G7 RENEWABLE ENERGIES

RICHTERSVELD WIND FARM:

Ecological and Biodiversity Assessment:

Terrestrial Vertebrate Fauna & Botanical Specialist Study.

DEA Reference Number: 12/12/20/1964
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Final Report
Prepared by
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DECLARATION OF CONSULTANTS INDEPENDENCE

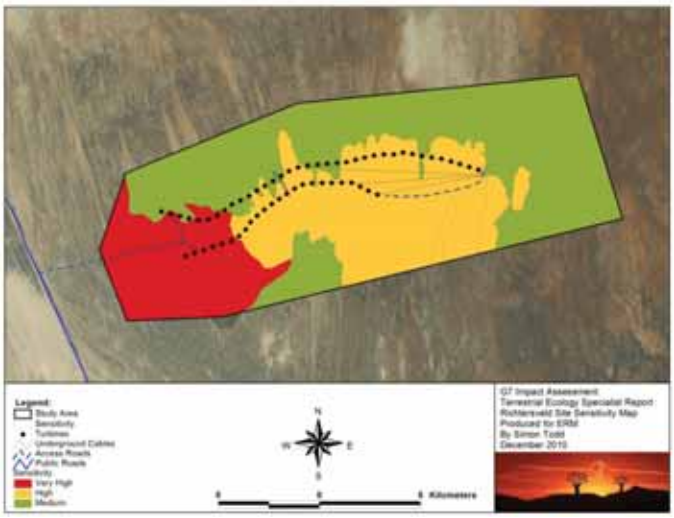
The author of this report, Simon Todd, does hereby declare that he is an independent consultant appointed by ERM for G7and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed 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

May 2011

EXECUTIVE SUMMARY

G7 Renewable Energies (Pty) (G7) proposes to establish a wind energy facility in the Richtersveld, between Port Nolloth and Alexander Bay. The facility will consist of up to 75 wind turbines which will generate up to 225 MW of electricity which will be fed into the National Power Grid. This report details the likely impacts of the proposed development on the flora and terrestrial vertebrate fauna of the site.



Following a site visit and desktop study, a sensitivity map for the site was generated and is depicted left. The assessment revealed that the western portion of the site, which is associated with a granitic outcrop and the coastal strip should be considered Very High Sensitivity due to the presence of listed plant and animal species in this area. Approximately 10 turbines are located within the Very High Sensitivity area and it recommended that these are relocated to less sensitive areas to the east or omitted altogether. The majority of turbines are located within an area of vegetated, stabilized dunes which are considered High Sensitivity as a result of their vulnerability to wind erosion. The adjacent plains are less vulnerable to disturbance and are considered Medium Sensitivity.

The major risk factors and mitigation priorities associated with the development are seen to be:

- Wind Erosion
- Destruction and Loss of Vegetation
- Impacts on Listed Plant Species
- Direct Faunal Impacts
- Alien Plant Invasion

The majority of pre-mitigation impacts are assessed to be of Minor to Moderate significance. After the appropriate mitigation measures as outlined in this report have been implemented, most impacts would be reduced to Minor significance. Provided that the sensitive areas are not developed, then the residual impact of the development would be low. Due to the aridity and high winds associated with the West Coast, wind erosion is singled out as one of the primary risk factors associated with the development. A large proportion of the turbines are located along the crests of the taller dunes at the site and these areas are identified as being particularly vulnerable to wind erosion due to their elevated, exposed position and the unconsolidated, loose nature of the sand in these areas. The loose sand is also identified as potentially preventing construction and service vehicles from being able to navigate the site and at least some of the roads at the site will probably need to be surfaced or compacted in some way. Due to the high risk associated with wind erosion at the site it would require specific and dedicated

mitigation. As specialized knowledge in this regard is required, a contractor with experience of rehabilitation measures appropriate along the West Coast should be contracted to perform rehabilitation and wind erosion control at the site during the construction phase. Translocation of established plants from areas to be cleared to sites where vegetation needs to be reestablished is recommended as a mitigation and rehabilitation strategy.

A summary of the pre-and post-mitigation significance rating for the different impacts identified in the assessment is provided below. All impacts are negative.

Phase	**Impact**	**Significance Pre Mitigation**	**Significance Post Mitigation**
Construction	Destruction & Loss of Vegetation	Moderate	Minor
	Protected Plant Species	Moderate	Minor
	Faunal impacts – Construction Disturbance	Moderate	Minor-Moderate
	Faunal Impacts – Hunting & Illegal Collection	Minor-Moderate	Minor
Operation	Erosion Potential	Moderate-High	Minor
	Alien Plant Invasion	Minor-Moderate	Minor
	Hunting and Collecting of Fauna & Flora	Moderate	Minor
	Loss of landscape connectivity for fauna	Minor	Minor
	Impact on Critical Biodiversity Areas	Minor	Minor
Decommissioning	Inadequate rehabilitation	Moderate-High	Minor

1 BACKGROUND & SCOPE

G7 Renewable Energies (Pty) (G7) proposes to establish a wind energy facility in the Richtersveld, between Port Nolloth and Alexander Bay along the West Coast of the Western Cape Province. The proposed project is adjacent to the R382 and will be located on Rooibank (Farm 7/2), Witbank (6/2) and part of the remaining extent of Farm 1 (Re/1). The facility will consist of up to 75 wind turbines and will generate up to 225 MW of electricity which will be fed into the National Power Grid. An Environmental Impact Assessment (EIA) for the proposed development is required in terms of the EIA Regulations of 2006 under the National Environmental Management Act (NEMA) (Act No. 107 of 1998). This report contributes towards meeting these requirements and details the likely impact of the proposed development on the terrestrial ecology (terrestrial vertebrate and flora) of the Site.

The broad terms of reference for the study provided to the consultant by ERM include the following aspects regarding the vegetation assessment:

- Conduct vegetation and plant species surveys noting conservation significance and status.
- Identify and map vegetation habitats in the study area, paying careful attention to conservation constraints, threatened species that exist or may exist in the project area.
- Indicate presence of any seasonal wetlands, rivers, streams, dams etc.
- Provide photos illustrating any conservation action or plant species that may need special attention.
- Produce a vegetation sensitivity map of the project area which will be used to inform the layout of project infrastructure.

In terms of the terrestrial fauna of the site, the following terms of reference were provided:

- A description of the occurrence and distribution of fauna (i.e. amphibians, reptiles and small-, medium- and large mammals) in the study area, which may be influenced by the proposed facility.
- The identification of Red Data species potentially affected by the proposed development.
- The identification of species-specific habitats in the study area, which may be influenced by the proposed development.
- An assessment of the potential impacts (positive, negative or cumulative if relevant) on fauna during the construction and operation of the proposed development.
- The identification of specific mitigating measures, for enhancing benefits and avoiding or mitigating negative impacts and risks, which should be implemented during design, construction and operation of the proposed development.
- The formulation of a simple system to monitor potential impacts, and their management, based on key indicators.

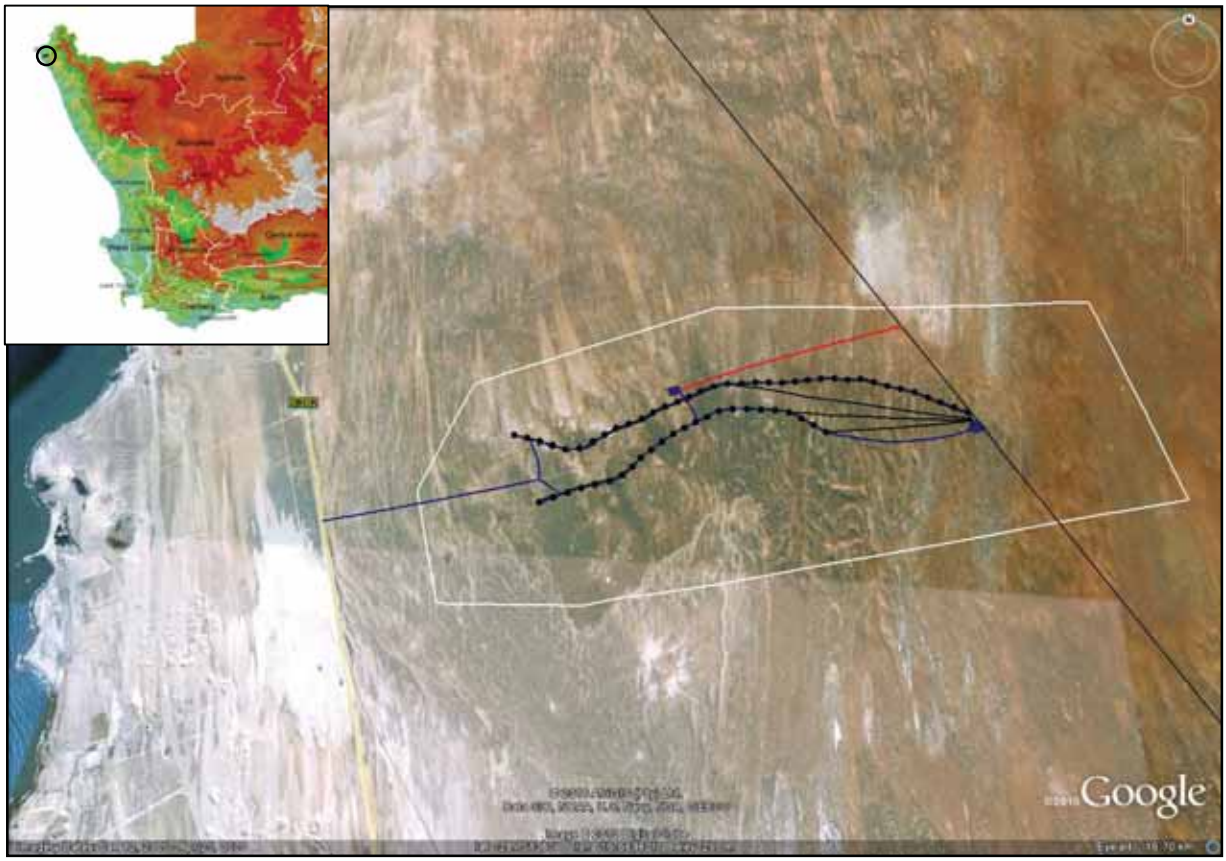


Figure 1. Location of the G7 Richtersveld Wind Farm site in relation to the regional context (inset) as well as the local environment as depicted by the Google Earth image. The indicative layout of the wind turbines and underground cables at the Site is illustrated. The black line traversing the site in a north-westerly direction is the existing 220 kV ESKOM transmission line.

2 *APPLICABLE POLICIES, LEGISLATION, STANDARDS AND GUIDELINES*

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.

Environmental 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.

The National Protected Area Expansion Strategy (NPAES) falls under NEMBA and is South Africa's national strategy for expansion of the protected area network. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. Focus areas for protected area expansion are identified in the NPAES. These are large, intact, unfragmented areas of high importance for land-based protected area expansion, suitable for the creation or expansion of large protected areas, which may occur formally as under proclaimed National Parks or less formally under various stewardship and private conservation arrangements. Development within NPAES areas is not recommended and where fine-scale conservation plans have been conducted, these areas are usually classified as CBAs.

NEMBA also deals with endangered, threatened and otherwise controlled species. 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). *Hoodia gordonii* was observed at the site and is listed under NEMBA as a protected species.

In terms of the above the following activities are restricted:

- Picking parts of, or cutting, chopping off, uprooting, **damaging or destroying, any specimen of a listed threatened or protected species**;
- Any other prescribed activity which involves a specimen of a listed threatened or protected species;

Certain activities, known as Restricted Activities, are regulated by a set of permit regulations published under the Act. 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:
i. the electricity output is more than 10 megawatts but less than 20 megawatts; or
ii. the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare.

