

SCOPING REPORT:

Specialist ecological study on the potential impacts of the proposed
Spitskop Wind Energy Facility near Riebeeck East, Eastern Cape
Province

Prepared by

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on behalf of
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18 April 2011

FINAL SCOPING REPORT:



David Hoare Consulting cc

**Biodiversity Assessments, Vegetation Description /
Mapping, Species Surveys**

REGULATIONS GOVERNING THIS REPORT

This report has been prepared in terms the EIA Regulations promulgated under the *National Environmental Management Act* No. 107 of 1998 (NEMA) and is compliant with Regulation 385 Section 33 - Specialist reports and reports on specialized processes under the Act. Relevant clauses of the above regulation are quoted below and reflect the required information in the "Control sheet for specialist report" given above.

Regulation 33. (1): An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialized process.

Regulation 33. (2): A specialist report or a report on a specialized process prepared in terms of these Regulations must contain:

- (a) details of (i) the person who prepared the report, and
(ii) the expertise of that person to carry out the specialist study or specialized process;
- (b) declaration that the person is independent in a form as may be specified by the competent authority;
- (c) indication of the scope of, and the purpose for which, the report was prepared;
- (d) description of the methodology adopted in preparing the report or carrying out the specialized process;
- (e) description of any assumptions made and any uncertainties or gaps in knowledge;
- (f) description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
- (g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;
- (h) description of any consultation process that was undertaken during the course of carrying out the study;
- (i) summary and copies of any comments that were received during any consultation process;
- (j) any other information requested by the competent authority.

Appointment of specialist

David Hoare of David Hoare Consulting cc was commissioned by Savannah Environmental (Pty) Ltd to provide specialist consulting services for the Environmental Impact Assessment for the proposed Spitskop Wind Energy Facility near Riebeeck East in the Eastern Cape Province. The consulting services comprise an assessment of potential impacts on the flora, fauna, vegetation and ecology in the study area by the proposed project.

Details of specialist

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Summary of expertise

David Hoare:

- PhD in ecology
- Registered professional member of The South African Council for Natural Scientific Professions (Ecological Science, Botanical Science), registration number 400221/05.
- Founded David Hoare Consulting cc, an independent consultancy, in 2001.
- Ecological consultant since 1995.
- Conducted, or co-conducted, over 250 specialist ecological surveys as an ecological consultant.
- Published six technical scientific reports, 15 scientific conference presentations, seven book chapters and eight refereed scientific papers.
- Attended 15 national and international congresses & 5 expert workshops, lectured vegetation science / ecology at 2 universities and referee for 2 international journals.

Independence

David Hoare Consulting cc and its Directors have no connection with Renewable Energy Systems Southern Africa. David Hoare Consulting cc is not a subsidiary, legally or financially, of the proponent. Remuneration for services by the proponent in relation to this project is not linked to approval by decision-making authorities responsible for authorising this proposed project and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project. David Hoare is an independent consultant to Savannah Environmental (Pty) Ltd and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work. The percentage work received directly or indirectly from the proponent in the last twelve months is 0% of turnover.

Scope and purpose of report

The scope and purpose of the report are reflected in the "Terms of reference" section of this report

Conditions relating to this report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. David Hoare Consulting cc and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

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INTRODUCTION

Terms of reference and approach

Savannah Environmental (Pty) Ltd. was appointed by Renewable Energy Systems Southern Africa to undertake an application for environmental authorisation through an Environmental Impact Assessment (EIA) for the proposed "Spitskop Wind Energy Facility Project." The project involves the establishment of a wind energy facility and associated infrastructure, including up to 200 wind turbines and concrete foundations to support them, cables between turbines to be laid underground where practical, substation/s to connect the wind energy facility and the grid, workshop area for control, maintenance and storage and internal access roads to each turbine. The purpose of the EIA is to identify environmental impacts associated with the project.

In January 2011 David Hoare Consulting cc was appointed by Savannah Environmental (Pty) Ltd to undertake an ecological assessment of the study area. The specific terms of reference for the ecological scoping are as follows:

- to provide a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project;
- to provide a description and evaluation of potential environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified;
- Direct, indirect and cumulative impacts of the identified issues must be evaluated within the Scoping Report in terms of the following criteria:
 - the **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected;
 - the **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issue/impacts;
- a comparative evaluation of any identified feasible alternatives (and if relevant the nomination of a preferred alternative for consideration in the EIA phase);
- identification of potentially significant impacts to be assessed within the EIA phase;
- to provide recommendations regarding the methodology to be adopted in assessing potentially significant impacts in the EIA phase (sufficiently detailed to be included within the Plan of Study for EIA and must include a description of the proposed method of assessing the potential environmental impacts associated with the project).

This report provides details of the results of the Scoping phase. The findings of the study are based on a desktop assessment of the study area and expert knowledge of the general area gained from general fieldwork conducted in the Eastern Cape over a number of years.

Study area

At a regional level the study area falls within the Eastern Cape Province near the town of Riebeek East. A more detailed description of the study area is provided in a section below.

METHODOLOGY

The environmental study was undertaken in two phases, a Scoping phase and an Environmental Impact Assessment phase. The objective of the Scoping phase study was to review fauna and flora patterns within the study area in order to identify any highly sensitive areas that should be avoided during development. It was therefore necessary to provide checklists of sensitive species that could potentially occur in the study area as well as habitats with high conservation value. For potential species, only those of high conservation concern are provided. It was also intended to provide a draft habitat map of the study area based on available maps and database information. The results of the Scoping phase study are provided in this report.

Assessment philosophy

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

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

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

Species

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

Ecosystems

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

Processes

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

It is not the intention to provide comprehensive lists of all species that occur on site, since most of the species on these lists are usually common or widespread species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which are most likely to result in significant negative impacts on the ecological environment. The focus on national and provincial priorities and critical biodiversity issues is in line with National legislation protecting environmental and biodiversity resources, including, but not limited to the following which ensure protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment:

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

Plant and animal species of concern

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

Lists were compiled specifically for any species of conservation concern previously recorded in the area and any other species with potential conservation value. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute for the quarter degree squares within which the study area is situated.

Regulations published for the National Forests Act provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area.

Provincial and National legislation was evaluated in order to provide lists of any plant or animal species that have protected status. The most important legislation is the following: *National Environmental Management: Biodiversity Act (Act No 10 of 2004)*.

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

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

For all threatened or protected organisms (flora and fauna) that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

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

Habitats of concern

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

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

Limitations

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be located in an area where it was not previously known to exist.

Limitations and exclusions

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

DESCRIPTION OF STUDY AREA

Location

The study site is situated in Eastern Cape Province west of the town of Riebeeck East, which is to the north west of Grahamstown (Figure 1). The N10 from Bloemfontein to Port Elizabeth passes through the western third of the study area. The R400 from Riebeeck East to Jansenville runs approximately along the southern boundary of the study area. The site falls within the quarter degree grids 3325BA, 3325BB and 3326AA.

The wind energy facility is proposed on the following farm portions: Steenkampsberg 590, the remainder of the farm Buffels Drift 61, Farm 597, Portion 1 of Farm 61 Junction Drift, portion 2,3 and the remainder of portion 1 of Farm 60, portion 2 and 3 of the Farm Groot Fontein 138, portion 1 and the remaining extent of the Farm Bosch Fontein 143, portion 2, 3 and the remainder of portion 1 of the Farm Groot Fontein 140, portion 2, the remainder of portion 1 and the remaining extent of the Farm Ebenezer 141, portion 3, 4 and the remaining extent of the Farm 144, portion 3 of the farm Modderfontein 302, portion 1 and the remaining extent of the Farm Bothas Hoop 358, the remaining extent of the Farm Draai Van Klein Visch Rivier 254, portion 1 and the remaining extent of the Farm Gras Fonteyn 258, the farm Springbok Vlakte 434, portion 3 and the remaining extent of the farm Driefontein 259, the remainder of portion 1, the remainder of portion 6 and portion 11 of the farm Witte Poort 262, portion 1 and 2 of the Farm Varkens Kuil 269, the remaining extent of the farm Brand Rug 268, portion 1 of the Farm Commadagga 264, farm 369, portion 2 and the remainder of portion 1 of the Farm Brakfontein 261, portion 1 and 3 of the Farm Commadagga 263, portion 2, 6, 7, 8, the remainder of portion 3, the remainder of portion 4 and the remaining extent of the Farm Commadagga 266, the Farm Driefontein 436, the remaining extent of the Farm 267, portion 1, 2, the remaining extent of the Farm 145, the remaining extent of Farm 66 and the remaining extent of Portion 1 of Farm 139.

Landuse and landcover of the study area

A landcover map of the study area (Fairbanks *et al.* 2000) indicates that most of the study area consists of natural vegetation, including "shrubland and low fynbos" and "thicket and bushland". There are a few small areas of cultivation indicated within the floodplain of the Klein Visrivier (Fairbanks *et al.* 2000). This landcover information is based on coarse-scale satellite imagery, which is poor at resolving detailed information at a site-specific scale. The assessment is, however, largely supported by the 1:50 000 topocadastral maps for the area and Google imagery of the study area.

Broad vegetation types of the region

The study area is within an area where three Biomes meet, i.e. the Nama-Karoo Biome, the Fynbos biome and the Albany Thicket biome (Mucina & Rutherford 2006). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina *et al.* 2006). According to this vegetation map of the country the study area includes a number of national vegetation types, namely the following:

- Albany Broken Veld (Nama-Karoo Biome);
- Kowie Thicket (Albany Thicket Biome);
- Great Fish Thicket (Albany Thicket Biome);
- Southern Karoo Riviere (azonal vegetation);
- Suurberg Quartzite Fynbos (Fynbos Biome);

- Suurberg Shale Fynbos (Fynbos Biome).

