
- Is the protection of biodiversity features on the site of national/provincial importance?
- Would development of the site lead to contravention of any international, national or provincial legislation, policy, convention or regulation?

Thus, the general approach adopted for this type of study is to identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place, i.e. to specifically focus on red flags and/or potential fatal flaws. Biodiversity issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species. These can be organised in a hierarchical fashion, as follows:

#### Species

1. threatened plant species
2. protected trees
3. threatened animal species

#### Ecosystems

1. threatened ecosystems
2. protected ecosystems
3. critical biodiversity areas
4. areas of high biodiversity
5. centres of endemism

#### Processes

1. corridors
2. mega-conservancy networks
3. rivers and wetlands
4. important topographical features

It is not the intention to provide comprehensive lists of all species that occur on site, since most of the species on these lists are usually common or widespread species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which are most likely to result in significant negative impacts on the ecological environment. The focus on national and provincial priorities and critical biodiversity

issues is in line with National legislation protecting environmental and biodiversity resources, including, but not limited to the following which ensure protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment:

1. Environment Conservation Act (Act 73 of 1989)
2. National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998)
3. National Environmental Management Biodiversity Act, 2004. (Act 10 Of 2004)

### Species of conservation concern

There are two types of species of concern for the site under investigation, (i) those listed by conservation authorities as being on a Red List and are therefore considered to be at risk of extinction, and (ii) those listed as protected according to National and/or Provincial legislation.

#### *Red List plant species*

Determining the conservation status of a species is required in order to identify those species that are at greatest risk of extinction and, therefore, in most need of conservation action. South Africa has adopted the IUCN Red List Categories and Criteria to provide an objective, rigorous, scientifically founded system to identify Red List species. A published list of the Red List species of South African plants (Raimondo et al. 2009) contains a list of all species that are considered to be at risk of extinction. This list is updated regularly to take new information into account, but these are not published in book/paper format. Updated assessments are provided on the SANBI website (<http://redlist.sanbi.org/>). According to the website of the Red List of Southern African Plants (<http://redlist.sanbi.org/>), *the conservation status of plants indicated on the Red List of South African Plants Online represents the status of the species within South Africa's borders. This means that when a species is not endemic to South Africa, only the portion of the species population occurring within South Africa has been assessed. The global conservation status, which is a result of the assessment of the entire global range of a species, can be found on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species: <http://www.iucnredlist.org>.* The South African assessment is used in this study.

The purpose of listing Red List species is to provide information on the potential occurrence of species at risk of extinction in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their habitat requirements in order to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (<http://posa.sanbi.org>) for the quarter degree square/s within which the study area is situated. Habitat information for each species was obtained from various published sources. The probability of finding any of these species was then assessed by comparing the habitat requirements with those habitats that were found, during the field survey of the site, to occur there.

#### *Protected trees*

Regulations published for the National Forests Act (Act 84 of 1998) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list was obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI Biodiversity Information System website

(<http://sibis.sanbi.org/>) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed and were considered as being at risk of occurring there. The site was searched for these species during the field survey and any individuals or concentrations noted.

#### *Other protected species*

National legislation was evaluated in order to provide lists of any plant or animal species that have protected status. The most important legislation is the following:

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

This legislation contains lists of species that are protected. These lists were scanned in order to identify any species that have a geographical range that includes the study area and habitat requirements that are met by those found on site. These species were searched for within suitable habitats on site or, where relevant, it was stated that it was considered possible that they could occur on site.

There is additional legislation that provides lists of protected species, but the legislation to which these are attached deal primarily with harvesting or trade in listed species and do not specifically address transformational threats to habitat or individuals. This includes the following legislation:

- *CITES: Convention on the Trade in Endangered Species of Wild Fauna and Flora.*

#### *Red List animal species*

Lists of threatened animal species that have a geographical range that includes the study area were obtained from literature sources (for example, Alexander & Marais 2007, Branch 1988, 2001, du Preez & Carruthers 2009, Friedmann & Daly 2004, Mills & Hes 1997, Monadjem et al. 2010). The likelihood of any of them occurring was evaluated on the basis of habitat preference and habitats available at each of the proposed sites. The three parameters used to assess the probability of occurrence for each species were as follows:

- *Habitat requirements:* most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics within the study area were assessed;
- *Habitat status:* in the event that available habitat is considered suitable for these species, the status or ecological condition was assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Data species (especially wetland-related habitats where water-quality plays a major role); and
- *Habitat linkage:* movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to these surrounding habitats and adequacy of these linkages are assessed for the ecological functioning Red Data species within the study area.

#### *Species probability of occurrence*

Some species of plants may be cryptic, difficult to find, rare, ephemeral or generally not easy to spot while undertaking a survey of a large area. An assessment of the possibility of these species occurring there was therefore provided. For all threatened or protected flora that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- **LOW:** no suitable habitats occur on site / habitats on site do not match habitat description for species;
- **MEDIUM:** habitats on site match general habitat description for species (e.g. karoo shrubland), but detailed microhabitat requirements (e.g. mountain shrubland on shallow soils overlying sandstone) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;

- HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g. mountain shrubland on shallow soils overlying sandstone);
- DEFINITE: species found in habitats on site.

### Habitat sensitivity

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

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

An explanation of the different sensitivity classes is given in Table 1. Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity.

Table 1: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
VERY HIGH	<p>Indigenous natural areas that are highly positive for <u>any</u> of the following:</p> <ul style="list-style-type: none"> <li>• presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species.</li> <li>• <u>High</u> conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk).</li> <li>• <u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)</li> </ul> <p>And may also be positive for the following:</p> <ul style="list-style-type: none"> <li>• <u>High</u> intrinsic biodiversity value (<u>high</u> species richness and/or turnover, unique ecosystems)</li> <li>• <u>High</u> value ecological goods &amp; services (e.g. water supply, erosion control, soil formation, carbon storage, pollination,</li> </ul>	<ul style="list-style-type: none"> <li>• CBA 1 areas.</li> <li>• Remaining areas of vegetation type listed in Draft Ecosystem List of NEM:BA as Critically Endangered, Endangered or Vulnerable.</li> <li>• Protected forest patches.</li> <li>• Confirmed presence of populations of threatened species.</li> </ul>

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
	refugia, food production, raw materials, genetic resources, cultural value) <ul style="list-style-type: none"> <li>• <u>Low</u> ability to respond to disturbance (low resilience, dominant species very old).</li> </ul>	
HIGH	Indigenous natural areas that are positive for any of the following: <ul style="list-style-type: none"> <li>• <u>High</u> intrinsic biodiversity value (<u>moderate/high</u> species richness and/or turnover).</li> <li>• presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species).</li> <li>• <u>Moderate</u> ability to respond to disturbance (<u>moderate</u> resilience, dominant species of intermediate age).</li> <li>• <u>Moderate</u> conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk).</li> <li>• <u>Moderate to high</u> value ecological goods &amp; services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value).</li> </ul> And may also be positive for the following: <ul style="list-style-type: none"> <li>• <u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM: BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>CBA 2 “critical biodiversity areas”</b>.</li> <li>• Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records).</li> <li>• Confirmed habitat for species of lower threat status (near threatened, rare).</li> <li>• Habitat containing individuals of extreme age.</li> <li>• Habitat with low ability to recover from disturbance.</li> <li>• Habitat with exceptionally high diversity (richness or turnover).</li> <li>• Habitat with unique species composition and narrow distribution.</li> <li>• Ecosystem providing high value ecosystem goods and services.</li> </ul>
MEDIUM-HIGH	Indigenous natural areas that are positive for <u>one</u> or <u>two</u> of the factors listed above, but not a combination of factors.	<ul style="list-style-type: none"> <li>• <b>CBA 2 “corridor areas”</b>.</li> <li>• Habitat with high diversity (richness or turnover).</li> <li>• Habitat where a species of lower threat status (e.g. (near threatened, rare) could potentially occur (habitat is suitable, but no confirmed records).</li> </ul>
MEDIUM	Other indigenous natural areas in which factors listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.	

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation.	
LOW	No natural habitat remaining.	

Any natural vegetation within which there are features of conservation concern will be classified into one of the high sensitivity classes (MEDIUM-HIGH, HIGH or VERY HIGH. The difference between these three high classes is based on a combination of factors and can be summarised as follows:

1. Areas classified into the VERY HIGH class are vital for the survival of species or ecosystems. They are either known sites for threatened species or are ecosystems that have been identified as being remaining areas of vegetation of critical conservation importance. CBA1 areas would qualify for inclusion into this class.
2. Areas classified into the HIGH class are of high biodiversity value, but do not necessarily contain features that would put them into the VERY HIGH class. For example, a site that is known to contain a population of a threatened species would be in the VERY HIGH class, but a site where a threatened species could potentially occur (habitat is suitable), but it is not known whether it does occur there or not, is classified into the HIGH sensitivity class. The class also includes any areas that are not specifically identified as having high conservation status, but have high local species richness, unique species composition, low resilience or provide very important ecosystem goods and services. **CBA2 "irreplaceable biodiversity areas" would qualify for inclusion into this class, if there were no other factors that would put them into the highest class.**
3. Areas classified into the MEDIUM-HIGH sensitivity class are natural vegetation in which there are one or two features that make them of biodiversity value, but not to the extent **that they would be classified into one of the other two higher categories. CBA2 "corridor areas" would qualify for inclusion into this class.**

#### Limitations and exclusions

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be unexpectedly located in an area.
- This study excludes invertebrates, avifauna and bats, all of which are addressed in separate specialist studies.

#### Impact assessment methodology

The Impact Assessment Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.



### *Determination of Significance of Impacts*

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 2.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

### *Impact Rating System*

The impact assessment takes into account the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact is detailed.

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Description of terms

NATURE		
A brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		

1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
<b>IRREPLACEABLE LOSS OF RESOURCES</b>		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
<b>DURATION</b>		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 - 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 - 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 - 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 - 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
<b>CUMULATIVE EFFECT</b>		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative Impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
<b>INTENSITY / MAGNITUDE</b>		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).

3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
<b>SIGNIFICANCE</b>		
<p>Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:</p> <p>(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.</p> <p>The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.</p>		
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Table 2: Impact table format

IMPACT TABLE FORMAT	
<i>Environmental parameter</i>	<i>A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water</i>
<i>Issue/Impact/Environmental Effect/Nature</i>	<i>A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota The environmental impact that is likely to positively or negatively affect the environment as a result of the proposed activity e.g. oil spill in surface water</i>

<i>Extent</i>		
<i>Probability</i>	<i>A brief description indicating the chances of the impact occurring</i>	
<i>Reversibility</i>	<i>A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity</i>	
<i>Irreplaceable loss of resources</i>	<i>A brief description of the degree in which irreplaceable resources are likely to be lost</i>	
<i>Duration</i>	<i>A brief description of the amount of time the proposed activity is likely to take to its completion</i>	
<i>Cumulative effect</i>	<i>A brief description of whether the impact will be exacerbated as a result of the proposed activity</i>	
<i>Intensity/magnitude</i>	<i>A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily</i>	
<i>Significance rating</i>	<i>A brief description of the importance of an impact which in turn dictates the level of mitigation required</i>	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	4	1
Probability	4	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	1
Cumulative effect	4	1
Intensity/magnitude	4	1
Significance rating	-96 (high negative)	-6 (low negative)
Mitigation measures	<i>Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analyzing the significance. These measures will be detailed in the EMPR.</i>	

## DESCRIPTION OF STUDY AREA

### Location

The study site is situated approximately 15 km north-east of Copperton and approximately 30 km west-south-west of the town of Prieska within the Northern Cape (Figure 1). The site falls on the boundary of three quarter degree grids: 2922CD, 2922DC and 3022BA. It falls within the Siyathemba Local Municipality that forms part of the Pixley ka Seme District Municipality. The project includes the following farms:

- Portion 1 of the farm Drielings Pan No. 101
- Portion 2 of the farm Drielings Pan No. 101
- Portion 3 of the farm Drielings Pan No. 101
- Remainder of the farm Drielings Pan No. 101

The project site near Copperton has been identified through pre-feasibility studies conducted by BioTherm based on an estimation of the solar energy resource as well as weather, dust, dirt, and surface albedo. Grid connection, competition, flat topography, land availability and site access were also important initial considerations.

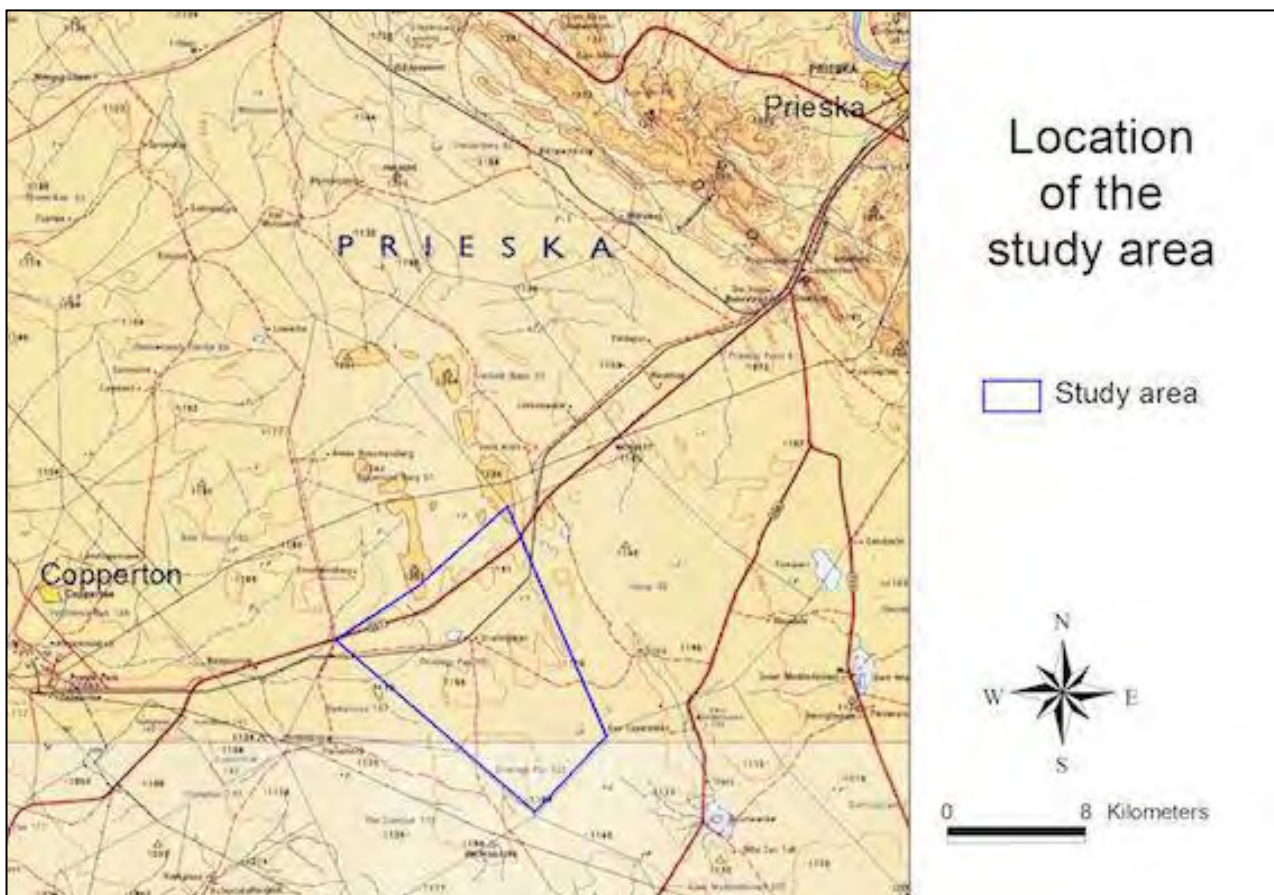


Figure 1: Location of the study area.