Activity 11 (Xi): The construction of infrastructure or structures covering 50 square metres or more where where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.

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

Activity 12. The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation:
(b) Within critical biodiversity areas identified in bioregional plans;

Activity 13. The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, (Linear activities excluded) within:
(a) Critical biodiversity areas and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority.
(b) National Protected Area Expansion Strategy Focus areas.
(dd) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined.

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(d): 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. Within:

(bb) National Protected Area Expansion Strategy Focus areas;

(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;

Activity 19(d): The widening of a road by more than 4 meters, or the lengthening of a road by more than 1 kilometre. Within:

ii. All areas outside urban areas;

It is important to note that the above thresholds and activities also apply to phased developments "*where any phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold."*

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".*

No protected tree species were observed within or near the study area and it is highly unlikely that any protected tree species would be impacted by the development.

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. This legislation is relevant as the disturbance associated with the development is likely to encourage the invasion of alien plant species on the site.

3 METHODOLOGY

3.1 APPROACH AND ASSESSMENT PHILOSOPHY

The vegetation (botanical) and terrestrial ecology assessment was conducted according to the ToR provided by ERM and the guidelines and principles for biodiversity assessment provided by Brownlie (2005), De Villiers et al. (2005) and CapeNature. These include the following:

1. A description of the broad ecological characteristics of the site and its surrounds in terms of patchiness, patch size, relative isolation, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.
2. In terms of biodiversity pattern, the following will be identified and described where appropriate:

   Community and ecosystem level

   - The main vegetation types, their aerial extent and interaction with neighbouring types, soils or landforms;
   - The types of plant communities that occur on and in the vicinity of the site.
   - Threatened or vulnerable ecosystems (With reference to Mucina and Rutherford (2006) and the NSBA (Driver *et al.* 2005).

   Species level

   - Species of Conservation Concern (Red Data Book species), of both flora and fauna.
   - The viability of and estimated population size of the RDB species that are present (including the degree of confidence in prediction based on availablitiy of information and specialist knowledge (High=70-100% confidence, Medium 40-70% confidence, low 0-40% confidence).
   - The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (including the degree of confidence).

   Other pattern issues

   - Any significant landscape features or rare or important vegetation/faunal 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.
3. In terms of biodiversity process, the following will be identified or described:
   - The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire and grazing.
   - Environmental gradients (e.g. upland-lowland), biome boundaries, soil interfaces or sand movement corridors on the site or in its vicinity.

- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- The condition and functioning of rivers and wetlands (if present) in terms of: possible changes to the channel, flow regime and naturally-occurring riparian vegetation.

In addition the Assessment will include:

- 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 facility.
- A description and evaluation of the environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified.
- The nature and the extent, of the impact.
- A statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts.
- "Red Flag" any sensitive or no-go areas within the broader study area which could influence the siting of the infra-structure.
- Should potential conflicts arise, alternatives will be identified as far as the ToR allow.
- Ecological opportunities and constraints will be identified, which may include mitigation measures and offsets to reduce the ecological impact of the development.
- Recommendations for future management actions and monitoring.

3.2 FIELD SAMPLING & ASSESSMENT METHODOLOGY

The Site was visited over two full days on the 1st and 2nd of November 2010. During this time as much of the site as possible was reconnoitered using the available roads and tracks. However, not all areas were easily accessible by vehicle and so inaccessible areas were also hiked and sampled on foot. Sample sites were identified beforehand based on a stratification of the satellite imagery of the site, and then refined in the field to ensure that no environments or habitats were overlooked or under-sampled. At each site sampled, all plant species present were identified and recorded. In addition, photographs of significant features were taken at each sample site and any sensitive habitats such as wetlands and unique edaphic environments were identified and noted in the field and recorded on a GPS and printed maps of the satellite imagery of the site. In addition, at each site sampled, the environment was assessed in terms of the different habitats present and the likely presence of species of conservation concern as well as the potential impact the development is likely to have on the habitats and species present. The dominant ecological processes operating at the site were identified in the field and the manner in which these may be disrupted by the development noted. Where appropriate, different development alternatives such as the various substation options were investigated and compared in the field so as to ascertain the most ecologically suitable alternative.

All terrestrial vertebrate fauna directly or indirectly observed at the site were noted and certain habitats such as rocky outcrops or wetlands were specifically searched for reptiles and amphibians. Furthermore, the likely occurrence, based on the availability of suitable habitat, of species of conservation concern known to or potentially occurring in the area was assessed. In particular, a

number of species associated with the coastal corridor are known to occur in the area and may occur at the site based on its proximity to the coastline.

An ecological sensitivity map of the site was produced by integrating the above information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases (SIBIS, BGIS). 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, usually for agricultural purposes. These areas represent opportunities for development since they have low biodiversity value and the impact of development within these areas will generally be low. No Low Sensitivity areas were however mapped as no transformed areas were present at the site.
- **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 are can be developed with relatively low ecological impact provided that suitable mitigation and amelioration 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. Development within these areas is undesirable and should proceed extremely cautiously. Extensive mitigation measures may be necessary to reduce the ecological impact of development within these areas to an acceptable level.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These are essentially no-go areas from a development perspective and any direct or indirect impacts to these areas should be avoided at all costs.

The approach along with the ecological basis underlying the final classification of the sensitivity map produced is outlined below.

- The broad habitat units identified in the field were mapped based on the field data and mapping a well as the satellite imagery of the site. Any other habitat features such as the granitic outcrop were also mapped based on the geological maps of the area and augmented by the field data. Significant faunal habitats were also mapped where these did not coincide with an already mapped feature.
- Although no wetlands or clearly developed drainage lines were observed during the site visit, the potential presence of such features was also checked on satellite imagery of the site to ensure that no features had been overlooked.
- Thereafter, any other Very High Sensitivity areas associated with specific physical environments were identified and mapped. This includes rocky outcrops, quartz patches, steep slopes and southern aspects which are known to contain high biodiversity and also represent potential refuge areas under climate change.

- Any transformed areas present were then identified and mapped from the satellite imagery aided by the data and notes collected in the field. However, as no transformed areas were observed at the site, none were actually mapped.
- The sensitivity of each unit thus identified was then assessed based on the plant and faunal species recorded within each unit in the field as well as the ecological function each unit is likely to perform within the broader landscape.
- Species-specific information was incorporated into the map by including any known distribution data of listed plant and animal species in the area. Units known or highly likely to contain listed species were classified as High Sensitivity if they weren't already so ranked.
- General faunal information was incorporated into the map by including the habitat requirements of listed terrestrial vertebrate species.
- Finally, local and broad-scale ecological processes were captured. Local processes include the presence of upland-lowland gradients, movement corridors and habitat linkages. Broad-scale ecological processes include migration and dispersal corridors as well as broad-scale habitat linkages for climate change mitigation.

Following the identification of the different ecological features of the site, the lists of mammals, reptiles and amphibians observed at the site were augmented with species likely to occur in the area based on distribution records from the literature. Sources consulted include Branch (1988, 2001), Friendmann and Daly (2004) Marais (2004), Alexander and Marais (2007), Du Preez and Carruthers (2009), Skinner and Chimimba (2005) and spatial databases (SANBI's SIBIS and BGIS databases). The lists provided are based on species which are known to occur in the broad geographical area as well as an 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 (2010) 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.

3.3 LIMITATIONS AND ASSUMPTIONS OF THE STUDY APPROACH

Assessments such as the current study are conducted under stringent time constraints which introduce a number of potential shortcomings which should be acknowledged:

- **Limited Spatial Coverage:** As the site is extensive, remote and rugged, not all parts of the site could be visited during the site visit. Ideally, all parts of the site that will be directly affected by the development should be assessed in the field. In order to combat this limitation and adhere to the precautionary principle, additional precautionary measures and field-based activities during the construction phase may be recommended.
- **Narrow temporal window:** Ideally the site should be visited repeatedly to ensure that the full complement of species present is captured. However this is seldom possible with the consequence that the occurrence of many species is based on the literature, the content of various spatial databases or reports by residents or the landowner. The use of literature sources and databases also introduces some bias into the process, since many remote locations have been very poorly sampled for most groups of plants and animals and so the lists generated using these sources may under-represent certain groups of organisms and in particular rare species. In cases where rare or endangered species are involved, a greater degree of certainty is desirable and follow-up surveys may therefore be required or recommended.
- **Taxonomic scope:** A comprehensive faunal survey would examine all fauna, not only the terrestrial vertebrate fauna (this study), birds (separate specialist study), and bats (separate specialist study). There may be important invertebrates present that will be overlooked.
- **Limited expertise:** ideally all aspects of the ecology of the site should be assessed simultaneously and in an integrated fashion. In most cases, the biological component is covered by several separate specialist reports, with the consequence that certain interactions, issues and impacts may be overlooked.

In the current study, the major potential limitations of the study are the narrow temporal window and inaccessibility of the site. It was summer during the time of the site visit with the consequence that most of geophytes and annual species which occur in the area were not visible. The perennial grasses, shrubs and succulents were however largely readily identifiable at the time and the overall vegetation patterns observed are therefore likely to be representative. The inaccessibility of the site is to some extent addressed by the biophysical approach to assessing the sensitivity of the site. The precautionary principle is further applied in that preconstruction surveys of the turbine sites is recommended in order to avoid impacts on listed species and rare edaphic habitats.

3.4 RELEVANT ASPECTS OF THE PROPOSED DEVELOPMENT

According to the information provided to the consultant, the development of the site as a wind farm will involve the following activities and the construction of the following infra-structure as follows:

Wind Turbines

- There will be up to 75 wind turbines on the site.
- The turbines will be approximately 100 m high (to the turbine hub), with a blade diameter of approximately 90—117 m.
- Each turbine will have a concrete foundation at its base. The foundation will be approximately 20 m x 20 m backfilled or 5m x 5m protruding.
- There will be a gravel hard standing area adjacent to each turbine (approximately 2500 m^2) that will be used during construction and maintenance activities.
- Each turbine will be accompanied by an electrical transformer.

Access Roads

- The site will be accessed via the R382, and the existing access road to the Telkom communications mast will be upgraded.
- Existing farm tracks will be up-graded and new gravel roads will be constructed within the site to facilitate movement of construction and maintenance vehicles.
- Site access roads will be up to 12 m wide with drainage trenches adjacent to the road.
- Some existing public roads may need to be upgraded to facilitate the transport of the turbines and other construction materials to the site.

Additional Infrastructure

- An office and storage building with security and ablution facilities will be constructed on the site.
- A permanent wind measuring mast of up to 80 m will be erected to monitor wind conditions.
- Site fencing will be erected as required.

Electrical Connections

- The turbines will be connected to each other via medium voltage electrical cables which will be buried under the ground.
- A new substation will be built on the site. This substation will connect the facility to the National Power Grid Network via existing transmission lines.

A number of temporary activities will take place during construction of the wind farm. These will include:

- A temporary laydown area of up to 150 m x 20 m (hard standing) will be constructed for the storage of construction vehicles and materials.
- A temporary site compound will be created for the construction workforce.
- It is possible that borrow pits will be developed within the site (for production of construction aggregate). These will be backfilled as far as possible once construction is complete.

4 DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 TOPOGRAPHY, CLIMATE AND PHYSICAL ENVIRONMENT

The site lies adjacent to the R382, approximately 25 km south of Alexander Bay (Figure 1). The topography of the area is fairly flat and consists of numerous rounded hills and rolling dunes with intervening valleys and plains.