Albany Broken Veld occurs immediately to the north of the Zuurberg Mountains, including the areas north of the mountain ridges around Riebeek East (Mucina et al. 2006a). The vegetation type occurs on low mountain ridges and hills. It is a vegetation composed of an open grassy dwarf karroid shrubland with scattered low trees (Mucina et al. 2006a). The dwarf shrubs, *Becium burchellianum* and *Chrysocoma ciliata* form a matrix with the grass *Eragrostis obtusa*. Common low trees include *Boscia oleoides*, *Euclea undulata*, *Pappea capensis* and *Schotia afra* var. *afra*. This vegetation type occurs in the lower-lying areas south and north of the main ridge running through the study area and is the most commonly found vegetation type in the study area (Figure 2).

Kowie Thicket occurs in the river valleys of the Bushman's, Kariega, Kowie, Kleinemonde and Kap Rivers in the Eastern Cape, extending inland up these valleys to just past Riebeek East (Hoare et al. 2006). The vegetation type occurs on mainly steep and north-facing, dry slopes. It is a vegetation composed of tall thickets dominated by succulent euphorbias and aloes with a thick understorey composed of thorny shrubs, woody lianas and shrubby succulents (Hoare et al. 2006). Moister south-facing slopes support thorny thickets dominated by low evergreen trees and shrubs with fewer succulent shrubs and trees (Hoare et al. 2006). The herbaceous layer is poorly developed. This vegetation type occurs in a wide band from east to west through the study area and is the second-most commonly found vegetation type in the study area (Figure 2).

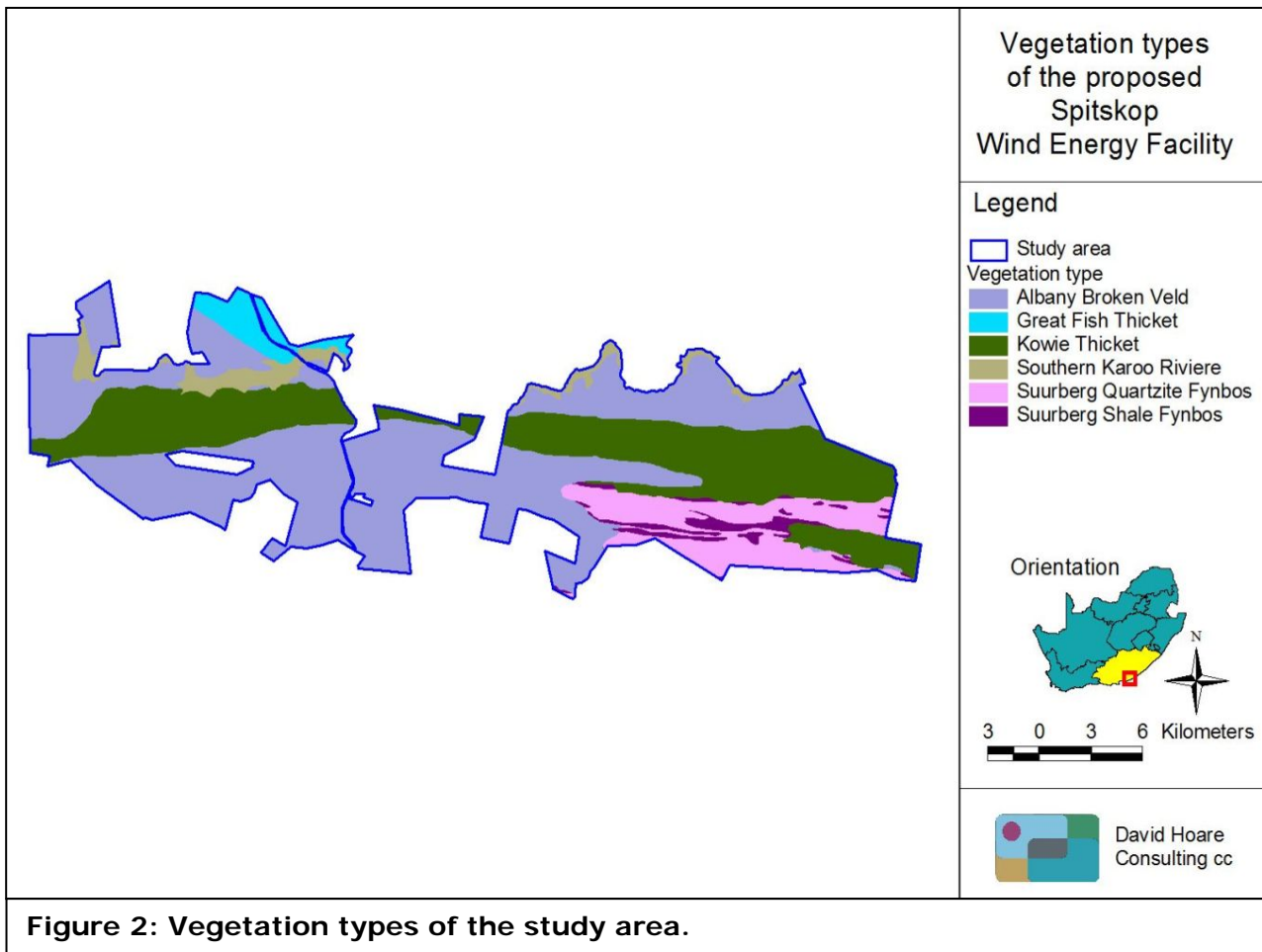
Great Fish Thicket occurs mainly in the lower Great Fish River and Keiskamma River valleys, extending up the Great Fish River to Cookhouse and into the southernmost part of the Cradock District (Hoare et al. 2006). This vegetation type is found on the steep slopes of deeply dissected rivers (Hoare et al. 2006). The vegetation is a short, medium or tall thicket (Hoare et al. 2006). Woody trees and shrubs and succulents are common to dominant and there are many spinescent shrubs (Hoare et al. 2006). The succulent shrub, *Portulacaria afra*, is locally dominant, but is replaced by *Euphorbia bothae* with increasing aridity, and by woody elements and the tall emergent succulents, *Euphorbia tetragona* and *Euphorbia triangularis* on southern aspects (Hoare et al. 2006). There is high heterogeneity within this vegetation unit and it has been divided up into nine distinct subtypes (Vlok & Euston-Brown 2002). This vegetation type is found on the flats to the north of the Klein Visrivier adjacent to the N10 national road that passes through the study area (Figure 2).

Southern Karoo Riviere occurs on the alluvia of the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega and Sundays Rivers and their tributaries (Mucina et al. 2006b). The vegetation type occurs on narrow riverine flats. It is a vegetation composed of a complex of *Acacia* karroo or *Tamarix usneoides* thicket up to 5 m tall fringed by tall *Salsola*-dominated shrubland up to 1.5 m tall, especially on heavier and salt-laden soils on very broad alluvia (Mucina et al. 2006b). This vegetation type occurs in the river valley of the Klein Visrivier in the north-western to northern part of the study area (Figure 2).

Suurberg Quartzite Fynbos occurs in the Kleinwinterhoekberge, the Suurberge north of Kirkwood, multiple ridges in the vicinity of Somerset East and Alicedale (including Riebeeck East) to the Kapriveirberge east of Grahamstown (Rebello et al. 2006). The vegetation type occurs on low rounded hills and mountains. It is a vegetation composed of low to medium-high, closed, ericoid shrubland or grassland, with closed restioid and/or grass understorey (Rebello et al. 2006). Grassy fynbos is the most typical structural type, with localised patches of dense proteoid and ericaceous fynbos. On drier, north-facing slopes grassland replaces this unit, but the south-facing slopes always carry fynbos unless converted to grassland by over-burning, or to thicket by over-protection from fire (Rebello et al. 2006). This vegetation type occurs in the south-eastern part of the study area (Figure 2) and is the more commonly found fynbos vegetation type on site.

Suurberg Shale Fynbos occurs in the east-west trending, complex and multiple bands of shale from the Klein Winterberg in the west, through the Suurberg, ending in a highly fragmented distribution around Riebeeck East and Grahamstown (Rebello et al. 2006). The vegetation type occurs on low mountains or hills. It is a vegetation composed of low to medium-high, closed, ericoid shrubland or grassland, with closed restioid and/or grass understorey (Rebello et al. 2006). Graminoid fynbos, with localised patches of dense proteoid fynbos also occurs. This vegetation type occurs as narrow bands and small patches in the south-western part of the study area (Figure 2).

Conservation status of broad vegetation types



The vegetation types of South Africa have been categorised according to their conservation status which is, in turn, assessed according to degree of transformation and rates of conservation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are as depicted in Table 1, as determined by best available scientific approaches (Driver et al. 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

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

Habitat remaining (%)	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protected on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are potentially fewer ecosystems of concern listed in the Draft Ecosystem List versus in the scientific literature.

According to the scientific literature (Driver et al. 2005; Mucina et al., 2006), all of the national vegetation types in the study area are listed as Least Threatened (Table 2). In addition, none of the vegetation types are listed in the Draft National List of Threatened Ecosystems (GN1477 of 2009).

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

Vegetation Type	Conservation status	
	Scientific literature	NEM:BA Draft Ecosystem List
Albany Broken Veld	Least Threatened	Not listed
Kowie Thicket	Least Threatened	Not listed
Great Fish Thicket	Least Threatened	Not listed
Southern Karoo Riviere	Least Threatened	Not listed
Suurberg Quartzite Fynbos	Least Threatened	Not listed
Suurberg Shale Fynbos	Least Threatened	Not listed

Red List plant species of the study area

Lists of plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in Appendix 1. Plant species are classified into various categories, depending on the degree of conservation concern (see Table 3 for categories). Only those species classified as Critically Endangered, Endangered or vulnerable are considered to be threatened. All other species are in categories of lesser concern.

