SAVANNAH ENVIRONMENTAL (PTY) LTD

GAROB WIND FARM:
FAUNA & FLORA SPECIALIST REPORT FOR IMPACT ASSESMENT

PRODUCED FOR

JUWI RENEWABLE ENERGIES (PTY) LTD

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DECLARATION OF CONSULTANTS' INDEPENDENCE

The author of this report, Simon Todd, does hereby declare that he is an independent consultant appointed by the Client 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 the specialist performing such work. All opinions expressed in this report are his own.

Simon Todd Pr.Sci.Nat

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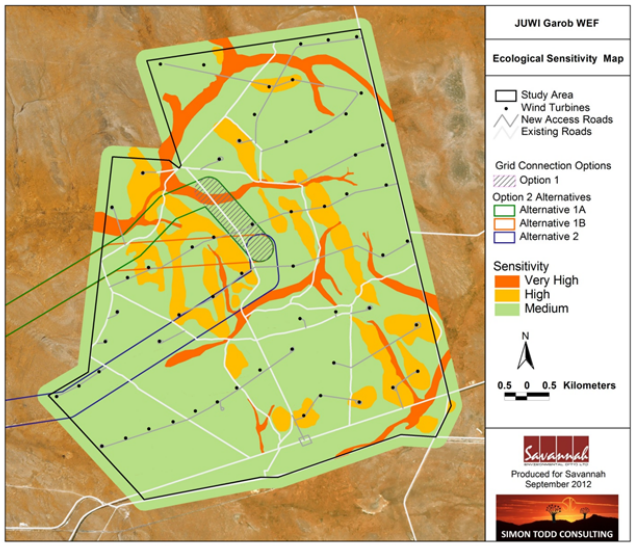
EXECUTIVE SUMMARY

This report details the terrestrial ecology impacts likely to be associated with the development of the proposed JUWI Garob Wind Energy facility near Copperton in the Northern Cape Province. The development would consist of up to 45 wind turbines distributed across the 5500 ha site, with associated infrastructure such as roads, underground cabling and a transmission line to link the facility to the ESKOM network.

A site visit and desktop study were conducted to assess the presence and distribution of ecologically sensitive, species, habitats and vegetation units at the site. A detailed vegetation map for the site was produced which illustrated that the site contains a far greater variety of vegetation types than is depicted by the national vegetation map. Of significance is the presence of quartzitic rocky hills at the site which contained relatively greater species richness of fauna and flora as compared to the adjacent habitats on sandy soils or calcrete. The sensitivity map generated for the site is depicted below and illustrates the sensitive nature of the drainage features of the site as well as the higher sensitivity of the rocky hills.

Six major impacts were identified as being associated with the development of the site and were assessed:

- Impacts on vegetation and listed plant species
- Increased alien plant invasion risk
- Loss of habitat for fauna
- Reduced landscape connectivity
- Direct faunal impacts
- Increased soil erosion risk



All of the impacts assessed can be reduced to a low or moderate level through mitigation and there are no impacts present which are likely to represent a red-flag for the development. Some impacts such as habitat loss for fauna and flora cannot be avoided. However, this would amount to only about 100 ha, which is not highly significant when considered in the light of the surrounding landscape which is almost entirely intact. Furthemore, the site does not appear to contain any specific features that are not widely available in the surrounding landscape. As a result, the impacts of the development are likely to be largely local in nature and there do not appear to be any impacts which would be of wider significance. Four different overhead power line options to link the facility to the ESKOM grid are also considered. The preferred option would be Alternative 1 which is a loop in loop out connection from the on-site substation to the ESKOM Burchell/Ferrum power line which runs through the site. This option would result in significantly lower impact than the other alternatives. If this is not possible, then Option 1B, Alternative 1A which aligns with the existing ESKOM transmission line which traverses the site is identified as the next preferred option. In the long-term, erosion is one of the major risks associated with the

development and should the development go ahead, specific precautions to reduce, manage and monitor erosion at the site should be implemented. Provided that suitable measures to control erosion and other potential impacts are implemented, the development of the site is not likely to result in significant degradation or biodiversity loss within the receiving environment.

Summary assessment of the pre- and post-mitigation impacts associated with the development of the Garob Wind Energy Facility.

Impact	Pre Mitigation	Post Mitigation
Vegetation and listed species	Medium-High (60)	Medium (32)
Alien plant invasion risk	Medium (44)	Low (15)
Habitat loss for fauna	Medium (55)	Medium (36)
Reduced landscape connectivity	Medium (48)	Medium (33)
Direct faunal impacts	Medium (44)	Low (24)
Increased erosion risk	Medium (48)	Low (21)

Summary assessment of the three different overhead power line options associated with the development.

Impact	Option 1		Option 2					
			Alternative 1A		Alternative 1B		Alternative 2 (Least)	
	Pre Mitigation	Post Mitigation	Pre Mitigation	Post Mitigation	Pre Mitigation	Post Mitigation	Pre Mitigation	Post Mitigation
Vegetation and listed species	Low (14)	Low (6)	Medium (40)	Low (24)	Medium (48)	Low (24)	Medium (55)	Medium (33)
Alien plant invasion risk	Low (14)	Low (6)	Medium (36)	Low (15)	Medium (36)	Low (15)	Medium (36)	Low (15)
Increased erosion risk	Low (14)	Low (6)	Medium (33)	Low (12)	Medium (44)	Low (18)	Medium (44)	Low (18)

1 INTRODUCTION

Juwi Renewable Energies (Pty) Ltd proposes to develop a wind energy facility near to Copperton in the Northern Cape Province. The current development proposal is for up to 58 turbines of 2.4 MW each. In terms of the EIA regulations, environmental authorization is required before the development can proceed. Savannah Environmental has been appointed to undertake the EIA process for the above facility and has appointed Simon Todd Consulting to conduct a terrestrial fauna and flora specialist assessment as part of the EIA for the development.

The detailed terms of reference for the project are detailed below

1.1 SCOPE OF STUDY

The scope of the study includes the following activities

- a description of the environment that may be affected by the activity and the manner in which the environ mint may be affected by the proposed project
- a description and evaluation of environmental issues and potential impacts (incl. using direct, indirect and cumulative impacts) that have been identified
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts
- an indication of the methodology used in determining the significance of potential environmental impacts
- an assessment of the significance of direct indirect and cumulative impacts in terms of the following criteria :
    - the nature of the impact, which shall include a description of what causes the effect, what will be affected and how it will be affected
    - the extent of the impact, indicating whether the impact will be local (limited to the immediate area or site of development), regional, national or international
    - the duration of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0-5 years), medium-term (5- 15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity) or permanent
    - the probability of the impact, describing the likelihood of the impact actually occurring, indicated as improbable (low likelihood) probable (distinct possibility), highly probable (most likely), or definite (Impact will occur regardless of any preventable measures)
    - the severity/beneficial scale indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit with no real alternative to achieving this benefit) severe/beneficial (long-term impact that could be mitigated/long-term benefit) moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight or have no effect
    - the significance which shall be determined through a synthesis of the

characteristics described above and can be assessed as low medium or high
    - the status which will be described as either positive, negative or neutral
    - the degree to which the impact can be reversed
    - the degree to which the impact may cause irreplaceable loss of resources
    - the degree to which the impact can be mitigated
- a description and comparative assessment of all alternatives
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Programme (EMPr)
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
- a description of any assumptions uncertainties and gaps in knowledge
- an environmental impact statement which contains :
    - a summary of the key findings of the environmental impact assessment;
    - an assessment of the positive and negative implications of the proposed activity;
    - a comparative assessment of the positive and negative implications of identified alternatives

General Considerations:

- Disclose any gaps in information or assumptions made.
- Recommendations for mitigatory measures to minimise impacts identified.
- An outline of additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the Environmental Management Plan (EMP) for faunal related issues.

A description of the potential impacts of the development and recommended mitigation measures are to be provided which will be separated into the following project phases:

- Pre-construction
- Construction
- Operational phase

1.2 DATA SOURCING AND REVIEW

Apart from the data collected on-site, other data sources consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status was extracted from the South African National Vegetation Map (Mucina and Rutherford 2006).
- Information on plant and animal species recorded for the Quarter Degree Squares (QDS) 2922 CD and DC, 3022 AB and BA was extracted from the SABIF/SIBIS database hosted by SANBI.

- The IUCN conservation status (Table 1) of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2011).
- Threatened Ecosystem data was extracted from the National List of Threatened Ecosystems 2010.
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and various spatial databases (SANBI's SIBIS and BGIS databases).
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- The reptile list derived from the literature was also supplemented with species known to occur in the area extracted from the SARCA web portal, hosted by the ADU, http://vmus.adu.org.za
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site. For each species, the likelihood that it occurs at the site was rated according to the following scale:
    - **Low:** The available habitat does not appear to be suitable for the species and it is unlikely that the species occurs at the site.
    - **Medium:** The habitat is broadly suitable or marginal and the species may occur at the site.
    - **High:** There is an abundance of suitable habitat at the site and it is highly probable that the species occurs there.
    - **Definite:** Species that were directly or indirectly (scat, characteristic diggings, burrows etc.) observed at the site.

- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 3.1 (2012) (See Table 1) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals and amphibians, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming, the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

Table 1. The IUCN Red List Categories for fauna and flora. Species which fall within the categories in red and orange below, are of conservation concern.

IUCN Red List Category
Critically Endangered (CR)
Endangered (EN)
Vulnerable (VU)
Near Threatened (NT)
Critically Rare
Rare
Declining
Data Deficient - Insufficient Information (DDD)
Data Deficient - Taxonomically Problematic (DDT)
Least Concern

2 REGULATORY AND LEGISLATIVE OVERVIEW

A summary of the relevant portions of the Acts which govern the activities and potential impacts to the environment associated with the development are listed below. Provided that standard mitigation and impact avoidance measures are implemented, not all the activities listed in the Acts below would actually be triggered.