## Topography

The study site is situated in a relatively flat landscape. The elevation varies from approximately 1122 m above sea level to approximately 1228 m above sea level. The landscape slopes towards the drainage areas. There are some low hills in the northern part of the site as well as along the eastern boundary.

There are various watercourses and drainage areas in the project study area, as well as a number of small pan depressions.

## Land types and soils

Detailed soil information is not available for broad areas of the country. As a surrogate, landtype data was used to provide a general description of soils in the study area (landtypes are areas with largely uniform soils, topography and climate). There is a single main land type in the study area, the Ag landtype (Land Type Survey Staff, 1987) as well as a very small area of the Ic land type.

The A-group of land types refer to yellow and red soils without water tables belonging to one or more of the following soil forms: Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly. The Ag landtype consists of red, high base status soils, < 300 mm deep with no dunes (MacVicar et al. 1974). The soils on site are therefore expected to be relatively shallow, although probably reasonably fertile.



Figure 2: Aerial image of the study area.



The Ic land type refers to areas with exposed rock (exposed country rock, stones or boulders) covering more than 80% of the area. The rocky portions of Ic may be underlain by soil which would have qualified the unit for inclusion in another broad soil pattern were it not for the surface rockiness. The low hills fall mostly within the Ic land type.

## Climate

The climate is arid to semi-arid. Rainfall occurs from November to April, but peaks in mid- to late summer (February / March). Mean annual rainfall is 140 mm to 170 mm per year. All areas with less than 400 mm rainfall are considered to be arid. The study area can therefore be considered to be arid to very arid.

## Landuse and landcover of the study area

A landcover map of the study area (Fairbanks *et al.* 2000) indicates that the study consists of natural vegetation, **classified as "shrubland and low fynbos"** and some small fragments of "thicket and bushland". The 1:50 000 topocadastral map of the site (Figure 1) and a Google image of the site (Figure 2) show essentially the same pattern. Vegetation typical of the general study area is shown in Plate 1.



Plate 1: Typical vegetation structure within the general study area.

## Broad vegetation types of the region

The sites fall within the Nama-Karoo Biome (Rutherford & Westfall 1986, Mucina & Rutherford 2006). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina *et al.* 2006). This map shows six vegetation types occurring within the broad study area (Figure 3), of which only two are affected directly by the proposed project alternatives. These vegetation types are described in more detail below.

### *Bushmanland Arid Grassland*

This vegetation type occurs on extensive, relatively flat plains and is sparsely vegetated by tussock grasses, including *Stipagrostis ciliata*, *Aristida adscensionis*, *Aristida congesta*, *Enneapogon desvauxii*, *Eragrostis nindensis*, *Schmidtia kalahariensis* and *Stipagrostis obtusa*. In some years after good rains there are abundant displays of annual herbs (Mucina *et al.* 2006). There are no known endemics in this vegetation type (Mucina *et al.* 2006), but does contain endemics belonging to the Griqualand West or Gariiep Centres of Endemism (van Wyk & Smith 2001), namely *Aizoon asbestinum*, *Maerua gilgii*, *Ruschia muricata* and *Aloe gariiepensis*. The vegetation type also contains the protected tree species, *Acacia erioloba* (camel thorn), *Acacia haematoxylon* (grey camel thorn) and *Boscia albitrunca* (shepherd's bush).

This was the most commonly occurring vegetation type found on site. Vegetation on the plains on site broadly matched the general description for this vegetation type, an example of which is shown in Plate 1 on the previous page.

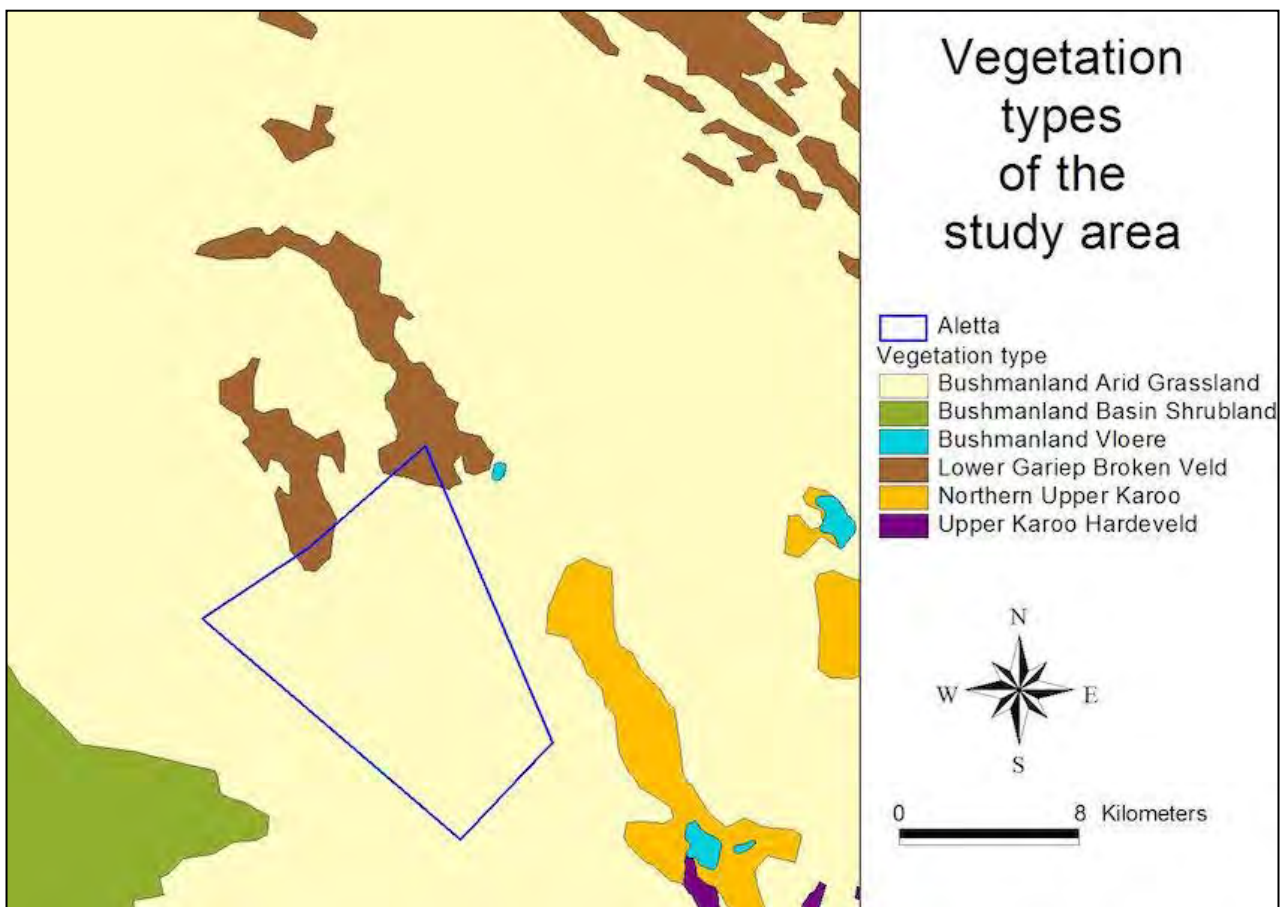


Figure 3: Vegetation types of the project study area.



### *Lower Gariiep Broken Veld*

This consists of sparse vegetation dominated by shrubs and dwarf shrubs, with annuals conspicuous, especially in spring, and perennial grasses and herbs occurring in low amounts. On the slopes of koppies groups of widely scattered low trees such as *Aloe dichotoma* occur and the sandy soils of footslopes *Acacia mellifera* occurs. Known endemics in this vegetation include the tall shrub *Caesalpinia bracteata* and the succulent shrub *Ruschia pungens* (Mucina et al. 2006). The vegetation contains endemics belonging to the Griqualand West or Gariiep Centres of Endemism (van Wyk & Smith 2001), namely *Digitaria polyphylla* and *Crassula corallina* subsp. *macrorrhiza*. At a national scale this vegetation type has been transformed only a small amount and is also conserved in Au-grabies Falls National Park. It is not considered to be a threatened vegetation type (Mucina et al. 2006).

The vegetation of the low hills on site matches the description of this vegetation type most closely, an example of which is shown in Plate 2 below. Note the band of *Acacia mellifera* shrubs around the base of the hill (on the footslopes).

### *Bushmanland Basin Shrubland*

This vegetation type occurs in the Northern Cape Province in the Large Bushmanland Basin centred on Brandvlei and Vanwyksvlei, from Granaatboskolk in the west to Copperton in the east and Kenhardt in the north to Williston in the south (Mucina et al. 2006). It is found on slightly irregular plains. The vegetation is a dwarf shrubland dominated by a mixture of low sturdy, spiny and sometimes succulent shrubs (*Rhigozum*, *Salsola*, *Pentzia* and *Erioccephalus*), white grasses and, in years of high rainfall, abundant annuals, such as *Gazania* and *Leysera*. In comparison to the bordering Bushmanland Arid Grassland, the vegetation of this unit shows



Plate 2: Typical vegetation of the hills within the study area.

increased presence of shrubs and plant indicators of high salt status of soils.

#### *Bushmanland Vloere*

This is the vegetation of the salt pans and broad riverbeds of the central Bushmanland basin (Mucina et al. 2006). It occurs in areas of flat and very even surfaces of pans and broad bottoms of intermittent dry rivers. Typically, the central parts are devoid of vegetation. Around this is loosely patterned scrub dominated by *Rhigozum trichotomum* and various species of *Salsola* and *Lycium*, with a mixture of karroid dwarf shrubs. In places loose thickets of *Parkinsonia africana*, *Lebeckia linearifolia* and *Acacia karroo* may be found.

Local vegetation matching this description was found in a number of small pans located on site. An example is shown in Plate 3 below, which shows pan vegetation surrounded by plains vegetation.

#### *Northern Upper Karoo*

This vegetation type occurs in the Northern Cape and Free State in the northern regions of the Upper Karoo Plateau from near Prieska, Vosburg and Carnarvon in the west to Philipstown, Petrusville and Petrusburg in the east. It is found on flat to gently sloping landscapes. The vegetation is a shrubland dominated by dwarf karoo shrubs, grasses and *Acacia mellifera* and some other low trees. This vegetation type did not occur on site.

#### *Upper Karoo Hardeveld*

This vegetation type is found in the Northern, Western and Eastern Cape Provinces in the region from Middelpoos in the west to Strydenburg, Richmond and Nieu-Bethesda in the east. Most of



Plate 3: Typical vegetation within pans in the study area.

the crest areas and steep slopes of the Great Escarpment facing south between Teekloofpas and Graaff-Reinet are covered in this vegetation. The vegetation occurs on steep slopes of koppies, butts, mesas and parts of the Great Escarpment covered with large boulders and stones. The vegetation is a sparse dwarf Karoo scrub with drought-tolerant grasses. The vegetation unit contains a number of endemics, especially within the Great Escarpment part. This vegetation type did not occur on site.

### Conservation status of broad vegetation types

On the basis of a recently established approach used at national level by SANBI (Driver *et al.* 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 1, as determined by best available scientific approaches (Driver *et al.* 2005).

The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al.* 2005).

All of the vegetation types occurring in the study area (Table 2) are classified as Least Threatened (Driver *et al.* 2005; Mucina *et al.*, 2006). None of the vegetation types are flagged therefore as being of conservation concern.

Table 1: Determining ecosystem status (from Driver *et al.* 2005). \*BT = biodiversity target (the minimum conservation requirement).

Habitat remain in a (%)	80-100	least threatened	LT
	60-80	vulnerable	VU
	*BT-60	endangered	EN
	0-*BT	critically endangered	CR

Table 2: Conservation status of different vegetation types occurring in the study area, according to Driver *et al.* 2005 and Mucina *et al.* 2005.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver <i>et al.</i> 2005; Mucina <i>et al.</i> , 2006	Draft Ecosystem List (NEMBA)
Bushmanland Arid Grassland	21	1	1	Least Threatened	Not listed
Lower Gariep Broken Veld	21	4	1	Least Threatened	Not listed
Bushmanland Basin Shrubland	21	0	1	Least Threatened	Not listed
Bushmanland Vloere	24	0	2	Least Threatened	Not listed
Northern Upper Karoo	21	0	4	Least Threatened	Not listed
Upper Karoo Hardeveld	21	3	0	Least Threatened	Not listed



## Biodiversity Conservation Plans

There are no fine-scale biodiversity conservation plans for the study area (bgis.sanbi.org). **According to SANBI,** "Presently BGIS has no Systematic Biodiversity Conservation Plan for the Northern Cape other than the Namakwa District Biodiversity Sector Plan therefore the Biodiversity Summaries Map is used in its place for land use decision support in the province." The Biodiversity Summary Map for the Pixley ka Seme District Municipality shows all natural vegetation within the municipal area, except along the Orange River, to be Least Threatened and no areas mapped as of particular biodiversity concern.