The species on this list were evaluated to determine the probability of occurring on site. One Endangered plant species, *Haworthia aristata*, has been evaluated as having a high probability of occurring on site. This species occurs in thicket mosaics between Port Elizabeth and Kommadagga and has been previously recorded at Kommadagga in the grid 3325BB. The vegetation in this area is Kowie Thicket so it is assumed that this vegetation on site has a high risk of containing this species. Two near threatened species, *Curtisia dentata* and *Encephalartos longifolius*, have a high probability of occurring in the study area. *Curtisia dentata* is found in evergreen forests and is likely to be restricted to mesic woodland vegetation within steeply incised drainage lines in steep areas where forest patches are most likely to occur. *Encephalartos longifolius* is found in the Kouga Mountains to Grahamstown on steep rocky slopes in dense thicket.

The remaining species on the list are of lower conservation concern and are not considered to be threatened or near threatened.

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

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

In summary, there is one plant species of conservation concern that is potentially problematic from the point of view of developing site, as follows:

- *Haworthia aristata* (classified as Endangered),
- *Curtisia dentata* (classified as Near threatened),
- *Encephalartos longifolius* (classified as Near threatened).

Red List animal species of the study area

All Red List vertebrates (mammals, birds, reptiles, amphibians) that could occur in the study area are listed in Appendix 2. Those vertebrate species with a geographical distribution that includes the study area and habitat preference that includes habitats available in the study area are discussed further.

There are six mammal species of conservation concern that could occur in available habitats in the study area. This includes one species classified as Endangered, the White-tailed Rat, one species classified as Vulnerable, the Tree Hyrax, three species classified as Near Threatened (NT), the Brown Hyaena, the Natal Long-fingered Bat and the Cape Horseshoe Bat, and one species currently classified as Least Concern, but listed recently as Endangered, the Samango Monkey.

The White-tailed Rat occurs in Highveld and montane grassland, but requires sandy to loam soils with good cover. It has been previously recorded in the eastern grid of the study area, which probably means it was recorded within the fynbos area. The geology of these areas promotes the formation of sandy soils. There is therefore a high probability of these areas being suitable for this species.

The Tree Hyrax is an arboreal browser confined to forest habitats and dense thickets. It has specialized habitat requirements, utilizing hollow trees in indigenous forests, particularly Outeniqua yellowwood, forest boerboon, white milkwood and Cape teak (Mills & Hes 1997). It prefers upright living trees with many cavity entrances (Mills & Hes 1997). The possible presence of this species on site is dependent on the presence of forests with preferred hollow trees present.

The Brown Hyaena has a medium chance of occurring on site since the distribution range includes the study area, however there are no historical records from nearby. It is a mobile animal that is likely to move away from the path of any construction and development of parts of the site is therefore highly unlikely to have a noticeable negative effect on the species.

The Natal Long-fingered Bat and Cape Horseshoe Bat may use the site for foraging and they could therefore potentially be affected by construction or operation of infrastructure on site. The site is therefore considered to be potentially important for these two bat species.

The Samango Monkey (*Cercopithecus mitis* subsp. *labiatus*) is listed as Endangered in the Mammal Red List (Friedmann & Daly 2004), but is listed on the IUCN website as Least Concern. The IUCN website does not, however, distinguish to subspecies level. It is the subspecies *labiatus* that is listed as Endangered (Friedmann & Daly 2004). The subspecies is therefore treated as of conservation concern for this project. This subspecies occurs in Afromontane forest, including those in the Eastern Cape, but seldom in forest patches smaller than 50-100 ha (Mills & Hes 1997). It has been previously recorded in the grids in which the study area is located, but this includes the Swartwatersberg to the south of the study area, where the monkey is more likely to be found. There is one forest patch in the south-eastern part of the study area that may be nearly 50 ha in total and there are a number of small forest patches that are close enough together to provide corridors of movement for the monkey. It is therefore considered possible that this species occurs on site.

There is one protected frog species previously recorded in the grids in which the study area is located and which could occur on site, the Giant Bullfrog. This species is widely distributed in South Africa, mainly at higher elevations. It inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas and also utilises non-permanent vleis and shallow water on margins of waterholes and dams. It prefers sandy substrates although it sometimes inhabits clay soils. The species was previously categorized as Near Threatened, but has since been re-classified as Least Concern.

There is one reptile species of conservation concern that has a distribution that includes the study area and which could occur on site, the Yellow-bellied House Snake (Near Threatened). This species is found in old termitaria and under stones or underground throughout the more mesic parts of South Africa. It's preferred habitat varies from fynbos scrub to arid savanna and grassland. Specimens from near Grahamstown were found on rocky, grassy hillsides with a semi-closed tree canopy (Marais 2004). It has not been previously recorded in the study area or nearby, but there is a possibility it could occur there. Given the habitat description from Grahamstown, it is most likely to be found in the fynbos area in the south-eastern part of the study area.

There are twenty three bird species of conservation concern that may make use of the site. Twelve are listed as Vulnerable and eleven as Near Threatened. The Vulnerable species are the African Finfoot, African Marsh Harrier, Black Harrier, Blue Crane, Cape Vulture, Kori Bustard, Lesser Kestrel, Ludwig's Bustard, Martial Eagle, Stanley's Bustard, Striped Flufftail and Whitebellied Korhaan. In a number of these cases, there is not a high chance of the site being important for these species. Potential impacts of infrastructure, such as powerlines, may still be of concern for some species. Of particular concern are those species that may be resident on site, i.e. use the site for more than foraging, including possibly the Blue Crane, Kori Bustard, Ludwig's Bustard, Stanley's Bustard and White-bellied Korhaan. Raptors may be especially vulnerable to impacts with turbines in places where they may be utilizing thermals to obtain vertical lift. This may affect the Black Harrier, Lesser Kestrel and Martial Eagle.

The Near Threatened species of bird are the Black Stork, Blackwinged Plover, Blue Korhaan, Crowned Eagle, Halfcollared Kingfisher, Knysna Woodpecker, Lanner Falcon, Pallid Harrier, Peregrine Falcon, Secretarybird and Yellow-billed Stork. The site is thought to be potentially of high value to the Blue Korhaan, Knysna Woodpecker, Lanner Falcon, Peregrine Falcon and Secretarybird, although this will have to be confirmed during the site investigation. Of these, the Knysna Woodpecker is likely to be confined to its preferred habitat and it is less likely to be affected by the presence of a wind energy facility.

In summary, the following animal species are potentially of concern for development of the study area:

1. White-tailed Rat (EN),
2. Samango Monkey (*labiatus* subspecies) (EN),
3. Tree Hyrax (VU),
4. Natal Long-fingered Bat (NT),
5. Cape Horseshoe Bat (NT),
6. Yellow-bellied House Snake (NT),

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3. Those that have a geographical distribution that includes the study area are *Catha edulis*, *Curtisia dentata*,

Ocotea bullata, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *Podocarpus latifolius*, *Prunus africana* and *Sideroxylon inerme* subsp. *inerme*.

Catha edulis is found in evergreen forest, often in rocky places. *Curtisia dentata* occurs in coastal and montane forest. *Ocotea bullata* occurs in montane forest. *Pittosporum viridiflorum* occurs along forest margins, in bush-clumps and in bushveld, often in rocky outcrops. *Podocarpus falcatus* is found in Afromontane forest. *Podocarpus latifolius* is found in coastal and Afromontane forest. *Prunus africana* occurs in montane forest, usually in mistbelt areas. *Sideroxylon inerme* subsp. *inerme* usually only occurs in coastal areas, in dune thicket and forest, but may also occur on termitaria in bushveld.

If any of these species occur in the study area, the most likely places would be on the steep valleys containing mesic woodland in the eastern part of the study area (in the areas indicated as fynbos vegetation in Figure 2). It is not certain if there are small forest patches here, but the vegetation density (as seen from an aerial photograph) and habitat may be suitable for forest development. The exception is *Pittosporum viridiflorum*, which may be more widespread and could occur in any dense woodland in the study area, especially with any thicket vegetation that may occur in the study area. *Curtisia dentata*, *Podocarpus falcatus* and *Sideroxylon inerme* subsp. *inerme* have been previously recorded in the grids that include the study area (see Appendix 4). These grids include some distinct forest patches to the south of Riebeeck East, which is outside the study area, but the possibility of these species occurring on site is relatively high.

