ENVIRONMENTAL SCOPING ASSESSMENT FOR THE PROPOSED MARALLA WEST WIND ENERGY FACILITY:

FAUNA & FLORA SPECIALIST SCOPING REPORT

PRODUCED FOR WSPGroup

ON BEHALF OF BIOTHERM ENERGY (PTY) LTD

BY

SIMON TODD CONSULTING

Simon.Todd@3foxes.co.za

Christy@3foxes.co.za

May 2016

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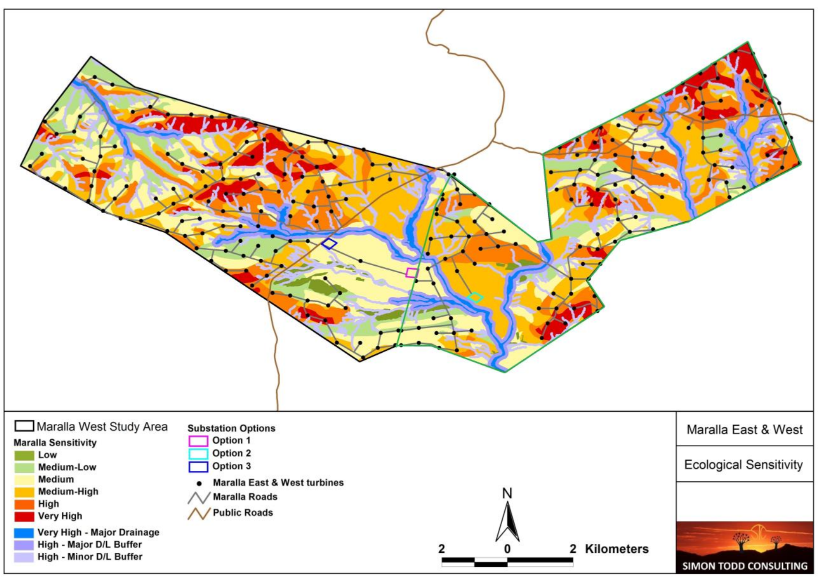
EXECUTIVE SUMMARY

BioTherm Energy (Pty) Ltd is proposing to develop a wind energy facility of up to 250MW between Matjiesfontein and Sutherland within the Laingsburg Local Municipality, Western Cape Province. The facility will be known as the Maralla West Wind Energy Facility and would comprise up to 125 wind turbines with associated infrastructure such as access roads and grid connection infrastructure. The development is currently in the Scoping Phase and the purpose of the Ecological Scoping Report is to describe and detail the ecological features of the proposed site; provide a preliminary assessment of the ecological sensitivity of the site and identify the likely impacts that may be associated with the development. Furthermore, the study outlines a plan of study for the EIA which will follow the Scoping Study.

A site visit and a desktop review of the available ecological information for the area were used to identify and characterize the ecological features of the site and identify potential sensitivities. A draft ecological sensitivity map for the site was developed, which is depicted below. Although there are no listed vegetation types in the area, a large proportion of the site falls within a CBA and a NPAES focus area and the development would potentially have some impact on the CBA and future conservation options within the Western Karoo focus area.



In terms of fauna, the area has a diversity of habitats and overall faunal diversity is likely to be fairly high, but there are few species of concern present and impacts on fauna in the long-term are likely to be relatively low.

The high elevation parts of the site, above 1500m are considered generally more sensitive and development within these areas should proceed with caution. These areas are of limited extent and hence vulnerable to habitat loss and cumulative impact and also contain a higher abundance of listed and endemic plant species. In addition, the high elevation areas are considered important for long-term climate change mitigation and adaptation for fauna and flora.

Overall, the site should be considered moderately to highly sensitive. There are however fairly large areas present that are considered potentially suitable for development and of lower sensitivity. Within the higher sensitivity parts of the site, a variety of avoidance and mitigation measures should be implemented at the project planning stage to reduce the impact of the development to an acceptable level. The overall impact of the development will to a large extent depend on the final layout and the extent to which the high sensitivity areas can be avoided.

1 INTRODUCTION

BioTherm Energy (Pty) Ltd is proposing to develop a Wind Energy Facility, namely the Maralla West Wind Energy Facility. The Wind Farm is located between Sutherland and Laingsburg along the boundary of the Northern and Western Cape. The Wind Farm will consist of up to 125 Wind Turbines, covering several properties within the Sutherland Local Municipality (Maralla West). The proposed Maralla project is intended to feed into the Eskom grid west of the site at the Eskom Komsberg Main Transmission Substation.

This Ecological Specialist Scoping Report forms part of the required EIA process for the Maralla development and details the ecological features of the proposed site, provides a preliminary assessment of the ecological sensitivity of the site and identifies the likely impacts that may be associated with the development. A desktop review of the available ecological information for the area was conducted in order to identify and characterize the ecological features of the site and develop a draft ecological sensitivity map for the site. The information and sensitivity map provides an ecological baseline that can be used in the planning phase of the development to ensure that the potential negative ecological impacts associated with the development can be minimized going into the EIA phase. Furthermore, the study defines the terms of reference for the EIA phase of the project, provides a preliminary assessment of potential impacts and outlines a plan of study for the EIA which will follow the Scoping Study. The full scope of study is detailed in Section 2.3 below.

2 STUDY APPROACH

2.1 SCOPE OF STUDY

The specific terms of reference for the scoping study includes the following:

- a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project;
- a description and evaluation of potential environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified;
- Direct, indirect and cumulative impacts of the identified issues are evaluated within the Scoping Report 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), regional, national or international;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issue/impacts;

- Identification of potentially significant impacts to be assessed within the EIA phase and the details of the methodology to be adopted in assessing these impacts. This should be detailed enough to include within the Plan of Study for EIA and include a description of the proposed method of assessing the potential environmental impacts associated with the project

2.2 Assessment Approach & Philosophy

The assessment will be conducted according to the EIA Regulations, published by the Department of Environmental Affairs (2014) as well as within the best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers et al. (2005).

This includes adherence to the following broad principles:

- That a precautionary and risk-averse approach be adopted towards projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. Critical Biodiversity Areas (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

- Demonstrate how the proponent intends complying with the principles contained in section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), which, amongst other things, indicates that environmental management should.

    - In order of priority aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity;
    - Avoid degradation of the environment;
    - Avoid jeopardising ecosystem integrity;
    - Pursue the best practicable environmental option by means of integrated environmental management;
    - Protect the environment as the people's common heritage;
    - Control and minimise environmental damage; and
    - Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

These principles serve as guidelines for all decision-making concerning matters that may affect the environment. As such, it is incumbent upon the proponent to show how proposed activities would comply with these principles and thereby contribute towards the achievement of sustainable development as defined by the NEMA.

In order to adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:
The study will include data searches, desktop studies, site walkovers / field survey of the property and baseline data collection, describing:

- A description of the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of **pattern**, the following will be identified or described:

Community and ecosystem level

- The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography;
- Threatened or vulnerable ecosystems (*cf. SA vegetation map/National Spatial Biodiversity Assessment, fine-scale systematic conservation plans, etc*).

Species level

- Red Data Book species (giving location if possible using GPS)
- The viability of an estimated population size of the RDB species that are present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
- The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (include degree of confidence).

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Clarify species of special concern (SSC) and that are known to be:
  - endemic to the region;
  - that are considered to be of conservational concern;
  - that are in commercial trade (CITES listed species);
  - or, are of cultural significance.

- Provide monitoring requirements as input into the Environmental Management Plan (EMP) for faunal related issues.

Other pattern issues

- Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
- The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
- The condition of the site in terms of current or previous land uses.

In terms of **process**, the following will be identified or described:

- The key ecological "drivers" of ecosystems on the site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries)
- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the EIA process will be outlined.
- All relevant legislation, permits and standards that would apply to the development will be identified.
- The opportunities and constraints for development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

2.3 Relevant Aspects of the Development

The Wind Farm will have an energy generation capacity of up to 250MW. It is anticipated that the facility will comprise the following components:

- Up to 125 Wind Turbines Generators. Turbines will have a generating capacity of between 2 and 4MW each. The turbines will have a hub height of up to 120m and rotor diameter of up to 150m.
- Concrete foundation to support the Turbines
- Onsite 132kV Substation, with the transformers for voltage step up from medium voltage to high voltage. Substation will occupy an area of 150mx 150m
- The medium voltage collector system will comprise of cables (1kV up to and including 33kV) that will be run underground, expect where a technical assessment suggest that overhead lines are applicable, in the facility connecting the turbines to the onsite substation.
- A laydown area for the temporary storage of materials during the construction activities. The laydown area will be a maximum of 4ha in size
- Permanent laydown for turbine crane platforms
- Haul roads between 4 – 6m wide. Double width roads required in strategic places for passing
- Temporary site compound for Contractors
- Operations and Maintenance compound area including O&M building, car park and storage area

2.4 Limitations & Assumptions

The site visit for the current study took place during the autumn season, which is not an optimal time of year as many of the species of concern are not active at this time. However large parts of the site especially in the east have been well sampled in the past by the consultant, which significantly reduces the assumptions associated with the development as reliable species lists are available for these areas. As a result, the results of the current study are considered reliable and accurate for the purposes of the scoping report. However additional field sampling in the wet season is recommended in order to check the development footprint areas in greater detail.