## Proposed protected areas

According to the National Parks Area Expansion Strategy (NPAES), the central part of the site has been identified as a priority area for inclusion in future protected areas. According to the guideline description of the strategy, the "focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with strong emphasis on climate change resilience and requirements for freshwater ecosystems. These areas should not be seen as future boundaries of protected

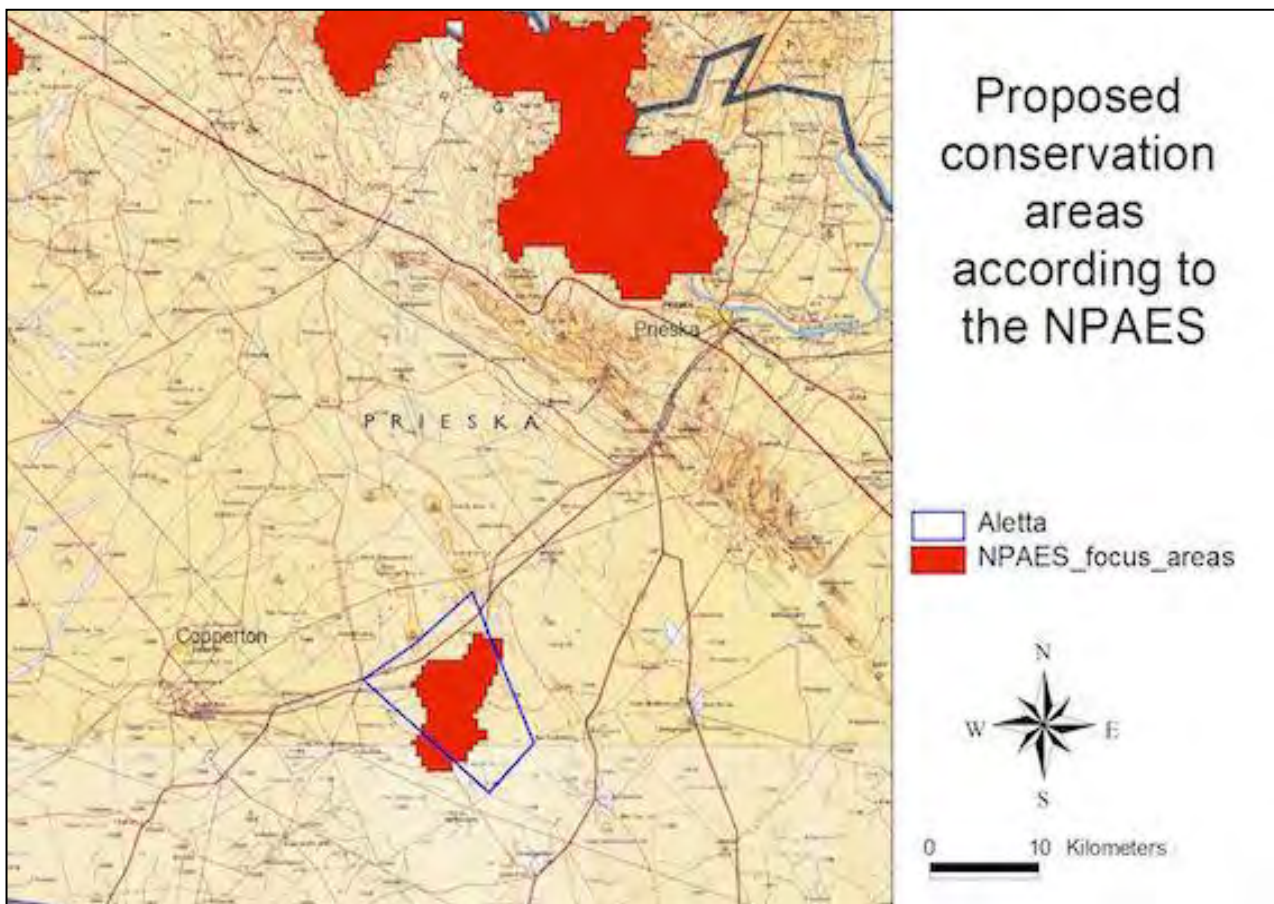


Figure 4: Proposed National Park expansion areas according to the NPAES.

areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES". No description is provided of specific biodiversity features per proposed area.

The area on site shown as being included in the NPAES (see Figure 4) includes a small portion of the hills as well as mostly plains areas. Based on the field assessment of this site as well as that for the nearby Eureka project, the specific areas selected for inclusion in the NPAES are not unique to that specific location and could be accommodated in adjacent areas. The hills on site were considered to all have equivalent biodiversity patterns. Some of the plains in the selected area were considered to be slightly compromised by existing activities on site (farm-house, roads and livestock impacts). The opportunity to implement a more detailed conservation plan is therefore not compromised by the proposed project.

### Red List plant species of the study area

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

There is one species that was considered to possibly occur in the study area, the succulent, *Hoodia officinalis* subsp. *officinalis*. This species is listed as Near Threatened (see Table 3 for explanation of categories). The species is found in Desert, Nama Karoo and Succulent Karoo and is found inside bushes in flat or gently sloping areas. The species has been recorded in two neighbouring grids and the possibility of it occurring in the study area was therefore considered to be high. A detailed search across the entire site did not locate any individuals of this species. The plants are relatively conspicuous and should have been visible if they occurred there. It is therefore considered unlikely, although not impossible, that the species occurs on site.

There is another Near Threatened plant species that could potentially occur in the study area, namely *Drimia sanguinea*. The main occurrence of this species is, however, more to the north and north-east of the current site. No individuals of this species were seen during the field survey.

Table 3: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

## Red List animal species of the study area

All Red List vertebrates (mammals, reptiles, amphibians) that could occur in the study area are listed in Appendix 3.

Excluding bats, which are assessed in a separate specialist study, there are two mammal species of low conservation concern that could occur in available habitats in the study area. These are the Honey Badger and **Littledale's** Whistling Rat. Both of these species are classified nationally as near threatened (NT), but globally as Least Concern. They are, therefore, of relatively low conservation concern in comparison to more threatened species found in other parts of the country. The Honey Badger is protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. **Only the Honey Badger and Littledale's Whistling Rat** were considered likely to be found on site. The Honey Badger is a mobile species and it is considered unlikely that construction and operation of the proposed Wind Energy Facility would affect it significantly. Individuals are likely to move away from the path of construction and then return during operation to undisturbed habitats. No evidence of Littledale's Whistling Rat was found on site during the field survey. There is a possibility of it occurring there, but it is considered unlikely at this stage.

The Giant Bullfrog is the only amphibian species with a distribution that includes the study area and which could occur on any of the sites. This species is classified as Least Concern globally and Near threatened in South Africa. It is, however, protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. The study area is at the limits of the distribution of this species. No evidence of it was found on site, but there is still the possibility that it occurs there.

There are no reptile species of conservation concern that have a distribution that includes the study area.

## Protected plants (National Environmental Management: Biodiversity Act)

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

*Hoodia gordonii* is found in Namibia, Botswana, Angola and the dry margins of the summer rainfall region of South Africa, including parts of the Western Cape, Northern Cape and Free State Provinces. It 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 has not been previously recorded in this grid, but has been recorded in the grid to the north-east. Suitable habitat conditions occur on site relative to the species requirements. However, no individuals of this species were found on site. It is therefore considered unlikely that it occurs there.

*Harpagophytum procumbens* occurs in Angola, Botswana, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe. Within South Africa this species occurs in the Northern Cape, North West, Free State, and Limpopo Provinces and the largest populations are found in the communally owned areas of the North West Province and the north eastern parts of the Northern Cape. The species Well drained sandy habitats in open savanna and woodlands. It has not been

previously recorded in this grid, but has been recorded in the grids to the north. Marginally suitable habitat conditions were found on site relative to the species requirements. However, no individuals of this species were found on site and it is considered unlikely that it occurs there.

#### Protected plants (Northern Cape Nature Conservation Act, No. 9 of 2009)

The Act provides lists of protected species for the Province, which is very lengthy and includes a number of commonly occurring species (see Appendix 7). According to Northern Cape Nature Conservation officials, a permit is required for the removal of any species on this list. Based on previous experience on projects in the Northern Cape Province, it must be assumed that a permit application will need to be undertaken and that it will include a variety of species found on site, including various common species.

The following species were found on site that are protected according to the Northern Cape Nature Conservation Act:

1. *Eberlanzia ferox* (MESEMBRYANTHEMACEAE) - very common
2. *Sutherlandia frutescens*
3. *Boscia albitrunca*
4. *Aloe claviflora*
5. *Moraea* species (IRIDACEAE)
6. Unknown bulb that could be *Drimia sanguinea* (see Plate 4 below)
7. *Babiana* species (IRIDACEAE)
8. Unknown bulb 2



Plate 4: Unknown bulb found on site - looks like *Drimia sanguinea*.



It is likely that detailed site-specific searches will reveal a number of additional species that are protected according to the Northern Cape Nature Conservation Act.

#### Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3. The only one that has a geographical distribution that includes the study sites is *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi). *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi) occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils.

A number of individuals of *Boscia albitrunca* were found on site, especially within the low hills on the eastern side of the site. These varied from upright individuals in open areas to sprawling, decumbent plants in rocky areas (see Plate 5 below). There is a high probability that proposed infrastructure will affect individuals of this species.

#### Protected animals

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). According to this Act, "a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species



Plate 5: Typical *Boscia albitrunca* trees on site.



without a permit issued in terms of Chapter 7". Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution that includes the site are listed in Appendix 6, marked with the letter "N". This includes the following species: White Rhinoceros, Black Wildebeest, Oribi, Cheetah, Cape Clawless Otter, Black-footed Cat, Brown Hyaena, Serval, Spotted-necked Otter, Honey Badger, Leopard, Cape Fox, Southern African Hedgehog, Southern African Python and Giant Bullfrog.

Due to habitat and forage requirements and the fact that some species are restricted to game farms and/or conservation areas, only the Black-footed Cat, Honey Badger, Leopard, Cape Fox and Giant Bullfrog have a likelihood of occurring on site. All of these species are mobile animals that are likely to move away in the event of any activities on site disturbing them. They are therefore unlikely to be affected by the proposed development of the wind energy facility and associated infrastructure.

#### Alien invasive species observed on site

The tree, *Prosopis glandulosa*, was seen on site in localised places and is present in the general study area. There is a high risk of this species becoming invasive in the project area. The only other declared weed seen on site was *Datura ferox*, which also has the potential to become

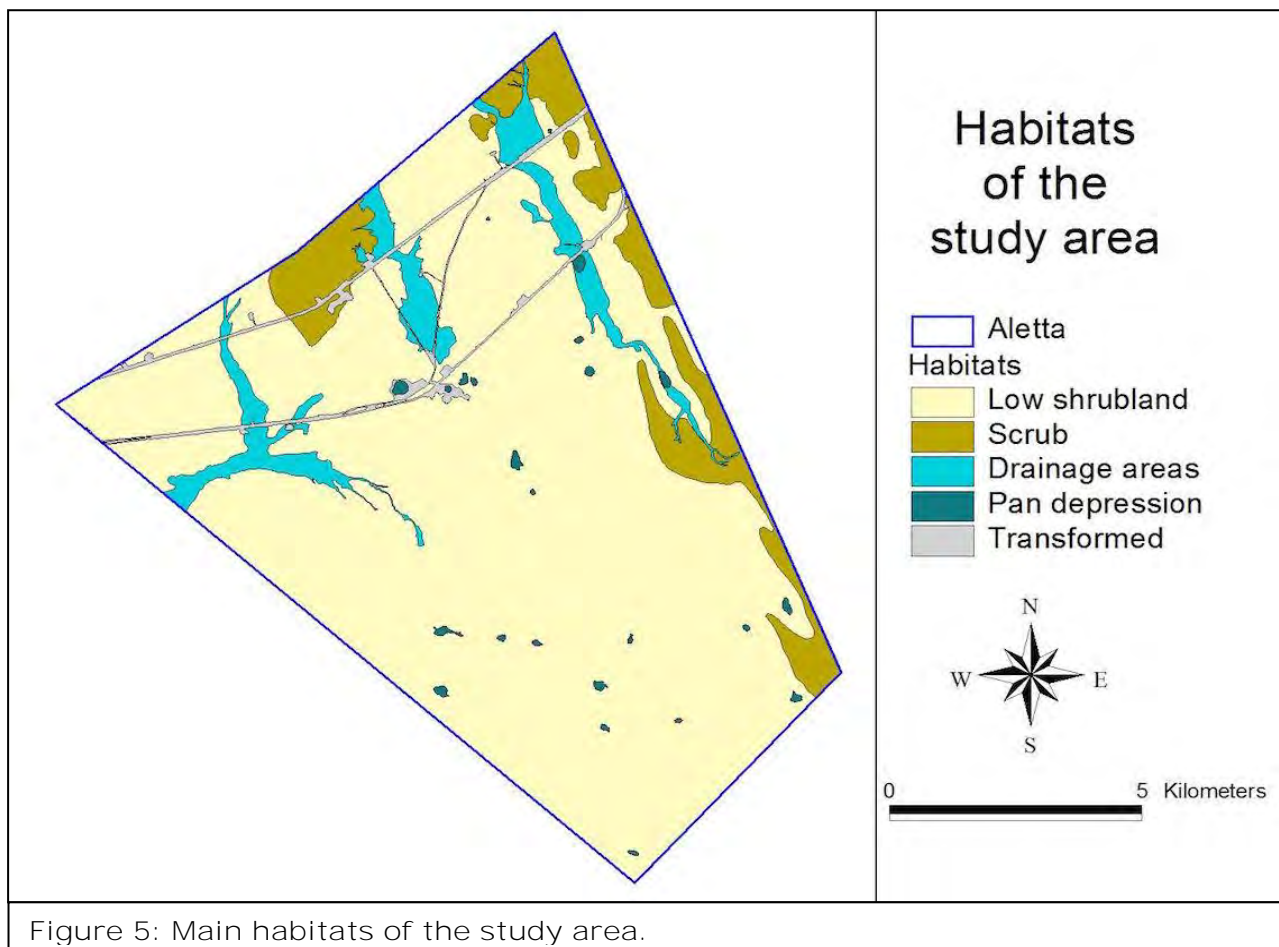


Figure 5: Main habitats of the study area.

problematic. Other species seen in the general area are *Opuntia ficus-indica* and *Schinus molle*. There are a wide variety of other species that occur in the general geographical area and any of these could become established on site.

### Habitats on site

The distribution of main habitats on site is shown in Figure 5. Aerial imagery and the field survey indicates that most of the site consists of natural vegetation (karroid dwarf shrubland called Bushmanland Arid Grassland). There are very shallow drainage areas running through the site and a number of small pan depressions. These lowland areas have deeper, calcareous soils and the vegetation is distinctly different to the surrounding plains. These areas of deeper soils have a higher incidence of animal burrows and, based on excavations that were examined, the water table appears to be closer to the surface. There are also some low hills along the northern and eastern boundary of the site where quartzite rocks outcrop from the surrounding plains. These hills have shallow soils and high surface rock cover. The different physiographic units harbour different vegetation structure and species composition.

### Pans and drainage areas

The study area contains some drainage areas and pans. These are visible on aerial imagery and are shown in Figure 5. The drainage areas and pans, as mapped here, define habitat units and not wetlands, as defined in the National Water Act. Wetlands, riparian zones and watercourses are defined in the National Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). It is important that these areas are properly delineated according to accepted methods and that impacts on them are kept to a minimum, if possible.