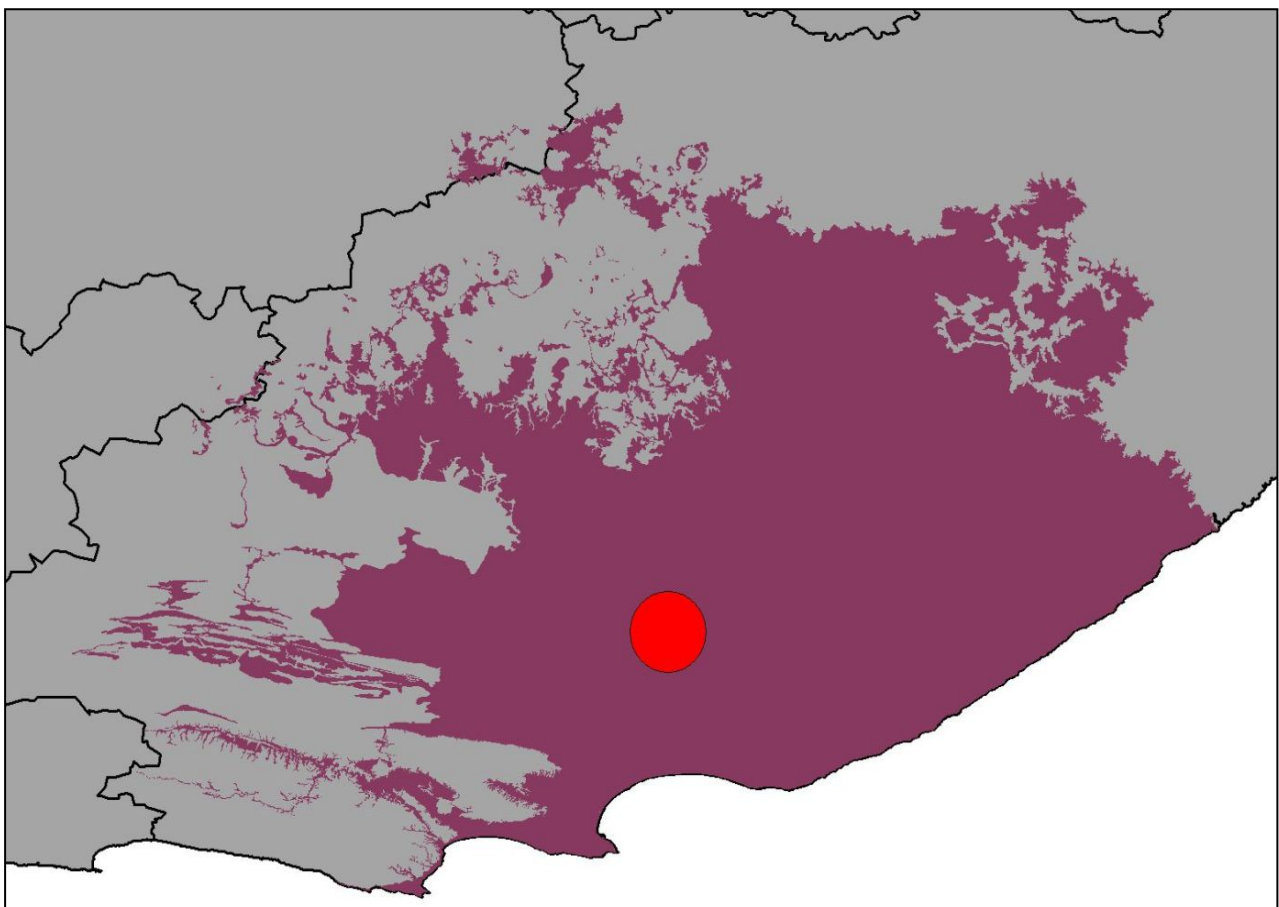


Figure 3: Relationship of the Albany Centre to the study area (red circle).

The Albany Centre of Endemism

The study site occurs within the Albany Centre of Floristic Endemism (van Wyk & Smith 2001) (see Figure 3). This region was originally defined as the whole of the drainage area of the Great Fish River (Croizat 1965) and is recognised as an important centre of plant diversity and endemism in Africa (Davis et al. 1994). This area is also one of the earth's 25 hotspots, i.e. geographical areas that contain the world's greatest plant and animal diversity while also being subjected to high levels of pressure from development and/or degradation (Mittermeier et al. 2000, Steenkamp et al. 2004, 2005).

The Albany Centre comprises a diverse mosaic of floristic and vegetation elements. Thicket is the most conspicuous component of this Centre and there is a high degree of endemism amongst succulent plants in this Centre of Endemism. However, the region is at the convergence of five phytochoria (White 1983) and there are at least 40 vegetation types that have been mapped in the recently compiled vegetation map of South Africa (Mucina, Rutherford & Powrie 2005) of a total of 435 vegetation types of the whole country that occur within the Albany Centre.

The study area is within the core of the Albany Centre of Endemism and contains two thicket vegetation types.

The Cape Floristic Region

The study area occurs within the Cape Floristic Region (see Figure 4), which is recognised as

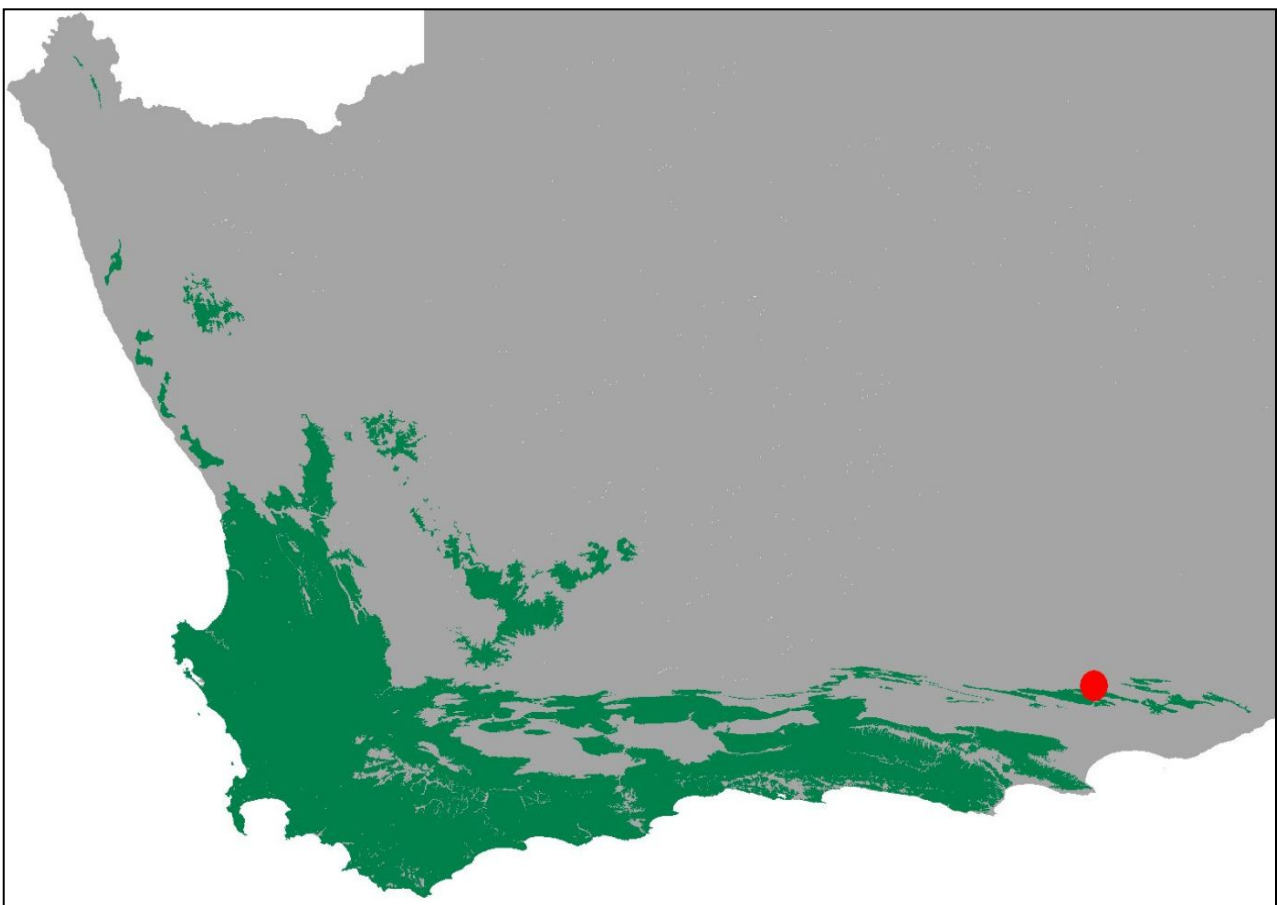


Figure 4: Relationship of the Fynbos Biome to the study area (red circle).

one of the principal centres of diversity and endemism in Africa (van Wyk & Smith 2001). Moreover, it is one of the earth's 25 hotspots, i.e. geographical areas that contain the world's greatest plant and animal diversity while also being subjected to high levels of pressure from development and/or degradation (Mittermeier *et al.* 2000). The Cape Floristic region is also the only hotspot that encompasses an entire Floristic Kingdom. This region has the greatest extratropical concentration of plant species in the world, with 9000 plant species, 6210 of which are endemics (Cowling & Pierce 2000). Diversity and endemism are high at the generic and familial level as well, with five of South Africa's 12 endemic plant families.

The characteristic and most widespread vegetation of the Cape Floristic Region is fynbos, consisting of hard-leaved, evergreen, fire-prone shrubs. Other vegetation types occurring in the CFR are Renosterveld, Succulent Karoo, Subtropical Thicket and Afromontane forest, although only Fynbos and Renosterveld are considered to be the main vegetation types in the CFR. Fynbos is associated with the nutrient poor soils of the Cape fold Belt mountains. It is very species rich, with over 75% of the CFR species associated with it, including all the endemic families and most of the endemic genera (van Wyk & Smith 2001). The vegetation type is characterized by a preponderance of Restionaceae, Ericaceae and Proteaceae and a paucity of annuals and grasses. Fynbos is rich in geophytes, notably from the families Liliaceae, Iridaceae and Orchidaceae, and is thought to harbour the richest geophyte flora in the world (Cowling & Richardson 1995). Many different types of Fynbos vegetation are recognised: a total of 78 fynbos and 38 renosterveld vegetation types have been mapped in the recently compiled vegetation map of South Africa (Mucina, Rutherford & Powrie 2005) of a total of 435 vegetation types of the whole country (more than a quarter of the total).

The Fynbos Biome and the CFR are largely concurrent and also match the boundaries of the two main vegetation types, fynbos and renosterveld.

Permanent and complete transformation of habitat has affected 33% of the CFR hotspot. Less than 20% of the total area covered by the CFR hotspot can be considered close to the pristine state in the sense that it is entirely free of alien plants and subjected to appropriate fire and grazing regimes (Cowling & Pierce 2000). The study area is within this hotspot area near its eastern end (see Figure 4) and, although the hotspot contains a wide variety of vegetation types, the study area contains vegetation types that are typical of the areas of concern within the hotspot.