National Environmental Management Act (NEMA) (Act No 107, 1998):

NEMA requires that measures are taken that "prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." In addition:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied:
- That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

Environment Conservation Act (ECA) (No 73 of 1989 Amendment Notice No. R1183 of 1997)

This Act provides for the effective protection and controlled utilisation of the environment. This Act has been largely repealed by NEMA, but certain provisions remain, in particular provisions relating to environmental impact assessments. The ECA requires that developers

must undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations.

National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004):

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009) has been gazetted for public comment. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the NSBA 2004. In terms of the EIA regulations, a basic assessment report is required for the transformation or removal of indigenous vegetation in a critically endangered or endangered ecosystem regardless of the extent of transformation that will occur. However, all of the vegetation types within and surrounding the study site are classified as Least Threatened.

NEM:BA also deals with endangered, threatened and otherwise controlled species, under the TOPS Regulations (Threatened or Protected Species Regulations). The Act provides for listing of species as threatened or protected, under one of the following categories:

- **Critically Endangered:** any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered:** any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- **Vulnerable:** any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- **Protected species:** any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

A TOPS permit is required for any activities involving any TOPS listed species.

Certain activities, known as Restricted Activities, are regulated by a set of permit regulations published under the Act. These activities may not proceed without environmental authorization. Those relevant to the current study are listed below.

Under the **Environmental Impact Assessment Regulations Listing Notice 1 of 2010** (No. R.544) the following activities are likely to be triggered:

Activity 1: The construction of facilities or infrastructure for the generation of electricity where:

ii. the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare.

Under the **Environmental Impact Assessment Regulations Listing Notice 2 of 2010** (No. R.387) the following activities are likely to be triggered:

Activity 1: The construction of facilities or infrastructure, including associated structures or infrastructure, for -

(a) the generation of electricity where –
(i) the electricity output is 20 megawatts or more; or
(ii) the elements of the facility cover a combined area in excess of 1 hectare;

And, under **Environmental Impact Assessment Regulations Listing Notice 3** of 2010 (*R.546):*

Activity 14. The clearing of an area of 5 hectares or more of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation.

Activity 16 IV: The construction of infrastructure covering 10 square meters of more where such construction occurs within a watercourse of within 32 metres of a watercourse measured from the edge of the watercourse, excluding where such construction will occur behind the development setback line.

National Forests Act (No. 84 of 1998):

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: "*no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated".*

The only listed tree species observed at the site was *Boscia albitrunca*, which was abundant across most parts of the site. This species is however not rare and the potential loss of some individuals from the area as a result of the development is not a significant concern.

Conservation of Agricultural Resources Act (Act 43 of 1983):

The Conservation of Agricultural Resources Act provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. The Conservation of Agricultural Resources Act defines different categories of alien plants and those listed under Category 1 are prohibited and must be controlled while those listed under Category 2 must be grown within a demarcated area under permit. Category 3 plants includes ornamental plants that may no longer be planted but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the floodline of water courses and wetlands.

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

The purpose of this Act is to prevent and combat veld, forest and mountain fires. The Act provides for a variety of institutions, methods and practices for achieving the purpose such as the formation of fire protection associations. It also places responsibility on landowners to develop and maintain firebreaks as well be sufficiently prepared to combat veld fires.

The site is however arid and given the low plant cover, it is highly unlikely that fires are a normal occurrence in the area but may occasionally occur following years of exceptional rainfall

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

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the development may require.

Manipulation of boundary fences

19. No Person may –

(a) erect, alter remove or partly remove or cause to be erected, altered removed or partly removed, any fence, whether on a common boundary or on such person's own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom;

The Act also lists protected fauna and flora under 3 schedules ranging from Endangered (Schedule 1), protected (schedule 2) to common (schedule 3). The majority of mammals, reptiles and amphibians are listed under Schedule 2, except for listed species which are under Schedule 1. Of relevance for the current development is the fact that several plant families and genera are listed in their entirety as protected, this includes, inter alia *Mesembryanthemaceae*, *Amaryllidaceae*, *Apocyanceae*, *Asphodeliaceae*, *Crassulaceae*, *Iridaceae* and *Euphorbia*. Although there are few species of conservation concern within these families and genera at the site, the species present within the development footprint will need to be listed with the permit application. A permit obtainable from the DENC permit office in Kimberly would be required for the site clearing. A permit would also be required to destroy or translocate any nationally or provincially listed species from the site. A single integrated permit, which covers all of these permitting requirements as well as meets TOPS regulations, is used.

3 METHODOLOGY

3.1 SITE VISIT

The site visit took place over two full days from the 13th–14th of September 2012. During the site visit, the available roads and tracks within the site were driven and an overall impression of the broad-scale ecological patterns within the site established and used to allocate sampling effort and distribution for the detailed biodiversity studies. During the course of the field assessment, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. Walk-through-surveys were conducted within representative areas across the different habitats units identified and all plant and animal species observed were recorded. Active searches for reptiles and

amphibians were also conducted within habitats likely to harbor or be important for such species. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS and mapped onto satellite imagery of the site.

3.2 SENSITIVITY MAPPING & ASSESSMENT

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases. This includes delineating the different habitat units identified in the field and assigning sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Units with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. This category is reserved specifically for areas where the natural vegetation has already been transformed. In the current study mining activities are the major agent of transformation, but may also result from intensive agriculture. Most types of development can proceed within these areas with little ecological impact. As there is no intensive agriculture in the area, there were no transformed areas within the development area and so there were no areas classified as Low sensitivity.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of faunal habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

3.3 SAMPLING LIMITATIONS AND ASSUMPTIONS

The major potential limitation associated with the sampling approach is the narrow temporal window of sampling. Ideally, a site should be visited several times during different seasons to ensure that the full complement of plant and animal species present are captured. However, this is rarely possible due to time and cost constraints and therefore, the

representivity of the species sampled at the time of the site visit should be critically evaluated. It was reasonably dry at the time of sampling and there were few forbs and annuals present. A number of geophytes were however observed and the plant species list of the site can be considered to be representative of the shrubs, trees and perennial grasses and reasonably representative of geophytes, but not adequate for forbs and annuals. The implications of this for the study are however not highly significant as the absence of annuals and forbs is not likely to influence the sensitivity of the different landscape units identified. Faunal activity at the site was also reasonably low, probably also on account of the dry conditions at sampling. The lists of amphibians, reptiles and mammals for the site are however based on those observed at the site as well as those likely to occur in the area based on their distribution and habitat preferences. This represents a sufficiently conservative and cautious approach which takes the study limitations into account.

3.4 RELEVANT ASPECTS OF THE DEVELOPMENT

A single site is being considered and alternative sites are not being assessed or compared to one another. The location of the turbines will however be optimized to minimise ecological as well as other impacts, based on the results of this and the other specialist studies. The current layout takes cognisance of the ecological scoping report that was produced for the site. The proposed wind farm is situated approximately 10 km east of Copperton on Farm 103, portion 5 (Nelspoortjie farm), an area of approximately 5520 ha in extent.

The proposed winder energy facility would include:

- Wind turbines of between 2-3MW in capacity
- Concrete foundations to support the turbines
- Cabling between the turbines, to be laid underground where practical
- An on-site substation to facilitate the connection between the wind energy facility and the elelctricity grid
- Internal access roads to each turbine
- Workshop area/office for control, maintenance and storage
- A new 132 kV overhead power line. Two options are being considered as follows:
    - Option 1: Loop in and out of the existing Burchell/Cuprum 132 kV line
    - Option 2: would be to connect directly to the existing Eskom Caprum substation via a 132 kV power line. Two alternatives are being considered for this option:
        - **Alternative 1** would be to connect directly to the existing Eskom Caprum substation via the ***northern corridor*** parallel to the Burchell/Cuprum 132 kV line. Two sub alternatives are being considered within this corridor; a) sub alternative A is the shortest route with a section crossing the wind farm site in a westerly direction; b) sub alternative B is the longer route (approximately 2.5 km longer than sub-alternative A) (Yellow and Orange in Figure 1 below)

- **Alternative 2** will be to connect directly to the existing Eskom Caprum substation via a ***southern corridor*** which follows a route to avoid traversing the adjacent property (Farm 103/7) which forms part of another proposed renewable energy project.

Figure 1. Satellite view of the proposed Garob Wind Energy Facility site, showing the proposed location of the turbines as well as the different power line route options as described above.

4 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE

4.1 VEGETATION

4.1.1 Broad-Scale Vegetation Types

According to the national vegetation map (Mucina & Rutherford 2006), the site lies entirely within the Bushmanland Arid Grassland vegetation type (Figure 2). This vegetation unit is the second most extensive vegetation type in South Africa and occupies an area of 45478 km^2 and extends from around Aggeneys in the east to Prieska in the west. It is associated largely with red-yellow apedal (without structure), freely drained soils, with a high base status and mostly less than 300 mm deep. Due the arid nature of the unit which receives between 70 and 200 mm annual rainfall, it has not been significantly impacted by intensive agriculture and more than 99% of the original extent of the vegetation type is still intact

and its' conservation status is classified as Least Threatened. Mucina & Rutherford (2006) list 6 endemic species for the vegetation type which is relatively few given the extensive nature of the vegetation type. Other vegetation types which occur in the vicinity are Bushmanland Basin Shrubland and Lower Gariep Broken Veld. The site visit clearly demonstrated that the vegetation of the site cannot be considered to represent only Bushmanland Arid Grassland. Indeed, Mucina & Rutherford (2006), recognized that along the eastern border of the vegetation type it often intermingles with Lower Gariep Broken Veld, Kalahari Karroid Shrubland and Gordonia Duneveld. Such intermingling of vegetation types is a conspicuous feature of the site, which also contains extensive elements of Lower Gariep Broken Veld and Bushmanland Basin Shrubland. These patterns are discussed in detail in the following section.