The lists of amphibians, reptiles and mammals for the site are based on those observed at the site and on the adjacent sites as well as those likely to occur in the area based on their distribution and habitat preferences. Several site visits have been conducted during various seasons to the area and information on fauna observed in the area is included where relevant. This represents a sufficiently conservative and cautious approach which takes the study limitations into account.

3 METHODOLOGY

3.1 DATA SOURCING AND REVIEW

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Critical Biodiversity Areas for the site and surroundings were extracted from the *Namakwa District Biodiversity Sector Plan* (Desmet & Marsh 2008) as well as the *Biodiversity Assessment of the Central Karoo District Municipality* (Skowno et al. 2009).
- Information on plant and animal species recorded for the Quarter Degree Squares (QDS) 3220DB 3220DD 3221CA 3221CC was extracted from the SABIF/SIBIS database hosted by SANBI. This is a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has probably not been well sampled in the past.
- The IUCN conservation status (Figure 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 (2013).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011). This includes rivers, wetlands and catchments defined under the study.
- 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 the ADU databases http://vmus.adu.org.za.
- 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 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.
- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria 2015 (See Figure 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.

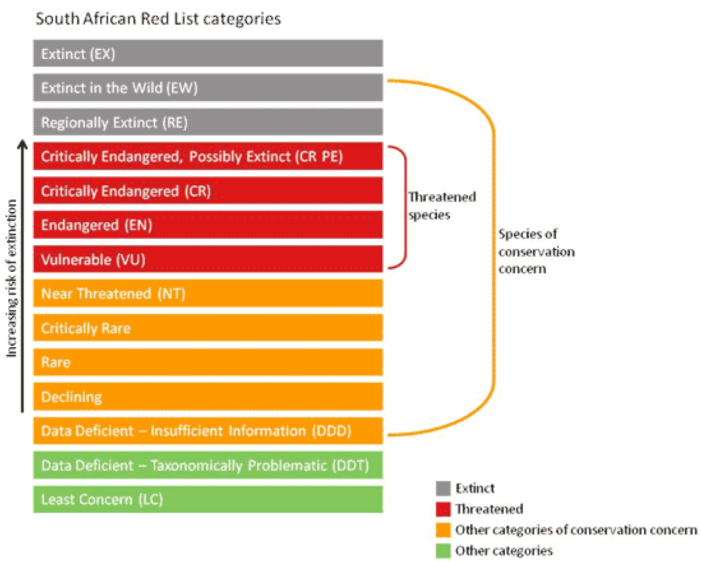


Figure 1. Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

3.2 SITE VISIT

A preliminary site visit to the study area was conducted on 4th of April 2016. The primary purpose of the site visit was to investigate and identify sensitive features within the development target areas that should be avoided or where specific mitigation may be required, as well as obtain a preliminary characterization of the habitats and ecosystems within the site. The site is within the winter rainfall area and many of the listed species from the area are geophytes that only emerge in the winter, so additional site visits in the wet season would be required to fully establish the sensitivity of the site.

Apart from the current site visit, the area has also been visited in the past at different times of the year for a variety of other assessments. The facility lies within the original project area of the Mainstream Sutherland WEF which the consultant sampled in 2011. In addition, it lies adjacent to the ACED Komsberg West WEF which was sampled in 2015. This information is used to inform the current study as appropriate and as the area has been sampled numerous times at different seasons, this significantly reduces the uncertainty associated with the current assessment.

3.3 SENSITIVITY MAPPING & ASSESSMENT

A draft 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 purpose of this map is to provide a guide to development at the site and ensure that areas that are intrinsically sensitive or vulnerable to disturbance could be accommodated at the planning stage within the layout as much as possible.

The ecological sensitivity of the different units identified in the mapping procedure for the broad-scale sensitivity map was rated according to the following scale:

- **Low –** Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **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 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 usually 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. However, in case of linear features such as drainage lines, it may be necessary for access roads and other infrastructure to traverse such features. However no turbines should be located within such areas and other disturbance should be minimized. Excessive disturbance or impact to such areas may be considered to constitute a fatal flaw of the development and as such should be avoided and minimized as much as possible.
- In some situations, areas were also classified between the above categories, such as Medium-High, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately between two sensitivity categories.

4 DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 Broad-Scale Vegetation Patterns

According to the national vegetation map, four vegetation types occur within the study area (Figure 2); the majority of the site falls within the Central Mountain Shale Renosterveld vegetation type, followed with a much smaller extent of Tanqua Escarpment Shrubland in the far west and a very small extent of Roggeveld Shale Renosterveld along the north-eastern border of the site, while a large part of the power line corridors are within the Koedoesberge-Moordenaars Karoo vegetation type.

According to Mucina & Rutherford (2006) Central Mountain Shale Renosterveld occurs in the Western and Northern Cape on the southern and southeastern slopes of the Klein Roggeveldberge and Komsberg below the Komsberg section of the Great Escarpment as well as farther east below Besemgoedberg and Suurkop and in the west in the Karookop area. It is associated with clayey soils overlying Adelaide Subgroup mudstones and subordinate sandstones with landtypes mostly Ib and Fc. Although this vegetation type is classified as Least Threatened, it has a very limited extent of 1236km^2 and is not formally conserved anywhere. Levels of transformation are however low and it is considered to be 99% intact. Although no endemic species are known to occur within this vegetation type, little is known about this Renosterveld type and it has been poorly sampled. Experience from this and other projects in the area indicate that this should be considered to be a relatively sensitive vegetation type with a relatively high abundance of species of conservation concern. The Komsberg area is also a recognized centre of plant diversity and endemism and the majority of this diversity is associated with the high elevation areas of Central Mountain Shale Renosterveld (Clark et al. 2011).

Tanqua Escarpment Shrubland occurs as a narrow belt on northwest-facing slopes of the Klein-Roggeveldberge and on southwest-facing and west-facing slopes of the Roggeveld Escarpment at altitudes of 620-100m (Mucina & Rutherford 2006). This vegetation type usually occupies steep flanks below an escarpment overlooking a basin, supporting succulent shrubland of medium height with *Tylecodon* (botterboom) and *Euphorbia tanica* (melkboom)(Mucina & Rutherford 2006). This vegetation type is classified as Least Threatened, and only a very small portion is formally conserved in the Tankwa Karoo National Park. Levels of transformation are however low but it is part of the Hantam-Roggeveld Centre of Endemism and is one of the least studied vegetation types of the country (Mucina & Rutherford 2006).

Roggeveld Shale Renosterveld occurs in the Northern and Western Cape and occupies the majority of the Roggeveld from the edge of the Western edge of the Great Escarpment mostly above the Tanqua Basin, reaching as far east as the higher-lying areas of the Teekloof Pass south of Fraserburg along the northwest summit plateaus of the Nuweveldberge (Mucina &

Rutherford 2006). It occupies undulating, slightly sloping plateau landscapes, with low hills and broad shallow valleys supporting mainly moderately tall shrublands dominated by renosterbos with a rich geophytic flora in the wetter and rocky habitats. It occurs mostly on mudrocks and sandstones of the Adelaide Subgroup. The land types present are mostly Fc and Da. Mucina & Rutherford (2006) list 12 endemic species for this vegetation type, which is a large number given that the total extent of the vegetation type is only 2917 km^2.

According to Mucina & Rutherford (2006) the Koedoesberge-Moordenaars Karoo vegetation type has an extent of 4714km^2. This unit occurs in the Western and Northern Cape on the Koedesberge and Pienaar se Berg low mountain ranges bordering on the southern Tanqua Karoo and separated by the Klein Roggeveld Mountains from the Moordenaars Karoo in the broad area of Laingsburg and Merweville. Koedoesberge-Moordenaars Karoo is associated with slightly undulating to hilly landscape covered by low succulent scrub with scattered tall shrubs. It occurs on mudstones, shale and sandstone of various origins including Adelaide Subgroup, Ecca Group and Dwyka Group diamictites, which give rise to shallow skeletal soils. Land types are mainly Fc and lesser extents of Ib. This vegetation type is classified as Least Threatened and has not been significantly impacted by transformation. Conservation status is however poor and of the target of 19% only a very small proportion is conserved within the Gamkapoort Nature Reserve (<1%). At least 14 endemic species are known from this vegetation type, which is a high number considering that this vegetation unit occupies less than 5000km^2. In addition, the majority of listed species known from the broader area are associated with this vegetation type. It is however very poorly known and little research has been conducted within this unit.