Important Biodiversity Areas

There have been a number of regional conservation assessments produced within the Eastern Cape Province, including the following:

- Subtropical Thicket Ecosystem Programme (STEP)
- Succulent Karoo Ecosystems Programme (SKEP)
- National Spatial Biodiversity Assessment (NSBA)
- Eastern Cape Biodiversity Conservation Plan (ECBCP).

These studies identify patterns and processes that are important for maintaining biodiversity in the region. Unfortunately, many of these studies have been done using coarse scale satellite imagery that does not provide spatial or spectral accuracy at the scale of the present study. They are, however, useful for understanding broad issues and patterns within the area. The ECBCP has integrated all previous studies and is a useful reference for identifying conservation issues in the study area and surrounds.

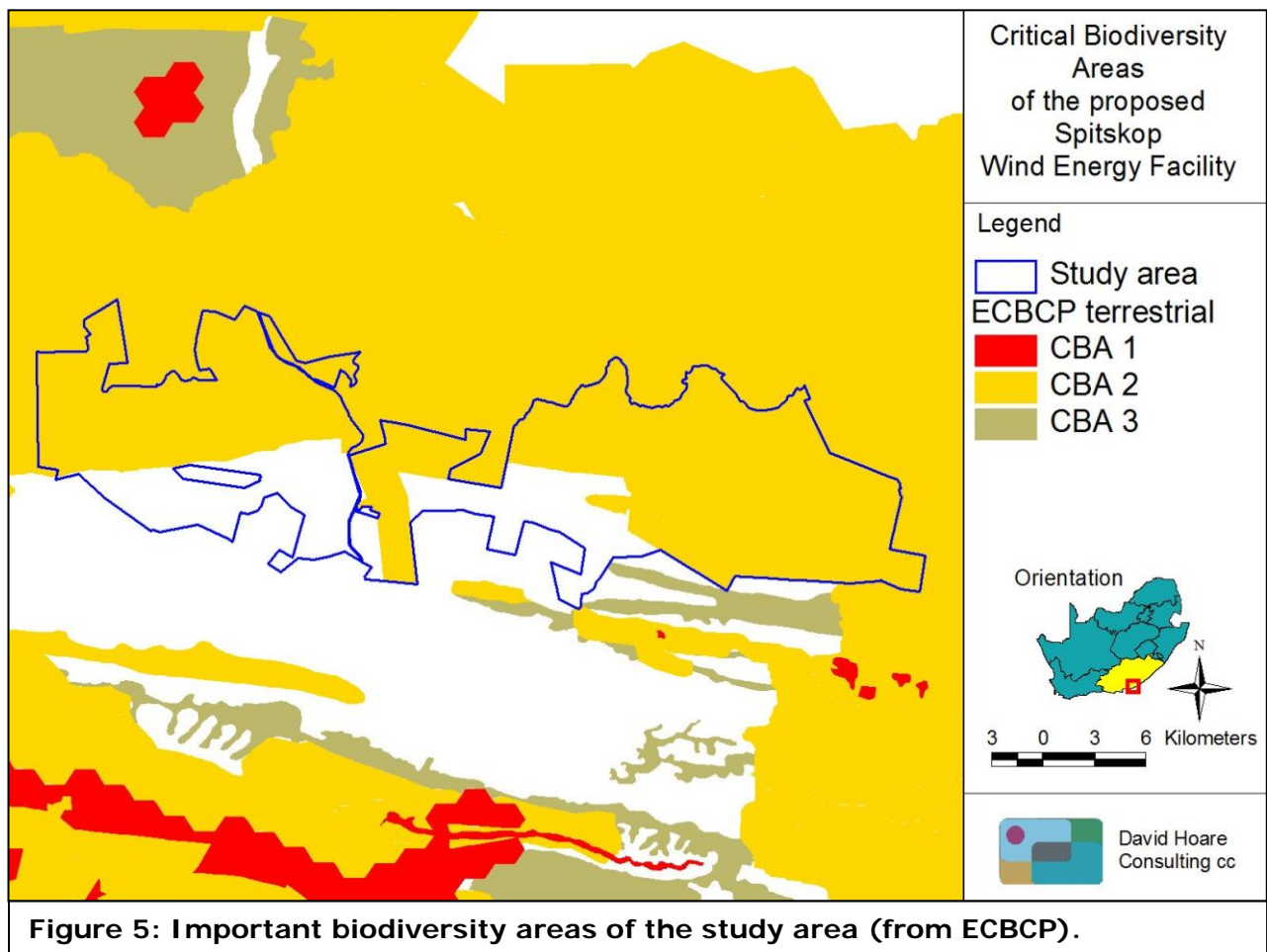
The ECBCP identifies Critical Biodiversity Areas (CBAs), which are terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning (Berliner & Desmet 2007). The ECBCP identifies CBAs at different levels with decreasing biodiversity importance, as follows (for the study area and surroundings):

1. PA: Protected areas.
2. CBA 1: CR vegetation types and irreplaceable biodiversity areas (areas definitely required to meet conservation targets).
3. CBA 2: EN vegetation types, ecological corridors, forest patches that do not fall into CBA 1, 1 km coastal buffer, irreplaceable biodiversity areas that do not fall into CBA 1.
4. CBA 3: VU vegetation types.

Within and around the study area, the ECBCP identifies CBAs at one level that occurs within the study area (Figure 5). The CBA 2 areas that fall within the study area are corridor areas, which are important for a number of reasons, including the maintenance of ecological processes.

Preliminary sensitivity assessment

The preliminary sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. Areas of potential sensitivity in the broader study area are shown in Figure 6 in red. The information provided in the preceding



sections was used to compile a map of remaining natural habitats and areas important for maintaining ecological processes in the study area. Broad scale mapping was used to provide information on the location of sensitive features. There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

1. vegetation of conservation importance: this is based primarily on the situation of the site within a vegetation type classified as Endangered in the scientific literature and Vulnerable according to the Draft Ecosystem List;
2. potential occurrence of populations of Red List organisms, including flora and fauna that have been evaluated as having a probability of occurring within natural habitats within the study area.

These factors have been taken into account in evaluating sensitivity within the study area. It must be emphasized that this is a preliminary map (Figure 6), based on broad information, excluding a site visit. It is vitally important to confirm these patterns during the EIA phase. It must also be noted that this excludes the following features:

1. perennial and/or non-perennial wetlands and drainage lines, which must be mapped in detail from aerial imagery in order to locate their boundaries;
2. forest patches, which should be treated as "no-go" areas.

Areas classified as having HIGH sensitivity are potentially restricted in terms of development footprints (require mitigation to offset impacts or parts of which could potentially be treated as "no-go" areas, depending on the outcome of the field-based study), areas classified as having MEDIUM sensitivity are negotiable (may also require mitigation to offset impacts) and remaining areas are preferred as sites for potential development.

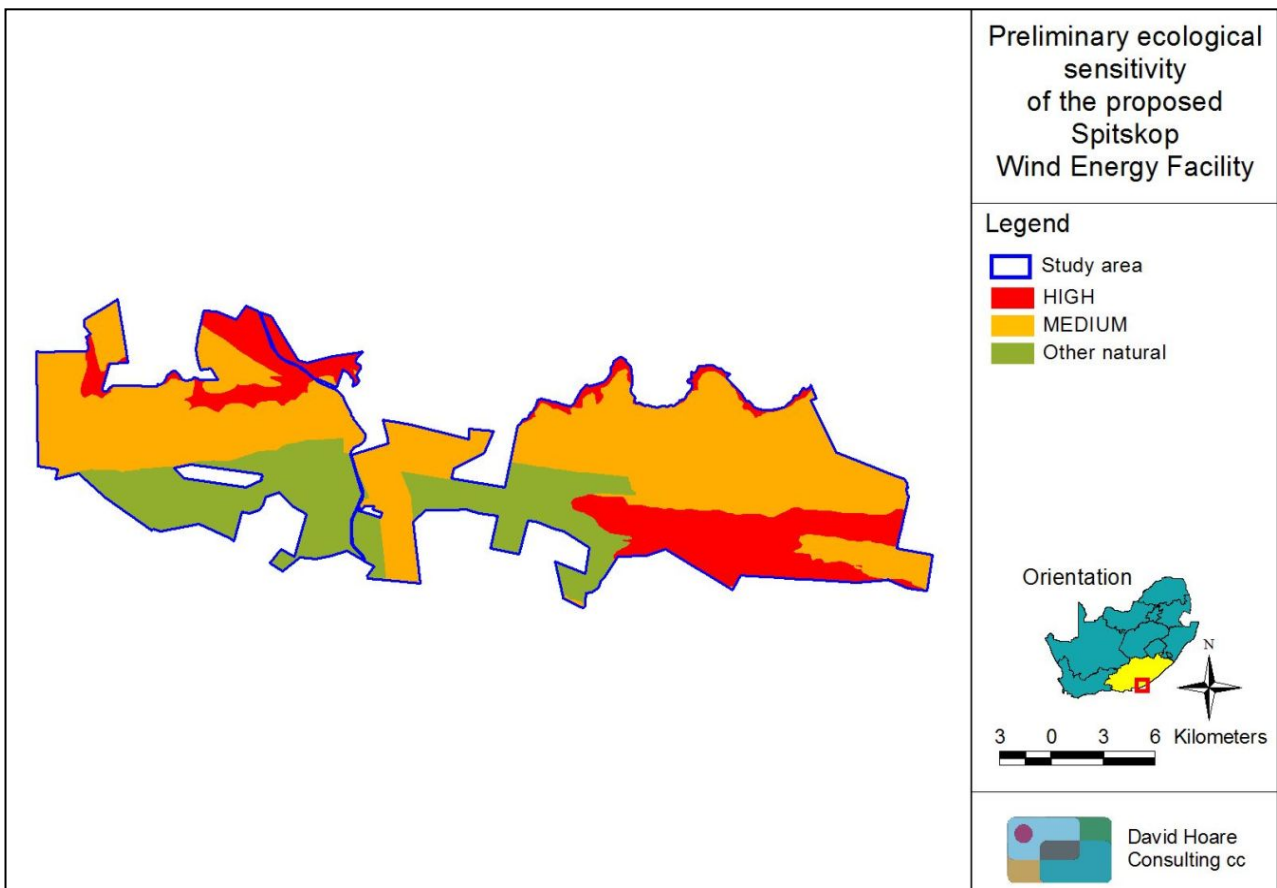


Figure 6: Potentially sensitive parts of the study area.

RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

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

Legislation

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

NEMA requires, inter alia, that:

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

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

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

The ECA states that:

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

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

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

National Forests Act (Act no 84 of 1998)

Protected trees

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

Forests

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

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

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

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).

- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

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

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

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

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

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

National Water Act, No. 36 of 1998

Provides for the protection of water resources in South Africa, including protecting aquatic and associated ecosystems and their biological diversity, reducing, and preventing pollution and degradation of water resources. According to the Act, water use includes impeding or diverting the flow of water in a watercourse and altering the bed, banks, course, or characteristics of a watercourse. Any contemplated water use requires the issuing of a permit from the Department.

IDENTIFICATION OF RISKS AND POTENTIAL IMPACTS

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

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

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

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

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

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

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

- Collisions with flying animals. This may have local impacts on populations as well as cumulative effects on species over wider areas.

Description of potential impacts

Major potential impacts are described briefly below. These are compiled from a generic list of possible impacts derived from previous projects of this nature and from a literature review of the potential impacts of wind energy facilities on the ecological environment. There are two major ways that the development may influence ecosystem structure and functioning—through direct impacts on individual organisms and through impacts on habitat structure and functioning.

Impact 1: Loss of habitat for threatened animals

Nature: Threatened animal species are affected primarily by the overall loss of habitat, since direct construction impacts can often be avoided due to movement of individuals from the path of construction.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localized populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

There are four animal species of conservation concern that could potentially be affected by the proposed wind energy facility:

1. White-tailed Rat (EN),
2. Samango Monkey (*labiatus* subspecies) (EN),
3. Tree Hyrax (VU),
4. Yellow-bellied House Snake (NT),

Specific habitats of concern are any forest patches (for the Samango Monkey and the Tree Hyrax) and fynbos vegetation suitable for the White-tailed Rat.

Extent: The impact will occur at the site of the proposed wind energy facility. It could potentially have an effect at a more regional level, since it could affect entire populations of affected species, but it is more likely to affect local populations, depending on the species.

Potential significance: Loss of key habitat could potentially be an impact of permanent duration and moderate magnitude (in terms of effects on population processes). The suitability of the site for these species can only be assessed by assessing the habitat on site for suitability for these species. Assuming that impacts will definitely occur, potential impacts on these species are likely to be of moderate to high significance.

Impact 2: Impacts on bats

Nature: Bird and bat deaths are one of the most controversial biological issues related to wind turbines. The deaths of birds and bats at wind farm sites have raised concerns by conservation agencies internationally. In order to address this issue in South Africa, the Endangered Wildlife

Trust (EWT) and BirdLife South Africa (BLSA) have combined efforts to lobby for the appropriate consideration of the potential negative effects of wind energy production.

Bats have been found to be particularly vulnerable to being killed by wind turbines. It has long been a mystery why they should be so badly affected since bat echo-location allows them to detect moving objects very well. A recent study in America has found that the primary cause for mortality is a combination of direct strikes and barotrauma (bats are killed when suddenly passing through a low air pressure region surrounding the turbine blade tips causing low pressure damage the bat's lungs, Baerwald *et al.* 2008). The relative importance of this impact on bat populations depends on which species are likely to be affected, the importance of the site for those species and whether the site is within a migration corridor for particular bat species.

The most vulnerable species are those that are already classified as threatened species, including those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species unless the impact occurs across a wide area that co-incides with their overall distribution range. Loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

It has been evaluated that there are two Near Threatened (NT) bat species that could potentially be affected by the proposed wind energy facility, as follows:

1. Natal Long-fingered Bat (NT),
2. Cape Horseshoe Bat (NT),

Both of these species are most likely to be affected by the operation of the WEF to a greater extent than the construction of the WEF.

Extent: The impact will occur at the site of the proposed WEF, but will have an impact at a more regional level, since it affects entire populations of affected species and may affect migration routes of species.

Potential significance: The impact will occur for the duration of the operation of the wind energy facility, which is long-term. The potential magnitude of the impact is moderate and will potentially result in population processes within worst-affected species continuing but in a modified way. Assuming that impacts will definitely occur, potential impacts on the most vulnerable species are likely to be of moderate significance.

Impact 3: Loss of populations of threatened plants

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

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localized populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences may include:

1. fragmentation of populations of affected species;
2. reduction in area of occupancy of affected species; and
3. loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

There is one Red List and two Orange List (near threatened) plant species that have a geographic distribution that includes the study area and are likely to occur in the types of habitats that are probably available on site. These species are as follows:

- *Haworthia aristata* (classified as Endangered),
- *Curtisia dentata* (classified as Near threatened),
- *Encephalartos longifolius* (classified as Near threatened).

Extent: The impact will occur at the site of the proposed wind energy facility. For the Endangered species, the impact can be considered to be global due to the potential global effect of a loss of any populations. The location of infrastructure is critical relative to suitable habitat.

Potential significance: Assuming the Endangered species does occur on site and that it will be affected by infrastructure (the worst-case scenario), the potential magnitude of the impact is likely to be moderate and will result in population processes continuing but in a modified way. The impact could therefore potentially be of high significance. It is, however, not likely that an impact would occur or more likely that a species of lesser conservation concern would be affected, in which case the impact could potentially be of low significance.

Impact 4: Impacts on protected tree species

There are a number of tree species that are protected according to Government Notice no. 1012 under section 12(l)(d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of section 15(1) of the National Forests Act, 1998 "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 license granted by the Minister to an applicant and subject to such period and conditions as may be stipulated".

A number of species have a geographic distribution that includes the study area appear on this list, including the following: *Catha edulis*, *Curtisia dentata*, *Ocotea bullata*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *Podocarpus latifolius*, *Prunus africana* and *Sideroxylon inerme* subsp. *inerme*. They all occur primarily in forest habitat. It is considered possible that they occur on site, especially three species that have previously recorded in the grid squares in which the study area is located, namely *Curtisia dentata*, *Podocarpus falcatus* and *Sideroxylon inerme* subsp. *inerme*.

Extent: The impact will occur at the site of the proposed WEF. It may affect single individuals of protected species.

Potential significance: Various protected tree could possibly occur on site, but are likely to be restricted to particular habitats that are unlikely to be affected by development. Even if the species occurs on site, it is likely to only be a small number of individuals. The possible presence of this species on site can only be assessed by assessing the habitat on site to determine whether the species occur there or not. Due to the small number of individuals that are likely to be affected (if any are affected), the impact is likely to be of low significance. However, a permit would need to be obtained for any protected trees that are affected, so a legal obligation remains irrespective of the significance of the impact.

Impact 5: Loss or fragmentation of indigenous natural vegetation

Construction of infrastructure may lead to direct loss of vegetation. This will lead to localised or more extensive reduction in the overall extent of grassland vegetation. Where this vegetation has already been stressed due to degradation and transformation at a regional level, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat and a change in the conservation status (current conservation situation). Consequences of the impact occurring may include:

1. negative change in conservation status of habitat (Driver et al. 2005);
2. increased vulnerability of remaining portions to future disturbance;
3. general loss of habitat for sensitive species;
4. loss in variation within sensitive habitats due to loss of portions of it;
5. general reduction in biodiversity;
6. increased fragmentation (depending on location of impact);
7. disturbance to processes maintaining biodiversity and ecosystem goods and services; and
8. loss of ecosystem goods and services.

It has been established that the major vegetation type that occurs in the study area are classified in the scientific literature (Mucina et al. 2006) as Least Concern and are not listed in the Draft Ecosystem List of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). Nevertheless, the site falls within the Albany Centre of Endemism and partly within the fynbos biome and parts of the site have been identified in the Eastern Cape Biodiversity conservation Plan as having elevated conservation value. The natural vegetation on site therefore potentially has moderate to high ecological sensitivity and conservation value.

Extent: The impact will occur at the site of the proposed wind energy facility, but will have an impact at a more regional level, since it affects areas classified regionally as having high conservation value (ecological corridor, within Centres of Endemism).

Potential significance: The potential magnitude of an impact is likely to be low and will likely only cause a slight impact on ecological processes. The fact that the site is mostly natural means that an impact is definite to occur and will be permanent. The potential significance of this impact could therefore potentially be of moderate significance.

Impact 6: Damage to wetlands

Construction may lead to some direct or indirect loss of or damage to seasonal marsh wetlands or drainage lines or impacts that affect the catchment of these wetlands. This will lead to localised loss of wetland habitat and may lead to downstream impacts that affect a greater extent of wetlands or impact on wetland function. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to wetlands can have an impact on the functioning of those wetlands. Consequences may include:

1. increased loss of soil;
2. loss of or disturbance to indigenous wetland vegetation;
3. loss of sensitive wetland habitats;
4. loss or disturbance to individuals of rare, endangered, endemic and/or protected species that occur in wetlands;
5. fragmentation of sensitive habitats;
6. impairment of wetland function;
7. change in channel morphology in downstream wetlands, potentially leading to further loss of wetland vegetation; and
8. reduction in water quality in wetlands downstream of road.