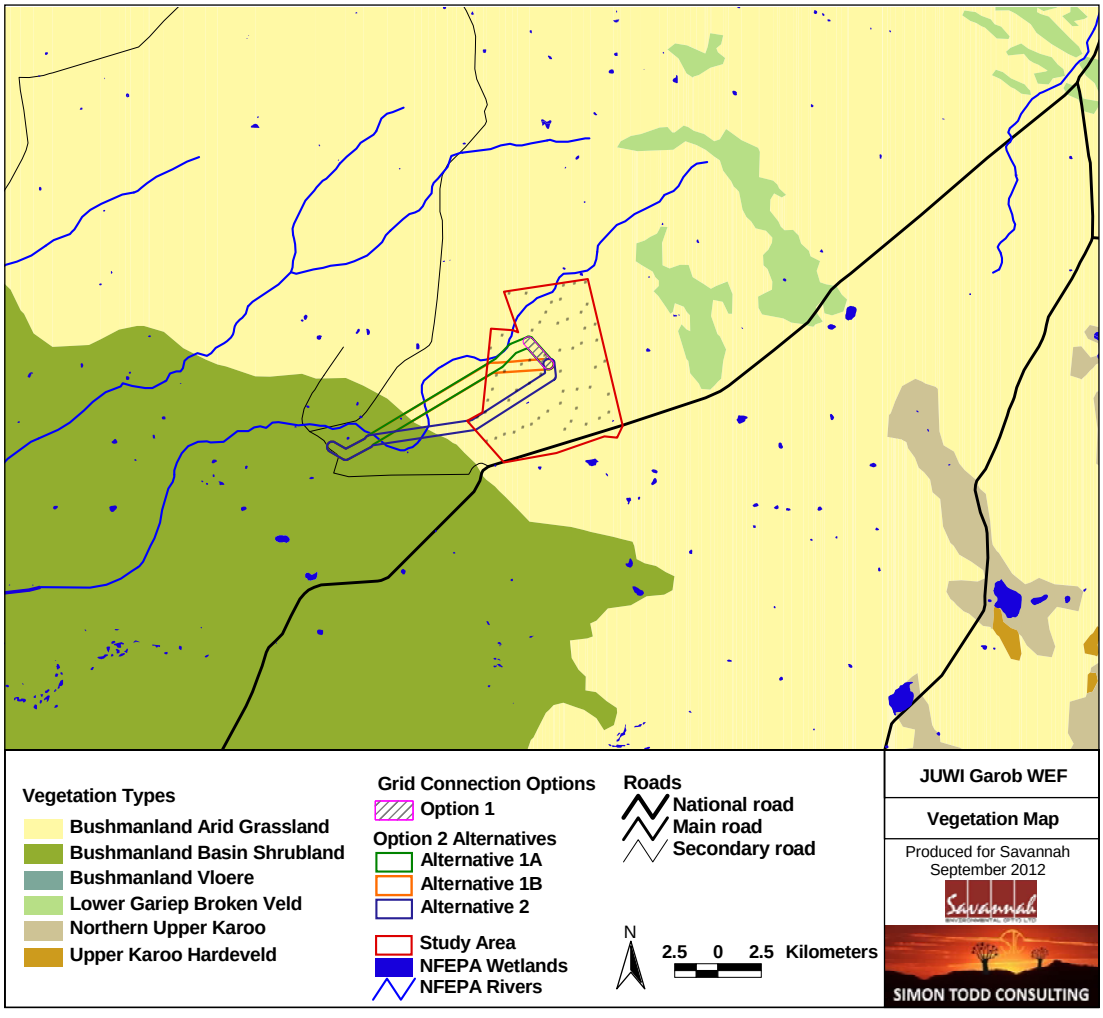


Figure 2. Broad-scale overview of the vegetation in and around the proposed Garob Wind Energy Facility. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers, pans and wetlands delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011).

4.1.2 Fine-Scale Vegetation Patterns

Within the site, several different plant communities could be recognised, each associated with the different substrate. Each of these different communities is mapped in Figure 3 below and described in detail.

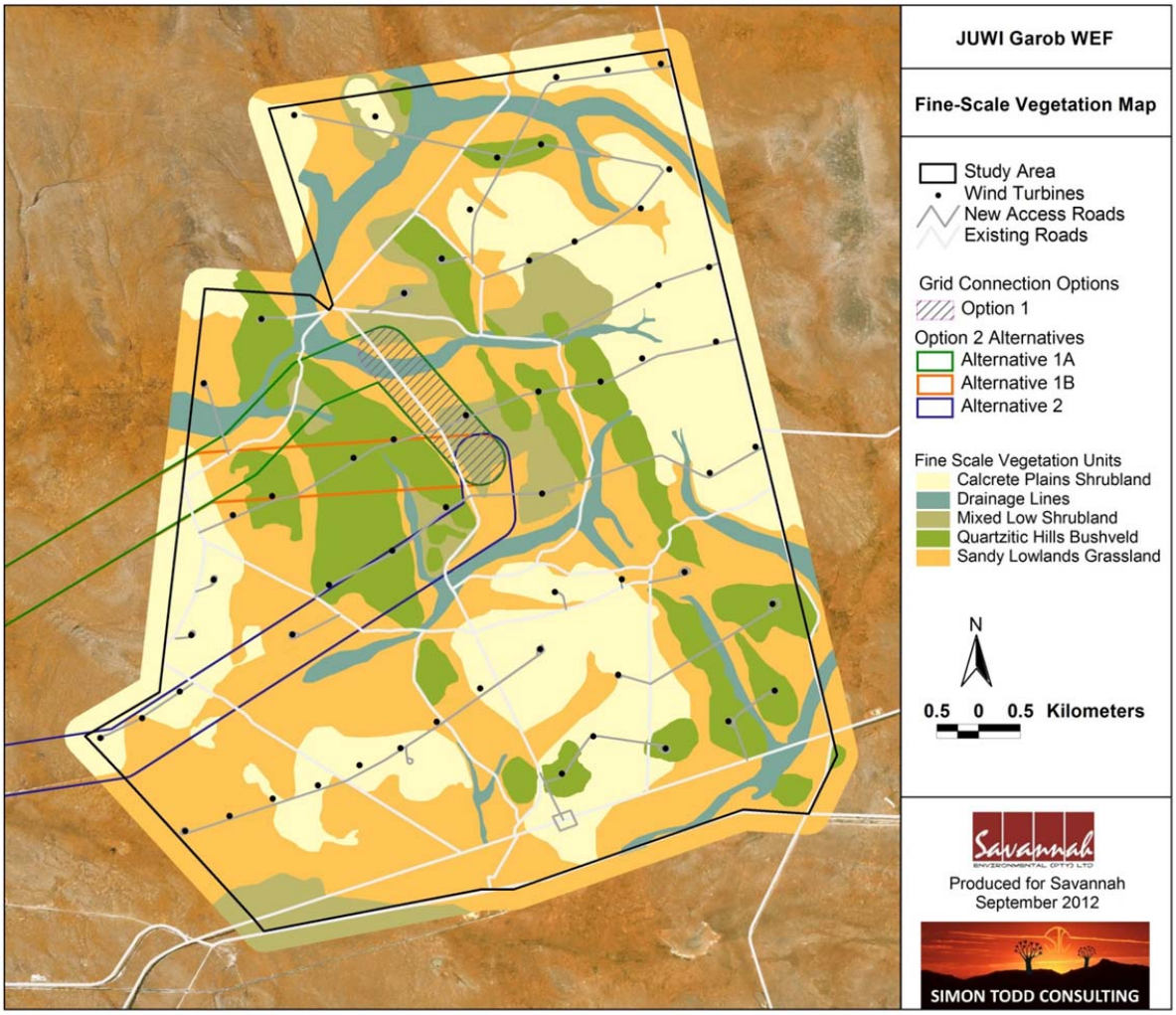


Figure 3. Fine-scale vegetation map of the Garob wind farm site. Each of the different vegetation types depicted above is described in detail below.

Sandy Lowlands Grassland

The lowlands of the site which occur on deep sands can be considered to represent the Bushmanland Arid Grassland vegetation type of Mucina & Rutherford (2006). These areas dominated by perennial grasses such as *Stipagrostis ciliata*, *S.obtusa*,

S.anomala, *S.uniplumis* and *Schmidtia kalahariensis*; with varying densities of shrubs such as *Lebeckia spinescens*, *Phaeoptilum spinosum*, *Rhigozum trichotomum*, *Gnidia polycephala* and *Lycium pumilium*. Within some areas, the density of *Rhigozum trichotomum* is very high, suggesting that these areas are to some extent degraded as a result of overgrazing. This is not a highly sensitive plant community as the diversity is quite low and it occurs largely on flat and gently sloping areas. It does however tend to occur in proximity to drainage lines. In some parts of the site, this vegetation type and the calcrete shrubland grade into one another slowly and there are extensive areas of shallow soils overlying calcrete which are comprised of a mix of shrubs and grasses, which were mapped as a separate unit in Figure 3 as Mixed Shrubland, but basically represent transition areas between the two vegetation types.

Figure 4. Examples of the Sandy Lowlands vegetation type at the site. This vegetation unit occurs on deep red Kalahari sands and is dominated by various *Stipagrostis* species with scattered shrubs of *Rhigozum trichotomum*, *Phaeoptilum spinosum* and *Lycium pumilum*.

Calcrete Plains Shrubland

The Calcrete Plains vegetation unit occurs in areas of shallow soils overlying calcrete, often with the calcrete exposed. This vegetation unit is broadly equivalent to the Bushmanland Basin Shrubland vegetation type of Mucina & Rutherford (2006). This is a low open shrubland with few trees. Dominant species include *Pteronia sordida*, *Pteronia glomerata*, *Rosenia humilis*, *Pentzia incana*, *Stipgrostis obtusa*, *Enneapogon desvauxii*, *Plinthus karooicus* and *Lycium cinereum*. This is not considered to be a sensitive plant community as the plant diversity is quite low and it occurs on gently sloping plains where the risk of secondary impact such as erosion is low. This community is particularly prominent in the eastern part of the site where a large proportion of the turbines are located.