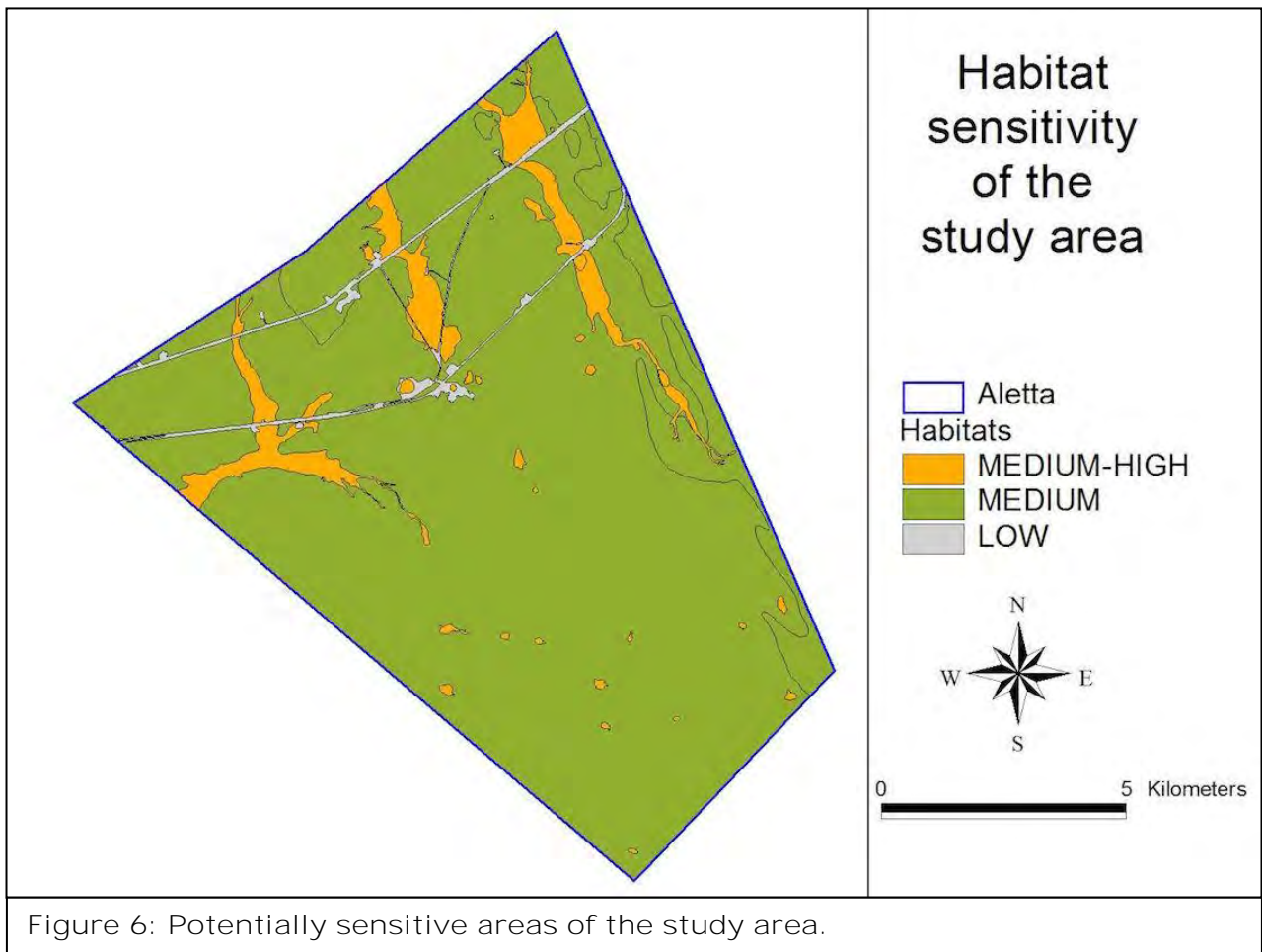
### Sensitivity assessment

The sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. Areas of potentially high sensitivity are shown in Figure 6. The information provided in the preceding sections was used to compile a map of remaining natural habitats and areas important for maintaining ecological processes in the study area. The only features of potential concern that need to be taken into account in order to evaluate sensitivity in the study area is the presence of non-perennial watercourses and pan depressions. These represent ecological processes, including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;

These factors have been taken into account in evaluating sensitivity within the study area. Watercourses are considered to be the most sensitive features on site. The sensitivity classification is as follows:

1. MEDIUM-HIGH: All of the watercourses, pans and drainage areas on site are classified as having medium-high sensitivity (see Figure 6). They are protected according to the National Water Act (Act 36 of 1998). Ecologically, they are areas that provide moderate value ecosystem goods and services. They have deeper soils and there is a higher probability of burrowing animals occurring within this habitat.
2. MEDIUM: The majority of the study area is classified as having medium sensitivity (see Figure 6). These are areas of natural vegetation which harbour no particular features of conservation concern, except for habitat that is potentially suitable for five near

threatened animal species and one near threatened plant species (none confirmed to



occur on site). There is one protected tree species that may also occur within some of these areas.

3. LOW: Transformed areas are classified as having low sensitivity (see Figure 6). These are areas in which no intact natural habitat still remains.

## RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

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

### Legislation

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

NEMA requires, inter alia, that:

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

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

*Environment Conservation Act No 73 of 1989 Amendment Notice No R1183 of 1997*

The ECA states that:

Development must be environmentally, socially and economically sustainable. Sustainable development requires the consideration of inter alia the following factors:

- that pollution and degradation of the environment is avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
- that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and
- that negative impacts on the environment and on peoples’ environmental rights be anticipated and prevented, and where they cannot be altogether prevented are minimised and remedied.

The developer is required to undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations in order to control activities which might have a detrimental effect on the environment. Such activities will only be permitted with written authorisation from a competent authority.

*National Forests Act (Act no 84 of 1998)*

### Protected trees

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

### Forests

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

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

In terms of the Biodiversity Act, the developer has a responsibility for:

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

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

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

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

Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. According to Section 75 of the Act, "Control and eradication of listed invasive species":

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

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

Published under Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). This Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

The Environmental Impact Assessment (EIA) Regulations include three lists of activities that require environmental authorisation:

- Listing Notice 1: activities that require a basic assessment (R544 of 2010),
- Listing Notice 2: activities that require seeing and environmental impact report (EIR) (R545 of 2010),
- Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (R546 of 2010).

Activity 12 in Listing Notice 3 relates to the clearance of 300m<sup>2</sup> of more of vegetation, which will trigger a basic assessment within any critically endangered or endangered ecosystem listed in terms of S52 of the Biodiversity Act. This means any development that involves loss of natural habitat in a listed critically endangered or endangered ecosystem is likely to require at least a basic assessment in terms of the EIA regulations.

It is important to note that while the original extent of each listed ecosystem has been mapped, a basic assessment report in terms of the EIA regulations is triggered only in remaining natural habitat within each ecosystem and not in portions of the ecosystem where natural habitat has already been irreversibly lost.

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

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

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

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

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

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

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

*National Water Act (Act 36 of 1998)*

Wetlands, riparian zones and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (Act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

Any collection of water which the Minister may, by notice in the gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

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

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

*Northern Cape Nature Conservation Act, No. 9 of 2009*

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

- **Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property;**
- **Aquatic habitats may not be destroyed or damaged;**
- **The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species.**

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

*Other Acts*

Other Acts that may apply to biodiversity issues, but which are considered to not apply to the current site are as follows:

- National Environmental Management Protected Areas Act (Act No. 57 of 2003)
- Marine Living Resources Act (Act No. 18 of 1998)
- Sea Birds and Seals Protection Act (Act No. 46 of 1973)
- Lake Areas Development Act (Act No. 39 of 1975)
- Mountain Catchment Areas Act (Act No. 63 of 1970)
- Integrated Coastal Zone Management Act (Act No. 24 of 2008)





## ASSESSMENT OF POTENTIAL IMPACTS

### Description of potential impacts

Potential issues relevant to potential impacts on the ecology of the study area include the following:

- Impacts on biodiversity: this includes any impacts on populations of individual species of concern (flora and fauna), including protected species, and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of concern.
- Impacts on sensitive habitats: this includes impacts on any sensitive or protected habitats, including indigenous forest and/or woodland and wetland vegetation that leads to direct or indirect loss of such habitat.
- Impacts on ecosystem function: this includes impacts on any processes or factors that maintain ecosystem health and character, including the following:
  - disruption to nutrient-flow dynamics;
  - impedance of movement of material or water;
  - habitat fragmentation;
  - changes to abiotic environmental conditions;
  - changes to disturbance regimes, e.g. increased or decreased incidence of fire;
  - changes to successional processes;
  - effects on pollinators;
  - increased invasion by alien plants.

Changes to factors such as these may lead to a reduction in the resilience of plant communities and ecosystems or loss or change in ecosystem function.

- Secondary and cumulative impacts on ecology: this includes an assessment of the impacts of the proposed project taken in combination with the impacts of other known projects for the area or secondary impacts that may arise from changes in the social, economic or ecological environment.
- Impacts on the economic use of vegetation: this includes any impacts that affect the productivity or function of ecosystems in such a way as to reduce the economic value to users, e.g. reduction in grazing capacity, loss of harvestable products. It is a general consideration of the impact of a project on the supply of so-called ecosystem goods and services.

A number of direct risks to ecosystems that would result from construction of the proposed wind energy facility are as follows:

- Clearing of land for construction.
- Construction of access roads.
- Establishment of borrow, spoil and laydown areas.
- Chemical contamination of the soil by construction vehicles and machinery.
- Operation of construction camps.
- Storage of materials required for construction.

There are also risks associated with operation of the proposed facility, as follows:

- Maintenance of surrounding vegetation as part of management of the wind energy facility.
- Invasion of habitats by alien plants as a consequence of disturbance.

## Potential issues for the general study area

A summary of the potential ecological issues for the study area is as follows (issues assessed by other specialists, e.g. on flying animals and on wetlands, are not included here):

- Presence of natural vegetation on site, although of low conservation priority.
- Potential presence of a number of Provincially protected plant species.
- Presence of one protected tree species, *Boscia albitrunca*.
- Potential presence of the following partly sedentary animals of conservation concern:
  - **Littledale's Whistling Rat (NT)**
  - Giant Bullfrog (NT/LC).
- Potential invasion of natural habitats by alien invasive plants, thus causing additional impacts on biodiversity features.

Potential risks to the ecological receiving environment are therefore the following:

8. Loss of indigenous natural vegetation during construction;
9. Impacts on protected plant species;
10. Impacts on a protected tree species;
11. Impacts on sensitive habitats;
12. Mortality of populations of sedentary species during construction;
13. Displacement of populations of mobile species;
14. Introduction and/or spread of declared weeds and alien invasive plants in terrestrial habitats.

## Planning Phase impacts

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

## Construction Phase impacts

### *Impact 1: Impacts on indigenous natural vegetation*

The regional terrestrial vegetation type in the broad study area is Bushmanland Basin Shrubland, listed as Least Threatened. Some loss of habitat will occur, but this will be insignificant in comparison to the total area of the vegetation type concerned. The assessment here is for all infrastructure components and assumes a significant impact due to the construction of internal access roads.

Table 4: Impact table for Impact 1.

Loss of indigenous natural vegetation	
<i>Environmental parameter</i>	<i>Indigenous natural vegetation</i>
<i>Issue/Impact/Environmental Effect/Nature</i>	<i>Loss, degradation or fragmentation of vegetation.</i>
<i>Extent</i>	<i>The impact will affect natural vegetation on site and possibly in immediately surrounding areas.</i>
<i>Probability</i>	<i>The impact will definitely happen.</i>
<i>Reversibility</i>	<i>Irreversible in human timeframes, since natural successional processes cannot compensate for complete local loss of habitat and diversity. Secondary vegetation</i>

	<i>will probably never resemble the original vegetation found on site.</i>	
<i>Irreplaceable loss of resources</i>	<i>Significant loss of resources will occur.</i>	
<i>Duration</i>	<i>The impact will be permanent (mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient.)</i>	
<i>Cumulative effect</i>	<i>Low cumulative impact. Added to existing impacts on natural habitat from mining activities in the general region as well as other proposed alternative energy projects, the current project will cause additional loss of vegetation, the cumulative effect of which will possibly be noticeable.</i>	
<i>Intensity/magnitude</i>	<i>Low. Regional vegetation will continue to function.</i>	
<i>Significance rating</i>	<i>Medium negative impact expected.</i>	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	4	4
Irreplaceable loss	3	3
Duration	4	4
Cumulative effect	3	2
Intensity/magnitude	2	2
Significance rating	-38 (high negative)	-36 (medium negative)
Mitigation measures	<p><i>It is not possible to avoid impacts on indigenous vegetation for this project. The following mitigation measures would help to limit impacts:</i></p> <ol style="list-style-type: none"> <li><i>1. Restrict impact to development footprint only and limit disturbance creeping into surrounding areas.</i></li> <li><i>2. As far as possible, locate infrastructure within areas that have been previously disturbed or in areas with lower sensitivity scores.</i></li> <li><i>3. Avoid sensitive features and habitats when locating infrastructure.</i></li> <li><i>4. Undertake detailed field surveys of the proposed footprint of infrastructure to locate any sensitive species and/or ecological features. If necessary, shift infrastructure to avoid impacts on species or specific features.</i></li> <li><i>5. Compile a Rehabilitation Plan.</i></li> <li><i>6. Compile an Alien Plant Management Plan, including monitoring, to ensure minimal impacts on surrounding areas.</i></li> <li><i>7. The footprint of the proposed road infrastructure needs to be assessed again once it is known. Where possible, this should be located along existing farm roads.</i></li> <li><i>8. Access to sensitive areas should be limited during construction.</i></li> </ol>	

	9. Undertake monitoring to evaluate whether further measures would be required to manage impacts.
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*Impact 2: Impacts on protected plant species*

Nature: Plant species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

There are two species protected according to the National Environmental Management: Biodiversity Act, *Hoodia gordonii* and *Harpagophytum procumbens*, neither of which are considered likely to occur on site. There are a number of species that are protected according to the Northern Cape Nature Conservation Act. A number of these occur on site and there is a high probability that additional species occur there and that one or more of these species will be affected by proposed activities on site.

Table 5: Impact table for Impact 2.

Loss of individuals of protected plants		
<i>Environmental parameter</i>	<i>Protected plants, as per NEM:BA and Northern Cape Nature Conservation Act.</i>	
<i>Issue/Impact/Environmental Effect/Nature</i>	<i>Loss of individuals.</i>	
<i>Extent</i>	<i>The impact will affect local populations or individuals of the affected species.</i>	
<i>Probability</i>	<i>Based on the list of species that are protected, the impact will almost certainly happen.</i>	
<i>Reversibility</i>	<i>Partly reversible. Individuals can be rescued or else cultivated to replace lost specimens.</i>	
<i>Irreplaceable loss of resources</i>	<i>Marginal loss of resources could occur. The species that are likely to occur on site are likely to be relatively common throughout their range.</i>	
<i>Duration</i>	<i>The impact will be medium-term.</i>	
<i>Cumulative effect</i>	<i>Low cumulative impact. Cumulative effects will not be significant.</i>	
<i>Intensity/magnitude</i>	<i>Low. Loss of some individuals will be insignificant compared to the number that probably occur in surrounding areas.</i>	
<i>Significance rating</i>	<i>Low negative impact expected.</i>	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	2	2
Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	2	1
Intensity/magnitude	1	1
Significance rating	-11 (low negative)	-9 (low negative)
Mitigation measures	<i>It is possible to a limited extent to avoid some impacts on protected species for this project. The following</i>	

	<p>mitigation measures would help to avoid and limit impacts:</p> <ol style="list-style-type: none"> <li>1. It is a legal requirement to obtain permits for specimens that will be lost.</li> <li>2. A pre-construction walk-through survey will be required during a favourable season to locate any protected plants. This survey must cover the footprint of all proposed infrastructure, including internal access roads.</li> <li>3. Plants lost to the development can be rescued and planted in appropriate places in rehabilitation areas. This will reduce the irreplaceable loss of resources as well as the cumulative effect.</li> <li>4. A Plant Rescue Plan must be compiled to be approved by the appropriate authorities.</li> <li>5. Where large populations of affected species are encountered, consideration should be given to shifting infrastructure to avoid such areas.</li> </ol>
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*Impact 3: Loss of individuals of protected trees*

There is one protected tree species that occurs on site, *Boscia albitrunca*. This species is found primarily within the rocky hills, but also as lone individuals in other areas.