Aerial imagery indicates that there are a number of drainage lines on site that could support wetland vegetation. There are also significant riparian areas associated with the main rivers and streams. Damage to these areas could have an impact at the site of the impact as well as down-stream and the effect could potentially be long-lasting.

Extent: The impact will occur at the site of the individual infrastructure, but could have downstream impacts. The extent of the potential impact is therefore on the site and surroundings.

Potential significance: The potential significance of this impact may be moderate to high due to the sensitivity of wetlands to disturbance thus leading to impacts of potentially high magnitude. Mitigation measures could be put in place to avoid or reduce the potential impact to a low significance. There is also a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.

Impact 7: Increased risk of veld fires

During construction there is a higher risk of veld fires around construction sites due to the use of fires for cooking and warmth by construction workers. Impacts that may arise from this may include:

1. Damage to sensitive habitats, especially damage to woodland vegetation and change in species composition in grasslands;
2. Damage to populations of sensitive plant species;
3. Loss of vegetation biomass; and
4. Increased soil erosion due to loss of vegetation cover.

The site is within an area of mixed vegetation in which fire does not necessarily form a natural ecological component on a regular basis. Fynbos is associated with fires that are likely to occur on a 10 to 20 year cycle. Grassland that is managed for livestock farming tends to have a higher fire regime. Thicket and woodland usually does not have regular natural fires and can be severely damaged by inappropriate fires. Karoo mostly has a low fuel load and is unlikely to burn easily. It is possible that there would be a higher risk of fires occurring in the vicinity of the construction of the wind energy facility or during the operation of the facility.

Extent: The impact will occur at the site of the proposed WEF and possibly surrounding areas, if fires spread.

Potential significance: The magnitude of the impact is likely to be high due to the low naturally occurring fire frequencies in thicket vegetation. The duration of an impact would be long-term. The potential significance of this impact is therefore likely to be medium.

Impact 8: Establishment and spread of declared weeds and alien invader plants

Major factors contributing to invasion by alien invader plants includes high disturbance, fostering/utilisation as hedges, woodlots or fruit trees, negative grazing practices, and deforestation (Zachariades *et al.* 2005). Exotic species are often more prominent near infrastructural disturbances than further away (Gelbard & Belnap 2003, Watkins *et al.* 2003). Consequences of this may include:

1. loss of indigenous vegetation;
2. change in vegetation structure leading to change in various habitat characteristics;
3. change in plant species composition;
4. change in soil chemical properties;
5. loss of sensitive habitats;
6. loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
7. fragmentation of sensitive habitats;
8. change in flammability of vegetation, depending on alien species;
9. hydrological impacts due to increased transpiration and runoff; and
10. impairment of wetland function.

It is not known what alien plants occur on site. Due to the diverse environment and mixture of different vegetation types, there are many species that could potentially be problematic in this region.

Extent: The impact will occur at the site of the proposed wind energy facility, but could potentially spread extensively into the surrounding landscape. The impact will therefore be evaluated at a scale of site and surroundings or regional.

Potential significance: There is a moderate likelihood that alien species will spread on site in the absence of control measures. It is likely to be a long-term impact with potentially high magnitude of impact on local ecosystems. The impact could therefore potentially be of moderate to high significance. Standard control measures, if put in place, would adequately control this impact and reduce the significance to low.

DISCUSSION AND CONCLUSIONS

The major vegetation types that occur in the study area are classified in the scientific literature (Mucina et al. 2006) as Least Threatened. They are not listed in the Draft Ecosystem List of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). However, significant parts of the study site potentially have elevated conservation value due to being within either the Fynbos Biome or the Albany Centre of Endemism. A large proportion of the vegetation of the study area is classified in an intermediate level of conservation value in the Eastern Cape Biodiversity Conservation Plan (Figure 2).

Wetlands and drainage lines are protected under national legislation (National Water Act). There are a number of drainage lines on site that could support wetland vegetation. There are also significant riparian areas associated with the main rivers and streams. Damage to these areas could have an impact at the site of the impact as well as down-stream and the effect could potentially be long-lasting. Any impacts on these areas would require a permit from the National Department of Water Affairs.

There are three protected tree species that have a geographical distribution that includes the site and which have been previously recorded in the area that includes the study area. Aerial imagery indicates that there may be suitable habitat on site for these species, as well as others that have a geographical distribution that includes the site. The protected tree species are *Catha edulis*, *Curtisia dentata*, *Ocotea bullata*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *Podocarpus latifolius*, *Prunus africana* and *Sideroxylon inerme* subsp. *inerme*. They all occur primarily in forest habitat.

There is one Red List and two Orange List (near threatened) plant species that have a geographic distribution that includes the study area and are likely to occur in the types of habitats that are probably available on site. These species are *Haworthia aristata* (classified as Endangered), *Curtisia dentata* (classified as Near threatened) and *Encephalartos longifolius* (classified as Near threatened). A botanical survey in suitable habitat on site should establish whether the species have a likelihood of occurring there or not.

There are a number of animal species of conservation concern that may occur in habitats within the study area. Many of these are mobile animals that are likely to move away from the path of any construction. Six species of concern were identified that may be negatively affected by development of the site, the White-tailed Rat (EN), Samango Monkey (*Labiatus* subspecies) (EN), Tree Hyrax (VU), Natal Long-fingered Bat (NT), Cape Horseshoe Bat (NT) and Yellow-bellied House Snake (NT). The suitability of habitats for these species will have to be confirmed during the field survey of the site during the EIA. Preliminary habitat requirements are provided in the appendices to this report.

Most of the study area appears, from aerial imagery, to be in a natural state and in reasonably good condition. Any areas in moderate to good condition could potentially be classified as having moderate or high sensitivity and conservation value. The condition of the vegetation will have to be determined during detailed field surveys to be undertaken during the EIA phase of the project.

A risk assessment was undertaken which identified eight main potential negative impacts on the ecological receiving environment. The significance of these impacts will be assessed during the EIA phase after collection of relevant field data. An initial assessment indicates that many of these impacts are likely to be significant or that there is a legislative benefit to establishing whether they will occur or not. The identified potential impacts are the following (with potential significance of impacts in brackets):

1. Loss of habitat for threatened animals (MEDIUM to HIGH)
2. Impacts on bats (MEDIUM)
3. Loss of populations of threatened plants (LOW to HIGH)
4. Loss of individuals of protected trees (LOW)
5. Loss or fragmentation of indigenous natural vegetation (MEDIUM)
6. Damage to wetlands (MEDIUM to HIGH)
7. Increased risk of veld fires (MEDIUM)
8. Establishment and spread of declared weeds and alien invader plants (MEDIUM to HIGH).

Summary of proposed EIA methodology

The following assessments should be undertaken during the EIA phase in order to properly assess potential impacts on the ecological receiving environment by the proposed wind energy facility:

- The presence and distribution of wetlands on site will be confirmed. This will be done primarily using aerial photograph interpretation, but will be confirmed in the field
- A detailed sensitivity map of the entire site will be produced from aerial photography during the EIA phase. This will include mapping and incorporation of any sensitive features, for example drainage lines, that may occur on site.
- The potential presence of protected trees on site must be evaluated by searching habitats where these are most likely to be found.
- The presence of species of concern must be evaluated during the EIA phase for selected sites. For plants this must be done by searching for populations of plants that could occur in the study area based on habitat requirements and historical collection records. For animals this must be done by assessing habitat suitability for those species that have been assessed as potentially occurring in the area. The lists provided in this Scoping Report will form the basis for those assessments and surveys. Particular attention should be paid to those species classified as threatened (VU, EN or CR), Near Threatened or Critically Rare and which have a high probability of occurring on site or being affected by the proposed infrastructure, including the following:
 - White-tailed Rat (EN),
 - Samango Monkey (*labiatus* subspecies) (EN),
 - Tree Hyrax (VU),
 - Natal Long-fingered Bat (NT),
 - Cape Horseshoe Bat (NT),
 - Yellow-bellied House Snake (NT),
 - *Haworthia aristata* (EN),
 - *Curtisia dentata* (NT),
 - *Encephalartos longifolius* (NT).

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

Sources: South African National Biodiversity Institute in Pretoria.

*IUCN (3.1) Categories:

VU = Vulnerable

EN = Endangered

CR = Critically Endangered

NT = Near Threatened

Table A: Threatened, Near Threatened and Declining plant species that could potentially occur in the study area

Species	Global (IUCN) Status	Regional (SA) status	Grid	Distribution and habitat	Likelihood of occurrence
<i>Boophone disticha</i>	LC	Declining	3325BB	Most of South Africa and up to Uganda. Dry grassland and rocky areas.	HIGH
<i>Crassula socialis</i>	LC	Rare	3325BB	King William's Town to Kommadagga (3325BB).	HIGH
<i>Curtisia dentata</i>	LC	NT	3326AA	Evergreen forest, coast to 1800m a.s.l., Cape Peninsula to the Zimbabwe and Mozambique highlands.	HIGH
<i>Encephalartos longifolius</i>	NT	NT	3325BB	Kouga Mountains to Grahamstown on steep rocky slopes in dense thicket.	HIGH
<i>Faucaria gratiae</i>	LC	Rare	3326AA	Riebeeck East area (Mitford Park and Palmietfontein) in grassland with open patches of thicket.	HIGH
<i>Gasteria baylissiana</i>	LC	Rare	3326AA	Known only from a single gorge in the Zuurberg range in the eastern Cape. Sheer rock faces derived from quartzitic sandstone of the Witteberg Group usually in light shade. Historical collection from Swartwaterspoort near Riebeeck East.	MEDIUM
<i>Gasteria bicolor</i> var. <i>liliputana</i>	LC	Rare	3326AA	Sandstone ridges at Grahamstown district, Pluto's Vale. The specimen from Swartwaterspoort near Riebeeck East has recently been described as a different species.	MEDIUM
<i>Haworthia aristata</i>	EN	EN	3325BB	Thicket mosaics from Port Elizabeth to Kommadagga.	HIGH
<i>Loxostylis alata</i>	LC	Declining	3326AA	Western Cape to southern KwaZulu-Natal.	MEDIUM
<i>Polygala bowkeriae</i>	DDD	DDD	3326AA	Uncertain: various scattered localities including Riebeeck East in rocky scrub.	MEDIUM

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria

Appendix 2: Threatened vertebrate species with a geographical distribution that includes the current study area.