Rainfall in the area is extremely low and the annual rainfall is 50-70 mm. An important component of the climate system in the area and along the West Coast in general is the occurrence of coastal fog. The fog is biologically significant as it contributes to the water balance of many plants and animals in the fog zone and also serves to reduce the intensity of the summer heat and drought conditions along the coastline. Although such fog may occur as much as 50 km inland, the frequency and overall significance is related to the distance from the coastline. The area also experiences very high winds and sandblasting from the south, which has implications for the development and any activities which result in the loss or disturbance of the natural vegetation.

In terms of geology, the area is homogenous and consists largely of Quaternary sands and calcrete with occasional granitic outcrops of the Namibian group. Soils are mainly yellow, wind-blown sands of coastal origin which may occur as flat sand shields or as low "whale-backs" and steeper dunes. There is very little soil in some of the inter-dune areas and open plains of the site and the underlying calcrete is exposed in some of these areas. Around the granitic outcrops the soils are not mobile, contain a larger clay fraction and are characterized by the presence of heuweltjies. In some places, mobile sands from the adjacent areas overly the granite-derived soils around the outcrops.

4.2 VEGETATION

Broad-Scale Patterns

According to the vegetation map of Mucina and Rutherford (2006) the entire site falls within the Northern Richtersveld Yellow Duneveld vegetation unit. This vegetation type occurs as a band 5-25 km wide, east of the coastline, stretching over 45 km from south of Brandkaros to the Holgat river in the south. Richtersveld Coastal Duneveld occurs along the R382 to the south and along the first section of the access road to the site, but not within any areas that lie within the footprint of the development.

Northern Richtersveld Yellow Duneveld is dominated by succulent shrub species such as *Euphorbia burmannii*, *E.chersina*, *E.mauritannica*, *Othonna cylindrica*, *Aridaria serotina*, *Cephalophyllum ebracteatum*, *Cheirodopsis robusta*, *Didelta carnosa*, *Hypertelis salsoloides*, *Jordaaniella cuprea*, *Lampranthus hoerleinianus*, *Salsola tuberculata*, *Zygophyllum morgsana*. Common woody shrubs include *Asparagus capensis*, *Lebeckia cinerea* and *L.multifolia*. Mucina & Rutherford note that this unit is characterized by high beta diversity (species turnover from site to site) as a result of dune structures

with large differences between mobile and fixed sand areas. None of this vegetation is currently conserved and a small amount has been transformed for mining. Mucina and Rutherford (2006) state that no major threat to this vegetation type has been identified.

Plate 1. Looking out over the Northern Richtersveld Yellow Duneveld of the plains from the higher dunes of the site. Although the vegetation looks homogenous from a distance there is a large amount of turnover within the vegetation type based on subtle differences in soil type, which is typical of most Succulent Karoo vegetation types.

Local Drivers

Although the site falls entirely within Northern Richtersveld Yellow Duneveld, several different plant communities and habitats were discernable at the site and the vegetation composition of parts of the site resembles that of some of the surrounding vegetation types more closely than Northern Richtersveld Yellow Duneveld. This is related to the presence of rocky outcrops and tall dunes at the site, which do not commonly occur within Northern Richtersveld Yellow Duneveld. Overall, soil depth, texture and sand mobility appear to be the dominant drivers of vegetation composition at the site. Four distinctive habitats with associated plant communities are recognized at the site, these are described in detail below.

Granite Outcrops

The granite outcrop comprises the hill towards the western extent of the site where the Telkom communications tower is located. Parts of the lower slopes have been covered by wind-blown sand and the vegetation of these areas resembles the dunes rather than the rest of the hill. A relatively small

amount of rock is actually exposed and the majority of this unit comprises the non-mobile soils of the hill itself. The rocky outcrop is considered a sensitive environment due to the novel habitat it contributes and the unique vegetation associated with it. Common species associated with this habitat include succulent and woody shrubs such as *Zygophyllum cordifolium*, *Tylecodon reticulatus*, *Sarcocaulon patersonii*, *Psilocaulon absimile*, *Brownanthus arenosus*, *Othonna cylindrica*, *Mesembryanthemum guerichianum*, *Euphorbia burmannii*, *Salsola tuberculata*, *E.chersina* and *Crassula columella;* the grasses *Schismus barbatus* and *Dregeochloa pumila*. Listed plant species that were observed within this habitat include *Crassula brevifolia* subsp. *psammophila* and *Crassula plegmatoides*, both of which are listed as Vulnerable.

Plate 2. Two views of the rocky granite outcrop which occurs north of the communications mast towards the western boundary of the site. The rocky outcrop and the surrounding area is classified as a sensitive habitat due to the listed plant species which occur here as well as the unique and restricted habitat it provides.

Sand Dunes

The sand dunes consist of both tall relatively steep dunes as well as low flat dunes, both types are well vegetated and are not mobile. The sand dunes comprise a large proportion of the site and the majority of the turbines are located within this habitat type. The vegetation associated with this habitat is generally taller than the other habitat types which can be ascribed to the deep sands associated with the dunes. This habitat type also contained a larger proportion of woody shrubs than the other habitat types. Common and dominant species include *Salvia lanceolata*, *Zygophyllum morgsana*, *Tetragonia fruticosa*, *Cladoraphis cyperoides*, *Othonna cylindrica*, *Stoeberia utilis*, *Cotyledon orbiculata*, *C.paniculata*, *Cephalophyllum ebracteatum*, *Asparagus capensis*, *A.retrofractus*, *Mesembryanthemum barklyi*, *Lycium cinereum*, *Lebeckia sericea*, *Searsia cf marlothii*, *Grielum grandiflorum*, *Didelta carnosa var tomentosa*, *Arctotis cf scullyi*, *Tripteris oppositifolia*, *Aloe arenicola*. This vegetation unit is considered High Sensitivity as a result of the steep nature of the dunes and the potential for wind erosion in disturbed areas.

Plate 3. Examples of the dune habitat. In the left image the dunes near to the existing Eskom 220 Kv overhead line. The dunes in this area are particularly tall and steep and the consultant had difficulty mounting the dunes in a four wheel drive bakkie, suggesting that construction vehicles will not be able to work in these areas without hardened roads. In the right image the vegetation typical of the dune crests is illustrated and is dominated by *Triperis oppositifolia*, *Stoeberia utilis*, *Zygophyllum morgsana* and *Othonna cylindrica*.

Plate 4. Example of the plains habitat, taken looking west towards the coast, where the two Boegoeberg mountains can be seen protruding above the near horizon. The vegetation of the plains tend to be more open than the dunes and was dominated by low and creeping species such as *Zygophyllum clavatum*, *Lycium decumbens*, *Euphorbia ramiglans* and *Brownanthus pseudoschilchtianus*.

Plains Habitat

The plains habitat occurs around the fringes of the site, and a small number (about 10) of the turbines are located within this habitat type. The vegetation composition of this habitat type had several dominant species in common with the granitic areas but also contained several species which distinguished it from the other habitats. There was also some differentiation within this habitat based on the depth and mobility of the sand overlying the calcrete. Common species within this habitat type that were less common or did not occur within other habitat units include *Zygophyllum clavatum*, *Lycium decumbens*, *Lebeckia spinescens*, *Salsola tuberculata*, *Pteronia glabrata*, *Euphorbia ramiglans*, *Brownanthus pseudoschilchtianus*, *Chrysocoma puberula* and *Atriplex vestita*. This appeared to be an important habitat type for fauna due to the stability of the substrate and a number of burrow systems were observed within this unit.

Coastal Belt

That part of the site which lies to the west of the Telkom tower appears to experience a greater occurrence and ecological expression of coastal fog. Although there were no distinct communities that could be identified, several species indicative of or associated with the coastal belt were observed in this area. This includes *Fenestraria rhopalophylla* subsp *aurantiaca* as well as *Dregeochloa pumila*, both of which are also highly localized species. The dunes in this area were also observed to be more mobile and there was greater evidence of wind blasting in this area as compared to the rest of the site.

Plate 5. Looking out from the hill near the telecommunications mast towards the coastline. The two Boegoeberg mountains can just be made out in the distant haze. This section of the site exhibited greater affinity with the coastline and coastal fog and wind appeared to play a greater role in this part of

the site. Due to a number of listed species associated with the coastal strip which may occur inland for a distance of up to 10 km, this area is classified as a sensitive environment.

Sensitive Habitats

There were no significant drainage lines visible at the site, which can be ascribed to the extremely low rainfall the area experiences. Run-on areas contained a greater density and stature of the vegetation, but there appeared to be little overall differentiation in species composition. The dunes contained the steepest habitat at the site, but due to the depth of the sand in these areas there is little or no run-off from the dunes. Some erosion was evident around the granitic areas, due largely to the roads and tracks which had captured overland flow and caused some superficial gulley erosion. Those parts of the granitic areas not overlaid with coarse wind-blown sand had hard soils with a very fine texture that were usually capped with a biological crust which may also impede infiltration and increase runoff from these areas. Therefore, apart from the rocky outcrop, there were very few specialized unique and localized habitats at the site that require specific action regarding the potential development of the site.

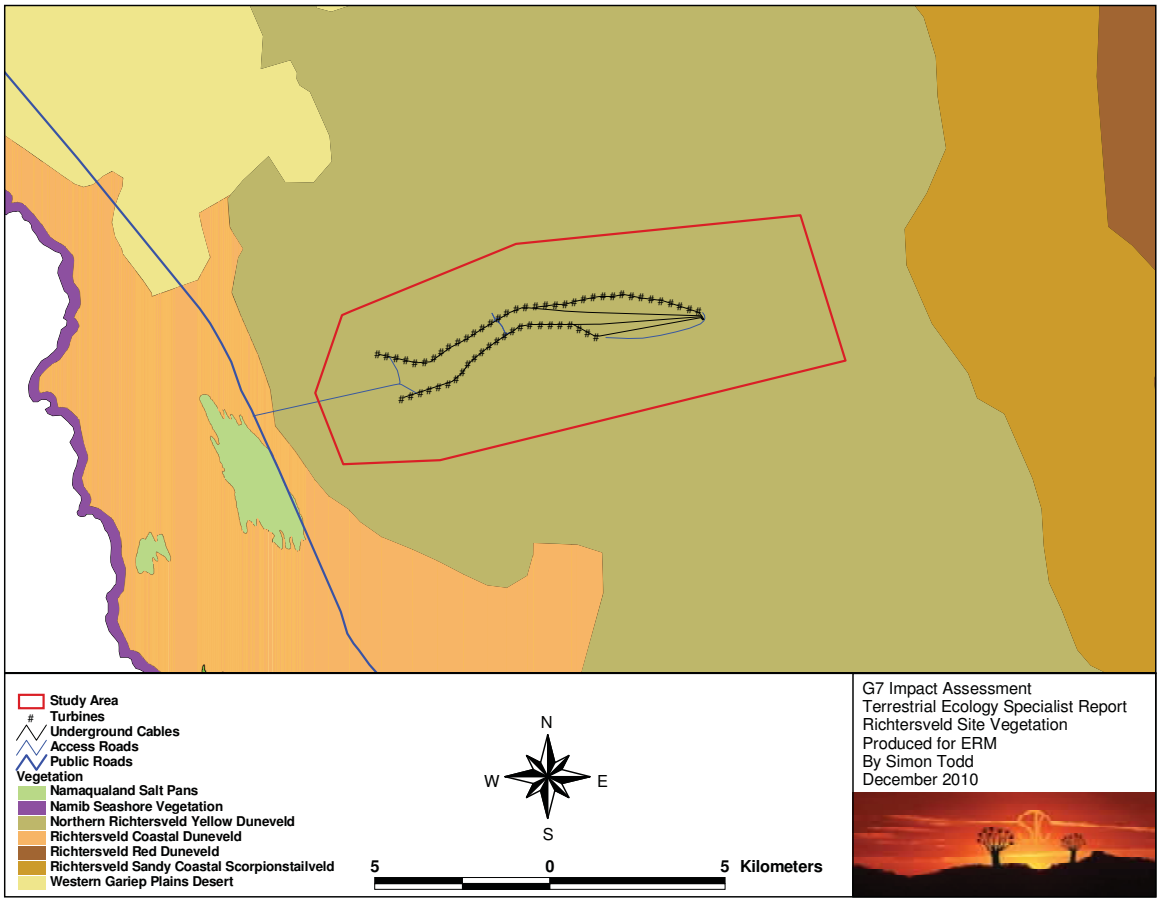


Figure 2. Overview of the major vegetation types in the broad area surrounding the G7 Richtersveld Wind Farm, as mapped by Mucina and Rutherford (2006), *Vegetation of South Africa, Lesotho and Swaziland*.