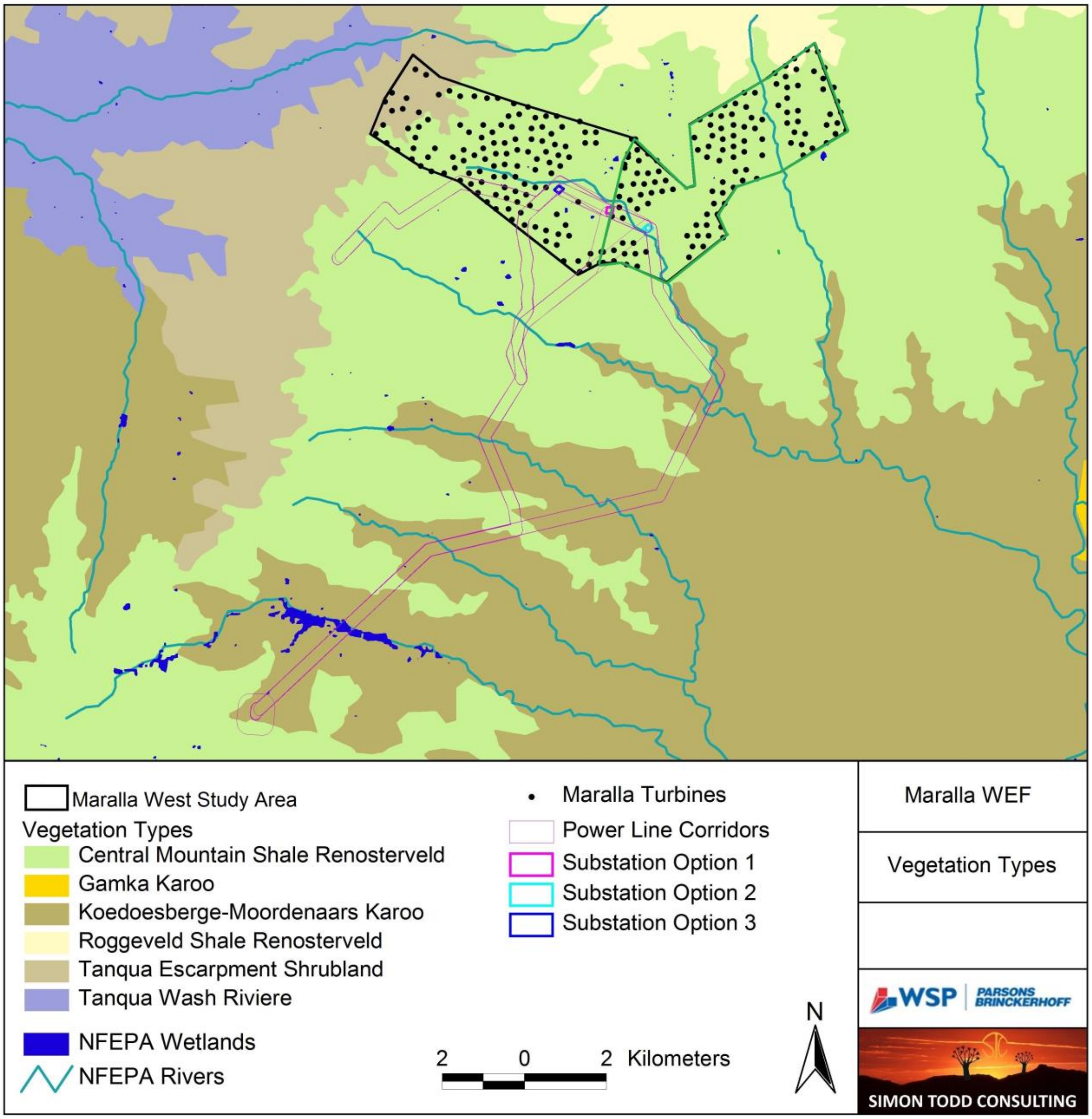


Figure 2. Vegetation map (Mucina and Rutherford 2006) of the Maralla East and West Wind Farms and grid connection options. The majority of the affected area falls within the Central Mountain Shale Renosterveld with smaller amounts of Tanqua Escarpment Shrubland and Roggeveld Shale Renosterveld.

4.2 Site Description

4.2.1 Maralla West

Typical turbine target areas within Maralla West, showing Central Mountain Shale Renosterveld dominated by low shrubs such as *Pteronia pallens*, *Ruschia intricata*, *Eriocephalus microphyllus* var. *microphyllus*, *Chrysocoma ciliata*, *Asparagus capensis*, *Amphiglossa tomentosa*, *Pteronia ciliata*, *Pteronia sordida* and *Pentzia incana*.

4.3 Listed & Protected Plant Species

According to the SANBI SIBIS database, 514 indigenous species have been recorded from the four quarter degree squares around the site. This includes 22 species of moderate to high conservation concern. Species that can be confirmed present include *Boophone disticha* (Declining), *Brunsvigia josephinae* (VU), *Eriocephalus grandiflorus* (Rare) *Drimia altissima* (Declining). In general, the abundance of listed species within the study area is concentrated within certain habitats such as the drainage lines or high-lyhing ridges, while the lower plains of the site have a low abundance of such species.

Table 1. Numbers of the species within the different conservation status categories as indicated below, data derived from the SANBI SIBIS database.

Status/ IUCN Red List Category	No. Species
Critically Endangered (CR)	0
Endangered (EN)	1
Vulnerable (VU)	5
Near Threatened (NT)	3
Rare	12
Declining	1

Data Deficient - Insufficient Information (DDD)	**2**
Data Deficient - Taxonomically Problematic (DDT)	**5**
Least Concern	**485**
Total	**514**

4.4 Critical Biodiversity Areas & Broad Scale Ecological Processes

The site lies along the boundary of two fine-scale conservation plans, with the Namakwa District Biodiversity Sector Plan (Desmet & Marsh 2008) in the Northern Cape (Maralla West). These district-wide biodiversity assessments were commissioned to inform Spatial Development Frameworks (SDFs), Biodiversity Sector plans, Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and the Environmental Impact Assessment (EIA) process. The Biodiversity Assessments identify Critical Biodiversity Areas (CBAs) which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to meet national biodiversity objectives. The CBA map for the general area surrounding the site is depicted below in Figure 3. There are some small scattered CBAs within Maralla West associated with south-facing slopes that are considered important for climate change resilience.

Given that the objective of CBAs is to identify biodiversity priority areas which should be maintained in a natural to near natural state, development within CBAs is not encouraged and may not be compatible with the objectives of the CBA if there are significant impacts on areas of high biodiversity or species not found elsewhere. The likely implications and impacts of development within the CBAs and their immediate environment is a potential concern for the development that needs to be carefully addressed through avoidance of sensitive areas identified in the EIA as well as thereafter through the implementation of a robust and effective environmental management plan that reduces construction and persistent operational phase impacts. Pertinent issues in this regard include establishing the underlying reasons that an area has been identified as a CBA and if there are any mitigation measures that can be implemented that can significantly reduce or avoid impacts on the CBAs or those receptors which were identified as being significant.