Figure 5. Typical example of the calcrete plains vegetation unit at the Garob site. As can be seen from the picture, this is a low open shrubland dominated by typical karroo shrub species such as *Pteronia*, *Pentzia* and *Rosenia*.

Quartzitic Hills Bushveld

The majority of the rocky hills within the site are quartzitic in nature and contain a greater amount of large woody species as compared to the other communities at the site. This vegetation type is similar to the Lower Gariep Broken Veld of Mucina and Rutherford (2006). Dominant woody species include trees such as *Acacia mellifera*, Boscia albitrunca and Rhus burchellii and shrubs such as *Hermannia desertorum*, *Aptosimum spinescens*, *Sericocoma avolans*, *Asparagus capensis* and *Rhigozum trichotomum*. Dominant grass species include *Digitaria eriantha*, *Oropetium capense*, *Heteropogon contortus* and *Aristida diffusa* subsp. *burkei*. This is a diverse community and contains much higher species richness than the other plant communities at the site. In addition, the rocky areas also provide habitat for reptiles and small mammals that is not available elsewhere at the site. Due to the higher plant and faunal diversity of the rocky hills, they are considered more sensitive than the surrounding communities. Species of conservation significance which were observed in this community include Boscia albitrunca, Pachypodium succulentum, Lithops

Figure 6. Examples of the Quartzitic Hills vegetation unit. As can be seen from the photos, this community is associated with the rocky hills at the site and is generally dominated by trees such as *Acacia mellifera* and *Boscia albitrunca* with a grass or shrub sublayer. The large variation in the grass layer as evident from the two photos appears to be related to grazing pressure as well as the aspect, with north-facing slopes having a greater proportion of grasses.

Drainage Lines

The drainage lines at the site were generally poorly developed on account of the fact that the site is toeards the top of the catchment and there were no drainage lines at the site which received runoff from a very large area. Also, within the sandy lowlands, the deep sands present in these areas has a high infiltration capacity and there was little runoff from these areas and drainage lines which entered these areas from the rocky hills were often dissipated by the sandy substrate. The drainage lines themselves were usually characterized by the presence of woody species such as *Acacia mellifera*, *Boscia albitrunca*, *Ehretia rigida*, *Lycium oxycarpum* and *Phaeoptilum spinosum*. As drainage lines are important for fauna as well as perform an important ecological role in regulating runoff, they should be avoided wherever possible.

Figure 7. Drainage line community, indicated by the dense woody vegetation consisting mainly of *Acacia mellifera*, *Boscia albitrunca* and *Phaeoptilum spinosum*.

4.1.3 Plant Species of Conservation Concern

Only two listed plant species are known from the area, *Hoodia gordonii* which is listed as DDD (data deficient, insufficient information) and *Salsola apiciflora* which is listed DDT (Data Deficient – Taxonomically Problematic). Niether of these species were observed at the site and although *Hoodia gordonii* may be present, this species is widespread across the karoo and Kalahari and is not a significant conservation concern. As *Hoodia gordonii* is usually quite conspicuous it is not likely that it occurs at the site and if it does then it is certainly not abundant.

Other species of conservation concern that were observed at the site includes *Boscia albitrunca* which was common across the site. This species is however widely distributed and is not rare and the loss of some individuals from the development footprint would not compromise the local population of this species. A few notable edaphic specialists were observed at the site such as *Titanopsis calcarea* which is restricted to areas of exposed calcrete gravel and *Lithops hallii* which was observed on several of the quartzitic hills at the site. Both these species are currently listed as Least Concern, but as they are edaphic specialists they should be avoided where possible. A number of other species protected under provincial legislation were also observed at the site including *Pachypodium succulentum*, *Mestoklema tuberosum*, *Tritonia laxifolia*, *Aloe claviflora* and *Avonia ustulata*. None of these species are however very rare and most of them are suitable candidates for search and rescue and so any affected individuals within the development footprint could be translocated to safety.

4.2 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

No fine-scale conservation planning has been done in the district and as a result, no Critical Biodiversity Areas have been defined. The site also does not fall within an area that has identified as focus areas under the National Protected Areas Expansion Strategy, suggesting that the site does not fall within an area that has been identified as being important for biodersity maintenance at a landscape scale. There is however a small NPAES focus area approximately 5 km southeast of the site. There is however no evidence to suggest that the site lies within an area that is likely to be highly significant as faunal movement or migration pathway. The area is generally homogenous and given the extensive amount of intact vegetation in the area, there is likely to be little disruption to the broad-scale connectivity of the landscape as a result of the development.

4.3 FAUNAL COMMUNITIES

Terrestrial Mammals

The site falls within the distribution range of 43 terrestrial mammal species, indicating that the potentially has quite high mammalian diversity. Species that were observed at the site include Cape Porcupine *Hystrix africaeaustralis*, Steenbok *Raphicerus campestris*, Aardvark *Orycteropus afer*, Rock Hyrax *Procavia capensis*, Cape Hare *Lepus capensis*, South African Ground Squirrel *Xerus inauris*, Namaqua Rock Mouse *Aethomys namaquensis*, Yellow Mongoose *Cynictis penicillata* and Striped Polecat *Ictonyx striatus*. Although the site contains a variety of habitats, it does not contain any perennial water sources or significant rocky outcrops. The rocky slopes at the site consist of loose boulders and stones and there are very few areas with significant crevices and shelter sites within rock faces or boulder piles. As a result species associated with such habitats are not likely to be common at the site. For example, Rock Hyrax were only observed along the ESKOM powerline which traverses the site, in an area where boulder piles had been created by ground clearing during construction.

Two species of conservation concern may occur at the site, the Black-footed cat *Felis nigripes* (Vulnerable) and the Honey Badger *Mellivora capensis* (SA RDB Endangered). However as both these species are widely distributed across the arid and semi-arid areas of South Africa, the development would not amount to a significant amount of habitat loss for these two species. The construction phase of the development would generate a lot of noise and disturbance which would deter many larger mammals from the area. However during the operational phase the levels of disturbance will be significantly lower and disturbed species or individuals are likely to return to the site. Initially, some mammals may be wary of the turbines, but are likely to become habituated to their presence.

Reptiles

The site falls within the distribution of range of 39 reptile species and an additional four species have been recorded from the area by SARCA, which are outside their published

distribution range. The reptile community composition of the site is likely to be very high in lizards and skinks relative to snakes other groups. Species observed during the site visit include the Variegated Skink *Mabuya variegata*, Karoo Girdled Lizard *Cordylus polyzonus*, Ground Agama *Agama aculeata*, Spotted Sand Lizard *Pedioplanis lineoocellata* and Namaqua Sand Lizard *Pedioplanis namaquensis*. No listed reptiles are known from the area. Although the rocky hills are likely to contain greater reptile species richnes than other habitats, there are no specific habitats at the site which are particularly important for reptiles. As a result impacts on reptiles are likely to result largely from habitat loss and the disruption of landscape connectivity, rather than a specific threat to any rare or unique reptile habitats. Many reptiles are vulnerable to predation when traversing open areas and the presence of the roads will result in increased predation risk for susceptible reptiles. The overall impact on reptiles is however not likely to be highly significant as the total amount of habitat loss is not very large and the surrounding landscape is overwhelmingly intact and there are no rare or restricted reptile habitats that would be affected by the development.

Amphibians

The site lies within the distribution range of 10 frog species. Of these, only the Giant Bullfrog *Pyxicephalus adspersus* is of conservation concern and is listed as Near Threatened. This species is associated with temporary pans and as there were no temporary or permanent water bodies within the site, it is not likely that it is an important area for the Giant Bullfrog. In terms of the other species which may occur at the site, only those species which are able to survive away from permanent water are likely to occur at the site. Given the paucity of temporary or permanent water at the site, it is not likely to have a very diverse amphibian population and impacts on amphibians are not likely to be of much consequence. The greatest threat to amphibians associated with the development is probably chemical and fuel/oil spills related to the construction activities, rather than the presence of the development in the long-term. It is not likely that the development of the facility would have a significant long-term impact on local amphibian populations.

4.4 SITE SENSITIVITY ASSESSMENT

The ecological sensitivity map for the site is depicted below (Figure 7). The drainage lines are the only feature at the site which are considered to be Very High sensitivity. No turbines should be located within such areas, but is may be necessary for roads and other infrastructure to traverse these areas. In such situations, measures should be taken to ensure that the natural flow of water is not disrupted or diverted by the infrastructure and that the development footprint is kept to a minimum.

The quartzitic hills are considered to be High sensitivity on account of the higher flora and fauna richness associated with these areas. However, there were few threatened species present even within this habitat and with appropriate avoidance and mitigation measures the impacts to the rocky hills could be significantly reduced. The new access roads required for the facility, are currently aligned directly up and down the slopes of the hills and specific measures to reduce erosion potential will be required in these areas. In addition, it is

recommended that on the steeper slopes the roads follow less direct routes with lower erosion risk or contain switchbacks which reduce the slope angle and limit the slope length that water would travel before leaving the road.