4.3 CRITICAL BIODIVERSITY AREAS

The site lies within the planning domain of the *Namakwa District Biodiversity Sector Plan* (Desment & Marsh 2008). District-wide biodiversity assessments such this are performed 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. Once gazetted, and incorporated into municipal SDFs and bioregional plans, such fine-scale plans are recognized under NEMA and the various activities listed under the act come into effect. The CBA map for the general area surrounding the site is depicted in Figure 3. The map indicates that while the coastal strip falls within a CBA, the site itself is not classified as a CBA. Although the development is outside the CBA, the existing access road which traverses a short (500 m) section of CBA will need to be upgraded and some loss of adjacent vegetation will occur. However, this is not likely to significantly impact the CBA given that a relatively large road is already present. Provided that the upgrade proceeds sensitively and the appropriate erosion control structures are put in place, the upgrade will not significantly impact the CBA or the local environment.

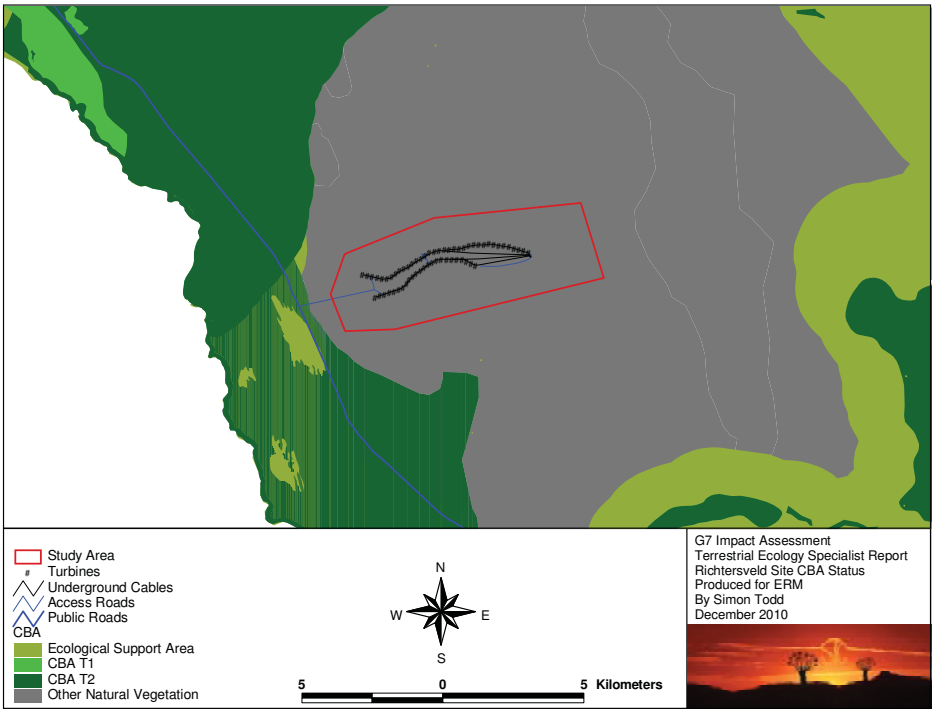


Figure 3. Critical Biodiversity Areas map of the proposed G7 Richtersveld Wind Farm and the surrounding area. The CBA map was produced as part of the *Namakwa District Biodiversity Sector Plan* (Desment & Marsh 2008). The various coverages constituting the map are available from the SANBI BGIS website.

4.4 CURRENT STATE OF THE ENVIRONMENT

In terms of the current land use, the site is used exclusively for extensive livestock grazing with sheep and goats. Due to the low rainfall, there is no cropping or intensive agriculture in the area. As the area is a communal rangeland, it is used by a number of pastoralists who herd their livestock during the day and bring them back to a kraal for shelter and protection from predators at night. Each pastoralist makes use of several such sites and moves from one to the other according to the available forage and other needs such as water availability. There are no fences which restrict livestock movement and the rangeland is open access to all pastoralists who have user-rights (these are usually obtained by birth right). Areas close to the livestock posts showed greater evidence of livestock impact while areas that were far from any livestock posts showed little evidence of livestock grazing. In general, from an ecological perspective, the vegetation of the area can be considered to be in a fair to good condition.

4.5 FAUNAL COMMUNITIES

Due to the diversity of habitats and environments present, the site has a diverse and fairly rich faunal community.

Mammals

Approximately 40 mammal species potentially occur at the site (Appendix 2). Due to the relatively low diversity of habitats available, not all of these are likely to occur at the site. There is a paucity of rocky habitats at the site and larger mammals such as Klipspringer and Rock Hyrax associated with rocky outcrops are not likely to occur at the site. This effect would less significant for small mammals as they are able to make use of small outcrops such as occur at the site. Larger mammals common or likely to occur at the site include Steenbok *Raphicerus campestris*, Common Duiker *Sylvicapra grimmia*, Jackal *Canis mesomelas*, Caracal *Caracal caracal,* Porcupine *Hystrix africaeaustralis* and Aardvark *Orycteropus afer*. Due to the mobility and broad habitat tolerances of these species, they are not likely to be highly sensitive to the development of the area.

The site contains a diverse small mammal community and a relatively large number of rodents, shrews, moles and mole rats occur in the area. Common species observed within the site include Brants's Whistling Rat *Parotomys brantsii*, Namaqua Rock Mouse *Micaelamys namaquensis* and the Bush Vlei Rat *Otomys unisulcatus*. Species associated with sandy habitats are likely to occur in the dunes while those which require a firmer substrate are likely to occur in the granitic outcrops as well as on the plains. Several listed species potentially occur in the area, these include Grant's Golden Mole *Eremitalpa granti* which is likely to occur in the dunes of the site and De Winton's Golden Mole *Cryptochloris wintoni* which occurs in sandy areas of the Namaqualand coastal plain and may occur within the western parts of the site. Both of these species are listed as Vulnerable as a result of their scarcity and the impact coastal mining activities have had on their habitat.

Reptiles

As many as 73 reptiles may occur at the site, indicating that the area has a very high reptile diversity. The reptile fauna is potentially composed of 4 tortoise species, 24 snakes, 30 lizards and skinks, two chameleons and 13 geckos. This indicates that the area is particularly rich in snakes, lizards and skinks. Common species observed during the site visit include Smith's Desert Lizard *Meroles ctenodactylus* (pictured title page), Peers Girdled Lizard, *Cordylus peersi* and the Spotted Desert Lizard *Meroles suborbitalis*.

Eight species of conservation concern may occur in the area (Table 1), all of which are listed as Vulnerable or Near Threatened. Of these, species likely to occur at the site include the Namaqua Dwarf Adder, Lomi's Blind Legless Skink, Namaqua Plated Lizard and the Namaqua Day Gecko. The species associated with dunes or sandy habitats are likely to be most affected by the development, this includes the Namaqua Dwarf Adder and Lomi's Blind Legless Skink. Most of the other species are associated with rocky outcrops or stony hillsides, which are restricted in extent at the site. The site falls within the range of the little-known Fisk's House Snake *Lamprophis fiskii* which is listed as Vulnerable and has usually been recorded in karroid sandy areas. This species may therefore occur within the site. The Armadillo Girdled Lizard and Namaqua Day Gecko are associated with rocky outcrops and it is therefore not likely that these species will be directly affected by the development which is likely to avoid the few rocky areas at the site. The Namaqua Plated Lizard may be more common than believed (Alexander & Marais 2007), and occurs in karroid succulent veld where it digs burrows at the base of shrubs. This species is therefore likely to be widespread at the site and since it is not strictly dune dwelling, is more likely to occur within the plains habitat which will not be highly impacted by the development.

Tortoises were relatively abundant at the site and several Angulate Tortoises, *Chersina angulata* were observed. Tortoises may be negatively impacted by the development as they are vulnerable to collisions with motor vehicles and predation by avian predators while traversing open areas. Attractive species such as tent tortoises (*Psammobates tentorius*) are also vulnerable to collection for use as pets or trade, and the increased accessibility resulting from the new roads that will be constructed as part of the development would raise the risk for these species.

Table 1. Reptile species of conservation concern which may occur at the G7 Richtersveld Wind Farm.

Scientific Name	Common Name	Distribution	Status	Habitat
Homopus signatus	Speckled Padloper	Endemic	Near Threatened	Ridges and stony areas, often on plateaus and ridges
Lamprophis fiskii	Fisk's House Snake	Endemic	Vulnerable	Karroid sandy veld, but few specimens from widely scattered localities
Bitis schneideri	Namaqua Dwarf Adder	Narrow Endemic	Vulnerable	Semi-stable, vegetated coastal dunes
Typhlosaurus lomiae	Lomi's Blind Legless Skink	Endemic	Vulnerable	Sandy soils in succulent veld
Gerrhosaurus typicus	Namaqua Plated Lizard	Endemic	Near Threatened	Karroid succulent veld
Cordylus cataphractus	Armadillo Girdled Lizard	Endemic	Vulnerable	Rock outcrops and mountain ranges
Cordylus lawrenci	Lawrence's Girdled Lizard	Narrow Endemic	Near Threatened	Suculent karroid veld
Phelsuma ocellata	Namaqua Day Gecko	Endemic	Near Threatened	Boulder strewn hillsides and rocky

outcrops

Amphibians

The site lies within the known distribution range of seven frog and toad species. However, as a result of the scarcity of fresh water in the area, only three or four are likely to occur at the site. Species such as the Common Platanna *Xenopus laevis*, Namaqua Stream Frog *Strongylopus springbokensis* and to a lesser extent the Namaqua Caco *Cacosternum namaquense* are dependent to a greater or lesser degree on surface water for habitat or breeding purposes. The remaining species are either largely independent of water (*Breviceps* spp) or well adapted to arid conditions (*Vandijkophrynus* spp.). The Desert Rain Frog *Breviceps macrops* occurs in Strandveld vegetation up to 10 km from the coastline and is listed as Vulnerable. Since the site is less than 10 km from the coast and several other indicators of coastal affinity were observed at the site, it is likely that this species occurs along the western boundary of the site, as far east as the communications mast at least. As there are no wetlands at the site, there do not appear to be any specific areas that are important for amphibians. Nevertheless, for those species which require surface water at least for breeding purposes, any areas where standing water may occasionally gather for a few weeks at a time would be important. Amphibians are 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 of the site is depicted in Figure 4 below. Based on the indicative turbine locations provided, 10 turbines are located within areas classified as Very High Sensitivity, 36 within High Sensitivity, and 14 within Moderate Sensitivity areas. The turbines within the Very High Sensitivity areas are those which are located on the granitic outcrop as well as those on the western, coastal side of the outcrop. Development within these areas should be minimized or avoided as far as possible due to the sensitive nature of this area and potential negative impacts the development might have on the listed species which occur in this part of the site. The turbines within the Moderate Sensitivity areas are those on the lower slopes of the dunes and on the plains. Although the risks associated with development in these areas are the lowest within the context of the site, the lower lying nature of these areas probably means that these are also sub-optimal for the placement of the turbines. The remainder of the turbines are within the dunes which are classified as High Sensitivity. Although the vegetation of the dune areas is not intrinsically more sensitive than any of the other habitats, the sandy substrate makes these areas vulnerable to disturbance within the context of the aridity and high winds which characterize the West Coast. The overall implications of the sensitivity map include that fact that the site is generally a sensitive environment in terms of vulnerability to disturbance and also that there appear to be few options with regards to finding alternative lower sensitivity placements for the turbines.