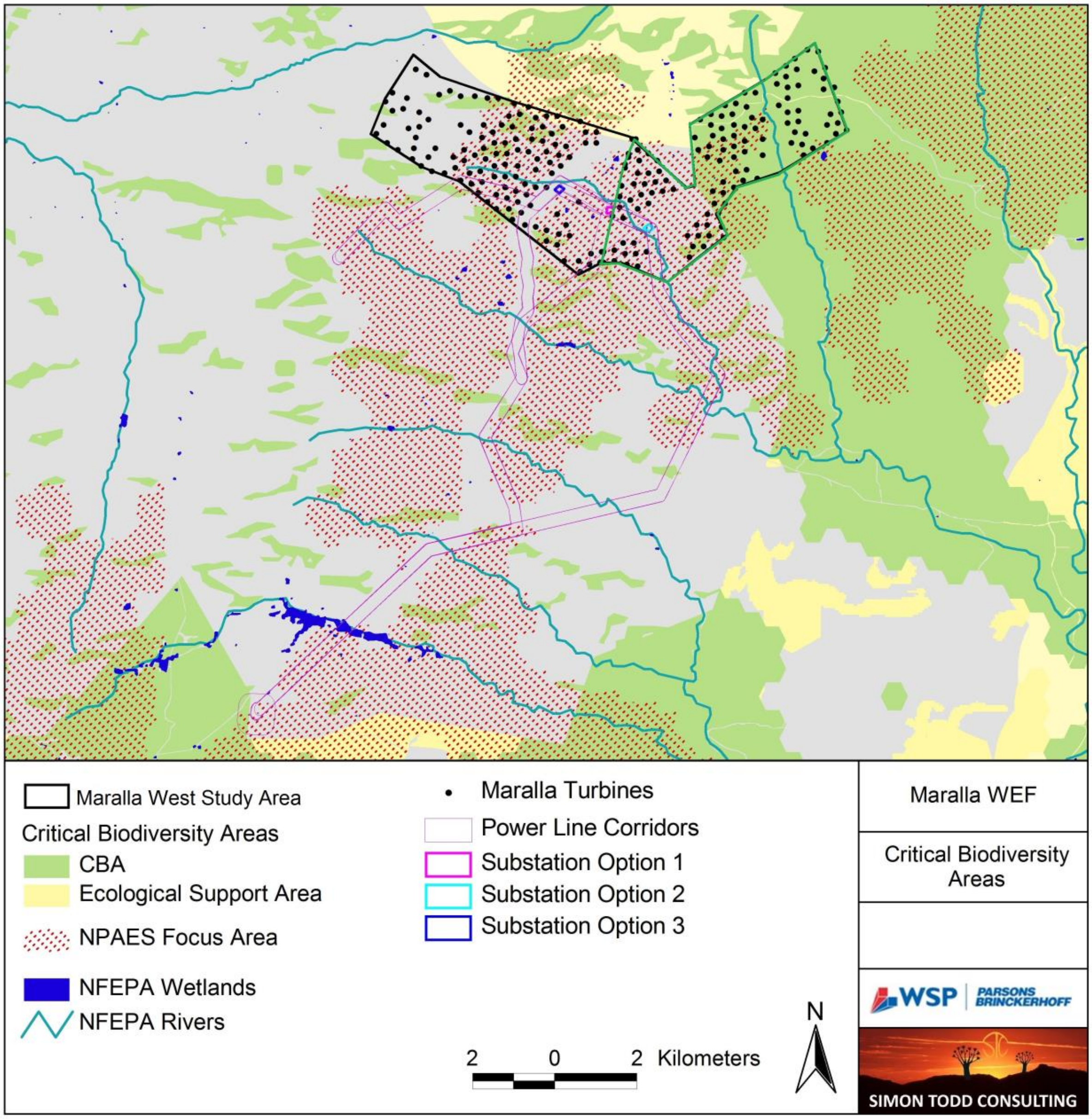


Figure 3. Critical Biodiversity Areas map of the proposed Maralla West Wind Farm and the surrounding area.

4.5 Cumulative Impact

According to the map of DEA-registered projects as at April 2016, there are a large number of renewable energy project applications in the area (Figure 4). These are concentrated along the escarpment as well as on the Elandsberge south of the escarpment. In terms of cumulative impact it is important to consider the vegetation types and habitats that would bear the brunt of development in the area.

The broad area is quite diverse in terms of the different vegetation types present in the area, with the result that each development tends to impact different vegetation types. Cumulative impacts on Central Mountains Shale Renosterveld however appear to be a particular concern as this vegetation type has a relatively limited extent and a significant proportion, especially in the west is within renewable energy development application areas. The current development potentially consists of several phases and possibly a large number of turbines, with the result that the potential contribution to cumulative impact from the development is high. As the impact results from transformation as well as the presence of the facility, this impact cannot be avoided, although reducing the footprint will also reduce the impact to some degree

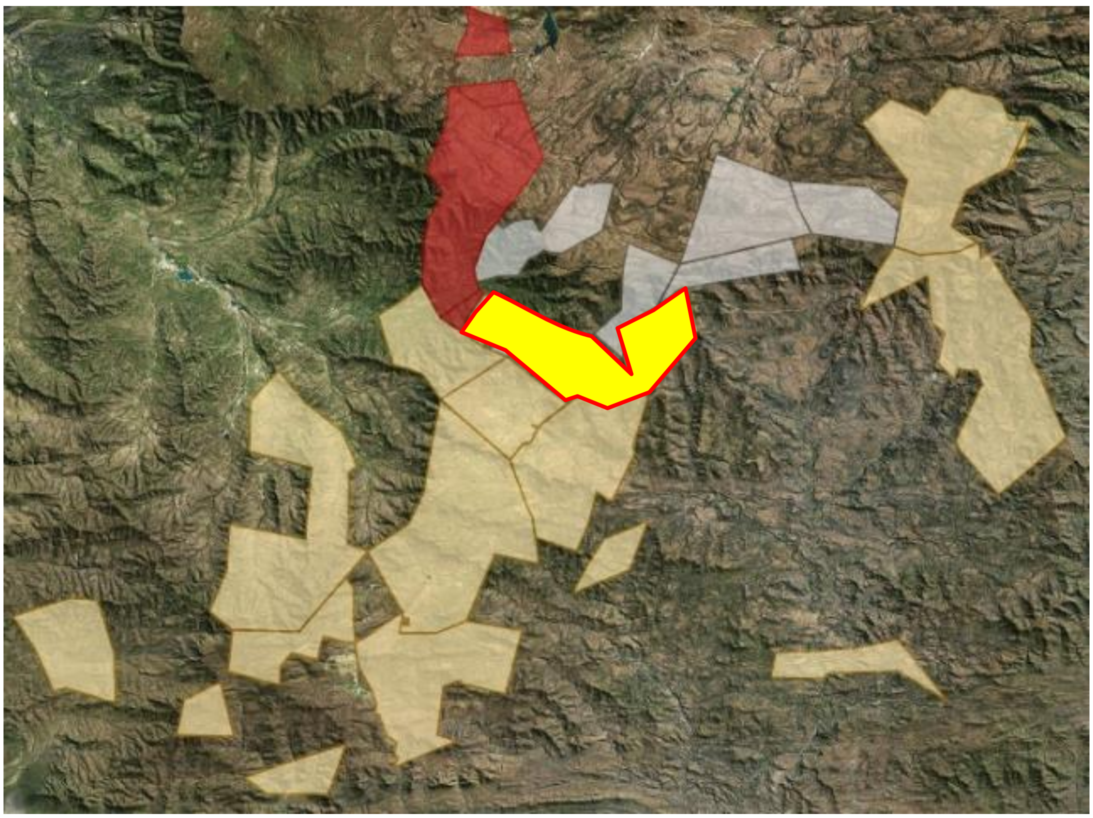


Figure 4. Current (April 2016) DEA-registered projects known from the vicinity of the Maralla Wind Farm, the rough position of which is shown in yellow with a red border. Pale yellow polygons are wind energy developments and red are solar projects (The red area is however the Gunstfontein WEF and is erroneously listed as a solar project), but it is important to note that wind turbines may be restricted to a small proportion of the indicated areas. The grey polygons are unknown technologies at this date, but are likely wind energy facilities as well.

4.6 Faunal Communities

Mammals

At least 50 mammal species potentially occur at the site (Appendix 2). Due to the diversity of habitats available, which includes rocky uplands, densely vegetated kloofs and riparian areas, as well as open plains and low shrublands, the majority of species with a distribution that includes the site are likely to be present in at least part of the broader site. The mammalian community is therefore relatively rich and due to the remote and inaccessible nature of large parts of the area probably has not been highly impacted by human activities aside from livestock grazing, which is largely compatible with most biodiversity processes.

Despite trapping and hunting by the local landowners, medium sized carnivores such as jackal and caracal appear to be relatively common in the area. The ridges, hills and uplands of the site, with rocky outcrops, rocky bluffs and cliffs provide suitable habitat for species which require or prefer rock cover such as Cape Rock Elephant Shrew, *Elephantulus edwardii*, Hewitt's Red Rock Hare *Pronolagus saundersiae*, Namaqua Rock Mouse *Micaelamys namaquensis* and Rock Hyrax, *Procavia capensis*. The lowlands are likely to contain an abundance of species associated with lowland habitats such as deeper soils and floodplain habitats, which includes Brants's Whistling Rat *Parotomys brantsii*, the Bush Vlei Rat *Otomys unisulcatus*, Hairy-footed Gerbil *Gerbillurus paeba* and Common Duiker *Sylvicapra grimmia*.

A number of antelope are common in the affected area and would potentially be impacted by the development. Both Duiker and Steenbok *Raphicerus campestris* are adaptable species that are able to tolerate moderate to high levels of human activity and are not likely to be highly sensitive to the disturbance associated with the development. Grey Rhebok *Pelea capreolus* are common at the site and although this species may become habituated to the presence of the facility, they may avoid the vicinity of the turbines and experience some habitat loss as a result.

The Riverine Rabbit *Bunolagus monticularis* which is listed as Critically Endangered and is regarded as the most threatened mammal in South Africa is known to occur in the broader area. This species is usually associated with alluvial terraces and floodplains of ephemeral rivers of the Karoo. As there does not appear to be any suitable habitat within the site, it is not likely that this species would be impacted by the development.

Reptiles

There is a wide range of habitats for reptiles present at the site, including rocky uplands and cliffs, open flat and lowlands and densely vegetated riparian areas. As a result the site is likely to have a relatively rich reptile fauna which is potentially composed of 7 tortoise species, 20 snakes, 17 lizards and skinks, two chameleons and 10 geckos. The area has however been very poorly sampled as illustrated by the fact that there are only 18 records representing 9 species for the 4 quarter degree squares around the site, within the ReptileMap database of the ADU. Consequently, the estimate of potential richness is based on broad-scale distribution maps in the literature and not the ADU database. Some little-known species which have previously been listed but have been recently downgraded to Least Concern may occur in the area, this includes Fisk's House Snake *Lamprophis fiskii* and the Namaqua Plated Lizard *Gerrhosaurus typicus*. The only currently listed species which may occur at the site is the Karoo Padloper *Homopus boulengeri* which is listed as Near Threatened.