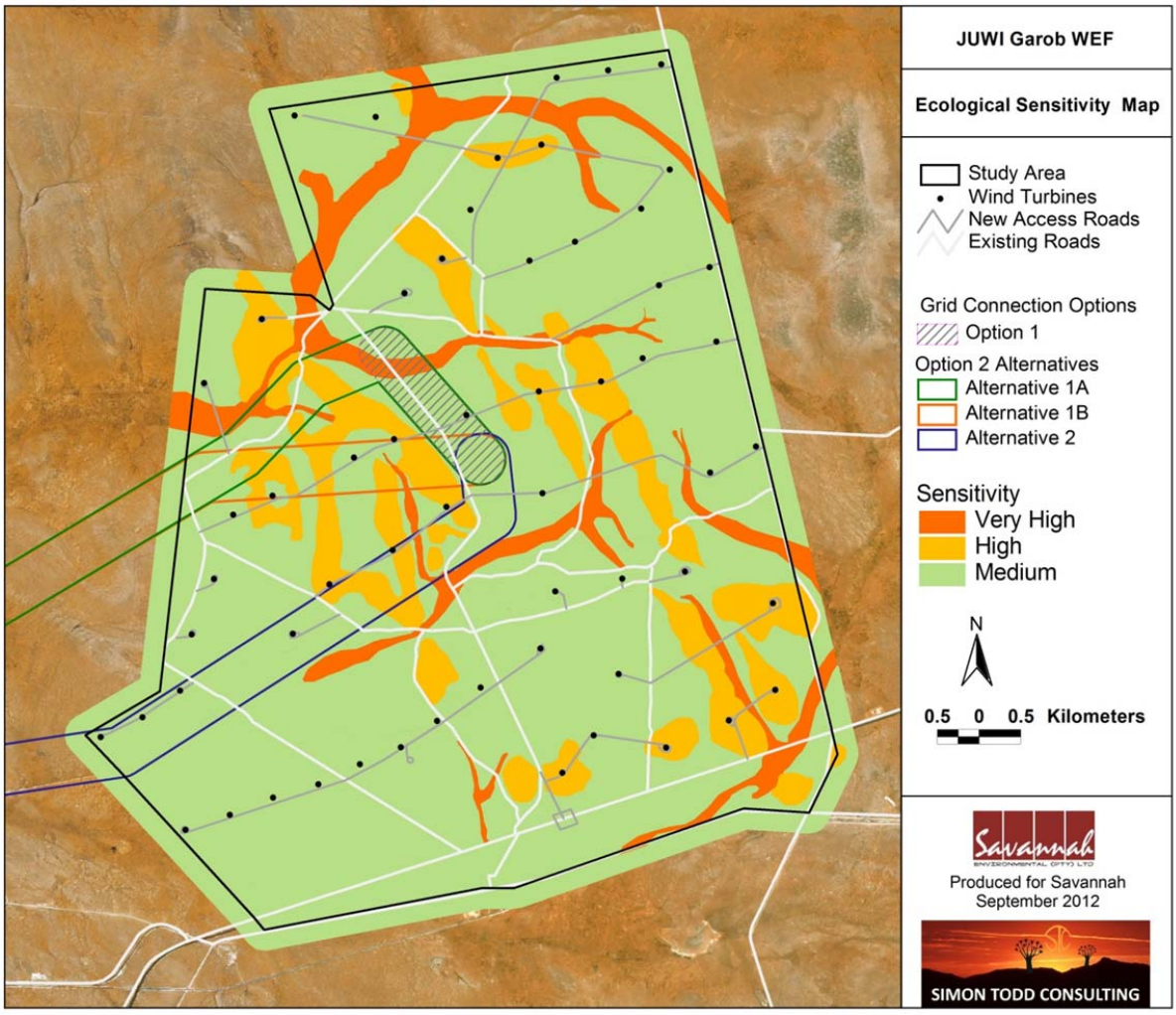


Figure 8. Ecological Sensitivity map of the proposed Garob Wind Energy Facility, illustrating the turbine locations and new access roads required for the facility, as well as the different grid connection options.

The grassy lowlands and the calcrete shrublands which comprise the largest proportion of the site are not considered to be highly sensitive on account of their relatively low species richness and the low risk of other ecological impacts such as erosion within these habitats. The greatest ecological risk factor likely to be associated with the development is erosion, particularly on the slopes of the hills and near drainage lines. Faunal impacts are not likely to be of high significance due to the lack of sensitive features and species within the site.

Although there are quite a number of individuals of protected species within the site, impacts to these species could either be mitigated to an acceptable level through turbine micrositing, or would not be of wider significance on account of the wide distribution of the affected species.

In terms of the sensitivity along the different power line options, the loop in loop out option to the Burchell/Caprum line is clearly the preferred option. In terms of the remaning alternatives from Option 2, there is not a large difference between the different Alternatives. Alternative 2 is the least preferred option, as it does not align with the existing ESKOM line and would have a greater impact than the routes which run next to the existing line. Alternative 1B is slightly longer than Alternative 1A, but is the preferred option as it traverses less sensitive ground before aligning with the existing ESKOM line.

5 IMPACT ASSESSMENT

5.1 ASSESSMENT & SIGNIFICANCE CRITERIA

Direct, indirect and cumulative impacts of the issues identified in this report are assessed in terms of the following criteria:

- The **nature** which includes a description of what causes the effect what will be affected and how it will be affected.

- The **extent** wherein it is indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 is assigned as appropriate (with 1 being low and 5 being high):

- The **duration** wherein it is indicated whether:

    - the lifetime of the impact will be of a very short du ration (0- 1 years) - assigned a score of 1.
    - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2.
    - medium-term (5-15 years) - assigned a score of 3
    - long term (> 15 years) - assigned a score of 4; or
    - permanent - assigned a score of 5

- The **magnitude** quantified on a scale from 0-10 where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way 8 is high (processes are altered to the extent that they temporarily cease) and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

- The **probability** of occurrence, which shall describe the (likelihood of the impact actually occurring. Probability will be estimated on a scale of 1-5 where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but of low

likelihood) , 3 is probable (distinct possibility) , 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

The **significance** which shall be determined through a syntheses of the characteristics described above and can be assessed as low, medium or high;
and;
the status, which will be described as either positive, negative or neutral.
the degree to which the impact can be reversed.
the degree to which the impact may cause irreplaceable loss of resources.
the degree to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:
S = (E + D + M)P
Where

S = significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The significance weightings for each potential impact are as follows:

- **<30** points : **Low** (i.e. where this impact would not have a direct influence on the decision to develop in the area)
- **30-60** points : **Medium** (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
- **>60** points : **High** (i.e. where the impact must have an influence on the decision process to develop in the area).

6 IDENTIFICATION & NATURE OF IMPACTS

6.1.1 Impact Risk Factors

Potential ecological impacts resulting from the development of the wind energy facility at the Garob site would stem from a variety of different activities and risk factors associated with the construction and operational phases of the project including the following:

Construction Phase

- Vegetation clearing & site preparation
- Operation of heavy machinery at the site
- Human presence

Operational Phase

- Site maintenance activities

- Human presence
- Operation of the turbines

With regards to Wind Energy facility itself the above activities are likely to manifest themselves as the following impacts:

- Impacts on vegetation and listed plant species
- Increased alien plant invasion risk
- Loss of habitat for fauna
- Reduced landscape connectivity
- Direct faunal impacts
- Increased soil erosion risk

With regards to the construction of the overhead power line, the following impacts are assessed:

- Impacts on vegetation and listed plant species
- Increased alien plant invasion risk
- Increased soil erosion risk

Although there may be some faunal impact related to the construction of the power line, this is not likely to be significant given the low footprint the power line is likely to generate and the alignment of the preferred options with the existing line. Therefore, terrestrial faunal impacts are not assessed with regards to the power line and the mitigation measures to reduce impacts on flora and erosion potential would also be effective at reducing any impacts on fauna.

6.1.2 Impact Nature

Impacts on vegetation and listed plant species

Some loss of vegetation is an inevitable consequence of the development. Although there are not many red-data listed plant species at the site, there is a reasonably large number of protected species present. The potential impact of the development on protected plant species and sensitive vegetation units is a potential concern with regards to the development of the site.

Loss of habitat for fauna

The development of the wind energy facility will result in the loss of habitat for resident fauna. This potentially includes two listed mammals and a single listed amphibian. In terms of a direct loss of habitat, the development of the wind energy facility would result in the loss of approximately 100 ha of currently intact vegetation.

Increased Alien Plant Invasion Risk

Disturbance created at the site during construction would leave the site vulnerable to alien plant invasion. Many of the sandy areas were already invaded to some extent by *Prosopis*

and the presence of this species across the site, will increase the risk that it will spread and increase in abundance at the site. The disturbance created at the site would also encourage the invasion of other species, some of which may also be transported onto the site on dirty machinery or construction materials brought onto the site.

Reduced Landscape Connectivity

The extensive road network which is likely to amount to more than 60 km of hardened access roads is likely to have an impact on landscape connectivity for fauna. The current roads and tracks at the site are narrow and in most instances, have been cleared of vegetation only within the tyre tracks. The access roads required for the development will be approximately 8-10m wide and will need to be compacted so that they can support the heavy vehicles that must bring the turbine components in. Within the sandy lowlands, such roads would represent a barrier to movement for subterranean species. Slow moving species such as tortoises and some snakes are also vulnerable to predation when exposed and may suffer increased predation rates as a result of the roads. Although the impact at any one time is small, the roads may result in a longer-term cumulative impact and species which reproduce slowly such tortoises may be particularly affected. Larger mammals are likely to be less impacted due to their mobility.

Direct Faunal Impacts

Some smaller animals would not be able to move away from construction activity sufficiently quickly during construction and would be killed by vehicles and earth-moving machinery. In addition, the presence of a large work force on the site would pose a risk to species such as snakes, tortoises and mammals which would be vulnerable to poaching for food, trade or killed out of fear and superstition.

Increased Soil Erosion Risk

The development of the site would create a lot of soil disturbance, which would leave the site susceptible to wind and water erosion. The hardened surfaces of the roads would generate a lot of runoff, which may affect the areas receiving the runoff. Particular risk areas include the slopes of the rocky hills as well as the areas near to the drainage systems of the site.

6.2 ASSESSMENT OF IMPACTS – WIND ENERGY FACILITY

The six major impacts identified above which are likely to be associated with the development of the wind energy facility are assessed below.