Table 6: Impact table for Impact 3.

Loss of individuals of protected trees		
<i>Environmental parameter</i>	<i>Protected trees, as per National Forests Act.</i>	
<i>Issue/Impact/Environmental Effect/Nature</i>	<i>Loss of individuals.</i>	
<i>Extent</i>	<i>The impact will affect local populations or individuals of the affected species.</i>	
<i>Probability</i>	<i>The impact may possibly happen.</i>	
<i>Reversibility</i>	<i>Partly reversible. Individuals can be rescued or else cultivated to replace lost specimens, but this is likely to have limited value as a mitigation measure.</i>	
<i>Irreplaceable loss of resources</i>	<i>Marginal loss of resources could occur. The species that are likely to occur on site are likely to be relatively common throughout their range.</i>	
<i>Duration</i>	<i>The impact will be medium-term.</i>	
<i>Cumulative effect</i>	<i>Low cumulative impact. Cumulative effects will not be significant.</i>	
<i>Intensity/magnitude</i>	<i>Low. Loss of some individuals will be insignificant compared to the number that probably occur in surrounding areas.</i>	
<i>Significance rating</i>	<i>Low negative impact expected.</i>	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2

Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	2	1
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-9 (low negative)
Mitigation measures	<p><i>It is possible to some extent to avoid impacts on protected trees for this project. The following mitigation measures would help to avoid and limit impacts:</i></p> <ol style="list-style-type: none"> <li>1. <i>It is a legal requirement to obtain permits for specimens that will be lost.</i></li> <li>2. <i>A pre-construction walk-through survey will be required to locate any protected trees.</i></li> <li>3. <i>Concentrations of plants can be avoided by shifting infrastructure components, where necessary. This will reduce the irreplaceable loss of resources as well as the cumulative effect.</i></li> <li>4. <i>A Plant Rescue Plan must be compiled to be approved by the appropriate authorities.</i></li> </ol>	

*Impact 4: Impacts on sensitive habitats*

There is one main drainage area, one subsidiary drainage and three small pans occurring on site. The plant species composition within these areas is different to surrounding terrestrial areas, even though the site is within an arid region. The soils within these areas are also deeper and more suitable for burrowing animals. The low, rocky hills are also considered to be of higher sensitivity than surrounding areas due to the higher species richness and higher likelihood of encountering rare and/or protected species, especially geophytes. Some loss of habitat will probably occur within these more sensitive areas.

Table 7: Impact table for Impact 4.

Damage to sensitive habitats	
<i>Environmental parameter</i>	<i>Drainage areas, pan depressions and rocky hills</i>
<i>Issue/Impact/Environmental Effect/Nature</i>	<i>Loss, degradation or fragmentation of vegetation.</i>
<i>Extent</i>	<i>The impact may affect drainage areas, pan depressions and rocky hills on site.</i>
<i>Probability</i>	<i>Based on the proposed location of turbines, the impact will probably happen</i>
<i>Reversibility</i>	<i>Irreversible in human timeframes, since natural successional processes cannot compensate for complete local loss of habitat and diversity. Secondary vegetation will probably never resemble the original vegetation found on site.</i>
<i>Irreplaceable loss of resources</i>	<i>Significant loss of resources could occur.</i>
<i>Duration</i>	<i>The impact will be permanent (mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient.)</i>
<i>Cumulative effect</i>	<i>Medium cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional loss of habitat.</i>
<i>Intensity/magnitude</i>	<i>Medium. Sensitive ecosystems will probably continue to function, but in a modified way.</i>
<i>Significance rating</i>	<i>Medium negative impact expected.</i>

	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	4	2
Reversibility	4	2
Irreplaceable loss	3	2
Duration	4	2
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-36 (medium negative)	-10 (low negative)
Mitigation measures	<p><i>It is possible to some extent to avoid impacts on sensitive habitats for this project. The following mitigation measures would help to avoid or limit impacts:</i></p> <ol style="list-style-type: none"> <li>1. <i>Select alternative sites for infrastructure where features of concern may be affected.</i></li> <li>2. <i>Prevent erosion impacts on drainage systems.</i></li> <li>3. <i>Rehabilitate disturbance as quickly as possible.</i></li> <li>4. <i>Prevent invasion by alien plants.</i></li> <li>5. <i>Undertake monitoring to evaluate whether further measures would be required to manage impacts.</i></li> </ol>	

*Impact 5: Mortality of populations of sedentary species*

There are three animal species of conservation concern that could potentially be affected by the proposed project:

1. Honey badger (NT)
2. **Littledale's Whistling Rat (NT)**
3. Giant Bullfrog (NT/LC)

**Two of these species, Littledale's Whistling Rat and the Giant Bullfrog, are** relatively sedentary and therefore considered to be potentially vulnerable to habitat loss, as related to this project. The remaining species is highly mobile and will not be affected by some loss of habitat within their overall range.

Table 8: Impact summary table for Impact 5.

Mortality of individuals of sedentary fauna	
<i>Environmental parameter</i>	<b><i>Littledale's Whistling Rat and the Giant Bullfrog</i></b>
<i>Issue/Impact/Environmental Effect/Nature</i>	<i>Loss of individuals.</i>
<i>Extent</i>	<i>The impact will affect individuals on site and possibly in immediately surrounding areas.</i>
<i>Probability</i>	<i>The impact may possibly happen.</i>
<i>Reversibility</i>	<i>Partly reversible. Preventative measures could reduce mortality to below replacement levels.</i>
<i>Irreplaceable loss of resources</i>	<i>Marginal loss of resources will occur.</i>
<i>Duration</i>	<i>The impact will be long-term.</i>
<i>Cumulative effect</i>	<i>Medium cumulative impact. Cumulative effects will be minor.</i>
<i>Intensity/magnitude</i>	<i>Medium. May impact on population processes.</i>

<i>Significance rating</i>	<i>Low negative impact expected.</i>	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-11 (low negative)
Mitigation measures	<p><i>It is possible to some extent to avoid impacts on sensitive habitats for this project. The following mitigation measures would help to avoid or limit impacts:</i></p> <ol style="list-style-type: none"> <li><i>1. Continue to observe on site whether either species does or could occur on site or not.</i></li> <li><i>2. If either species is found to occur on site, the habitat requirements of the species on site needs to be determined. Infrastructure must then avoid sensitive areas or else measures must be put in place to minimise impacts.</i></li> </ol>	

*Impact 6: Displacement of mobile fauna*

Construction activities, loss of habitat, noise, dust and general activity associated with the construction phase of the project are likely to cause all mobile species to move away from the site. Mobile species of conservation concern (two sedentary species are discussed for the previous impact) that could potentially be affected by the proposed project are as follows:

1. Honey badger (NT)

The Honey Badger is a highly mobile terrestrial species with a large home range and the ability to travel long distances in short periods of time. It may be locally displaced, but this will have little effect on the overall range of the species nor is it expected that any overall impacts will result from local displacement.

Table 8: Impact summary table for Impact 6.

<b>Displacement of individuals of mobile fauna</b>	
<i>Environmental parameter</i>	<i>Mobile fauna of conservation concern</i>
<i>Issue/Impact/Environmental Effect/Nature</i>	<i>Displacement of individuals.</i>
<i>Extent</i>	<i>The impact will affect individuals on site and possibly in immediately surrounding areas.</i>
<i>Probability</i>	<i>The impact may possibly happen.</i>
<i>Reversibility</i>	<i>Partly reversible with time.</i>
<i>Irreplaceable loss of resources</i>	<i>No or low loss of resources will occur.</i>
<i>Duration</i>	<i>The impact will be short-term (construction phase).</i>
<i>Cumulative effect</i>	<i>Low cumulative impact. Cumulative effects will be minor.</i>
<i>Intensity/magnitude</i>	<i>Low. May impact on population processes.</i>
<i>Significance rating</i>	<i>Low negative impact expected.</i>



	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-8 (low negative)	-8 (low negative)
Mitigation measures	<i>None required</i>	

### Operational Phase impacts

#### *Impact 7: Establishment and spread of declared weeds and alien invader plants*

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

Table 9: Impact summary table for Impact 7.

Establishment and spread of declared weeds		
<i>Environmental parameter</i>	<i>Vegetation and habitat</i>	
<i>Issue/Impact/Environmental Effect/Nature</i>	<i>Loss of habitat due to invasion by alien plants</i>	
<i>Extent</i>	<i>The impact will affect habitat on site and possibly in immediately surrounding areas.</i>	
<i>Probability</i>	<i>The impact will probably happen in the absence of control measures.</i>	
<i>Reversibility</i>	<i>Partly reversible in the absence of control measures. Completely reversible if mitigation measures applied. Preventative measures will stop the impact from occurring.</i>	
<i>Irreplaceable loss of resources</i>	<i>Marginal to significant loss of resources will occur. Uncontrolled invasion can affect all nearby natural habitats.</i>	
<i>Duration</i>	<i>The impact will be long-term.</i>	
<i>Cumulative effect</i>	<i>Low cumulative impact. Cumulative effects will not be significant.</i>	
<i>Intensity/magnitude</i>	<i>Medium. Severe invasion can alter the functioning of natural ecosystems.</i>	
<i>Significance rating</i>	<i>Low negative impact expected.</i>	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	3	2
Duration	3	3

Cumulative effect	2	2
Intensity/magnitude	2	1
Significance rating	-28 (medium negative)	-11 (low negative)
Mitigation measures	<p><i>It is possible to avoid impacts due to alien plant invasions by undertaking the following mitigation measures:</i></p> <ol style="list-style-type: none"> <li>1. <i>Undertake a comprehensive alien plant species survey to determine which species occur on site and where they are located.</i></li> <li>2. <i>Compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control.</i></li> <li>3. <i>Undertake regular monitoring to detect alien invasions early so that they can be controlled.</i></li> <li>4. <i>Implement control measures.</i></li> </ol>	

#### Decommissioning Phase impacts

It is expected that the project will operate for a minimum of twenty years or more (a typical planned life-span for a project of this nature). Decommissioning will probably require a series of steps resulting in the removal of equipment from the site and rehabilitation of footprint areas. It is possible that the site could be returned to a rural nature, but it is unlikely that natural vegetation would become established at disturbed locations on site for a very long time. The reality is that it is not possible to determine at this stage whether rehabilitation measures will be implemented or not or what the future plans for the site would be nor is it possible at this stage to determine what surrounding land pressures would be. These uncertainties make it impossible to undertake any assessment to determine possible impacts of decommissioning. At best, it is recommended that a rehabilitation and closure plan be compiled and that this would be required to be implemented prior to closure of the project.

#### Cumulative impacts

There are a number of similar developments that have been proposed or authorised in the region within a 25 km radius of the current project area that could also lead to impacts on habitats and species. These include the projects listed in Table 10 below.

Table 10: Proposed renewable energy projects in the area

<b>Proposed Development</b>	<b>DEA Reference Number</b>	<b>Current Status of EIA</b>	<b>Proponent</b>	<b>Capacity</b>	<b>Farm Details</b>
The Badudex Solar Project	14/12/16/3/3/2/546	EIA underway	Budadex (Pty) Ltd	74 MW	Portion 1 of the Farm Vogelstruis Bult No 104
The Moiblox Solar Project	14/12/16/3/3/2/547	EIA underway	Moiblox (Pty) Ltd	75 MW	Remainder of the Farm Bosjesmansberg
Garob Wind Energy Facility Project	14/12/16/3/3/2/279	Awarded Preferred	Garob Wind Farm (Pty) Ltd	140 MW	Portion 5 of the Farm Nelspoortje No. 103

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Capacity	Farm Details
		Bidder Status.			
Copperton Wind Energy Facility	12/12/20/2099	Awarded Preferred Bidder Status.	Plan 8 Infinite Energy (Pty) Ltd	140 MW	Portion 4 of the Farm Nelspoortje No. 103; and Portion 7 of the Farm Nelspoortje No. 103.
Humansrus Solar PV Energy Facility 1 and 2	14/12/16/3/3/2/707 14/12/16/3/3/2/708	Authorised	Humansrus Solar PV Energy Facility 1 (Pty) Ltd	75 MW	Remainder the Farm Humansrus No. 147
Humansrus Solar PV Energy Facility 2 and 3	14/12/16/3/3/2/888 14/12/16/3/3/2/887	EIA underway	Humansrus Solar PV Energy Facility 3/4 (Pty) Ltd	75 MW	Remainder the Farm Humansrus No. 147
Mierdam Solar Photovoltaic Facility	12/12/20/2320/2	Authorised	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd	75 MW	Portion 1 of the Farm Kaffirs Kolk No. 118
Platsjambok East and West Solar Photovoltaic Facility	12/12/20/2320/4 12/12/20/2320/5	Authorised	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd	75 MW	Remainder of the Farm Platsjambok 102
Helena Solar 1, 2, and 3 PV energy facility	14/12/16/3/3/2/765 14/12/16/3/3/2/766 14/12/16/3/3/2/767	EIA underway	BioTherm Energy (Pty) Ltd	75 MW	Portion 3 of the Farm Klipgats Pan No. 117
Renewable Energy Farm near Prieska	14/12/16/3/3/2/608 14/12/16/3/3/2/609	EIA underway	NK Energie (Pty) Ltd	UNKN OWN	Portion 3 of the Farm Hedley Plains No. 64 and Portion 5 of the Farm Doonies Pan No. 106
Photovoltaic Power Generation Facility near Prieska	12/12/20/1722	Awarded Preferred Bidder Status in REIPPP Window 1.	Mulilo Renewable Energy Solar PV Prieska (RF) (Pty) Ltd	19.9 MW	Portion 1 of the Farm Volgelstruis Bult No 104

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Capacity	Farm Details
PV Energy Plant near Copperton	12/12/20/2502	Authorised	Mulilo Renewable Energy (Pty) Ltd	100 MW	Portion 1 of the Farm Volgelstruis Bult No 104
Mulilo Sonnedix Prieska PV	12/12/20/2503	Awarded Preferred Bidder Status in REIPPP Window 3. Currently being constructed.	Mulilo Sonnedix Solar Enterprises (Pty) Ltd	75 MW	Remainder of the Farm Hoekplaas No. 146
Mulilo Prieska PV	12/12/20/2501	Awarded Preferred Bidder Status in REIPPP Window 3. Currently being constructed.	Mulilo Prieska PV (Pty) Ltd	75 MW	Portion 4 of the Farm Klipgats Pan No. 117
PV 2, PV 3, PV 4, PV 5 and PV 7 Energy Plants on the Farm Klipgats Pan	14/12/16/3/3/2/486 14/12/16/3/3/2/487 14/12/16/3/3/2/488 14/12/16/3/3/2/489 14/12/16/3/3/2/491	EIA underway	Mulilo Renewable Energy (Pty) Ltd	75 MW	Portion 4 of the Farm Klipgats Pan No. 117
PV 2, PV 3, PV 4, PV 6, PV 7, PV 11 and PV 12 Solar Energy Plants on the Farm Hoekplaas	14/12/16/3/3/2/493 14/12/16/3/3/2/494 14/12/16/3/3/2/495 12/12/16/3/3/2/497 14/12/16/3/3/2/498 14/12/16/3/3/2/502 14/12/16/3/3/2/503	EIA underway	Mulilo Renewable Energy (Pty) Ltd	75 MW	Remainder of the Farm Hoekplaas No. 146
Proposed Aletta Wind Energy Facility	14/12/16/3/3/2/945	EIA underway	BioTherm Energy (Pty) Ltd	140MW	Portion 1 of Drielings Pan No.101 Portion 2 of Drielings Pan No.101 Portion 3 of Drielings Pan No.101

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Capacity	Farm Details
					Remainder of Drielings Pan No.101

The proposed projects relative to the current project are shown in Figure 8.