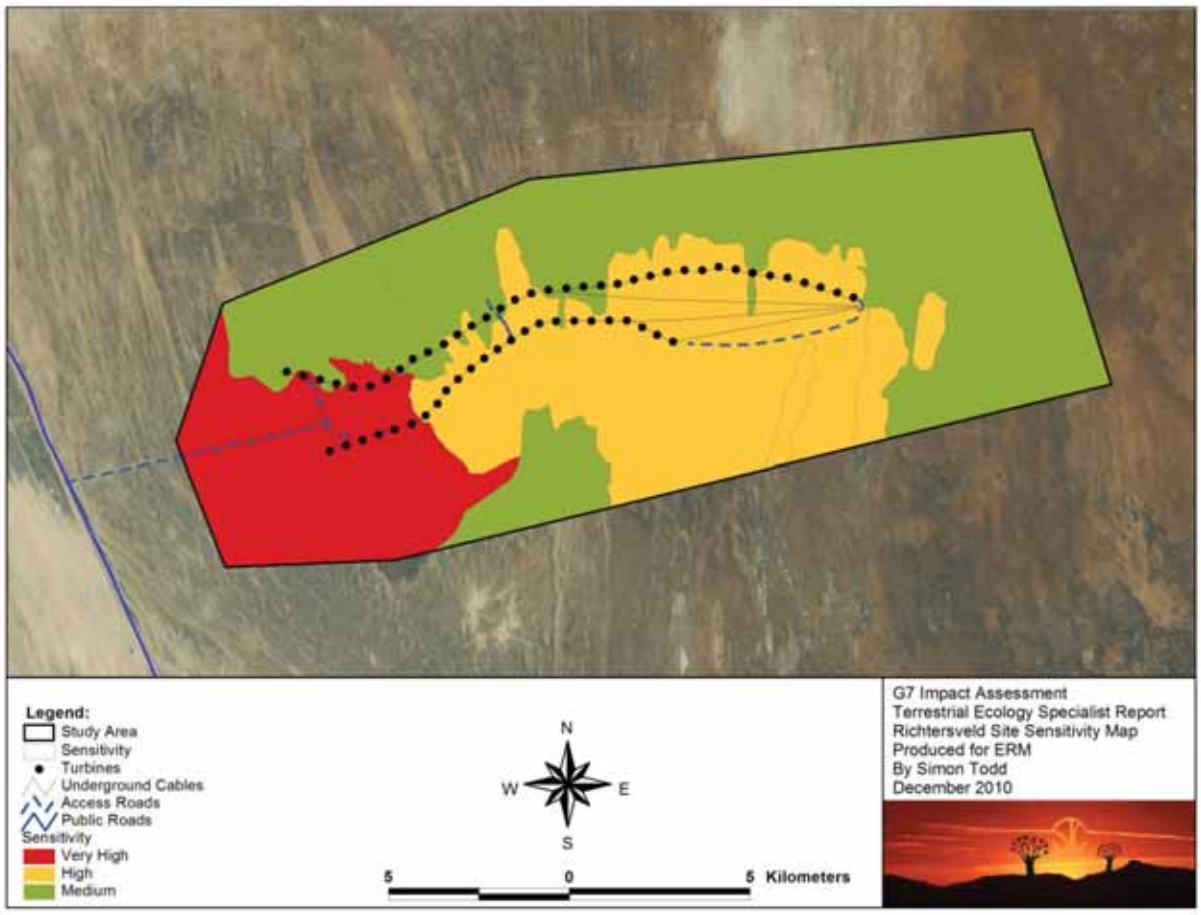


Figure 4. Sensitivity map of the G7 Richtersveld wind farm with the turbine locations depicted. The western portion associated with a granitic outcrop and the coastal corridor is considered Very High Sensitivity. The remaining High Sensitivity areas are largely stabilized, vegetated dunes, while the adjacent plains are considered Medium Sensitivity. There are no transformed areas which would be considered low sensitivity present within the study area.

5 IDENTIFICATION OF RISKS AND POTENTIAL IMPACTS

The likely impacts on the terrestrial ecology of the site resulting from the development of the Richtersveld Wind Farm as a wind energy facility are identified and assessed below according to the different phases of the project. The major risk factors and contributing activities associated with the development are identified and briefly outlined and summarized below before the impacts are assessed.

Destruction and Loss of Vegetation Cover

The development of the site will require the construction of a road network as well as lay-down and service areas for the turbines. The full 75 turbines would require an area of approximately 19 ha for the turbine foundations and hard standing areas. The amount of transformation resulting from road construction is similar and about 20 km of new roads would be required which would result in the transformation of about 16 ha of currently intact vegetation. There would also be some additional transformation resulting from temporary activities such as a construction camp and temporary lay-down area. The total loss of habitat would however amount to less than 1% of the study area. Nevertheless if this loss takes place within sensitive areas, significant impact could occur.

Impacts on Listed Plant Species

A number of listed plant species were observed at the site and would potentially be negatively affected by the development. As described in *Section 4.2* a number of these are restricted to the rocky outcrop and surrounding granitic area and provided that this area is avoided, then the potential impact on these species would be largely mitigated. Listed plant species which occur in the dunes are to some extent buffered from impacts as the dune habitat is fairly homogenous and such species are likely to have a wider distribution within the site. Furthermore, there are no Critically Endangered plant species which occur at the site and so the probability of the development impacting the viability of local or regional populations of any species is very low.

Direct Faunal Impacts

The development of the site would directly impact the fauna of the site in several different ways. Firstly, there would be a large amount of noise and disturbance associated with the construction phase. This would frighten many of the larger mammals away from the area and would probably cause increased mortality among these individuals as they would have to move into sub-optimal habitat or compete with other individuals for new territories. This effect would be transient and affected species would be able to return once construction has been completed. However, the presence of the turbines may deter sensitive species from returning or would require some time for them to become habituated to their presence. Secondly, the transformation of intact vegetation would constitute habitat loss and fragmentation for fauna. Given the limited extent of transformation of the site and the limited land requirement of the development relative to the extent of available intact habitat, the direct loss of habitat would be minimal for most faunal species. Provided that the rocky outcrop and coastal zone is not impacted, there do not appear to be any species which would be significantly impacted by the direct loss of habitat. Fragmentation poses a greater threat as some species may avoid open areas or become vulnerable to predation while traversing open ground. Slow moving reptiles and rodents would be particularly susceptible to this impact. The presence of a construction workforce would also increase the risk of poaching during the construction phase of the project. Smaller antelope such as Duiker and Steenbok would probably be the most vulnerable. As with listed plant species, the illegal collection of

tortoises and other reptiles for food, pets or trade would be an increased risk associated with the development. Attractive species such as the Tent Tortoise would be particularly at risk. The large amount of machinery and construction material present at the site during the construction phase would pose a pollution risk that could negatively affect local amphibian populations should any spills occur. Traffic at the site during all phases of the project would pose a risk of collisions with fauna. Slower groups 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.

Erosion

Erosion is probably the greatest potential impact associated with the development. It is important to recognise that this risk stems from wind and not water erosion. Therefore, the risk is not directly related to the steepness of the affected area or to rainfall and the measures usually used to combat water erosion are largely unsuitable for wind erosion. However, as with water erosion, vegetation cover plays a preeminent role in limiting the vulnerability and likelihood of erosion. The impacts and problems associated with wind erosion are clearly illustrated by the measures put in place to limit wind erosion around mining rehabilitation sites in the area. The disturbance created by the roads and turbine lay-down areas would render the affected highly vulnerable to wind erosion and mitigating measures would need to be taken to ensure that wind erosion is minimised. The dune crests where a large number of the turbines are located would be particularly vulnerable to wind erosion due to their exposed position and the deep, unconsolidated sands which are likely to occur in these areas. As the sand in these areas is very loose, repeated vehicle traffic would also cause problems due to the sand that would be dislodged each time a vehicle passed.

Wind erosion in previously stable dunes is problematic because once it has been initiated, the presence of vegetation may not be sufficient to arrest the erosion and the impact occurs both in the areas where the sand is being eroded as well as where it is being deposited as it smothers plants which are not adapted to mobile sand. Due to the loose unconsolidated nature of the sand in the dunes, the access roads and service pads associated with the turbines would probably need to be surfaced or compacted in some way to cover the sand and prevent wind erosion of these areas and maintain them in a navigable condition. Alternatively, those areas that do not require a compacted surface would need to be rehabilitated with plant cover during the construction phase.

Alien Plant Invasion

The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion. Since the site is currently hardly impacted by alien plants, this could potentially have a large impact on the site. Some alien invasion is inevitable and regular alien clearing activities would be required to limit the extent of this problem. The site will become less vulnerable to alien plant invasion over time, but the roadsides and turbine service areas are likely to remain foci of alien plant invasion.

Impacts on Critical Biodiversity Areas

As previously discussed, there are a number of large Critical Biodiversity Areas in the area. However, the site itself does not fall within a CBA and the potential of the development to impact the surrounding CBAs is low. The majority of the impacts associated with the development are likely to be local in nature and so the off-site effects of the development will be low and there do not appear to be any significant implications for the surrounding CBAs.

Cumulative impacts

There are a number of other wind farm developments in the broad area and the potential cumulative effect of these should be considered as the combined presence of several wind farms may disrupt broad-scale ecological processes such as dispersal and migration as well as prevent conservation targets for certain vegetation types being reached.

Contributing Activities

The above risk factors are in turn caused by or related to the following major activities which will be associated with the development of the site as a wind energy facility:

- Vegetation clearing for roads, lay-down areas, turbines etc.
- Construction activities including noise, pollution etc.
- Vehicle activity during and after construction
- Human activity during and after construction
- The excavation of borrow pits
- The laying of underground cables or overhead transmission lines

6 IMPACT ASSESSMENT

6.1 CONSTRUCTION PHASE

The major impact associated with the development will occur during the construction phase of the project. The major impacts at this stage will be the loss of natural vegetation and transformation and disturbance of natural ecosystems at the site. The presence of a sizeable construction workforce at the site also poses several risks, as does the operation and presence of construction machinery. In general, the major impacts associated with the construction phase of the development can be summarized under the following areas of impact which are discussed and assessed in more detail below.

- Destruction and Loss of Vegetation
- Direct Impact On Plant Species of Conservation Concern
- Direct Faunal Impact
- Loss of Faunal Habitat

Prior to the commencement of construction at the site, the following mitigation measures should be taken to reduce the overall impact of the development.

- An Environmental Control Officer (ECO) should be appointed. The responsibilities of the ECO should include monitoring and reporting as well as ensuring that the development takes place within the guidelines provided in this and the other specialist reports.
- Compile a monitoring schedule for the site based on the monitoring recommendations of this and the other specialist reports.
- The final layout of the development should be assessed in the field prior to the commencement of construction activities so that the exact placement of the turbines can be adjusted to avoid potentially sensitive areas.
- The location of borrow pits and any other infrastructure or major activity not specifically dealt with in the EIA phase should be assessed in the field prior to construction to ensure that suitable sites are identified.