Impact 1: *Impacts on vegetation and protected plant species*

Impact Nature: Impacts on vegetation and protected plant species would occur due to the construction of the facility.		
	Without Mitigation	**With Mitigation**

Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (2)
Magnitude	Medium-High (6)	Low (4)
Probability	Definite (5)	Highly Probable (4)
Significance	Medium-High (60)	Medium (32)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Yes	
Can impacts be mitigated?	To a large extent	
Mitigation	• Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. • Where roads and other infrastructure cross sensitive features such as drainage lines, caution should be exercised to ensure that impact to these features are minimised. • The final development area should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of construction. • Development would be likely to encourage alien plant invasion and measures to prevent and limit alien plant invasion should be implemented as part of the EMP for the development.	
Cumulative Impacts	The potential for cumulative impacts is quite low on account of the small development footprint of the facility in relation to the overwhelmingly intact nature of the surrounding landscape.	
Residual Impacts	Some loss of vegetation is inevitable and cannot be avoided	

Impact 2. *Increased alien plant invasion*

Impact Nature: Alien plants are likely to invade the site as a result of disturbance created during construction		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (1)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	Medium (44)	Low (15)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation	• Cleared areas which are not surfaced or required for construction should be revegetated with seed or plants of locally occurring species. • Regular monitoring for alien plants within the development footprint. • Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible. • Alien management plan should be developed as part of the EMPr for the development, it should aim to address alien plant problems within the whole site, not just the development footprint.	
Cumulative Impacts	If alien abundance, particularly *Prosopis* increases a lot then some impact on hydrology and the ecological functioning the area can be expected.	
Residual Impacts	If alien species at the site are controlled, then there will be very little residual impact	

Impact 3. *Habitat loss for fauna.*

Impact Nature: Transformation and loss of habitat will have a negative effect on resident fauna.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Low (3)
Probability	Definite (5)	Highly Probable (4)
Significance	Medium (55)	Medium (36)
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	To some degree, but not entirely	
Mitigation	• Vegetation clearing should be kept to a minimum. • Impacts to restricted or important habitats such as the drainage lines should be avoided. • The final placement of turbines must follow a micrositing procedure involving a walk-through and identification of any sensitive areas by botanical, faunal and avifaunal specialists.	
Cumulative Impacts	There is very little other development in the area and apart from the Copperton mine which is some distance from the facility. The potential for cumulative impacts is low on account of the largely intact nature of the surrounding landscape.	
Residual Impacts	Some habitat loss is an inevitable consequence of the development and cannot be fully mitigated.	

Impact 4. *Reduced landscape connectivity.*

Impact Nature: Roads, turbine lay-down areas and other transformed areas will represent barriers to movement for some species.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (6)	Medium(5)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (48)	Medium (33)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To some degree	
Mitigation	• Hardened surfaces should be kept to a minimum • Roads should be as narrow as possible and as short as possible. A natural surface such as gravel would be preferable to a tarred or concrete road, except in very steep areas where it would be difficult to prevent erosion of natural surfaces. • Vegetation should be allowed to remain alongside or encroach on the roads as much as possible. • Temporary lay-down areas should be in previously transformed areas or areas that will be used by the development.	
Cumulative Impacts	The development would contribute a small amount to the cumulative loss of landscape connectivity, but this is not likely to be highly significant when considered at the landscape scale.	
Residual Impacts	As the roads and turbines will continue to be present for the lifetime of the facility, some residual impact will remain for the lifetime of the facility.	

Impact 5. *Direct Faunal Impacts*

Impact Nature: Fauna will be directly impacted by the development as a result of construction activities and human presence at the site.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (4)	Short-term (4)
Magnitude	Medium (5)	Medium-Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (44)	Low (24)
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To some extent	
Mitigation	• Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person. • The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site. • Fires should only be allowed within fire-safe demarcated areas. • No fuelwood collection should be allowed on-site. • No dogs should be allowed on site. • If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • No unauthorized persons should be allowed onto the site. • All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.	
Cumulative Impacts	The potential for cumulative impacts is relatively low as there are few other developments currently underway in the	

	area which might generate similar impacts. .
Residual Impacts	Residual impacts for fauna can be mitigated to a large degree, although some mortality of a few immobile species can be expected.

***Impact 6**. Increased erosion risk.*

Impact Nature: Increased erosion risk as a result of soil disturbance and loss of vegetation cover. (Associated with the development as well as access roads)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Medium (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (48)	Low (21)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation	• All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.	
Cumulative Impacts	Higher sediment loads in rivers and streams will affect in-stream vegetation and biota	
Residual Impacts	If erosion at the site is controlled, then there will be no residual impact	

6.3 ASSESSMENT OF IMPACTS – OVERHEAD POWER LINE

The preferred option, Option 1, the loop in loop out of the existing Burchell/Caprum line, is less than 2 km long and apart from a drainage area, there are no sensitive areas within the corridor. As a result, the impact of this option would be very low and providing a full assessment of this option would be academic. However it is uncertain whether or not this option will be possible, the next preferred alternative, Alernative 1A is assessed in full below. The assessment would also apply to Alternative 1B which is similar. For comparative purposes, the impact associated with the other two alternatives is provided in the summary table at the end of the section.

Impact 1: Impacts on vegetation and protected plant species

Impact Nature: Impacts on vegetation and protected plant species may occur due to the construction of the power line.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (40)	Low (24)
Status	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of resources	No	
Can impacts be mitigated?	To a large extent	
Mitigation	• The final power line support structure locations and any access roads required for construction should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of construction. • Disturbance resulting from construction is likely to encourage alien plant invasion and measures to prevent and limit alien plant invasion along the power line route should be implemented as part of the EMPr for the development.	
Cumulative Impacts	The potential for cumulative impacts is quite low on account of the low footprint the power line is likely to generate.	

Residual Impacts	Provided that suitable mitigation measures are implemented residual impacts would be very low.

Impact 2. *Increased alien plant invasion*

Impact Nature: Alien plants are likely to invade the site as a result of disturbance created during construction		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Short-term (1)
Magnitude	Low (4)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	Medium (36)	Low (15)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation	• Vegetation clearing along the power line route to be kept to a minimum. • Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible. • Alien management plan should be developed as part of the EMPr for the development, it should aim to address alien plant problems within the whole site, not just the development footprint.	
Cumulative Impacts	If alien abundance, particularly *Prosopis* increases a lot then some impact on hydrology and the ecological functioning the area can be expected.	
Residual Impacts	If alien species at the site are controlled, then there will be very little residual impact	

***Impact 3**. Increased erosion risk.*

Impact Nature: Increased erosion risk as a result of soil disturbance and loss of vegetation cover.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Medium (5)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	Medium (33)	Low (12)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation	• Vegetation disturbance should be kept to a minimum, while shrubs and trees may need to be removed from the power line path, the ground layer should be left intact as • Any service roads required should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.	
Cumulative Impacts	Higher sediment loads in rivers and streams will affect in-stream vegetation and biota	
Residual Impacts	If erosion at the site is controlled, then there will be no residual impact	

Summary Assessment

The summary assessment for the Garob Wind Energy Facility is provided below in Table 2. All of the impacts assessed can be reduced to a low or moderate level through mitigation and there are no impacts present which are likely to represent a red-flag for the development. Some impacts such as habitat loss for fauna and flora cannot be avoided, but overall the significance of these impacts is not high on account of the low overall sensitivity of the receiving environment.

Table 2. Summary assessment of the pre- and post-mitigation impacts associated with the development of the Garob Wind Energy Facility.

Impact	Pre Mitigation	Post Mitigation
Vegetation and listed species	Medium-High (60)	Medium (32)
Alien plant invasion risk	Medium (44)	Low (15)
Habitat loss for fauna	Medium (55)	Medium (36)
Reduced landscape connectivity	Medium (48)	Medium (33)
Direct faunal impacts	Medium (44)	Low (24)
Increased erosion risk	Medium (48)	Low (21)

Table 3. Summary assessment of the different overhead power line options associated with the development.

Impact	Option 1		Option 2					
			Alternative 1A		Alternative 1B		Alternative 2 (Least)	
	Pre Mitigation	Post Mitigation	Pre Mitigation	Post Mitigation	Pre Mitigation	Post Mitigation	Pre Mitigation	Post Mitigation
Vegetation and listed species	Low (14)	Low (6)	Medium (40)	Low (24)	Medium (48)	Low (24)	Medium (55)	Medium (33)
Alien plant invasion risk	Low (14)	Low (6)	Medium (36)	Low (15)	Medium (36)	Low (15)	Medium (36)	Low (15)
Increased erosion risk	Low (14)	Low (6)	Medium (33)	Low (12)	Medium (44)	Low (18)	Medium (44)	Low (18)

7 CONCLUSION & RECOMMENDATIONS

Overall the site appears to be a favourable location for the proposed wind energy facility. There are some sensitive habitats present such as the drainage lines and rocky hills, but even these do not harbor a large amount of rare or endangered species. Therefore, the

impacts of the development are likely to be largely local in nature and there do not appear to be any impacts which would be of wider significance. The development of the facility would result in the loss of some habitat for fauna and flora. However, this would amount to about 100 ha, which is not highly significant when considered in the light of the surrounding landscape which is almost entirely intact. The site does not appear to contain any specific features that are not also widely available in the surrounding landscape.

In terms of the different overhead transmission line options, the loop in loop out option to the Burchell/Caprum line is clearly the preferred option and would have very little impact on the terrestrial environment. If this option is not possible, then Alternative 1B and Alternative 1A are the next preferred alternativs with Alternative 2 being the least preferred option.

In the long-term erosion is one of the major risks associated with the development. The road network required for the facility will be at least 60km long and the hardened surface will generate a lot of runoff which may cause erosion if not properly directed and regulated. Under the layout provided for the assessment, many of the new turbine access roads are aligned directely up and down the slopes of the ridges. It is recommended that some of these are realigned slightly to reduce the slope of the road or contain switchbacks to reduce the slope and erosion risk. Erosion not only impacts the biodiversity and ecological functioning of drainage systems, but in the current context is also likely to encourage invasion of the site by *Prosopis*. Provided that suitable measures to avoid erosion are implemented in the design of the facility and that effective erosion control and mitigation measures to reduce the other impacts of the development are implemented, the development of the site is not likely to result in significant degradation or biodiversity loss within the receiving environment.