An attempt was made to analyse ecological specialist studies for projects in the vicinity of the current project in order to review these. It is surprisingly difficult to obtain access to specialist reports for known projects, which are supposed to be public documents. Some companies, e.g. Aurecon, limit access to documents, unless you are registered as an I&AP. Specialist assessments of the following projects were available for comparison:

1. Garob Wind Energy Facility,
2. Helena Solar,
3. Humansrus Solar 3 Development,
4. Mierdam Solar PV Plant,
5. Mulilo Sonnedix PV project.

The assessment of impacts on biodiversity from these various projects identify similar issues as those found on the current site. These include the following ecological sensitivities that appear to be affected by all projects for which information was available:

1. quartzitic ridges,
2. ephemeral drainage areas,
3. pan depressions,
4. individuals of the protected tree, *Boscia albitrunca*,
5. protected plants.

Cumulative impacts are discussed below, taking into consideration information obtained from the review of various other projects in the area.

#### *Cumulative impacts on indigenous natural vegetation*

The regional terrestrial vegetation types in the broad study area are listed as Least Threatened. These are the same vegetation types that will be affected by any other projects that would take place in the area. Loss of habitat will definitely occur, but this will be a small area in comparison to the total area of the vegetation types concerned. Bushmanland Arid Grassland occupies an area in excess of 34 000 km<sup>2</sup>, of which less than 1% has been altered and Bushmanland Basin Shrubland occupies an area in excess of 45 000 km<sup>2</sup>, of which less than 1% has been altered. The total loss of habitat due to a number of projects together will be greater than for any single project, so a cumulative effect will occur. This will be especially apparent in the area around Copperton, where the projects are concentrated. However, the area lost in total will be small compared to the total area of the vegetation types and will not result in a change in the conservation status of the vegetation type. The cumulative effect at a regional level will therefore be low. At a more local scale, the loss of habitat in the area around Copperton will be more significant, but it is still considered to be low. It is preferable that the projects are concentrated in one area rather than having a disturbance impacts dispersed over a wider area.

#### *Cumulative impacts on protected plant species*

There are two nationally protected plant species and a whole list of Provincially protected plant species that may occur in the study area, all of which are relatively widespread. An increased number of projects increases the likelihood of individuals being affected, but unless large numbers of individuals are directly affected, there is little cumulative effect.

*Cumulative impacts on protected trees*

There is one protected tree species that occurs on site, *Boscia albitrunca*. With each additional project that is constructed there will be an increasing likelihood of individuals being affected and the number of individuals affected will increase. There is therefore a cumulative effect. The significance of this effect is, however, likely to be low due to the high number of individuals of *Boscia albitrunca* that occurs over the entire geographical range of the species and the low number that are likely to be affected by any single project. This is especially true if all projects take measures to avoid impacts on protected trees, which is considered likely, given the environmental authorisation process that needs to be undertaken for each project.

*Cumulative impacts on sensitive habitats*

The sensitive habitats identified for the current project include drainage areas, pans and low, rocky hills (quartzitic ridges). The rocky hills are in the eastern part of the group of projects and the Aletta project is the main one to potentially affect such habitat. The cumulative impact on this habitat will therefore be low. Drainage areas and pans are found throughout the area so the potential impact due to a number of projects together will be greater than for any single project, so a cumulative effect will occur. However, drainage areas and pans are protected according to the National Water Act and there is a high likelihood that all projects will be obliged to avoid and protect these habitats as much as possible. The cumulative impact of all the projects is therefore likely to be low, due primarily to legislative protection of the habitat concerned.

*Cumulative impacts on populations of sedentary fauna*

There are two species of sedentary fauna that could potentially be impacted by the current project, Littledale's Whistling Rat and the Giant Bullfrog. Both have a relatively wide

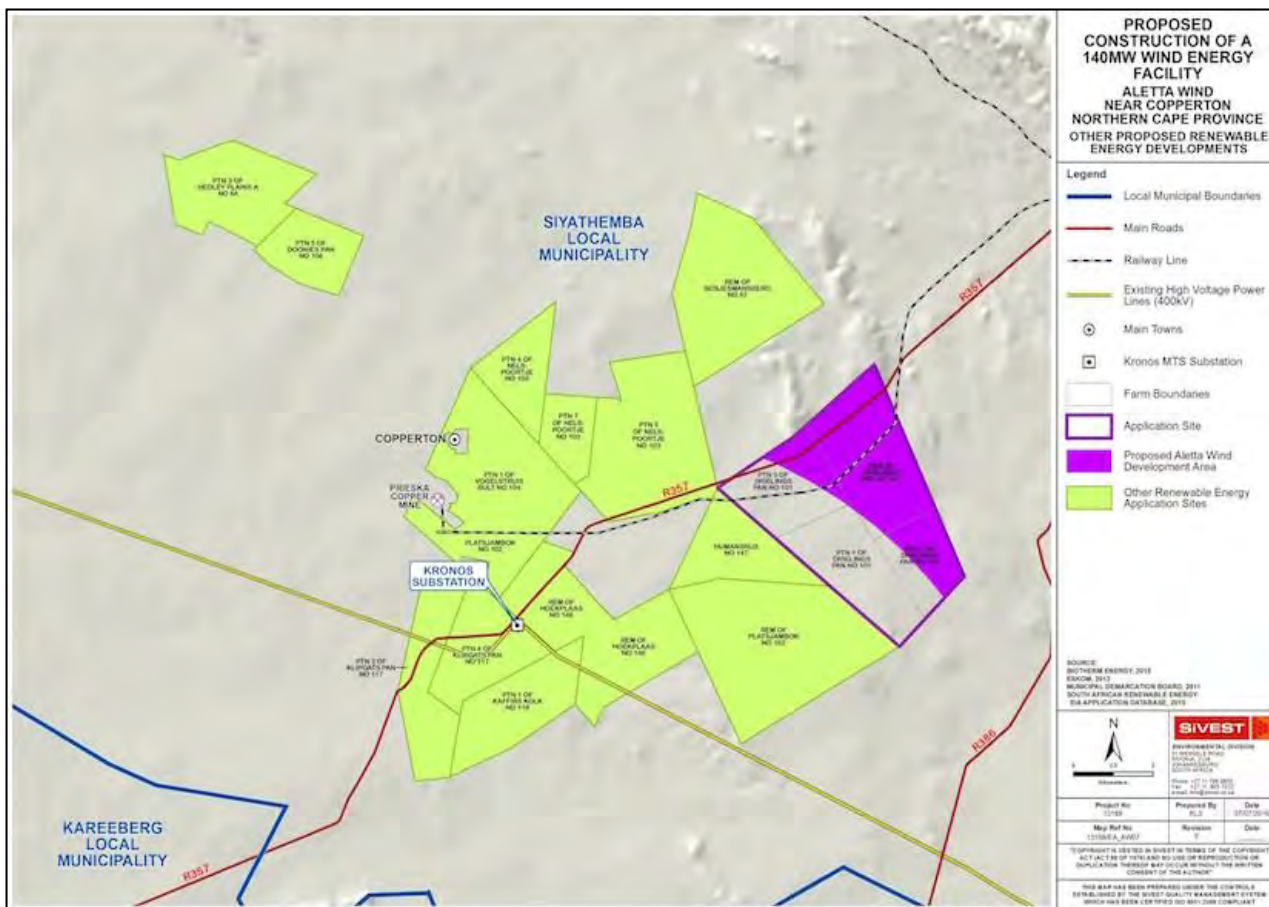


Figure 8: Other similar projects proposed or authorised in nearby areas.

geographical distribution and loss of some habitat in part of their range will have a minimal effect on the species. The combination of a number of projects will have a cumulative effect, but this is likely to be of low significance, since it will be geographically concentrated in the Copperton area, which is at the edge of the distribution range of both species.

*Cumulative impacts on mobile fauna*

Construction activities, loss of habitat, noise, dust and general activity associated with the construction phase of the project are likely to cause all mobile species to move away from the site. This effect will be increased if there are a number of projects being constructed at the same time or in quick succession, so the effect is likely to be cumulative. However, the geographical ranges of the species of concern is wide and it is considered that the significance of the effect will be low. In addition, the current project is a wind energy facility, which typically preserves large proportions of the landscape after construction and mobile species will return to these areas.

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

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



## COMPARISON OF PROJECT ALTERNATIVES

There are two possible sites for the combination of on-site substation and O&M buildings, named Option 1 and Option 2. The Option 1 site is approximately 2,3 km to the east-south-east of the existing farm homestead complex. Option 2 is another 2 km to the south-south-east of Option 1. Both sites were examined in detail in the field and no major features of concern were found at either site. Either site is therefore considered favourable. Option 2 appeared to be slightly more degraded from animal husbandry than Option 1 and Option 1 may have slightly higher species richness, but the differences are not sufficiently significant to favour either option over the other.

### Key

<b>PREFERRED</b>	The alternative will result in a low impact / reduce the impact
<b>FAVOURABLE</b>	The impact will be relatively insignificant
<b>NOT PREFERRED</b>	The alternative will result in a high impact / increase the impact
<b>NO PREFERENCE</b>	The alternative will result in equal impacts

Alternative	Preference	Reasons (incl. potential issues)
<b>SUBSTATION AND O &amp; M BUILDING ALTERNATIVES</b>		
Option 1	<b>FAVOURABLE</b>	The impact will be relatively insignificant
Option 2	<b>FAVOURABLE</b>	The impact will be relatively insignificant

## POSSIBLE MITIGATION MEASURES

This section of the report provides a description of mitigation measures that could be applied to minimize identified impacts for this project. The mitigation measures are specific to each component of the project, as shown in Figure 7. In terms of the location of features of concern, all mitigation measures apply to all components of the project.

### Mitigation measures

#### *Rehabilitation Programme*

A Rehabilitation Programme should be established before operation. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after closure. This Rehabilitation Programme must be approved by the relevant government departments.

#### *Restrict access to sensitive areas*

Impacts should be restricted to within the development footprint and disturbance of surrounding areas should be avoided or minimised. Sensitive habitats in close proximity to construction activities / sites should be fenced off or marked to indicate that they are No-Go areas.

#### *Locate internal roads judiciously to avoid sensitivities*

No internal road layout plan has been provided for assessment. It is assumed that this will be planned once the final location of turbines has been determined. If possible, roads should be located as close as possible to existing farm roads to minimise disturbance of natural areas. They should not cross sensitive habitats, if possible, or do this as little as possible.

#### *Botanical walk-through survey*

This is a requirement only to ensure legal compliance. A pre-activity walk-through survey should be undertaken to list the identity and location of all listed and protected species. The results of the walk-through survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development. If possible, areas of concentrations of species of concern should be avoided, i.e. if such concentrations are identified in the field, infrastructure components should be shifted to accommodate them.

#### *Obtain permits for protected plants*

It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants.

#### *Search and rescue*

Search and rescue operation of all listed species within the activity footprint. For each individual plant that is rescued, the plant must be photographed before removal, tagged with a unique number or code and a latitude longitude position recorded using a hand-held GPS device. The plants must be planted into a container to be housed within a temporary nursery on site or immediately planted into the target habitat. If planted into natural habitat, the position must be marked to aid in future monitoring of that plant. Rescued plants housed in temporary nursery may be used in one of two ways: (1) transplanted into suitable natural habitats near to where they were rescued, or (2) used for replanting in rehabilitation areas. Receiver sites must be matched as closely as possible with the origin of the plants and, where possible, be placed as near as possible to where they originated.

#### *Alien plant management plan*

It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species, especially within the riparian habitat. An Alien Invasive

Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), landowners are legally responsible for the control of alien species on their properties. The protection of our natural systems from invasive species is further strengthened within Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). This programme should include monitoring procedures.

*Undertake regular monitoring*

Monitoring should be undertaken to evaluate the success of mitigation measures.

## DISCUSSION AND CONCLUSIONS

### Biodiversity features in the study area

The vegetation types that occur on the sites are classified as Least Threatened and also have a wide distribution and extent. The natural vegetation on the sites is therefore not considered to have high conservation status. The area is not within a Centre of Plant Endemism or in areas identified in Provincial Conservation Plans to be of concern, but it does occur within an area identified as part of the National Parks Area Expansion Strategy.

The central part of the site is included in an area highlighted for possible inclusion in a future conservation area. The identification of the proposed area for conservation is probably preliminary, since it appears from the site visit that surrounding areas have equal or better characteristics for conservation. The opportunity for conserving equivalent habitat is therefore not lost.

Local factors that may lead to parts of the sites having elevated ecological sensitivity are the presence of drainage areas and pans as well as low, rocky hills on site, the presence of various protected plant species and the potential presence of various animal species of conservation concern. There is also a protected tree (*Boscia albitrunca*) that occurs on site.

Drainage lines and pans represent particularly vital natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as biological corridors, providing for movement between habitat patches. The drainage areas and pans on site have deeper soils and appear to harbour burrowing animals to a much greater extent than surrounding areas. Wetlands (including drainage lines) are protected under national legislation (National Water Act). Any impacts on these areas would require a permit from the National Department of Water Affairs.

The low, rocky hills have a higher species richness than surrounding areas, a different species composition and contain most of the protected species on site. They are also the most likely place to find the protected tree, *Boscia albitrunca*. They have therefore been classified as having elevated conservation value relative to surrounding plains areas.

There are three animal species of conservation concern that may occur in habitats within the study area. This includes one frog species, the Giant Bullfrog, and two mammal species (Honey Badger (NT) and **Littledale's Whistling Rat (NT)**). Lists and habitat requirements for these species are provided in the appendices to this report.

One protected amphibian species, the Giant Bullfrog, has a geographical distribution that includes the site, although it is near the limit of its distribution. This species is protected according to the National Environmental Management: Biodiversity Act (Act No 10 of 2004). Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. It is most likely to be found near seasonal pans or water sources and is not likely to be a major issue.

The study area consists almost entirely of natural vegetation, with the exception of the road and other linear infrastructure that passes through the site. Transformed and degraded areas in the project study area have low sensitivity and conservation value, but are localised to very small areas. Most areas have medium sensitivity and drainage areas and pan depressions have medium-high sensitivity, as do low, rocky hills.

## Summary of potential impacts

A summary of the potential risks to the ecological receiving environment are therefore the following:

1. Loss of indigenous natural vegetation during construction;
2. Impacts on protected plant species;
3. Impacts on a protected tree species;
4. Impacts on sensitive habitats;
5. Mortality of populations of sedentary species during construction;
6. Displacement of populations of mobile species;
7. Introduction and/or spread of declared weeds and alien invasive plants in terrestrial habitats.