Species observed in the area include Karoo Tent Tortoise *Psammobates tentorius tentorius*, Angulate Tortoise *Chersina angulata*, Puff Adder *Bitis arietans*, Karoo Girdled Lizard *Cordylus polyzonus*, Southern Rock Agama *Agama atra*, Namaqua Plated Lizard *Gerrhosaurus typicus*, Cape Skink *Mabuya capensis*, Namaqua Sand Lizard <u>*Pedioplanis namaquensis*</u> and Cape Cobra *Naja nivea*. Although there are a variety of different habitats present, the generally intact nature of the area means that most habitats have associated reptiles.

In general, the predominant potential impact associated with the development would be habitat loss and fragmentation for reptiles, with the potential for increased levels of predation being a secondary impact which may occur as a result of vegetation clearing for roads and turbine pads.

Amphibians

Although there are no perennial rivers within the site, many of the larger drainage lines contain pools which have water on a near-perennial basis. Cape River Frogs were observed using these pools and other species are likely to be breeding in them as well. In addition, there are a number of pans and irrigation dams at the site which would also represent important breeding sites for water-dependent species. The amphibian diversity at the site is however likely to be relatively low as the site lies within the distribution range of only eight frog and toad species. The only species observed during the site visit was the Cape River Frog *Amietia fuscigula* which is present in farm dams and pools in the rivers of the site. No species of conservation concern are known from the area and all the species which may be present are quite widespread species of low conservation concern.

In general, the most important areas for amphibians at the site are the riparian areas, seeps and wetlands and the man-made earth dams which occur in the area. As these are widely recognized as sensitive habitats, impacts to these areas are avoided largely at the design phase of the development and a minimum amount of infrastructure has been located in the vicinity of these features. Consequently, direct impacts on amphibians at the site are likely to be fairly low. Amphibians are however highly sensitive to pollutants and the large amount of construction machinery and materials present at the site during the construction phase would pose a risk to amphibians should any spills occur.

4.6 Site Sensitivity Assessment

The ecological sensitivity map of the site is depicted in Figure 5 below. High sensitivity areas include the very high lying ground in the northeast as well as steep, south-facing slopes distributed across the site. Preferably, the number of turbines within the Very High sensitivity areas should be reduced. At this point it is considered acceptable to have turbines within the High sensitivity areas but specific attention should be paid to these areas in the EIA phase to evaluate the presence of species and habitats of concern in these areas and the potential impact of the development on these features. In terms of the substation options, Option 1 and Option 3 (which lie in the Maralla West study area) are both considered acceptable while Option 2 (which lies in the Maralla East study area) is less desirable on account of the higher sensitivity of the affected area. The relatively high sensitivity of large parts of the site reflects the abundance of species of conservation concern in these areas. The primary implication of these results is that development within this area should proceed with caution as there are numerous sensitive features present and specific avoidance and mitigation is required to reduce the impact of the development to acceptable level.

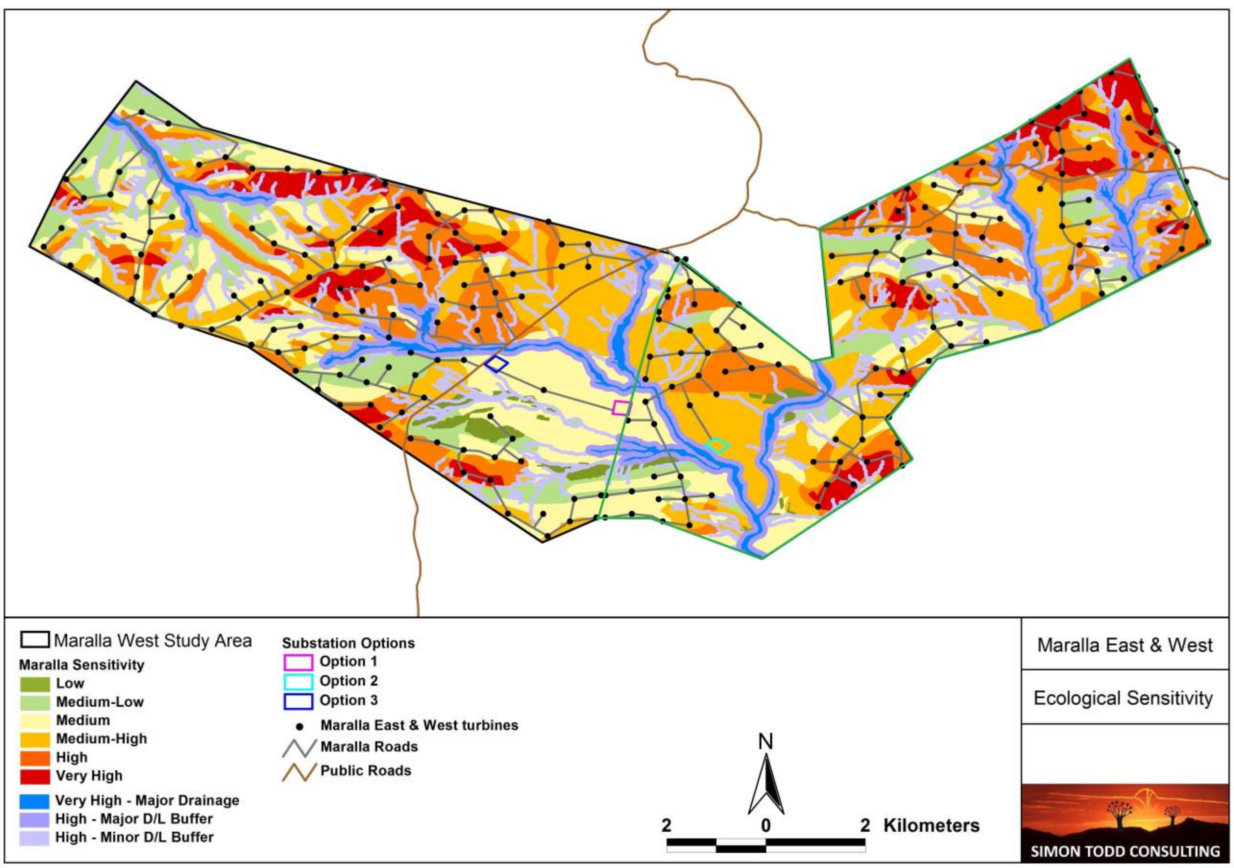


Figure 5. Ecological Sensitivity map of the Maralla WEF site, showing the turbine layout from both the Maralla East and Maralla West development.

5 *IMPACTS AND ISSUES IDENTIFICATION*

5.1 IDENTIFICATION OF POTENTIAL IMPACTS

The likely impacts on the terrestrial ecology of the site resulting from the development of the Maralla West Wind Farm are identified and discussed below with reference to the characteristics and features of the site. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarized below before the impacts are assessed

Impact 1. *Impacts on vegetation and listed or protected plant species*

The development would require vegetation clearing for turbines, roads and other hard infrastructure. Apart from the direct loss of vegetation within the development footprint, listed and protected species are also highly likely to be impacted. These impacts are likely to occur during the construction phase of the development, with additional vegetation impacts during operation likely to be relatively low. This impact should therefore be assessed for the facility as well as grid connection, for the construction phase only.

Impact 2. *Direct Faunal Impacts*

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed if proper management and monitoring is not in place. Traffic at the site during all phases of the project would pose a risk of collisions with fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible and the impact would be largely concentrated to the construction phase when vehicle activity was high. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. During the operational phase, noise generated by the operation of the turbines is likely to negatively affect at least some fauna. Faunal impacts should therefore be assessed during the construction and operational phase of the facility and for the construction phase only of the power line.

Impact 3. *Increased Erosion Risk*

The large amount of disturbance created during construction would leave the site vulnerable to soil erosion, especially as many parts of the site are steep. The soil disturbance associated with the development will render the impacted areas highly vulnerable to erosion and measures to limit erosion will need to be a key element of mitigation measures at the site. Furthermore, if the eroded material were to enter streams and rivers at the site it could have significant impact on these systems through siltation of pools and changes in the chemistry and turbidity of the water.

This impact is likely to manifest during construction and would persist into the operational phase and should therefore be assessed for both phases.

Impact 4. *Alien Plant Invasion*

The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some alien plant invasion is inevitable and regular alien plant clearing activities would be required to limit the extent of this problem. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion, however, the roadsides and turbine service areas are likely to remain foci of alien plant invasion for years. This impact would manifest during the operational phase, although some of the required measures to reduce this impact are required during construction.

Cumulative Impact 1. *Impacts on Critical Biodiversity Areas and broad-scale ecological processes*

Some small parts of the Maralla West site are within Critical Biodiversity Areas and habitat loss may be generated within these areas. While CBAs are not necessarily no-go areas, development within CBAs is not encouraged as such development may compromise the ecological functioning of the CBA or result in direct biodiversity loss within the CBA if not approached carefully and managed effectively. This impact can result from the presence of the facility as well as habitat loss within the CBAs. In addition, the presence of the wind turbines and daily operational activities at the site may deter certain species from the area, resulting in a loss in broad-scale landscape connectivity. In this regard it is important to note that while the development footprint is low in comparison with the total extent of the site, this impact should be considered in context of the impact on the affected ridges and their specific habitats which may be much more restricted, as well as the presence of the other similar developments in the area.