Impact 1

Impact 1. Destruction & Loss of Vegetation

Nature: The construction phase will require the construction of access roads as well as the clearing of vegetation for the turbines, their service areas and for buildings and temporary construction areas. Apart from the direct loss of vegetation, this will also render the disturbed areas vulnerable to erosion.

Impact Magnitude – Low-Moderate

- Extent: Local, the extent of the impact will be limited to the development footprint and near surroundings. Erosion may however also affect adjacent and downstream areas. As discussed above the footprint of the development in terms of direct habitat loss will be less than 40 ha.
- Duration: The duration of the impact will be long-term as the majority of impact will remain until the project is decommissioned.
- Intensity: Since this results in the total loss of vegetation within affected areas, the intensity is seen to be **Moderate**.

Likelihood: As this infrastructure is required for the operation and construction of the facility, this impact will definitely occur.

Impact Significance: Moderate (-ve)

Degree of Confidence: High. Based on the project description, this impact will definitely occur.

Mitigation:

- Areas to be cleared should be clearly demarcated.
- Vegetation should only be cleared when and where absolutely necessary. If possible a vegetative cover should be left in place. It is preferable to mow the vegetation down to the required height than to use other more destructive clearing methods such as grading.
- Where construction vehicles must traverse the site, they must remain on demarcated roads. If vehicles must leave the road for construction purposes, they should utilize a single track and should not take multiple paths.
- Where construction does not require the clearing of the vegetation, for example for the temporary lay-down areas, then construction should occur without clearing the vegetation as far as possible. No temporary lay down areas should be located within the dunes habitat, but should rather be located on the plains which are likely to recover more quickly and with less long-term impact from disturbance
- If topsoil must be removed from an area during construction, it should be replaced or used as soon as possible elsewhere as it will contain seed of local species which will aid the natural recovery of the vegetation.
- Appropriate erosion control structures should be constructed at the same time as the vegetation is cleared so that the loosened soil is not left vulnerable to wind erosion. Such structures usually consist of shadecloth barriers orientated perpendicular to the dominant wind direction.

Impact 2

Impact 2. Impact on Plant Species of Conservation Concern

Nature: The construction phase will require the clearing of vegetation in areas which were observed to contain listed plant species. The local populations of these species will therefore be impacted unless mitigation measures are implemented.

Impact Magnitude - Moderate

- Extent: **Local**. The extent of the impact will likely remain local as there are no highly threatened plant species which may be impacted on a broader regional basis. Furthermore, the extent of habitat for some of the listed species is highly restricted, suggesting that the site does not contain large populations of regional significance of such species.
- Duration: The duration of the impact will be **long-term** as the habitat will be unavailable to these species until the project is decommissioned.
- Intensity: Since this would result in the destruction of listed plant species within the affected areas, the intensity is seen to be **Moderate-High**.

Likelihood: Protected plant species were observed within the development footprint indicating that this impact will occur.

Impact Significance: Moderate (-ve) unless mitigation measures are implemented.

Degree of Confidence: Definite, the listed species were observed to occur at the site and within areas that are within the development footprint.

Mitigation:

- Since a large proportion of the listed species at the site are associated with the coastal strip and the granitic outcrop, this area which has been mapped as Very High Sensitivity should not be developed. This would require dropping or relocating at least 10 of the turbines and probably re-routing or relocating some of the other infrastructure such as the underground cabling to avoid excessive disturbance in this area.
- As many of the listed species are geophytes and succulents, the potential for successful translocation is high. Therefore, it is recommended that before construction commences individuals of listed species within the development footprint should be marked and translocated to similar habitat outside the development footprint under the supervision of an ecologist or someone with experience in plant translocation. Permits from the relevant provincial authorities will be required to relocate listed plant species.

Impact 3

Impact 3. Direct Faunal Impacts Due To Construction Disturbance

Nature: The construction phase will result in a lot of physical disturbance at the site as well as habitat destruction for resident faunal species. This will result in direct mortality for smaller fauna unable to move away from the construction activities and a loss of faunal habitat in general. The human activity and noise generated by the construction will also frighten most medium and larger fauna away from the construction area.

Impact Magnitude - Moderate

- Extent: **Local**, the extent of the impact will be limited to the site and near surroundings.
- Duration: The duration of the impact will be **short term** or as along as construction is underway. The impact with regards to habitat loss is considered part of the operational phase.
- Intensity: The large amount of activity at the site and the associated disturbance resulting from clearing and construction will constitute a **Moderate** disturbance intensity.

Likelihood: There is a very high likelihood that this impact will occur in and around construction areas.

Impact Significance: Moderate (-ve)

Degree of Confidence: Definite. Based on the project description, this impact will occur to a greater or lesser extent.

Mitigation:

- Any slow-moving fauna, such as tortoises or snakes observed at the site during the construction phase should be removed to safety by the ECO.
- In order to reduce collisions of vehicles with fauna, speed limits should apply to all roads and vehicles using the site, a maximum of 40 km/h is recommended. Animals should have right of way.
- All cleared areas which do not need to remain clear of vegetation should be rehabilitated or seeded with local species if natural recovery does not take place within a year of being cleared.

Impact 4

Impact 4. Direct faunal impacts due to poaching/hunting/poisoning

Nature: A significant number of construction workers will be on site during the construction phase posing a risk to fauna as a result of poaching and hunting of fauna for food or other purpose. Vulnerable species would include Tent Tortoises *Psammobates spp.* as well as mammals such as Steenbok, Duiker and hares (*Lepus* spp).

Impact Magnitude - Moderate

- Extent: **Local**, the extent of the impact will be limited to the site and near surroundings.
- Duration: The duration of the impact will be **short-term** or as along as construction is underway.
- Intensity: As this impact will be concentrated on a few targeted species, the impact on these species could be of **high intensity**.

Likelihood: There is a high probability that this would occur if appropriate mitigation measures are not taken.

Impact Significance: Minor-Moderate (-ve)

Degree of Confidence: High. This impact can be assessed with a moderate degree of certainty.

Mitigation:

- If construction staff are accommodated on the site, then staff accommodation should be fenced off and no personnel should be allowed to wander around at the site for any purpose after hours.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden.

- 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.
- As part of the EMP for the site, it should be mandatory for staff of both the developer as well as contractors to attend an environmental briefing and training session with respect to the guidelines outlined in this document and the EMP.

Other general mitigation measures recommended for the site during the construction phase include:

- 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.
- The large number of people on site during the construction phase will require that an on-site ablution, sanitation, litter and waste management program is implemented.

6.2 OPERATIONAL PHASE

During the operational phase, human activity and disturbance levels at the site should be relatively low as compared to the construction phase. During the operational phase, the major impacts are likely to be related to maintenance activities and carry-over effects resulting from the construction phase. In particular the site will remain highly vulnerable to wind erosion and alien plant invasion for some time following construction. Some fauna may also avoid areas near to the turbines because of the noise they make as well as their movement. Impacts associated with this phase of the project can be identified as follows:

- Post-construction vulnerability to erosion
- Post-construction vulnerability to alien plant invasion
- Negative consequences resulting from Increased accessibility of the site
- Loss of Landscape Connectivity for Fauna
- Impact on Critical Biodiversity Areas

Impact 1

Impact 1. Erosion Potential

Nature: Post construction, there will be a lot of disturbed and loose sand at the site which will render the area vulnerable to wind erosion, which is a significant problem along the West Coast and should not

be underestimated. As most of the site is very sandy, the potential for wind erosion is very high. Vulnerability will be caused by roads as well as the turbine service areas, which may be a greater threat as they are more extensive. Wind erosion is probably the greatest risk factors associated with the development and it is therefore critically important that proper erosion control structures are built and maintained over the lifespan of the project. A contractor with experience of rehabilitation measures appropriate along the West Coast should be contracted to perform rehabilitation and wind erosion control at the site.

Impact Magnitude – Moderate - High

- Extent: **Local**, the extent of the impact will be largely limited to the site.
- Duration: Should severe erosion occur then the duration of the impact will be **long-term** as such erosion is not easily remedied.
- Intensity: The intensity of the impact is potentially **high** due to the number and scattered distribution of turbine service areas and roads at the site.

Likelihood: Based on the large number of turbines that would be built at the site and their location in the most vulnerable parts of the landscape, there is a high likelihood that erosion would occur if mitigation measures are not taken.

Impact Significance: Moderate - High (-ve)

Degree of Confidence: There is a high degree of confidence in the assessment of this risk.

Mitigation:

- The unconsolidated sandy nature of the taller dunes, poses a significant obstacle for the development as it is highly unlikely that larger construction and service vehicles would be able to navigate roads and tracks in these areas. Therefore, the roads would need to be surfaced or compacted in some kind of way.
- Similarly, many of the turbine locations are on the dune crests which are highly sensitive to disturbance as a result of their elevated, exposed position and the depth of the sand in these areas. The leveling and construction of the turbine surface areas would create a large amount of disturbance, which would be significantly larger than the area actually required for the service areas. Furthermore, like the roads, these areas would need to be surfaced, both to allow the service vehicles to access the turbines and also to prevent wind erosion of the cleared area.
- Appropriate erosion control structures should be built along all roads and other disturbed areas during the construction phase. This should be done by a local rehabilitation contractor with experience in the area, as specific knowledge of the problems associated with the West Coast is required (see image below).
- An important mitigation measures would be to disturb only the minimum area required for the roads and turbine hard standings. Since only the bare soils would be vulnerable to erosion, this should be minimized wherever possible.
- Disturbed areas which will not be used, such as the disturbed areas around turbine foundations, should be rehabilitated as soon after construction as possible. Since a large proportion of the

plants at the site are succulents, the potential for relocation and transplant for rehabilitation of disturbed areas is high. Therefore it is recommended that plants from cleared areas are relocated to sites that require rehabilitation or revegetation wherever possible.

- Regular monitoring of the site (minimum of twice annually) for all erosion-related problems is recommended.
- Any erosion problems observed should be rectified as soon as possible and monitored thereafter to ensure that the affected areas recover and that they do not re-occur.
- All bare areas should be revegetated with locally occurring species, to bind the soil and limit erosion potential.

Plate 6. Rehabilitation underway at a mined area near to the site. The shadecloth barriers are to limit wind erosion and without them rehabilitation cannot take place due to sand movement which either smothers or erodes any seedlings being established. The image serves to illustrate the severity of wind erosion in the area and the extreme lengths that may be required to combats its' effects.

Impact 2

Impact 2. Alien Plant Invasion

Nature: The large amount of disturbed ground that is likely to be present at the site after construction will leave the site vulnerable to alien plant invasion. The presence of alien plants may prevent the natural recovery of the natural vegetation, reduce plant and animal diversity at the site as well as result in various other negative ecosystem consequences. Furthermore, the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.

Impact Magnitude –Low - Moderate

- Extent: Local, the extent of the impact will be largely limited to disturbed areas of the site, but adjacent areas may also become affected if invasion is severe.
- Duration: Should alien plants become established this would be considered to have a long-term impact as these plants would probably persist at the site for years or decades and once a seed bank has established, alien plants may be difficult to eradicate.
- Intensity: The intensity of the impact is likely to be of low to moderate intensity due to the low rainfall and because the soils at the site are generally quite nutrient poor which would reduce the potential for alien plant invasion.

Likelihood: Since the development of the site will result in a fairly extensive disturbance, it is highly likely that some alien plant invasion will occur.

Impact Significance: Minor to Moderate (-ve)

Degree of Confidence: There is a high degree of confidence in the assessment of this risk.

Mitigation:

- Regular monitoring for alien plants at the site should occur and could be conducted simultaneously with erosion monitoring.
- When alien plants are detected, these should be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur.
- Clearing methods should themselves aim to keep disturbance to a minimum.