A summary and comparison between pre- and post-mitigation phases is provided in Table 10 below. In all cases the impacts have been assessed as having medium or low significance before mitigation and low after mitigation. This, in combination with the limited amount of biodiversity of significance likely to be affected indicates that the project is unlikely to have significant biodiversity impacts, in terms of those issues investigated in this study. The current opinion is that the project should be able to proceed on condition the recommended mitigation measures suggested are put in place to minimise predicted impacts.

Table 10: Comparison of summarized impacts on environmental parameters.

<b>Environmental parameter</b>	<b>Issues</b>	<b>Rating prior to mitigation</b>	<b>Rating post mitigation</b>
Indigenous natural vegetation	Loss, degradation or fragmentation	-38	-36
Listed or protected plant species	Loss of individuals	-11	-9
Protected trees	Loss of individuals	-12	-9
Sensitive habitats	Loss, degradation or fragmentation	-36	-10
Sedentary fauna	Mortality of individuals	-26	-11
Mobile fauna	Displacement	-8	-8
Natural habitat	Invasion by alien invasive plant species leading to habitat loss and/or degradation	-28	-11
<b>Average score</b>		<b>- 23</b>	<b>-13</b>
		Low Negative Impact	Low Negative Impact

## Conclusions

There are some relatively minor issues related to the ecology of the site that could result in potentially significant ecological impacts. Mitigation measures are provided to avoid or minimise these impacts. Some impacts require permits to be issued, either by National or Provincial authorities. If mitigation measures are applied then the potential impacts can be well-managed, in which case the project is supported and it is recommended that it may be authorised.

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APPENDICES:

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

Sources: South African National Biodiversity Institute in Pretoria.

Family	Taxon	Status	Distribution and habitat	Likelihood of occurrence on site
APOCYNACEAE	Hoodia officinalis subsp. officinalis	NT	Southern Namibia (except winter rainfall areas and deep sands of Kalahari in the east) and from Griqualand West near Douglas to Kimberley and Jacobsdal. Free State and Northern Cape in SA. Desert, Nama Karoo, Succulent Karoo. Inside bushes in flat or gently sloping areas.	HIGH, within known distribution, habitat on site suitable.
HYACINTHACEAE	Drimia sanguinea	NT	Northern Cape and diagonally across to Limpopo and Mpumalanga Provinces, Namibia, Botswana and Zimbabwe. Distribution is somewhat to the north of the current area. Open veld and scrubby woodland in a variety of soil types.	LOW, edge of known range, although habitat on site may be suitable

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

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

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

*Boscia albitrunca* has a geographical distribution that coincides with the study areas.

Appendix 3: Animal species with a geographical distribution that includes the study area.

Notes:

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

Mammals:

Springbok  
<sup>N</sup>Black rhinoceros (arid ecotype)  
Klipspringer  
Gemsbok  
Steenbok  
Common duiker  
Rock hyrax  
Water mongoose  
Black-backed jackal  
Caracal  
Yellow mongoose  
<sup>N</sup>Black-footed cat  
African wild cat  
Small grey mongoose  
Small-spotted genet  
Striped polecat  
<sup>N</sup>Honey badger NT  
Bat-eared fox  
<sup>N</sup>Leopard  
Aardwolf  
Suricate  
<sup>N</sup>Cape fox  
**Leseur's wing-gland bat NT**  
Cape serotine bat  
Egyptian slit-faced bat  
**Geoffroy's horseshoe bat NT**  
**Darling's horseshoe bat NT**  
Egyptian free-tailed bat  
Reddish-grey musk shrew  
Cape/desert hare  
Scrub/savannah hare  
Namaqua rock mouse  
Short-tailed gerbil  
Hairy-footed gerbil  
Spectacled dormouse  
Porcupine  
Large-eared mouse  
Multimammate mouse  
Karoo bush rat  
**Brant's whistling rat**  
**Littledale's whistling rat NT**  
Springhare  
Striped mouse  
Bushveld gerbil  
Cape ground squirrel  
**Smith's rock elephant shrew**  
Round-eared elephant shrew

Aardvark

Reptiles:

Puff adder  
Horned adder  
Cape cobra  
Rinkhals  
Coral snake  
Dwarf beaked snake  
Karoo whip snake  
(Spotted skaapstecker)  
(Common tiger snake)  
**Beetz's tiger snake**  
Herald snake  
Brown house snake  
(Aurora house snake)  
(Spotted rock snake)  
**(Fisk's house snake)**  
Mole snake  
Sundevall's shovel-snout  
(Common slug-eater)  
Common wolf snake  
Common egg-eater  
Delalande's beaked blind snake  
Common ground agama  
**Anchieta's agama**  
Southern rock agama  
Common flap-necked chameleon  
Rock monitor  
(Bushveld lizard)  
Spotted desert lizard  
Western sandveld lizard  
(Plain sand lizard)  
Karoo (Cape) sand lizard  
(Spotted sand lizard)  
Common sand lizard  
Namaqua sand lizard  
(Striped dwarf legless skink)  
Cape skink  
Western three-striped skink  
(Kalahari tree skink)  
Western rock skink  
Variegated skink  
Karoo girdled lizard  
Common giant ground gecko  
**Bibron's gecko**  
Cape gecko  
(Common rough gecko)

Marico gecko  
**Purcell's gecko**  
Spotted barking gecko  
Marsh terrapin  
(Karoo padloper)  
Leopard tortoise  
(Karoo tent tortoise)  
**Verroxx's tent tortoise**

Amphibians  
(Bushveld rain frog)  
Guttural toad  
Southern pygmy toad  
Karoo toad  
(Bubbling kassina)  
Common platanna  
**Boettger's caco**  
Common river frog  
Cape river frog  
<sup>N</sup>Giant bullfrog NT  
Tremolo sand frog  
**Tandy's sand frog**

Appendix 4: Threatened vertebrate species with a geographical distribution that includes the Copperton area.

#### MAMMALS

Common name	Taxon	Habitat <sup>1</sup>	National status	Global status <sup>2</sup>	Likelihood of occurrence
Black rhinoceros	<i>Diceros bicornis bicornis</i>	Wide variety of habitats, but currently only occurs in game reserves.	CR	CR	NONE, only occurs in game reserves
Honey badger	<i>Mellivora capensis</i>	Wide variety of habitats. Probably only in natural habitats.	NT	LC	HIGH, overall geographical distribution includes this area, habitat is suitable.
Leseuer's wing-gland bat	<i>Cistugo leseuri</i>	Caves and subterranean habitats; fynbos, shrubland, grassland, succulent and Nama-karoo; insectivore	NT	LC	LOW, overall geographical distribution includes this area, general habitat is suitable - no caves on site.
Geoffroy's horseshoe bat	<i>Rhinolophus clivus</i>	Caves and subterranean habitats; fynbos, shrubland, grassland, succulent and Nama-karoo; insectivore	NT	LC	LOW, overall geographical distribution includes this area, general habitat is suitable - no caves on site.
Darling's horseshoe bat	<i>Rhinolophus darlingi</i>	Caves and subterranean habitats. Woodland savannah.	NT	LC	LOW, overall geographical distribution includes this area, general habitat not suitable - no caves on site.
Littledale's whistling rat	<i>Parotomys littledalei</i>	Desert, Karoo. Sandy or gravel open plains. Tends to excavate burrow beneath a shrub, but will also construct stick nest at the base of a shrub. Herbivorous, favouring leaves of <i>Zygophyllum</i> and Mesembryanthemaceae.	NT	LC	MEDIUM, overall geographical distribution includes this area, general habitat is suitable

<sup>1</sup>Distribution and national status according to Friedmann & Daly 2004.

<sup>2</sup>Global status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. ([www.iucnredlist.org](http://www.iucnredlist.org)). Downloaded on 11 September 2010.

#### AMPHIBIANS

Common name	Species	Habitat	Status	Likelihood of occurrence
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	Widely distributed in southern Africa, mainly at higher elevations. Inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas; also utilises non-permanent vleis and shallow water on margins of waterholes and dams. Prefer sandy substrates although they sometimes inhabit clay soils.	NT <sup>1</sup> LC <sup>2</sup> Protected (NEMBA)	MEDIUM, within known distribution range and partially suitable habitat occurs on site.

<sup>1</sup>Status according to Minter et al. 2004.

<sup>2</sup>Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. ([www.iucnredlist.org](http://www.iucnredlist.org)). Downloaded on 11 September 2010.

#### REPTILES

Common name	Species	Habitat	Status <sup>3</sup>	Likelihood of occurrence
None				

<sup>3</sup>Distribution according to Alexander & Marais 2007.

<sup>4</sup>Status according to Alexander & Marais 2007.

Appendix 5: Checklist of plant species recorded during previous botanical surveys in the study area and surrounds.

(Species from quarter degree grid in which the site is located as well as surrounding grids in which similar vegetation is found. **Species marked with a "1" were recorded in an Acocks site nearby.**)

<sup>1</sup>*Alternanthera pungens*  
<sup>1</sup>*Amaranthus thunbergii*  
*Aptosimum albomarginatum* Marloth & Engl.  
<sup>1</sup>*Aptosimum marlothii*  
*Aptosimum procumbens* (Lehm.) Steud.  
<sup>1</sup>*Aptosimum spinescens*  
<sup>1</sup>*Aristida adscensionis* L.  
*Aristida congesta* Roem. & Schult. subsp. *congesta*  
<sup>1</sup>*Aristida congesta* subsp. *barbicollis*  
*Asparagus bechuanicus* Baker  
*Asparagus glaucus* Kies  
*Barleria rigida* Nees  
<sup>1</sup>*Berkheya annectens*  
*Blepharis mitrata* C.B. Clarke  
<sup>1</sup>*Brachiaria marlothii*  
*Bulbine frutescens* (L.) Willd.  
*Calobota spinescens* (Harv.) Boatwr. & B.-E. van Wyk  
<sup>1</sup>*Chamaesyce inaequilatera*  
*Chascanum pumilum* E.Mey.  
*Chloris virgata* Sw.  
*Chrysocoma ciliata* L.  
*Chrysocoma obtusata* (Thunb.) Ehr. Bayer  
<sup>1</sup>*Convolvulus sagittatus*  
*Coronopus integrifolius* (DC.) Spreng.  
*Cucumis africanus* L.f.  
*Cullen biflora* (Harv.) C.H. Stirt.  
*Cullen tomentosum* (Thunb.) J.W. Grimes  
*Cynanchum orangeanum* (Schltr.) N.E. Br.  
<sup>1</sup>*Deverra denudata* subsp. *aphylla*  
*Dicoma capensis* Less.  
*Dipcadi viride* (L.) Moench  
<sup>1</sup>*Enneapogon desvauxii* P. Beauv.  
*Enneapogon scaber* Lehm.  
<sup>1</sup>*Eragrostis annulata* Rendle ex Scott-Elliot  
*Eragrostis biflora* Hack. ex Schinz  
*Eragrostis echinochloidea* Stapf  
*Eragrostis homomalla* Nees  
*Eragrostis lehmanniana* Nees var. *lehmanniana*  
<sup>1</sup>*Eragrostis lehmanniana* var. *chaunantha*  
*Eragrostis nindensis* Ficalho & Hiern  
*Eragrostis obtusa* Munro ex Ficalho & Hiern  
*Eragrostis porosa* Nees  
<sup>1</sup>*Eragrostis procumbens* Nees  
<sup>1</sup>*Eragrostis truncata* Hack.  
*Euphorbia inaequilatera* Sond. var. *inaequilatera*  
*Galenia africana* L.  
*Gazania jurineifolia* DC. subsp. *scabra* (DC.) Roessler  
*Gazania krebsiana* Less. subsp. *arctotoides* (Less.) Roessler

Geigeria acaulis (Sch.Bip.) Benth. & Hook.f. ex Oliv. & Hiern  
 Geigeria filifolia Mattf.  
 Geigeria ornativa O.Hoffm. subsp. ornativa  
 Gisekia pharnacioides L. var. pharnacioides  
<sup>1</sup>Gnidia polycephala  
<sup>1</sup>Gomphocarpus fruticosus subsp. fruticosus  
 Helichrysum herniarioides DC.  
 Helichrysum lucilioides Less.  
<sup>1</sup>Heliotropium lineare  
 Hermannia bicolor Engl. & Dinter  
<sup>1</sup>Hermannia coccocarpa  
<sup>1</sup>Hermannia comosa Burch. ex DC.  
 Hermannia pulverata Andrews  
 Hermannia spinosa E.Mey. ex Harv.  
 Hoodia flava (N.E.Br.) Plowes  
 Hypertelis salsoloides (Burch.) Adamson var. salsoloides  
<sup>1</sup>Indigofera alternans DC. var. alternans  
 Indigofera auricomma E.Mey.  
 Jamesbrittenia tysonii (Hiern) Hilliard  
 Kedrostis africana (L.) Cogn.  
 Kohautia cynanchica DC.  
<sup>1</sup>Lessertia pauciflora Harv. var. pauciflora  
<sup>1</sup>Leucas capensis  
 Limeum aethiopicum Burm.f. var. aethiopicum  
 Limeum aethiopicum Burm.f. var. glabrum Moq.  
 Limeum aethiopicum Burm.f. var. lanceolatum Friedrich  
<sup>1</sup>Limeum aethiopicum subsp. aethiopicum var. aethiopicum  
 Limeum argute-carinatum Wawra ex Wawra & Peyr. var. argute-carinatum  
 Limeum myosotis H.Walter var. confusum Friedrich  
 Limeum myosotis H.Walter var. myosotis  
 Lophiocarpus polystachyus Turcz.  
 Lotononis platycarpa (Viv.) Pic.Serm.  
<sup>1</sup>Lycium cinereum  
 Lycium horridum Thunb.  
 Lycium schizocalyx C.H.Wright  
 Mestoklema arboriforme (Burch.) N.E.Br. ex Glen  
 Microloma incanum Decne.  
 Microloma longitubum Schltr.  
<sup>1</sup>Mollugo cerviana (L.) Ser. ex DC. var. cerviana  
<sup>1</sup>Monechma incanum (Nees) C.B.Clarke  
 Monechma spartioides (T.Anderson) C.B.Clarke  
 Nolletia gariepina (DC.) Mattf.  
<sup>1</sup>Oligomeris dipetala var. dipetala  
 Oropetium capense Stapf  
 Osteospermum rigidum Aiton var. rigidum  
<sup>1</sup>Osteospermum spinescens  
<sup>1</sup>Panicum lanipes  
 Panicum maximum Jacq.  
 Pegolettia retrofracta (Thunb.) Kies  
 Peliostomum leucorrhizum E.Mey. ex Benth.  
 Pentzia incana (Thunb.) Kuntze  
 Pentzia lanata Hutch.  
 Phymaspermum parvifolium (DC.) Benth. & Hook. ex B.D.Jacks.  
 Polygala leptophylla Burch. var. leptophylla