Cumulative Impact 2: *Impacts on NPAES Focus Areas and loss future conservation options*

The development will contribute to cumulative habitat loss within the NPAES Focus Area and along with the other developments in the area, this may impact on future conservation options in the area. Due to the high number of developments in the area, this is a potentially significant long-term impact of the development.

6 SCOPING PHASE PRELIMINARY IMPACT ASSESSMENT

The assessment methodology will be in accordance with the recent revised 2014 EIA regulations and based on the assessment approach recommended by Hacking (2001). An impact screening tool has been developed to assess the significance of identified impacts. The screening tool is based on two criteria, namely probability and severity. The significance of environmental impacts is a function of the environmental aspects that are present and to be impacted on, the probability of an impact occurring and the severity of such an impact occurring before and after implementation of proposed mitigation measures. The mitigation measures are those intended for the planning phase and mitigation measures to be included in the EMP will be described in the EIA report.

Impact 1. *Impact on vegetation and listed plant species.*

Impact Phase: Construction				
Impact Description: Impact on vegetation and listed plant species due to transformation within the development footprint. This impact is certain to occur to some degree as transformation is required for the development. The significance of this impact will be determined largely by the abundance of species of conservation concern within the development footprint. Although some avoidance is possible, it is not likely that this impact can be mitigated to a low level.				
	Severity	**Probability**	**Status**	**Significance**
Without Mitigation	**3**	**4**	**-'tve**	**High**
With Mitigation	**2**	**3**	**-'tve**	**Medium**
Mitigation measures to reduce residual risk or enhance opportunities: 1) Minimise development footprint within high sensitivity areas and ensure that final development layout takes account of areas identified as sensitive during the field survey. Some avoidance and changes to the layout may be required if some areas with a high abundance of species of concern are shown to occur within the preferred development areas. 2) Ensure that lay-down and other temporary infrastructure is within low sensitivity areas, preferably previously transformed areas if possible.				
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes. Particular attention will be paid to the presence of listed species within the affected areas and the possibilities for avoidance and mitigation.			

Impact 2. *Direct faunal impacts during construction*

Impact Phase: Construction				
Impact Description: Direct faunal impacts due to construction phase noise and physical disturbance. As construction is required and there will be a large amount of activity at the site during this time, it cannot be mitigated to a low level. This impact would however be transient and disturbance would be significantly lower during operation.				
	Severity	**Probability**	**Status**	**Significance**
Without Mitigation	**3**	**4**	**-'tve**	**High**
With Mitigation	**2**	**3**	**-'tve**	**Medium**

Mitigation measures to reduce residual risk or enhance opportunities: 1) Avoid sensitive faunal habitats such as drainage lines and wetlands. 2) A variety of avoidance and mitigation measures to reduce impact on fauna will need to be implemented during construction, including limiting impacts from construction staff and the operation of construction vehicles.	
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes, the fauna present at the site will be characterized in the field and sensitive habitats identified and delineated.

Impact Phase: Operation				
Impact Description: Faunal impacts due to operational phase activities. During operation, the wind turbines will generate noise which may impact certain fauna while some species may also be sensitive to the presence of the turbines and avoid the area. Although this impact is likely to occur to some degree, it has not been well documented elsewhere and the severity of this impact is therefore difficult to assess with a large degree of certainty.				
	Severity	**Probability**	**Status**	**Significance**
Without Mitigation	**2**	**3**	**-'tve**	**Medium**
With Mitigation	**2**	**2**	**-'tve**	**Low**
Mitigation measures to reduce residual risk or enhance opportunities: 1) Ensure than management and maintenance activities are favourable for fauna. This includes minimizing disturbance at the site.				
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes, the potential for long-term impact on fauna is likely and will need to be assessed during the EIA.			

Impact 3. *Soil Erosion Risk*

Impact Phase: Operation				
Impact Description: Following construction, the site will be highly vulnerable to soil erosion. Although this impact is potentially high, it can be mitigated to a low level through standard erosion control and runoff abatement measures.				
	Severity	**Probability**	**Status**	**Significance**
Without Mitigation	**3**	**4**	**-'tve**	**High**
With Mitigation	**2**	**2**	**-'tve**	**Low**
Mitigation measures to reduce residual risk or enhance opportunities: 1) Runoff management and erosion control should be integrated into the project design				

2) Development on steep slopes should be avoided as much as possible and specific additional mitigation may be required where this cannot be avoided.	
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes. As this a highly likely potential impact, it will be assessed in the EIA phase

Impact 3. *Alien Plant Invasion*

Impact Phase: Operation				
Impact Description: Following construction, the site will be highly vulnerable to alien plant invasion. Some invasion of disturbed areas is highly likely to occur after construction, but with mitigation, this can be reduced to a low level.				
	Severity	**Probability**	**Status**	**Significance**
Without Mitigation	**3**	**3**	**-'tve**	**Medium**
With Mitigation	**2**	**2**	**-'tve**	**Low**
Mitigation measures to reduce residual risk or enhance opportunities: 1) Alien management plan to be part of the EMP. 2) Regular alien clearing where invasion occurs.				
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes. As this a highly likely potential impact, it will be assessed in the EIA phase			

Impact 5. *Impact on CBAs and Broad-Scale Ecological Processes*

Impact Phase: Operation				
Impact Description: Cumulative impact on CBAs and broad scale ecological processes. Cumulative impacts on CBAs are a significant concern at the site due to the large amount of wind energy development in the area. Furthermore, the development is within a CBA and the loss of habitat within CBAs may impact the ecological functioning of the CBA and result in increased habitat fragmentation and reduced landscape connectivity.				
	Severity	**Probability**	**Status**	**Significance**
Without Mitigation	**3**	**3**	**-'tve**	**Medium**
With Mitigation	**3**	**3**	**-'tve**	**Medium**
Mitigation measures to reduce residual risk or enhance opportunities: 1) Minimise the development footprint, especially within the very high sensitivity areas and some				

reduction in the number of turbines within these areas may be required. 2) There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora. 3) Specific avoidance and mitigation may be required to reduce the impact on certain habitats of limited extent and high ecological or conservation significance. 4) Buffers around significant landscape features such as large drainage systems are recommended to maintain corridors for faunal movement and limit impacts on landscape connectivity.	
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes. The habitats at the site will need to be better characterised in the field and the potential impact of the development considered in this light.

Impact 6. *Impact on NPAES Focus Areas and Future Conservation Options*

Impact Phase: Operation				
Impact Description: Cumulative impact NPAES Focus areas and future conservation options. The majority of the site is within a NPAES Focus Area and the habitat loss resulting from this as well as the other wind energy developments in the area will contribute to cumulative impacts on the NPAES and this may have consequences for future conservation options in the area and the ability of the county to meet its conservation targets.				
	Severity	**Probability**	**Status**	**Significance**
Without Mitigation	**3**	**3**	**-'tve**	**Medium**
With Mitigation	**2**	**2**	**-'tve**	**Low**
Mitigation measures to reduce residual risk or enhance opportunities: 1) Minimise the development footprint, especially within the very high sensitivity areas and some reduction in the number of turbines within these areas may be required. 2) Specific avoidance and mitigation may be required to reduce the impact on certain habitats of limited extent and high ecological or conservation significance.				
Impact to be addressed/ further investigated and assessed in Impact Assessment Phase?	Yes. The contribution of the development to cumulative impact in the area should be investigated in light of the development footprint and the extent of habitat lost and the similarity of the affected areas to other wind energy developments in the area.			

7 PROPOSED ACTIVITIES FOR THE EIA PHASE

The current study is based largely on knowledge, a site visit and a desktop assessment of the study area. Although this has increased the certainty around the findings of the Scoping Study, fieldwork during the EIA phase would be a key component required to better characterise the study area and identify any sensitivities prevailing at the site. Additional studies that will be conducted for the EIA phase of the development include the following:

- A more comprehensive site visit and field assessment in order to characterise the vegetation and plant communities present at the site in greater detail. This includes habitat mapping, developing species lists and descriptions of the typical and dominant species within the site and the potential impact of the development on these habitats and plant communities.
- Evaluate the possible impact of the development on landscape connectivity in the field based on the likely use of the area as a corridor for movement by fauna as well as any local impacts on faunal communities.
- Identify any possible areas that should be avoided or other mitigation measures that might be implemented to reduce the impact of the development on landscape connectivity and fauna in general.
- Identify and map any sensitive features at the site which are rare or contain a high abundance of species of concern and which should be avoided by the development.
- Evaluate, based on the site attributes, what the most applicable mitigation measures to reduce the impact of the development on the site would be and if there are any areas where specific precautions or mitigation measures should be implemented.
- Assess the impacts identified above in light of the site-specific findings and the final layout to be provided by the developer.