Impact 3

Impact 3. Impacts on fauna and flora due to illegal hunting and collecting

Nature: The development will result in the construction of a large amount of roads into previously inaccessible areas. This will increase the risk to fauna and flora as a result of poaching and illegal collection of plants and animals for trade or other purpose. Vulnerable species would include Tent Tortoises *Psammobates spp.* as well as various succulent and geophyte species which are sought-after among collectors.

Impact Magnitude – Low - Moderate

- Extent: **Local**, the extent of the impact will be limited to the site.
- Duration: The duration of the impact will be long-term as the roads will remain in place for the foreseeable future.
- Intensity: As this impact will be concentrated on a few targeted species which are also likely to be of conservation concern, the impact on these species could be of high intensity.

Likelihood: There is a high probability that this would occur if appropriate mitigation measures are not taken.

Impact Significance: Moderate (-ve)

Degree of Confidence: Moderate. This impact can be assessed with a moderate degree of certainty.

Mitigation:

- Access to the turbine roads should be strictly controlled and access to the area in general should be regulated.
- Staff present during the operational phase should receive environmental education so as to ensure that that no hunting or harvesting of plants and animals occurs.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden.

Impact 4

Impact 4. Loss of Landscape Connectivity for Fauna

Nature: Certain animals may avoid or be frightened away by the turbines. This would reduce the connectivity of the landscape as the turbines would form a barrier to movement for these species.

Impact Magnitude – Low

- Extent: **Local**, the extent of the impact will be limited to the site and surroundings.
- Duration: The duration of the impact will be **long-term** as the effect would persist as long as the turbines were present.
- Intensity: Since most species would probably become habituated to the presence of the turbines, the effect is deemed to have a **low** intensity.

Likelihood: The effect is likely to occur at least to some extent for certain species.

Impact Significance: Minor (-ve). The number of species affected is likely to be low and is likely to include the more mobile species present which would in any case probably be able to find the gaps in the turbine strings.

Degree of Confidence: This effect can be assessed with a moderate to low degree of confidence as little is known about how the local fauna is likely to respond to the presence of the turbines.

Mitigation:

- Apart from leaving gaps in the turbine strings, there is little that can be done to reduce this potential impact.

Impact 5

Impact 5. Impact on Critical Biodiversity Areas

Nature: Although the actual impacts on the terrestrial ecology of the site have been identified and assessed above, the potential of the development to impact local CBAs needs to be carefully examined. The site is surrounded by CBAs and so any broad-scale ecological processes operating across the site are likely to impact the adjacent CBAs as well. This might include the disruption of migration and movement pathways for resident fauna.

Impact Magnitude – Low

- Extent: Since there are no CBAs within the site, any impact would be of a regional extent.
- Duration: The impact would persist for the lifespan of the project and is thus considered long-term.
- Intensity: The intensity of the impact is likely to be of very low intensity.

Likelihood: This impact is not likely to occur as the development footprint is small when considered at the landscape scale. Futhermore, there was no evidence that the site falls within an important corridor of any kind that would be vulnerable to disruption from the development.

Impact Significance: Minor (-ve)

Degree of Confidence: There is a moderate degree of confidence in the assessment of this risk.

Mitigation:

- Mitigation measures to combat the other ecological impacts of the development as identified in this report would be the most effective method to ensure that broader-scale impacts do not occur. Therefore, no specific mitigation measures are recommended in this regard, beyond those already made with regards to the other impacts.

6.3 DECOMMISSIONING

During the decommissioning phase the project is likely to face similar issues generated by the construction phase; that is negative impacts related to disturbance and human presence at the site. The decommissioning phase should attempt to rehabilitate the site with as little disturbance as possible. The major risk associated with the decommissioning phase would be that the site is not adequately restored to its previous potential and a degraded, vulnerable and disturbed ecosystem is left behind.

Impact 1

Impact 1. Inadequate rehabilitation of the site.

Nature: Decommissioning will involve a large amount of disturbance at the site as the majority of infrastructure will need to be removed and some roads will need to be rehabilitated. This will leave the site vulnerable to wind erosion and alien plant invasion. If the site is not adequately restored at decommissioning, a degraded ecosystem would persist at the site for decades.

Impact Magnitude - Moderate

- Extent: Local, the extent of the impact will be largely limited to disturbed areas of the site, but adjacent areas could also be affected in the case of erosion problems.
- Duration: Should erosion occur and alien plants become established this would be considered to have a long-term impact as the problems would probably persist at the site for years or decades.
- Intensity: The intensity of the impact is likely to be of moderate intensity.

Likelihood: Since the decommissioning of the site will result in a fairly extensive disturbance, it is highly likely that some erosion and alien plant invasion will occur if mitigation measures are not implemented.

Impact Significance: Moderate (-ve)

Degree of Confidence: There is a high degree of confidence in the assessment of this risk.

Mitigation:

- All disturbed areas should be rehabilitated with locally-sourced seed of indigenous species, and erosion control structures should be put in place to limit wind erosion potential of all disturbed areas.
- The site should be monitored for a period of at least two years after the infrastructure has been removed to ensure that rehabilitation is successful and that areas that do not recover adequately can be identified and remedied.

6.4 CUMULATIVE IMPACTS

Before the cumulative impact of the current development can be adequately assessed, other developments that may occur or are currently being planned for the area need to be identified. At this stage and as far as can be ascertained, the Kannikwa Vlakte wind farm near Port Nolloth is the only other wind farm in the vicinity which has progressed to the EIA stage. The nearest other wind energy facilities are more than 300 km to the south near Koekenaap and Lambert's Bay. The Kannikwa Vlakte wind farm is planned to have 50-80 wind turbines and as such, is of a similar scale to the current development. Given the low number of wind farms in the area, the potential for cumulative impacts is currently low. In the long–term, the development of a large number of wind energy facilities along the coastline would potentially have a significant cumulative impact, as any ecological processes operating parallel to the coastline could be impacted. Overall the potential of the current site to contribute to cumulative impacts is viewed as being fairly low and the major impact of the development will be at a local scale.

6.5 SUMMARY ASSESSMENT

A summary of the pre and post mitigation significance ratings for the various impacts as identified is provided below. Most of the impacts can be mitigated to minor significance and provided that the mitigation measures as suggested in this report are effectively implemented, the residual impact of the development would be fairly low. The potential of the development to initiate wind erosion at the site is singled out as a significant concern regarding the development that would require specific and dedicated mitigation.

Table 2. Summary of pre and post mitigation impact significance ratings for the different impacts and risk factors identified for the different phases of the project.

Phase	Impact	Significance Pre Mitigation	Significance Post Mitigation
Construction	Destruction & Loss of Vegetation	Moderate	Minor
	Protected Plant Species	Moderate	Minor
	Faunal impacts – Construction Disturbance	Moderate	Minor-Moderate
	Faunal Impacts – Hunting & Illegal Collection	Minor-Moderate	Minor
Operation	Erosion Potential	Moderate-High	Minor
	Alien Plant Invasion	Minor-Moderate	Minor
	Hunting and Collecting of Fauna & Flora	Moderate	Minor
	Loss of landscape connectivity for fauna	Minor	Minor
	Impact on Critical Biodiversity Areas	Minor	Minor
Decommissioning	Inadequate rehabilitation	Moderate-High	Minor

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8 APPENDICES:

Appendix 1. List of plant species of conservation concern

List of plant species of conservation concern which are known to occur in the vicinity of the G7 Richtersveld Wind Farm. The list is derived from the SIBIS:SABIF website.

Family	Species	IUCN Status
AMARYLLIDACEAE	*Cyrtanthus herrei*	NT
	Gethyllis namaquensis	VU
	Strumaria bidentata	EN
APOCYNACEAE	*Ectadium virgatum*	NT
ASPHODELACEAE	*Bulbine rhopalophylla*	NT
ASTERACEAE	*Helichrysum dunense*	VU
	Helichrysum marmarolepis	NT
CRASSULACEAE	*Crassula ammophila*	NT
	Crassula brevifolia subsp. psammophila	VU
	Crassula plegmatoides	VU
	Crassula sladenii	NT
ERIOSPERMACEAE	*Eriospermum parvulum*	VU
IRIDACEAE	*Babiana thunbergii*	NT
MESEMBRYANTHEMACEAE	*Lampranthus amoenus*	EN
	Leipoldtia frutescens	VU
	Lithops olivacea	VU
SCROPHULARIACEAE	*Dischisma leptostachyum*	NT
	Phyllopodium hispidulum	VU

Appendix 2. List of Mammals

List of Mammals which potentially occur at the G7 Richterveld Wind Farm site. Taxonomy and habitat notes are derived from Skinner & Chimimba (2005), while conservation status is according to the IUCN 2010.

Scientific Name	Common Name	Status	Habitat	Probability
Afrosoricida (Golden Moles):				
Chrysochloris asiatica	Cape Golden Mole	LC	Coastal parts of the Northern and Western Cape	High
Eremitalpa granti	Grant's Golden Mole	Vulnerable	West coast of South Africa and Namibia in sand dunes	High
Cryptochloris wintoni	De Winton's Golden Mole	Vulnerable	Sandy areas of the Namaqualand coastal plain	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 ruprestris	Western Rock Elephant Shrew	LC	Rocky koppies, rocky outcrops or piles of boulders where these offer sufficient holes and crannies for refuge.	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	High
Tubulentata:				
Orycteropus afer	Aardvark	LC	Wide habitat tolerance, being found in open woodland, scrub and grassland, especially associated with sandy soil	Definite
Hyracoidea (Hyraxes)				
Procavia capensis	Rock Hyrax	LC	Outcrops of rocks, especially granite formations and dolomite intrusions in the Karoo. Also erosion gullies	Low
Lagomorpha (Hares and Rabbits):				
Lepus capensis	Cape Hare	LR/LC	Dry, open regions, with palatable bush and grass	High
Rodentia (Rodents):				
Bathyergus janetta	Namaqua Dune Mole Rat	LC	Sandy sunstrates along the coast or alluvium	High
Hystrix africaeaustralis	Cape Porcupine	LC	Catholic in habitat requirements.	Definite
Petromus typicus	Dassie Rat	LC	Mountainous regions and inselbergs, where they are confined to rocky outcrops and live in crevices or piles of boulders	Low
Graphiurus platyops	Rock Dormouse	LC	Rocky terrain, under the exfoliation on granite bosses, and in piles of boulders	Low
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	Definite
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.	Definite
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.	Definite
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

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
Petromyscus babouri	Barbour's Rock Mouse	LC	Associated with rocky areas.	Low
Primates:				
Papio hamadryas	Chacma Baboon	LR/LC	Can exploit fynbos, montane grasslands, riverine courses in deserts, and simply need water and access to refuges.	Low
Eulipotyphla (Shrews):				
Myosorex varius	Forest Shrew	LC	Prefers moist, densely vegetated habitat	Low
Suncus varilla	Lesser Dwarf Shrew	LC	Often associated with termitaria, little else known	Medium
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
Crocidura flavescens	Greater Red Musk Shrew	LC	Wide habitat tolerance	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
Parahyaena brunnea	Brown Hyaena	LC	Nama and Succulent Karoo and the drier parts of the 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	LC	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.	Low
Genetta genetta	Small-spotted genet	LR/LC	Occur in open arid associations	High
Suricata suricatta	Meerkat	LR/LC	Open arid country where substrate is hard and stony. Occur in Nama and Succulent Karoo but also fynbos	Definite
Galerella pulverulenta	Cape Grey Mongoose	LR/LC	Wide habitat tolerance	Definite
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	Definite
Ictonyx striatus	Striped Polecat	LR/LC	Widely distributed throughout the sub-region	High
Rumanantia (Antelope):				
Sylvicapra grimmia	Common Duiker	LR/LC	Presence of bushes is essential	High
Antidorcas marsupialis	Springbok	LC	Arid regions and open grassland.	Low
Raphicerus campestris	Steenbok	LR/LC	Inhabits open country,	Definite
Oreotragus oreotragus	Klipspringer	LR/cd	Closely confined to rocky habitat.	Low

Appendix 3. List of Reptiles.