<sup>1</sup>*Polygala seminuda* Harv.  
*Prosopis velutina* Wooton EXOTIC  
*Rhigozum trichotomum* Burch.  
<sup>1</sup>*Rosenia humilis* (Less.) K.Bremer  
*Salsola calluna* Fenzl ex C.H.Wright  
*Salsola kalaharica* Botsch.  
<sup>1</sup>*Salvia verbenaca* L.  
*Schoenoplectus leucanthus* (Boeck.) J.Raynal  
*Senecio niveus* (Thunb.) Willd.  
*Sericocoma avolans* Fenzl  
*Sesamum capense* Burm.f.  
*Setaria verticillata* (L.) P.Beauv.  
*Sisymbrium burchellii* DC. var. *burchellii*  
*Solanum namaquense* Dammer  
<sup>1</sup>*Sporobolus ioclados*  
*Sporobolus nervosus* Hochst.  
*Stipagrostis anomala* De Winter  
*Stipagrostis ciliata* (Desf.) De Winter var. *capensis* (Trin. & Rupr.) De Winter  
*Stipagrostis namaquensis* (Nees) De Winter  
<sup>1</sup>*Stipagrostis obtusa* (Delille) Nees  
*Sutherlandia frutescens* (L.) R.Br.  
*Syringodea concolor* (Baker) M.P.de Vos  
*Tetragonia arbuscula* Fenzl  
*Tetragonia calycina* Fenzl  
<sup>1</sup>*Thesium hystrix*  
*Thesium lineatum* L.f.  
*Tortula atrovirens* (Sm.) Lindb.  
*Trachyandra karrooica* Oberm.  
*Tragus berteronianus* Schult.  
<sup>1</sup>*Tragus racemosus* (L.) All.  
*Tribulus terrestris* L.  
<sup>1</sup>*Tribulus zeyheri* subsp. *zeyheri*  
*Ursinia nana* DC. subsp. *nana*  
*Wiborgia monoptera* E.Mey.  
*Xerocladia viridiramis* (Burch.) Taub.  
<sup>1</sup>*Zygophyllum flexuosum*  
*Zygophyllum lichtensteinianum* Cham. & Schltldl.  
<sup>1</sup>*Zygophyllum microcarpum*

Appendix 6: Flora and vertebrate animal species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Flora

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

Reptilia

Loggerhead sea turtle  
 Leatherback sea turtle  
 Hawksbill sea turtle

Aves

Wattled crane  
 Blue swallow  
 Egyptian vulture  
 Cape parrot

Mammalia

Riverine rabbit  
 Rough-haired golden mole

ENDANGERED SPECIES

Flora

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

Reptilia

Green turtle  
 Giant girdled lizard  
 Olive ridley turtle  
 Geometric tortoise

Aves

Blue crane  
 Grey crowned crane  
 Saddle-billed stork  
 Bearded vulture  
 White-backed vulture  
 Cape vulture  
 Hooded vulture  
 Pink-backed pelican  
**Pel's** fishing owl  
 Lappet-faced vulture

Mammalia

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

VULNERABLE SPECIES

Flora

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

Aves

White-headed vulture  
 Tawny eagle  
 Kori bustard  
 Black stork  
 Southern banded snake eagle  
 Blue korhaan  
 Taita falcon  
 Lesser kestrel  
 Peregrine falcon  
 Bald ibis

**Ludwig's bustard**

Martial eagle  
 Bataleur  
 Grass owl

## Mammalia

Cheetah  
 Samango monkey  
 Giant golden mole  
 Giant rat  
 Bontebok  
 Tree hyrax  
 Roan antelope  
 Pangolin

**Juliana's golden mole**

Suni  
 Large-eared free-tailed bat  
 Lion  
 Leopard  
 Blue duiker

## PROTECTED SPECIES

## Flora

Adenia wilmsii  
 Aloe simii  
 Clivia mirabilis  
 Disa macrostachya  
 Disa nubigena  
 Disa physodes  
 Disa procera  
 Disa sabulosa  
 Encephelartos altensteinii  
 Encephelartos caffer  
 Encephelartos dyerianus  
 Encephelartos frederici-guilielmi  
 Encephelartos ghellinckii  
 Encephelartos humilis  
 Encephelartos lanatus  
 Encephelartos lehmannii  
 Encephelartos longifolius  
 Encephelartos natalensis  
 Encephelartos paucidentatus  
 Encephelartos princeps  
 Encephelartos senticosus  
 Encephelartos transvenosus  
 Encephelartos trispinosus  
 Encephelartos umbeluziensis  
 Encephelartos villosus  
 Euphorbia clivicola  
 Euphorbia meloformis  
 Euphorbia obesa  
 Harpagophytum procumbens

Harpagophytum zeyherii  
 Hoodia gordonii  
 Hoodia currorii  
 Protea odorata  
 Stangeria eriopus

## Amphibia

Giant bullfrog  
 African bullfrog

## Reptilia

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

## Aves

Southern ground hornbill  
 African marsh harrier  
**Denham's bustard**  
 Jackass penguin

## Mammalia

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

Appendix 7: Flora protected under the Northern Cape Nature Conservation Act No. 9 of 2009.

SCHEDULE 1: SPECIALLY PROTECTED SPECIES

As per the Northern Cape Nature Conservation Act, No. 9 of 2009, Schedule 1

Family: AMARYLLIDACEAE	
<i>Clivia mirabilis</i>	Oorlofskloof bush lily / Clivia
<i>Haemanthus graniticus</i>	April fool
<i>Hessea pusilla</i>	
<i>Strumaria bidentata</i>	
<i>Strumaria perryae</i>	
Family: ANACARDIACEAE	
<i>Ozoroa</i> spp.	All species
Family: APIACEAE	
<i>Centella tridentata</i>	
<i>Chamarea snijmaniae</i>	
Family: APOCYNACEAE	
<i>Hoodia gordonii</i>	
<i>Pachypodium namaquanum</i>	Elephant's trunk
Family: ASPHODOLACEAE	
<i>Aloe buhrii</i>	
<i>Aloe dichotoma</i>	
<i>Aloe dichotoma</i> var. <i>rumosissima</i>	Maiden quiver tree
<i>Aloe dabenorisana</i>	
<i>Aloe erinacea</i>	
<i>Aloe meyeri</i>	
<i>Aloe pearsonii</i>	
<i>Aloe pillansii</i>	
<i>Trachyandra prolifera</i>	
Family: ASTERACEAE	
<i>Athanasia adenantha</i>	
<i>Athanasia spathulata</i>	
<i>Cotula filifolia</i>	
<i>Euryops mirus</i>	
<i>Euryops rosulatus</i>	
<i>Euryops virgatus</i>	
<i>Felicia diffusa</i> subsp. <i>khamiesbergensis</i>	
<i>Othonna armiana</i>	
Family: CRASSULACEAE	
<i>Tylecodon torulosus</i>	
Family: DIOSCORACEAE	
<i>Dioscorea</i> spp.	Elephant's foot, all species
Family: ERIOSPERMACEAE	
<i>Eriospermum erinum</i>	
<i>Eriospermum glaciale</i>	
Family: FABACEAE	
<i>Amphithalea obtusiloba</i>	
<i>Lotononis acutiflora</i>	
<i>Lotononis polycephala</i>	
<i>Lessertia</i> spp.	
<i>Sceletium toruosum</i>	
<i>Sutherlandia</i> spp.	Cancer Bush, all species
<i>Wiborgia fusca</i> subsp. <i>macrocarpa</i>	
Family: GERANIACEAE	

<i>Pelargonium</i> spp.	Pelargonium, all species
Family: HYACINTHACEAE	
<i>Drimia nana</i>	
<i>Ornithogalum bicornutum</i>	
<i>Ornithogalum inclusum</i>	
Family: IRI DACEAE	
<i>Babiana framesii</i>	
<i>Ferraria kamiesbergensis</i>	
<i>Freesia marginata</i>	
<i>Geissorhiza subrigida</i>	
<i>Hesperantha minima</i>	
<i>Hesperantha oligantha</i>	
<i>Hesperantha rivulicola</i>	
<i>Lapeirousia verecunda</i>	
<i>Moraea kamiesensis</i>	
<i>Moraea namaquana</i>	
<i>Romulea albiflora</i>	
<i>Romulea discifera</i>	
<i>Romulea maculata</i>	
<i>Romulea rupestris</i>	
Family: MOLLUGI NACEAE	
<i>Hypertelis trachysperma</i>	
<i>Psammotropha spicata</i>	
Family: ORCHI DACEAE	
<i>Corycium ingeanum</i>	
<i>Disa macrostachya</i>	Disa
Family: OXALI DACEAE	
<i>Oxalis pseudo-hirta</i>	Sorrel
Family: PEDALI ACEAE	
<i>Harpagophytum</i> spp.	Devils' claw
Family: POACEAE	
<i>Prionanthium dentatum</i>	
<i>Secale strictum</i> subsp. <i>africanum</i>	Wild rye
Family: PROTEACEAE	
<i>Leucadendron meyerianum</i>	Tolbos
<i>Mimetes</i> spp.	All species
<i>Orothamnus zeyheri</i>	
Family: ROSACEAE	
<i>Cliffortia arborea</i>	Sterboom
Family: SCROPHULARI ACEAE	
<i>Charadrophila capensis</i>	Cape Gloxinia
Family: STANGERI ACEAE	
<i>Stangeria</i> spp.	Cycads, all species
Family: ZAMI ACEAE	
<i>Encephalartos</i> spp.	Cycads, all species

## SCHEDULE 2: PROTECTED SPECIES

As per the Northern Cape Nature Conservation Act, No. 9 of 2009, Schedule 2

Family: ACANTHACEAE	
<i>Barleria paillosa</i>	
<i>Monechme saxatile</i>	
<i>Peristrophe</i> spp.	All species

Family: ADIANTHACEAE	
<i>Adiantum</i> spp.	Maidenhair Fern, all species
Family: AGAPANTHACEAE	
<i>Agapanthus</i> spp.	All species
Family: ALIZOACEAE (MESEMBRYANTHEMACEAE)	All species
Family: AMARYLLIDACEAE	All species except those listed in Schedule 1
Family: ANTHERICACEAE	All species
Family: APIACEAE	All species except those listed in Schedule 1
Family: APOCYNACEAE	All species except those listed in Schedule 1
Family: AQUIFOLIACEAE	All species
<i>Ilex mitis</i>	
Family: ARACEAE	
<i>Zantedeschia</i> spp.	Arum lilies, all species
Family: ARALIACEAE	
<i>Cussonia</i> spp.	Cabbage trees, all species
Family: ASPHODOLACEAE	All species except those listed in Schedule 1 and the species <i>Aloe ferox</i>
Family: ASTERACEAE	
<i>Helichrysum jubilatatum</i>	
<i>Felicia deserti</i>	
<i>Gnaphalium simii</i>	
<i>Lopholaena longipes</i>	
<i>Senecio albo-punctatus</i>	
<i>Senecio trachylaenus</i>	
<i>Trichogyne lerouxiae</i>	
<i>Tripteris pinnatilobata</i>	
<i>Troglophyton acocksianum</i>	
<i>Vellereophyton lasianthum</i>	
Family: BURMANNIACEAE	
<i>Burmannia madagascariensis</i>	Wild ginger
Family: BURSERACEAE	
<i>Commiphora</i> spp.	All species
Family: CAPPARACEAE	
<i>Boscia</i> spp.	Shepherd's trees, all species
Family: CARYOPHYLLACEAE	
<i>Dianthus</i> spp.	All species
Family: CELASTRACEAE	
<i>Gymnosporia</i> spp.	All species
Family: COLCHICACEAE	
<i>Androcymbium</i> spp.	All species
<i>Gloriosa</i> spp.	All species
Family: COMBRETACEAE	
<i>Combretum</i> spp.	All species
Family: CRASSULACEAE	All species except those listed in Schedule 1
Family: CUPPRESSACEAE	
<i>Widdringtonia</i> spp.	Wild cypress, all species
Family: CYATHEACEAE	
<i>Cyathea</i> spp.	Tree ferns, all species
<i>Cyathea capensis</i>	Tree Fern
Family: CYPERACEAE	

<i>Carex acocksii</i>	
Family: DROSERACEAE	
<i>Drosera</i> spp.	Sundews, all species
Family: DRYOPTERIDACEAE	
<i>Rumohra</i> spp.	Seven Weeks Fern, all species
Family: ERICACEAE	Erica, all species
Family: EUPHORBIACEAE	
<i>Alchornea laxiflora</i>	Venda Bead-string
<i>Euphorbia</i> spp.	All species
Family: FABACEAE	
<i>Aspalathus</i> spp.	Tea Bush, all species
<i>Erythrina zeyheri</i>	Ploughbreaker
<i>Argyrolobium petiolare</i>	
<i>Caesalpinia bracteata</i>	
<i>Calliandra redacta</i>	
<i>Crotalaria pearsonii</i>	
<i>Indigofera limosa</i>	
<i>Lebeckia bowieana</i>	
<i>Polhillia involucrate</i>	
<i>Rhynchosia emarginata</i>	
<i>Wiborgia humilis</i>	
Family: HYACINTHACEAE	
<i>Daubenia</i> spp.	
<i>Lachenalia</i> spp.	Daubenia, all species
<i>Veltheimia</i> spp.	Viooltjie, all species
<i>Eucomis</i> spp.	Pineapple flower, all species
<i>Neopatersonia namaquensis</i>	
<i>Ornithogalum</i> spp.	All species
Family: IRIDACEAE	All species except those listed in Schedule 1
Family: LAURACEAE	
<i>Ocotea</i> spp.	Stinkwood, all species
Family: MESEMBRYANTHEMACEAE	All species
Family: MELIACEAE	
<i>Nymania capensis</i>	Chinese Lantern
Family: OLEACEAE	
<i>Olea europea subsp. africana</i>	Wild olive
Family: ORCHIDACEAE	Orchids, all species except those listed in Schedule 1
Family: OROBANCHACEAE	
<i>Harveya</i> spp.	Harveya, all species
Family: OXALIDACEAE	
<i>Oxalis</i> spp.	Sorrel, all species except those listed in Schedule 1
Family: PLUMBAGINACEAE	
<i>Afrolimon namaquanum</i>	
Family: POACEAE	
<i>Brachiaria dura</i> var. <i>dura</i>	
<i>Dregeochloa calviniensis</i>	
<i>Pentaschistis lima</i>	
Family: PODOCARPACEAE	
<i>Podocarpus</i> spp.	Yellowwoods, all species
Family: PORTULACACEAE	
<i>Anacampseros</i> spp.	All species
<i>Avonia</i> spp.	All species

<i>Portulaca foliosa</i>	
Family: PROTEACEAE	All species except those listed in Schedule 1
Family: RESTIACEAE	All species
Family: RHAMNACEAE	
<i>Phyllica</i> spp.	All species
Family: RUTACEAE	
<i>Agathosma</i> spp.	Buchu, all species
Family: SCROPHULARIACEAE	
<i>Diascia</i> spp.	All species
<i>Halleria</i> spp.	All species
<i>Jamesbrittenia</i> spp.	All species
<i>Manulea</i> spp.	All species
<i>Nemesia</i> spp.	All species
<i>Phyllopodium</i> spp.	All species
<i>Polycarena filiformis</i>	
<i>Chaenostoma longipedicellatum</i>	
Family: STRELITZIACEAE	
<i>Strelitzia</i> spp.	All species
Family: TECOPHILACEAE	
<i>Cyanella</i> spp.	All species
Family: THYMELAEACEAE	
<i>Gnidia leipoldtii</i>	
Family: ZINGIBERACEAE	
<i>Siphonochilus aethiopicus</i>	Wild ginger