8 ACTIVITIES FOR INCLUSION THE DRAFT EMP

Below are the measures that should be implemented as part of the EMP for the development. The measures below do not exactly match with the impacts that have been identified above, as certain mitigation measures, such as limiting the loss of vegetation may be effective at combating several different impacts, such as erosion, faunal impact etc.

Objective: Limit disturbance of vegetation and loss of protected flora during construction			
Project component/s	Arrays, their supports, cabling; access and maintenance roads etc		
Potential Impact	Loss of plant cover leading to erosion as well as loss of faunal habitat and loss of specimens of protected plants.		
Activity/risk source	Construction activities		
Mitigation: Target/Objective	No wholesale clearing of vegetation outside of the development footprint Minimal impact on terrestrial environment. Successful translocation of protected species		
Mitigation: Action/control		Responsibility	Timeframe
(1) Preconstruction surveys for listed flora during the peak growing season. (2) Translocate protected species prior to the commencement of construction activities. (3) Erosion control should begin in the construction phase and should be integrated into the design features of the facility. (4) Demarcate areas to be cleared. (5) Revegetation of cleared areas that are no longer used or monitoring to ensure that recovery is taking place (6) Alien plant clearing where necessary.		Management/ECO	Construction
Performance	Disturbance footprint has been minimized through the construction		

Indicator	phase and low numbers of protected species affected.
Monitoring	• Monitor and document clearing activities. • Monitor alien plant abundance an annual basis. • Document revegetation actions taken and their success • Document erosion problems and the control measures implemented

Objective: Limit disturbance of vegetation and loss of faunal habitat during construction			
Project component/s	All activities which require or result in the clearing of or impact to vegetation.		
Potential Impact	Loss of faunal habitat and impacts on resident listed and non-listed species		
Activity/risk source	Construction activities		
Mitigation: Target/Objective	Minimal impact on terrestrial environment. Reduced impact and disturbance of terrestrial fauna		
Mitigation: Action/control		Responsibility	Timeframe
(1) Preconstruction walk-through of the development footprint to identify important faunal habitats such as wetlands or animal burrows that should be avoided during construction. (2) Demarcate important or sensitive areas as no-go areas.		Management/ECO	Construction
Performance Indicator	Walk-through report identifying sensitive areas. Adjustments to final layout to avoid these areas.		
Monitoring	• Monitor alien plant abundance an annual basis. • Document revegetation actions taken and their success • Document erosion problems and the control measures implemented		

Objective: Limit direct faunal impacts	
Project component/s	Construction activities and human presence
Potential Impact	Loss of individuals of affected species due to operation of construction machinery as well as poaching and hunting risk from

	personnel.		
Activity/risk source	Habitat transformation & earth-moving during construction; presence of construction and operation personnel.		
Mitigation: Target/Objective	Low faunal impact, during construction and operation.		
Mitigation: Action/control		Responsibility	Timeframe
(1) Environmental induction for all staff (2) ECO to monitor and enforce ban on hunting, collecting etc of all plants and animals or their products. (3) Speed limits to apply to all construction vehicles to reduce likelihood of collisions with fauna. (4) Dust suppression during construction.		Management/ECO	Construction & Operation
Performance Indicator	Low mortality of fauna during construction No poaching etc of fauna by construction personnel during construction		
Monitoring	• Monitoring for compliance during the construction phase		

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10 ANNEX 2. LIST OF TERRESTRIAL MAMMALS

List of mammals which are known to occur and are likely to occur in the vicinity of the Garob Wind Energy Facility. Habitat notes and distribution records are based on Skinner & Chimimba (2005), while conservation status is from the IUCN Red Lists 2012. IUCN-listed species are highlighted.

Scientific Name	Common Name	Status	Habitat	Likelihood
Macroscledidea (Elephant Shrews):				
Macroscelides proboscideus	Round-eared Elephant Shrew	LC	Species of open country, with preference for shrub bush and sparse grass cover, also occur on hard gravel plains with sparse boulders for shelter, and on loose sandy soil provided there is some bush cover	High
Elephantulus rupestris	Western Rock Elephant Shrew	LC	Rocky koppies, rocky outcrops or piles of boulders where these offer sufficient holes and crannies for refuge.	High
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	Confirmed
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	Confirmed
Lagomorpha (Hares and Rabbits):				
Lepus capensis	Cape Hare	LC	Dry, open regions, with palatable bush and grass	Confirmed
Lepus saxatilis	Scrub Hare	LC	Common in agriculturally developed areas, especially in crop-growing areas or in fallow lands where there is some bush development.	High
Rodentia (Rodents):				
Cryptomys hottentotus	African Mole Rat	LC	Wide diversity of substrates, from sandy soils to heavier compact substrates such as decomposed schists and stony soils	Confirmed
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Confirmed
Pedetes capensis	Springhare	LC	Occur widely on open sandy ground or sandy scrub, on overgrazed grassland, on the fringes of vleis and dry river beds.	High
Xerus inauris	South African Ground Squirrel	LC	Open terrain with a sparse bush cover and a hard substrate	Confirmed

Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	High
Rhabdomys pumilio	Four-striped Grass Mouse	LC	Essentially a grassland species, occurs in wide variety of habitats where there is good grass cover.	High
Mus minutoides	Pygmy Mouse	LC	Wide habitat tolerance	High
Mastomys coucha	Southern Multimammate Mouse	LC	Wide habitat tolerance.	High
Aethomys namaquensis	Namaqua Rock Mouse	LC	Catholic in their habitat requirements, but where there are rocky koppies, outcrops or boulder-strewn hillsides they use these preferentially	Confirmed
Parotomys brantsii	Brants' Whistling Rat	LC	Associated with a dry sandy substrate in more arid parts of the Nama-karoo and Succulent Karoo. Species selects areas of low percentage of plant cover and areas with deep sands.	High
Parotomys littledalei	Littledale's Whistling Rat	LC	Riverine associations or associated with Lycium bushes or Psilocaulon absimile	High
Otomys unisulcatus	Bush Vlei Rat	LC	Shrub and fynbos associations in areas with rocky outcrops Tend to avoid damp situations but exploit the semi-arid Karoo through behavioural adaptation.	Low
Desmodillus auricularis	Cape Short-tailed Gerbil	LC	Tend to occur on hard ground, unlike other gerbil species, with some cover of grass or karroid bush	High
Gerbillurus paeba	Hairy-footed Gerbil	LC	Gerbils associated with Nama and Succulent Karoo preferring sandy soil or sandy alluvium with a grass, scrub or light woodland cover	High
Gerbilliscus leucogaster	Bushveld Gerbil	LC	Predominantly associated with light sandy soils or sandy alluvium	Low
Gerbilliscus brantsii	Higheld Gerbil	LC	Sandy soils or sandy alluvium with some cover of grass, scrub or open woodland	Low
Malacothrix typica	Gerbil Mouse	LC	Found predominantly in Nama and Succulent Karoo biomes, in areas with a mean annual rainfall of 150-500 mm.	High
Primates:				
Papio ursinus	Chacma Baboon	LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	High

Eulipotyphla (Shrews):				
Crocidura cyanea	Reddish-Grey Musk Shrew	LC	Occurs in relatively dry terrain, with a mean annual rainfall of less than 500 mm. Occur in karroid scrub and in fynbos often in association with rocks.	High
Erinaceomorpha (Hedgehog)				
Atelerix frontalis	South African Hedgehog	LC	Generally found in semi-arid and subtemperate environments with ample ground cover	Low
Carnivora:				
Proteles cristata	Aardwolf	LC	Common in the 100-600mm rainfall range of country, Nama-Karoo, Succulent Karoo Grassland and Savanna biomes	High
Caracal caracal	Caracal	LC	Caracals tolerate arid regions, occur in semi-desert and karroid conditions	High
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	High
Felis nigripes	Black-footed cat	VU	Associated with arid country with MAR 100-500 mm, particularly areas with open habitat that provides some cover in the form of tall stands of grass or scrub.	**High**
Genetta genetta	Small-spotted genet	LC	Occur in open arid associations	High
Suricata suricatta	Meerkat	LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	High
Cynictis penicillata	Yellow Mongoose	LC	Semi-arid country on a sandy substrate	Confirmed
Herpestes pulverulentus	Cape Grey Mongoose	LC	Wide habitat tolerance	High
Vulpes chama	Cape Fox	LC	Associated with open country, open grassland, grassland with scattered thickets and coastal or semi-desert scrub	High
Canis mesomelas	Black-backed Jackal	LC	Wide habitat tolerance, more common in drier areas.	High
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	High
Ictonyx striatus	Striped Polecat	LC	Widely distributed throughout the sub-region	Confirmed
Mellivora capensis	Ratel/Honey Badger	IUCN LC/SA RDB EN	Catholic habitat requirements	High
Rumanantia (Antelope):				
Oryx gazella	Gemsbok	LC	Open arid country	Confirmed
Sylvicapra grimmia	Common Duiker	LC	Presence of bushes is essential	High

Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	Confirmed
Raphicerus campestris	Steenbok	LC	Inhabits open country,	Confirmed

11 ANNEX 3. LIST OF REPTILES

List of reptiles which are likely to occur at the proposed Garob Wind Energy Facility. The list is based on those which may occur at the site according to distribution maps in Branch (1998) and Alexander and Marais (2007), as well as those known from the quarter degree squares 2922 CD and DC, 3022 AB and BA according to the SARCA database (http://vmus.adu.org.za)