8 CONCLUSIONS & RECOMMENDATIONS

The Maralla West Wind Farm area consists of ridges and slopes along the face of the Komsberg Escarpment. This is a recognized centre of plant diversity and endemism and the abundance of endemic and listed plant species in the area is high. The steep slope of large parts of the site, along with the high abundance of species of conservation concern are the main drivers of the ecological sensitivity of the site. There are however extensive areas present on the lower slopes that are suitable for development and as much of the development footprint as possible should be focused on these areas.

As the density of renewable energy development in the area is high, cumulative impacts are a significant potential concern for the development potential of the site. A small part of the Maralla West development area is within a CBA. Apart from the impacts on CBAs, the development would also contribute to cumulative habitat loss within NPAES Focus Areas and may impact future conservation options in the area. This impact will need to be quantified in light of the final development footprint and the distribution of affected habitats within the site as well as within the other renewable energy developments in the area. The interpretation of the impacts on NPAES focus areas should take account of variation in composition across the broader Komsberg-Sutherland study area and existing and authorized development impacts on the different vegetation units and habitats of the area.

Due to the strongly seasonal nature of the vegetation of the area, it was not possible to adequately characterise the distribution of species of conservation concern at the site during the current phase of assessment. Consequently, additional fieldwork at the site to better characterise and map the distribution of species and habitats of conservation concern at the site will be an important activity going into the EIA phase. This will allow the impacts of the development to be assessed with greater certainty and also allow for more effective mitigation and avoidance measures to be implemented.

In terms of the existing layout plans, it is recommended that the footprint within the Very High sensitivity areas is reduced as far as possible as it may not be possible to reduce impact within these areas to acceptable levels. The High sensitivity areas are not considered no-go areas but identify areas within the site, where the abundance of species of concern is potentially high and where specific mitigation and avoidance are likely to be required to reduce the impact of the development to an acceptable level. Substation Option 1 and Option 3 (which lie in Maralla West study area) are considered the most favourable substation locations. In terms of the grid connection routes, the shorter options towards Soetwater Switching Station are most preferable. In terms of the options to Komsberg substation, the western route is considered most favourable as it is shorter and is located within an area that has higher existing levels of disturbance and human activity.

The likely impacts associated with the development of the Maralla West Wind Energy Facility are summarized below. Overall, after mitigation, the impact of the Maralla West Wind Energy Facility should be of moderate significance. While there are no impacts associated with the development that are highly likely to remain high after mitigation, impacts on fauna and flora during construction are likely to remain of moderate significance after mitigation as a result of the unavoidable high levels of disturbance which would be likely to occur at this time. Cumulative impacts are also a concern for the development given the abundance of adjacent facilities that would impact a similar environment to the Maralla development. The preliminary layout provided for the scoping, includes turbines within areas considered to be of Very High sensitivity and development within these areas generates a disproportionately high impact for the development and some reduction in the footprint within these areas is recommended.

Summary assessment for the Maralla West Wind Energy Facility, before and after mitigation.

Phase & Impact	Before Mitigation	After Mitigation
Planning & Construction Phase Impacts		
Impacts on vegetation and listed plant species	High	Medium

Phase & Impact	Before Mitigation	After Mitigation
Faunal impacts due to construction activities	High	Medium
Operational Phase Impacts		
Faunal impacts due to operational activities	Medium	Low
Increased alien plant invasion risk	Medium	Low
Increased erosion risk during operation	Medium	Low
Cumulative Impacts		
Impacts on CBAs and broad-scale ecological processes	Medium	Medium
Impacts on NPAES Focus Areas and future conservation options	Medium	Low

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10 APPENDICES:

Appendix 1. Listed Plant Species

List of plant species of conservation concern which are known to occur in the vicinity of the Maralla West Wind Farm. The list is derived from the SIBIS:SABIF website. Those in red are confirmed present at the site, but not necessarily within the development footprint.

Family	Species	Threat status
AMARYLLIDACEAE	***Brunsvigia josephinae (Redouté) Ker Gawl.***	VU
	Strumaria karooica (W.F.Barker) Snijman	Rare
	Strumaria pubescens W.F.Barker	Rare
ANTHERICACEAE	*Chlorophytum lewisiae Oberm.*	Rare
APOCYNACEAE	***Duvalia parviflora N.E.Br.***	VU
	Hoodia pilifera (L.f.) Plowes subsp. pilifera	NT
ASPHODELACEAE	*Astroloba herrei Uitewaal*	VU
	Bulbine torta N.E.Br.	Rare
	Haworthia fasciata (Willd.) Haw.	NT
	Gasteria disticha	CR
	Haworthia serrata	CR
	Haworthia pulchella M.B.Bayer var. pulchella	Rare
ASTERACEAE	*Cineraria lobata L'Hér. subsp. lasiocaulis Cron*	Rare
	Antithrixia flavicoma	VU
	Euryops namaquensis	VU
	Eriocephalus grandiflorus M.A.N.Müll.	Rare
	Phymaspermum schroeteri Compton	Rare
	Pteronia hutchinsoniana Compton	Rare
	Relhania tricephala (DC.) K.Bremer	NT
COLCHICACEA	*Wurmbea capensis*	VU
CRASSULACEAE	*Adromischus humilis (Marloth) Poelln.*	Rare
	Adromischus phillipsiae (Marloth) Poelln.	Rare
	Adromischus mammillaris	EN
	Crassula alpestris Thunb. subsp. massonii (Britten & Baker f.) Toelken	Rare
EUPHORBIACEAE	*Euphorbia nesemannii R.A.Dyer*	NT
FABACEAE	*Amphithalea spinosa (Harv.) A.L.Schutte*	VU
	Amphithalea villosa Schltr.	VU
	Lotononis comptonii B.-E.van Wyk	EN
	Lotononis gracilifolia B.-E.van Wyk	EN
	Lotononis venosa B.-E.van Wyk	VU
GERANIACEAE	*Pelargonium denticulatum Jacq.*	Rare
	Pelargonium torulosum E.M.Marais	Rare
HYACINTHACEAE	*Lachenalia maximiliani Schltr. ex W.F.Barker*	Rare

IRIDACEAE	*Geissorhiza inaequalis L.Bolus*	**Rare**
	Geissorhiza karooica Goldblatt	**NT**
	Ixia linearifolia Goldblatt & J.C.Manning	**Rare**
	Ixia parva Goldblatt & J.C.Manning	**VU**
	Moraea aspera Goldblatt	**VU**
	Romulea eburnea J.C.Manning & Goldblatt	**VU**
	Romulea syringodeoflora M.P.de Vos	**VU**
MESEMBRYANTHEMACEAE	*Cleretum lyratifolium Ihlenf. & Struck*	**Rare**
	Lampranthus amoenus (Salm-Dyck ex DC.) N.E.Br.	**EN**
OXALIDACEAE	*Oxalis tenuipes T.M.Salter var. tenuipes*	**Rare**
POACEAE	***Ehrharta eburnea Gibbs Russ.***	**NT**
POLYGALACEAE	*Muraltia karroica Levyns*	**VU**
PROTEACEAE	*Leucadendron teretifolium (Andrews) I.Williams*	**NT**
	Protea convexa E.Phillips	**CR**
	Protea lepidocarpodendron (L.) L.	**NT**
RUTACEAE	*Acmadenia argillophila I.Williams*	**NT**
SCROPHULARIACEAE	*Globulariopsis wittebergensis Compton*	**Rare**
	Oftia glabra Compton	**Rare**
	Selago albomontana Hilliard	**Rare**

Appendix 2. List of Mammals

List of Mammals which potentially occur at the Maralla West Wind Farm site. Taxonomy and habitat notes are derived from Skinner & Chimimba (2005), while conservation status is according to the IUCN 2016.