List of reptiles which potentially occur at the G7 Richtersveld Wind Farm site. Habitat notes and the conservation status are also provided. Conservation status lists CITES status and where it has been assessed the status according to the IUCN 2010. However, the majority of reptile species have not been assessed by the IUCN.

Scientific Name	Common Name	Distribution	Status	Habitat
Tortoises and Terrapins:				
Homopus signatus	Speckled Padloper	Endemic	Near Threatened	Ridges and stony areas, often on plateaus and ridges
Chersina angulata	Angulate Tortoise	Endemic	Appendix II Protected	Sandy coastal regions, incl valley bushveld & coastal fynbos, scarcer in arid hinterland
Psammobates tentorius tentorius	Karoo Tent Tortoise	Endemic	Appendix II Protected	Varied: usually arid karroid areas or rocky sandveld
Psammobates tentorius verroxii	Bushmanland Tent Tortoise	Endemic	Appendix II Protected	Varied: usually arid karroid areas or rocky sandveld
Snakes:				
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	Endemic	Data Deficient	Varied: semi-desert, coastal bush, fynbos & savannah
Rhinotyphlops schinzi	Beaked Blind Snake	Endemic	Data Deficient	Semi-deseet and arid savanna
Leptotyphlops occidentalis	Namaqua Worm Snake	Endemic	Data Deficient	Nambib Desert and Karoo scrub
Homoroselaps lacteus	Spotted Harlequin Snake	Endemic	Data Deficient	Deserted termite mounds or under rocks in fynbos, coastal scrub, sananna and grassland
Lamprophis fuliginosus	Brown House Snake	Widespread	Data Deficient	Common in highveld grassland & arid karroid regions, but found everywhere & tolerant of urban sprawl
Lamprophis guttatus	Spotted Rock Snake	Endemic	Data Deficient	Inland mnts of Cape & Cape fold mnts, extending into S.Namibia
Lamprophis fiskii	Fisk's House Snake	Endemic	VULNERABLE Protected	Karroid sandy veld, but few specimens from widely scattered localities
Pseudaspis cana	Mole Snake	Widespread	Data Deficient	Sandy scrubland in SW Cape, highveld grassland & mountainous & desert regions
Philothamnus semivariegatus	Spotted Bush Snake	Widespread	Data Deficient	River banks, shrubs or rocky regions in karoo scrub. Also savanna and lowland forest.
Prosymna frontalis	South-western Shovel-Snout	Widespread	Data Deficient	Rocky areas in arid regions
Dipsina multimaculata	Dwarf Beaked Snake	Endemic	Data Deficient	Rocky, sandy areas. Cape karroid areas.
Psammophylax rhombeatus	Spotted Or Rhombic Skaapsteker	Widespread	Data Deficient	Highland grassveld & fynbos, entering karroid areas
Psammophis notostictus	Karoo Sand or Whip Snake	Widespread	Data Deficient	Arid scrubland & karroid regions
Psammophis namibensis	Namib Sand Snake	Endemic	Data Deficient	Namib desert and karoo vegetation
Dasypeltis scabra	Common/Rhombic Egg Eater	Widespread	Data Deficient	Absent only from true desert & closed-canopy forest
Telescopus beetzii	Namib Tiger Snake	Endemic	Data Deficient	Rocky, arid regions
Aspidelaps lubricus	Coral Shield Cobra	Widespread	Data Deficient	Karroid & sandveld regions, entering dry valley plains in S and E Cape
Naja nivea	Cape Cobra	Endemic	Data Deficient	Arid karroid regions, particularly along river courses, entering well drained open areas along the southern coast
Naja nigricollis woodi	Black Spitting Cobra	Endemic	Data Deficient	Namibia to Citrusdal in karroid
Bitis arietans	Puff Adder	Widespread	Data Deficient	Absent only from desert & mnt tops
Bitis cornuta	Many-horned Adder	Endemic	Data Deficient	Mountainous regions, rocky outcrops. gravel plains and mountain fynbos
Bitis xeropaga	Desert Mountain Adder	Endemic	Data Deficient	Mountain slopes and sparsely vegetated rocky hillsides
Bitis caudalis	Horned Adder	Widespread	Data Deficient	Sandy regions, throughout Karoo
Bitis schneideri	Namaqua Dwarf Adder	Endemic	VULNERABLE	Semi-stable, vegetated coastal dunes

			Appendix II	
Lizard and Skinks:				
Acontias gracilicauda namaquensis	Thin-tailed Legless Skink	Endemic	Data Deficient	Valley bushveld, grassland entering sandy regions
Acontias lineatus	Striped Legless Skink	Endemic	Data Deficient	Sandy, arid soils
Acontias litoralis	Coastal Legless Skink	Narrow Endemic	Data Deficient	Sparesely vegetated coastal sands
Typhlosaurus lomiae	Lomi's Blind Legless Skink	Endemic	VULNERABLE Appendix II	Sandy soils in succulent veld
Typhlosaurus vermis	Boulenger's Blind Legless Skink	Endemic	Data Deficient	Sparsely vegetated coastal dunes
Scelotes sexlineatus	Striped Dwarf Burrowing Skink	Narrow Endemic	Data Deficient	Succulent Veld
Scelotes capensis	Western Dwarf Burrowing Skink	Endemic	Data Deficient	Leaf litter and friable sand
Mabuya acutilabrus	Wedge-snouted Skink	Widespread	Data Deficient	Desert and scrubland
Mabuya capensis	Cape Skink	Widespread	Data Deficient	Very varied: arid karroid veld, moist coastal bush, montane grassland, etc
Mabuya occidentalis	Western Three-Striped Skink	Widespread	Data Deficient	Arid Savanna karroid veld and desert
Mabuya sulcata	Western Rock Skink	Widespread	Data Deficient	Karroid areas
Mabuya variegata	Variegated Skink	Widespread	Data Deficient	Extremely varied; desert, karroid veld, montane grassland, savanna, coastal bush & valley bushveld
Meroles ctenodactylus	Smith's Desert Lizard	Narrow Endemic	Data Deficient	Vegetated coastal dunes and adjacent sandy plains
Meroles knoxii	Knox's Desert Lizard	Endemic	Data Deficient	Coastal dunes and succulent karroid veld
Meroles suborbitalis	Spotted Desert Lizard	Endemic	Data Deficient	Varied, arid savanna to desert
Nucras tessellata tessellata	Striped Sandveld Lizard	Widespread	Data Deficient	Open arid savannah & karroid veld
Pedioplanis laticeps	Cape Sand Lizard	Endemic	Data Deficient	Coastal dunes and succulent karroid veld
Pedioplanis lineoocellata	Spotted Sand Lizard	Endemic	Data Deficient	Very varied: karroid veld, valley bushveld & arid & mesic savannah
Pedioplanis namaquensis	Namaqua Sand Lizard	Widespread	Data Deficient	Karroid veld
Pedioplanis undata inorata	Western Sand Lizard	Widespread	Data Deficient	Semi desert including rocky flats
Cordylosaurus subtessellatus	Dwarf Plated Lizerd	Endemic	Data Deficient	Sandy areas among rocks
Gerrhosaurus typicus	Namaqua Plated Lizard	Endemic	Near Threatened	Karroid succulent veld
Cordylus peersi	Peers Girdled Lizard	Narrow Endemic	Data Deficient	Rocky outcrops in succulent karroid veld
Cordylus polyzonus	Karoo Girdled Lizard	Endemic	Appendix II Protected	Karroid regions
Cordylus cataphractus	Armadillo Girdled Lizard	Endemic	VULNERABLE Appendix II	Rock outcrops and mountain ranges
Cordylus lawrenci	Lawrence's Girdled Lizard	Narrow Endemic	Near Threatened	Suculent karroid veld
Platysaurus capensis	Cape Flat Lizard	Endemic	Data Deficient	Succulent Veld
Agama anchietae	Anchieta's Agama	Widespread	Data Deficient	Semi desert and arid savanna
Agama atra	Southern Rock Agama	Endemic	Data Deficient	Semi-desert to fynbos, from sea level to mountain tops
Agama hispida	Spiny Agama	Endemic	Data Deficient	Arid semi-desert, coastal dunes & salt pans
Chameleons:				
Bradypodion occidentale	Western Dwarf Chameleon	Endemic	Appendix II Protected	Strandveld and semi-stable dunes along the West Coast
Chamaeleo namaquensis	Namaqua Chameleon	Widespread	Appendix II Protected	Sandy regions (incl coastal dunes) with scrub vegetation
Geckos:				
Afroedura africana	African Flat Gecko	Endemic	Data Deficient	Rocky desert and succulent karroid veld
Chondrodactylus angulifer	Giant Ground Gecko	Endemic	Data Deficient	Gravel plains, interdune spaces & sandy flats

Chondrodactylus bibronii	Bibron's Tubercled Gecko	Endemic	Data Deficient	Rocky outcrops, cliffs and large trees
Pachydactylus austeni	Austen's Dune Gecko	Endemic	Data Deficient	Arid sandy habitats, sparsely vegetated, stable dunes
Pachydactylus labialis	Western Cape Gecko	Endemic	Data Deficient	Succulent karroid veld
Pachydactylus laevigatus	Button-scaled Gecko	Widespread	Data Deficient	Semi desert and arid savanna
Pachydactylus namaquensis	Namaqua Gecko	Narrow Endemic	Data Deficient	Karroid succulent veld
Pachydactylus weberi	Weber's Gecko	Endemic	Data Deficient	Succulent karroid veld
Phelsuma ocellata	Namaqua Day Gecko	Endemic	Near Threatened	Boulder strewn hillsides and rocky outcrops
Pachydactylus rugosus	Rough-scaled Gecko	Endemic	Data Deficient	Semi-desert and succulent karroid veld
Ptenopus garrulus	Common Barking Gecko	Endemic	Data Deficient	Desert and semi-desert on various soil types, preferring flat stable sandy soils with sparse vegetation cover
Goggia rupicola	Namaqua Leaf-toed Gecko	Endemic	Data Deficient	Rocky areas in Namaqualand
Goggia lineata	Striped Leaf-Toed Gecko	Endemic	Data Deficient	Coastal fynbos, succulent & transitional karroid veld, montane grassland

Appendix 4. List of Amphibians

List of amphibians which potentially occur at the G7 Richtersveld Wind Farm. 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)

Scientific Name	Common Name	Status	Habitat	Distribution	Likelihood
Breviceps macrops	Desert Rain Frog	Vulnerable	Up to 10km inland from the Namaqualand coast in Strandveld vegetation	Endemic	High
Breviceps namaquensis	Namaqua Rain Frog	Not Threatened	Arid sandy habitats from the coast to inland mountains	Endemic	High
Vandijkophrynus gariepensis	Karoo Toad	Not Threatened	Karoo Scrub	Widespread	High
Vandijkophrynus robinsoni	Paradise Toad	Not Threatened	Natural springs and waterholes in the arid areas of the Richtersveld	Endemic	Medium
Xenopus laevis	Common Platanna	Not Threatened	Any more or less permanent water	Widespread	Low
Cacosternum namaquense	Namaqua Caco	Not Threatened	Upland Succulent Karoo. Breeds in temporary or permanent natural or man-made pools	Endemic	Medium
Strongylopus springbokensis	Namaqua Stream Frog	Vulnerable	Mountainous areas of Namaqualand associated with seeps and springs	Endemic	Low