Scientific Name	Common Name	Distribution	Status	Habitat	Likelihood	SARCA
Tortoises and Terrapins:						
Geochelone pardalis	Leopard Tortoise	Widespread	Not Assessed	Varied: not restricted to montane grassland, also occurring in fynbos, valley bushveld, and arid & mesic savannah	High	SARCA
Psammobates tentorius verroxii	Bushmanland Tent Tortoise	Endemic	Not Assessed	Varied: usually arid karroid areas or rocky sandveld	High	SARCA
Snakes:						
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	Endemic	Not Assessed	Varied: semi-desert, coastal bush, fynbos & savannah	High	SARCA
Lamprophis capensis	Brown House Snake	Widespread	Not Assessed	Common in highveld grassland & arid karroid regions, but found everywhere & tolerant of urban sprawl	High	SARCA
Lycophidion capense	Common Wolf Snake	Widespread	Not Assessed	Lowland forest and fynbos to moist savanna, grassland and karoo scrub	Low	
Pseudaspis cana	Mole Snake	Widespread	Not Assessed	Sandy scrubland in SW Cape, highveld grassland & mountainous & desert regions	High	
Psammophis notostictus	Karoo Sand or Whip Snake	Widespread	Not Assessed	Arid scrubland & karroid regions	High	SARCA
Psammophis trinasalis	Kalahari Sand Snake	Widespread	Not Assessed	Mainly Kalahari thornveld but may also occur in savanna and grassland	High	
Dasypeltis scabra	Common/Rhombic Egg Eater	Widespread	LC	Absent only from true desert & closed-canopy forest	High	SARCA
Telescopus beetzii	Namib Tiger Snake	Endemic	Not Assessed	Rocky, arid regions	High	SARCA
Dispholidus typus	Boomslang	Widespread	Not Assessed	Widespread arboreal species	Low	
Elapsoidea sundervalli	Sundevall's Garter Snake	Endemic	Not Assessed	Coastal forest, sanannah, highveld grassland	Low	
Naja nivea	Cape Cobra	Widespread	Not Assessed	Arid karroid regions, particularly along river courses, entering well drained open areas along the southern	High	

				coast		
Hemachatus haemachatus	Rinkhals	Endemic	LC	Grassland from the coast up to 2500 m	High	
Bitis arietans	Puff Adder	Widespread	Not Assessed	Absent only from desert & mnt tops	High	SARCA
Bitis caudalis	Horned Adder	Widespread	Not Assessed	Sandy regions, throughout Karoo	High	
Worm Lizards						
Monopeltis infuscata	Dusky Spade-snouted Worm Lizard	Endemic	Not Assessed	Dry and moist savannah	High	
Lizard and Skinks:						
Acontias lineatus	Striped Legless Skink	Endemic	Not Assessed	Sandy, arid soils	High	SARCA
Mabuya capensis	Cape Skink	Widespread	Not Assessed	Very varied: arid karroid veld, moist coastal bush, montane grassland, etc	High	SARCA
Mabuya occidentalis	Western Three-Striped Skink	Widespread	Not Assessed	Arid Savanna karroid veld and desert	High	SARCA
Mabuya spilogaster	Kalahari Tree Skink	Widespread	Not Assessed	Arid Savannah	Low	SARCA
Mabuya sulcata	Western Rock Skink	Widespread	Not Assessed	Karroid areas	High	SARCA
Mabuya striata	Striped Skink	Widespread	Not Assessed	Varied, except desert areas, succulent karoo and fynbos	High	
Mabuya variegata	Variegated Skink	Widespread	Not Assessed	Extremely varied; desert, karroid veld, montane grassland, savanna, coastal bush & valley bushveld	Definite	SARCA
Heliobolus lugubris	Bushveld Lizard	Widespread	Not Assessed	Arid and mesic savannah	Low	SARCA
Meroles suborbitalis	Spotted Desert Lizard	Endemic	Not Assessed	Varied, arid savanna to desert	High	
Nucras tessellata	Western Sandveld Lizard		Not Assessed	Rocky ground in arid savanna and karroid veld		SARCA
Pedioplanis laticeps	Cape Sand Lizard	Endemic	LC	Coastal dunes and succulent karroid veld	High	
Pedioplanis lineoocellata	Spotted Sand Lizard	Endemic	Not Assessed	Very varied: karroid veld, valley bushveld & arid & mesic savannah	Definite	SARCA
Pedioplanis namaquensis	Namaqua Sand Lizard	Widespread	Not Assessed	Karroid veld	Definite	SARCA
Pedioplanis inornata	Plain Sand Lizard	Endemic	Not Assessed	Bedrock flats in semi-desert		SARCA
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	Widespread	Not Assessed	Montane grassland, savanna, bushveld and low open coastal forest	High	

Cordylus polyzonus	Karoo Girdled Lizard	Endemic	Not Assessed	Karroid regions, coastal renosterveld and succulent karoo	High	SARCA
Agama aculeata	Ground Agama	Widespread	Not Assessed	Semi desert and savanna	Definite	SARCA
Agama anchietae	Anchieta's Agama	Widespread	Not Assessed	Semi desert and arid savanna	High	SARCA
Agama atra	Southern Rock Agama	Endemic	Not Assessed	Semi-desert to fynbos, from sea level to mountain tops	High	
Geckos:				Not Assessed		
Chondrodactylus angulifer	Giant Ground Gecko	Endemic	LC	Gravel plains, interdune spaces & sandy flats	High	SARCA
Chondrodactylus bibronii	Bibron's Tubercled Gecko	Endemic	Not Assessed	Rocky outcrops, cliffs and large trees	High	SARCA
Pachydactylus capensis	Cape Thick-toed Gecko	Widespread	Not Assessed	Karroid veld, grassland and mesic savannah	High	SARCA
Pachydactylus latirostris	Quartz Gecko	Endemic	Not Evaluated	Central Northern Cape on rocky ground		SARCA
Pachydactylus mariquensis	Marico Thick-toed Gecko	Endemic	Not Assessed	Flat sandy plains with sparse vegetation	High	
Pachydactylus rugosus	Rough Thick-toed Gecko	Endemic	Not Assessed	Semi-desert and succulent karroid veld		SARCA
Ptenopus garrulus	Common Barking Gecko	Endemic	Not Assessed	Desert and semi-desert on various soil types, preferring flat stable sandy soils with sparse vegetation cover	High	SARCA

12 ANNEX 4. LIST OF AMPHIBIANS

List of amphibians which are likely to occur at the Garob Wind Energy Facility. Habitat notes and distribution records are based on Du Preez and Carruthers (2009), while conservation status is from the IUCN Red Lists 2012.

Scientific Name	Common Name	Status	Habitat	Distribution	Likelihood
Amietophrynus gutturalis	Guttural Toad	Not Threatened	Around open pools, dams, vleis and other semi-permanent or permenent water	Widespread	High
Poyntonophrynus vertebralis	Southern Pygmy Toad	Not Threatened	Nama karroo shrubland, grassland, dry savannah and pastureland. Breeds in temporary shallow pans, pools or depressions containing rainwater, quarries, and rock pools along rivers.	Endemic	High
Vandijkophrynus gariepensis	Karoo Toad	Not Threatened	Karoo Scrub	Widespread	High
Kassinia senegalensis	Bubbling Kassinia	Not Threatened	Grassland around vleis and pands	Widespread	Low
Pyxicephalus adspersus	Giant Bullfrog	Near Threatened	Breed in shallow margins of rain-filled depressions.	Widespread	Low
Xenopus laevis	Common Platanna	Not Threatened	Any more or less permanent water	Widespread	High
Cacosternum boettgeri	Common Caco	Not Threatened	Marshy areas, vleis and shallow pans	Widespread	High
Amietia angolensis	Common River Frog	Not Threatened	Banks of slow-flowing streams or permanent bodies of water	Widespread	High
Tomopterna cryptotis	Tremelo Sand Frog	Not Threatened	Savanna and grassland	Widespread	High
Tomopterna tandyi	Tandy's Sand Frog	Not Threatened	Nama karoo grassland and savanna	Widespread	High

SHORT CV OF CONSULTANT:

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SUMMARY OF EXPERTISE:

SIMON TODD

- Profession: Ecological Consultant
- Specialisation: Plant & Animal Ecology
- Years of Experience: 15 Years

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Fynbos, Succulent Karoo, Nama Karoo, Thicket, Arid Grassland and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

- 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute
- 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute
- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.

General Experience & Expertise

- Conducted a large number of fauna and flora specialist assessments distributed widely across South Africa. Projects have ranged in extent from <50 ha to more then 50 000 ha.
- Extensive experience in the field and exceptional level of technical expertise, particularly with regards to GIS capabilities which is essential with regards to producing high-quality sensitivity maps for use in the design of final project layouts.
- Strong research background which has proved invaluable when working on several ecologically sensitive and potentially controversial sites containing some of the most threatened fauna in South Africa.
- Published numerous research reports as well as two book chapters and a large number of papers in leading scientific journals dealing primarily with human impacts on the vegetation and ecology of South Africa.
- Maintain several long-term vegetation monitoring projects distributed across Namaqualand and the karoo.
- Guest lecturer at two universities and have also served as an external examiner.
- Reviewed papers for more than 10 international ecological journals.
- Past chairman and current committee member of the Arid Zone Ecological Forum.
- SACNASP registered as a Professional Natural Scientist, (Ecology) No. 400425/11.

A selection of recent work is as follows:

Specialist Assessments:

ESKOM 300MW Kleinsee Wind Energy Facility. Fauna Specialist Report For Impact Assessment. Savannah Environmental. 2012.

Karoshoek Solar Valley Development, Near Upington: Fauna & Flora Specialist Impact Assessment Report. Savannah Environmental. 2012.

Project Blue Wind And Solar Energy Facility, Near Kliensee. Fauna Specialist Report For Impact Assessment. Savannah Environmental. 2012.

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Witberg Wind Farm: Ecological and Biodiversity Assessment: Terrestrial Vertebrate Fauna & Botanical Specialist Study. Specialist Report for Environmental Resources Management (ERM). 2011.

Skuitdrift Solar Facility. Fauna & Flora Specialist Report for Basic Assessment. Specialist Report for Cape EAPrac. 2012.

Khoi-Sun Solar Facility. Fauna & Flora Specialist Scoping Report. Specialist Report for Cape EAPrac. 2012.

Boesmanland Solar Farm. Fauna & Flora Specialist Scoping Study. Specialist Report for Cape EAPrac. 2012.

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