Scientific Name	Common Name	Status	Habitat	Likelihood
Afrosoricida (Golden Moles):				
Chlorotalpa sclateri	Sclater's Golden Mole	LC	Montane grasslands, scrub and forested kloofs of the Nama Karoo and grassland biomes	Low
Chrysochloris asiatica	Cape Golden Mole	LC	Coastal parts of the Northern and Western Cape	High
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 edwardii	Cape Rock Elephant Shrew	LC	From rocky slopes, with or without vegetation, from hard sandy ground bearing little vegetation, quite small rocky outcrops	Confirmed
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):				
Bunolagus monticularis	Riverine Rabbit	CR	Confined to riparian bush on the narrow alluvial fringe of seasonally dry watercourses in the Central Karoo.	V.Low
Pronolagus saundersiae	Hewitt's Red Rock Hare	LR/LC	Confined to areas of krantzes, rocky hillsides, boulder-strewn koppies and rocky ravines	Confirmed
Lepus capensis	Cape Hare	LR/LC	Dry, open regions, with palatable bush and grass	Confirmed
Lepus saxatilis	Scrub Hare	LR/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

Graphiurus ocularis	Spectacled Dormouse	LC	Associated with sandstones of Cape Fold mountains, which have many vertical and horizontal crevices.	High
Acomys subspinosus	Cape Spiny Mouse	LC	Associated with rocky areas on mountain slopes in Fynbos	Low
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
Steatomys krebsii	Kreb's African Fat Mouse	LC		
Micaelamys 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
Micaelamys granti	Grant's Rock Mouse	LC	Restricted to the karoo where they are associated with rocky terrain.	High
Parotomys brantsii	Brants's 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	Low
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.	Confirmed
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
Tatera afra	Cape Gerbil	LC	Confined to areas of loose, sandy soils of sandy alluvium. Common on cultivated lands.	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
Dendromus melanotis	Grey Climbing Mouse	LC	Often associated with stands of tall grass especially if thickened with bushes and other vegetation	High
Primates:				
Papio hamadryas	Chacma Baboon	LR/LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Confirmed
Eulipotyphla (Shrews):				
Myosorex varius	Forest Shrew	LC	Prefers moist, densely vegetated habitat	High

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
Carnivora:				
Proteles cristatus	Aardwolf	LR/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	Confirmed
Felis silvestris	African Wild Cat	LC	Wide habitat tolerance.	High
Panthera pardus	Leopard	SARDB NT	Wide habitat tolerance, associated with areas of rocky koppies and hills, mountain ranges and forest	Low/Moderate
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	LR/LC	Occur in open arid associations	High
Genetta tigrina	Large-spotted genet	LR/LC	Fynbos and savanna particularly along riverine areas	Low
Suricata suricatta	Meerkat	LR/LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	Confirmed
Cynictis penicillata	Yellow Mongoose	LR/LC	Semi-arid country on a sandy substrate	Confirmed
Galerella pulverulenta	Cape Grey Mongoose	LR/LC	Wide habitat tolerance	Confirmed
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.	Confirmed
Otocyon megalotis	Bat-eared Fox	LC	Open country with mean annual rainfall of 100-600 mm	Confirmed
Aonyx capensis	Cape Clawless Otter	LC	Predominantly aquatic and do not occur far from permanenetpermanenet water	Medium
Ictonyx striatus	Striped Polecat	LR/LC	Widely distributed throughout the sub-region	Confirmed
Mellivora capensis	Ratel/Honey Badger	SARDB EN	Catholic habitat requirements	High
Rumanantia (Antelope):				
Sylvicapra grimmia	Common Duiker	LR/LC	Presence of bushes is essential	Confirmed
Pelea capreolus	Grey Rhebok	LC	Associated with rocky hills, rocky mountainsides, mountain plateaux with good grass cover.	Confirmed
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	Confirmed
Raphicerus campestris	Steenbok	LR/LC	Inhabits open country,	Confirmed

Raphicerus melanotis	Cape Grysbok	LC	Thick scrub bush, particularly along the lower levels of hills	Medium
Oreotragus oreotragus	Klipspringer	LR/cd	Closely confined to rocky habitat.	Confirmed

Appendix 3. List of Reptiles.

List of reptiles which are known from the broad area around the Maralla West Wind Farm site, according to the SARCA database, derived for the degree square 3220CD, DC and 3320AB, BA.

Family	Genus	Species	Subspecies	Common name	Red list category
Agamidae	*Agama*	*atra*		Southern Rock Agama	Least Concern
Agamidae	*Agama*	*hispida*		Spiny Ground Agama	Least Concern
Atractaspididae	*Homoroselaps*	*lacteus*		Spotted Harlequin Snake	Least Concern
Chamaeleonidae	*Bradypodion*	*gutturale*		Little Karoo Dwarf Chameleon	Least Concern
Chamaeleonidae	*Chamaeleo*	*namaquensis*		Namaqua Chameleon	Least Concern
Colubridae	*Psammophis*	*crucifer*		Cross-marked Grass Snake	Least Concern
Colubridae	*Pseudaspis*	*cana*		Mole Snake	Least Concern
Colubridae	Dasypeltis	scabra		Rhombic Egg-eater	Least Concern
Colubridae	*Dipsina*	*multimaculata*		Dwarf Beaked Snake	Least Concern
Cordylidae	*Cordylus*	*minor*		Western Dwarf Girdled Lizard	Least Concern
Cordylidae	*Hemicordylus*	*capensis*		Graceful Crag Lizard	Least Concern
Cordylidae	*Karusasaurus*	*polyzonus*		Karoo Girdled Lizard	Least Concern
Cordylidae	*Pseudocordylus*	*microlepidotus*	*namaquensis*	Nuweveldberg Crag Lizard	Least Concern
Elapidae	*Hemachatus*	*haemachatus*		Rinkhals	Least Concern
Elapidae	*Naja*	*nigricincta*	*woodi*	Black Spitting Cobra	Least Concern
Elapidae	*Aspidelaps*	*lubricus*	*lubricus*	Coral Shield Cobra	Not Listed
Gekkonidae	*Chondrodactylus*	*angulifer*	*angulifer*	Common Giant Ground Gecko	Least Concern
Gekkonidae	*Chondrodactylus*	*bibronii*		Bibron's Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*capensis*		Cape Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*formosus*		Southern Rough Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*geitje*		Ocellated Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*kladaroderma*		Thin-skinned Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*maculatus*		Spotted Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*mariquensis*		Marico Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*oculatus*		Golden Spotted Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*purcelli*		Purcell's Gecko	Least Concern
Gekkonidae	*Pachydactylus*	*weberi*		Weber's Gecko	Least Concern
Gerrhosauridae	*Cordylosaurus*	*subtessellatus*		Dwarf Plated Lizard	Least Concern
Gerrhosauridae	*Tetradactylus*	*tetradactylus*		Cape Long-tailed Seps	Least Concern
Lacertidae	*Nucras*	*tessellata*		Western Sandveld Lizard	Least Concern
Lacertidae	*Pedioplanis*	*burchelli*		Burchell's Sand Lizard	Least Concern
Lacertidae	*Pedioplanis*	*laticeps*		Karoo Sand Lizard	Least Concern
Lacertidae	*Pedioplanis*	*lineoocellata*	*pulchella*	Common Sand Lizard	Least Concern

Leptotyphlopidae	*Namibiana*	*gracilior*		Slender Thread Snake	Least Concern
Lamprophiidae	*Boaedon*	*capensis*		Brown House Snake	Least Concern
Lamprophiidae	*Prosymna*	*sundevallii*		Sundevall's Shovel-snout	Least Concern
Lamprophiidae	*Psammophis*	*notostictus*		Karoo Sand Snake	Least Concern
Lamprophiidae	*Psammophylax*	*rhombeatus*	*rhombeatus*	Spotted Grass Snake	Least Concern
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Least Concern
Scincidae	*Trachylepis*	*sulcata*	*sulcata*	Western Rock Skink	Least Concern
Scincidae	*Trachylepis*	*variegata*		Variegated Skink	Least Concern
Testudinidae	*Chersina*	*angulata*		Angulate Tortoise	Least Concern
Testudinidae	*Homopus*	*areolatus*		Parrot-beaked Tortoise	Least Concern
Testudinidae	*Homopus*	*boulengeri*		Karoo Padloper	Near Threatened
Testudinidae	*Homopus*	*femoralis*		Greater Padloper	Least Concern
Testudinidae	*Psammobates*	*tentorius*	*tentorius*	Karoo Tent Tortoise	Not listed
Testudinidae	*Psammobates*	*tentorius*	*verroxii*	Verrox's Tent Tortoise	Not listed
Typhlopidae	*Rhinotyphlops*	*lalandei*		Delalande's Beaked Blind Snake	Least Concern
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Least Concern

Appendix 4. List of Amphibians

List of amphibians which potentially occur at the Maralla West Wind Farm site. Taxonomy and habitat notes are from du Preez and Carruthers (2009) and conservation status from the IUCN 2010. (Status: LC = Least Concern, DD = Data Deficient) and additional data is from the ADU Amphibian Database for Quarter degree squares: 3220CD, 3220DC, 3320AB, 3320BA.

Scientific Name	Common Name	Status	Habitat	Distribution	Likelihood
Amietophrynus rangeri	Raucous Toad	Not Threatened	Rivers and stream in grassland and fynbos	Endemic	High
Vandijkophrynus gariepensis	Karoo Toad	Not Threatened	Karoo Scrub	Widespread	High
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 fuscigula	Cape River Frog	Not Threatened	Large still bodies of water or permanent streams and rivers.	Widespread	Confirmed
Cacosternum karooicum	Karoo Caco	DD	Dry kloofs and valleys in the Karoo	Endemic	High
Cacosternum karooicum	Karoo Dainty Frog	DD	Arid areas with unpredictable rainfall. Breeds in small streams as well as man-made dams.	Karoo Endemic	High
Tomopterna delalandii	Cape Sand Frog	Not Threatened	Lowlands in fynbos and Succulent Karoo	Endemic	High
Tomopterna tandyi	Tandy's Sand Frog	Not Threatened	Nama karoo grassland and savanna	Widespread	High