MAMMALS

Common name	Taxon	Distribution & habitat ¹	Status ²	Likelihood of occurrence
Oribi	<i>Ourebia ourebi</i>	Temperate grassland - open grassland with gentle topography. Mosaic of tall and short grasses required to meet resting and feeding requirements. Occurs throughout sub-Saharan Africa, associated with grasslands.	EN ¹ LC ² Protected (NEMBA)	LOW , previously recorded in grids to east and overall geographical distribution includes this parts of area, but habitat on site not suitable.
Tree hyrax	<i>Dendrohyrax arboreus arboreus</i>	Arboreal browser confined to forest habitats and dense thickets	VU	MEDIUM , previously recorded in neighbouring grid. Presence of suitable habitat on site unknown but possible.
Brown hyena	<i>Hyena brunnea</i>	Savanna, urban areas, scavenger	NT ^{1,2} Protected (NEMBA)	MEDIUM , within overall geographical distribution range.
Honey badger	<i>Mellivora capensis</i>	Wide variety of habitats. Probably only in natural habitats.	NT ¹ LC ²	MEDIUM , within overall geographical distribution range.
Lesser woolly bat	<i>Kerivoula lanosa</i>	Savanna and riparian woodland, roosts in disused bird nests.	NT ¹ LC ²	MEDIUM , within overall geographical distribution range.
Lesser long-fingered bat	<i>Miniopterus fraterculus</i>	Caves in a wide variety of habitats from drier savanna to Afromontane and coastal forest.	NT ¹ LC ²	MEDIUM , within overall geographical distribution range.
Natal long-fingered bat	<i>Miniopterus natalensis</i>	Caves and sub-terranean habitats in Fynbos, savanna, woodland, succulent and Nama Karoo, grassland; cave-dwelling aerial insectivore.	NT ^{1,2,3}	HIGH , within overall geographical distribution range, recorded in various surrounding grids, site could be used for foraging
Temminck's hairy bat	<i>Myotis tricolor</i>	Caves in forests, shrubland, savanna, grassland, mountains; cave-dwelling aerial insectivore.	NT ¹ LC ²	MEDIUM , edge of overall geographical distribution range, site could be used for foraging
Cape Horseshoe bat	<i>Rhinolophus capensis</i>	Caves and subterranean habitats; fynbos, shrubland and Nama-karoo in western and south-western parts of South Africa	NT ^{1,2,3}	HIGH , within overall geographical distribution range, recorded in various surrounding grids, site could be used for foraging
Geoffroy's horseshoe bat	<i>Rhinolophus clivosus</i>	Caves and subterranean habitats; fynbos, shrubland and Nama-karoo, widespread	NT ¹ LC ²	MEDIUM , within overall geographical distribution range, site could be used for foraging.
Samango monkey	<i>Cercopithecus mitis labiatus</i>	Arboreal, occurring in Afromontane, coastal and sand forests.	EN ¹ LC ² Protected (NEMBA)	HIGH , within overall geographical distribution range, previously recorded in all three grids
White-tailed rat	<i>Mystromus albicaudatus</i>	Highveld and montane grassland, requires sandy soils with good cover. Found throughout South Africa except Northern Cape and Limpopo	EN	HIGH , previously recorded in grid, overall geographical distribution includes this area.

¹Distribution according to Friedmann & Daly 2004.

²Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 10 January 2011.

³National status according to Monadjem et al. 2010

AMPHIBIANS

Common name	Species	Distribution & habitat ¹	Status ²	Likelihood of occurrence
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	Widely distributed in southern Africa, mainly at higher elevations. Inhabits a variety of vegetation	NT ¹ LC ²	HIGH , distribution includes site; there is

Common name	Species	Distribution & habitat ¹	Status ²	Likelihood of occurrence
		types where it breeds in seasonal, shallow, grassy pans in flat, open areas; also utilises non-permanent vleis and shallow water on margins of waterholes and dams. Prefer sandy substrates although they sometimes inhabit clay soils.	Protected (NEMBA)	probably suitable foraging and breeding habitat on site

¹Distribution according to du Preez & Carruthers 2009.

²Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 10 January 2011.

REPTILES

Common name	Species	Habitat ¹	Status ²	Likelihood of occurrence
Yellowbellied house snake	<i>Lamprophis fuscus</i>	Old termitaria and under stones, underground. Found throughout more mesic parts of South Africa (Cape, east coast, Highveld).	NT ²	MEDIUM , within overall distribution range and habitats may be available on site.

¹Distribution according to Alexander & Marais 2008.

²Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 10 January 2011.

Appendix 3: List of protected tree species (National Forests Act).

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

Catha edulis, *Curtisia dentata*, *Ocotea bullata*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *Podocarpus latifolius*, *Prunus africana* and *Sideroxylon inerme* subsp. *inerme* have a geographical distribution that coincides with the study area.

Appendix 4: Animal species with a geographical distribution that includes the study area.

Mammals:

African elephant
Klipspringer
Oribi
Grey rhebok
Bushpig
Steenbok
Cape grysbok
Reedbuck
Mountain reedbuck
Common duiker
Cape buffalo
Eland
Bushbuck
Kudu
Rock hyrax
Cape clawless otter
Water mongoose
Black-backed jackal
Caracal
Black-footed cat
African wild cat
Small grey mongoose
Small-spotted genet
Large-spotted genet
Large grey mongoose
Brown hyaena
Striped polecat
Spotted-necked otter
Honey badger
Bat-eared fox
Leopard
African weasel
Aardwolf
Suricate
Cape fox
Wahlberg's epauletted fruit bat
Long-tailed serotine bat
Lesser woolly bat
Lesser long-fingered bat
Natal long-fingered bat
Temminck's hairy bat
Cape serotine bat
Egyptian slit-faced bat
Cape horseshoe bat
Geoffroy's horseshoe bat
Egyptian fruit bat
Yellow house bat
Egyptian free-tailed bat
Mauritian tomb bat
Hottentot's golden mole
Reddish-grey musk shrew
Greater musk shrew
Forest shrew

Scrub hare
Hewitt's red rock rabbit
Vervet monkey
Samango monkey
Chacma baboon
Namaqua rock mouse
Common mole-rat
Grey climbing mouse
Brant's climbing mouse
Short-tailed gerbil
Hairy-footed gerbil
Woodland mouse
Woodland dormouse
Spectackled dormouse
Porcupine
Natal multimammate mouse
Pygmy mouse
White-tailed rat
Vlei rat
Saunders' vlei rat
Karoo bush rat
Springhare
Striped mouse
Pouched mouse
Greater cane rat
Smith's rock elephant shrew
Aardvark

Reptiles:

Eastern Cape dwarf chameleon
Puff adder
Berg adder
Rhombic night adder
Cape cobra
Rinkhals
Coral snake
Spotted harlequin snake
Boomsland
Karoo whip snake
Crossed whip snake
Spotted skaapsteker
Herald snake
Brown house snake
Aurora house snake
Spotted rock snake
Yellow-bellied house snake
Common brown water snake
Mole snake
Sundevall's shovel-snout
Spotted bush snake
Common slug-eater
Common wolf snake
Common egg-eater
Delalande's beaked blind snake

Bibron's blind snake
Cape worm snake
Rock monitor
Water monitor
Sand lizard species
Mountain lizard species
Legless skink species
Skink species
Girdled lizard species
Crag lizard species
Grass lizard
Short-legged seps
Plated lizard species
Flat gecko species
Tubercled gecko species
Spotted gecko species
Marico gecko
Marsh terrapin
Greater padloper
Angulate tortoise
Leopard tortoise
Karoo tent tortoise

Amphibians

Bushveld rain frog
Eastern leopard toad
Raucous toad
Karoo toad
Bubbling kassina
Snoring puddle frog
Common platanna
Boettger's caco
Bronze caco
Common river frog
Cape river frog
Giant bullfrog
Striped stream frog
Clicking stream frog
Tandy's sand frog

Appendix 5: Plant species previously recorded in grid that includes the study area.

Adiantum aethiopicum L.
Albuca maxima Burm.f.
Allophylus decipiens (Sond.) Radlk.
Aloe africana Mill.
Aloe arborescens Mill.
Aloe ferox Mill.
Aloe longistyla Baker
Aloe maculata All.
Aloe microstigma Salm-Dyck ssp. *microstigma*
Aloe pluridens Haw.
Aloe speciosa Baker
Aloe variegata L.
Alternanthera pungens Kunth
Ammocharis coranica (Ker Gawl.) Herb.
Anchusa capensis Thunb.
Anthospermum aethiopicum L.
Anthospermum herbaceum L.f.
Anthospermum paniculatum Cruse
Anthospermum spathulatum Spreng. ssp. *uitenhagense* Puff
Apodytes dimidiata E.Mey. ex Arn. ssp. *dimidiata*
Aptenia cordifolia (L.f.) Schwantes
Aptenia haeckeliana (A.Berger) Bittrich ex Gerbaulet
Aptosimum procumbens (Lehm.) Steud.
Aristida diffusa Trin. ssp. *burkei* (Stapf) Melderis
Aspalathus ericifolia L. ssp. *minuta* R.Dahlgren
Aspalathus hispida Thunb. ssp. *hispida*
Aspalathus kougaensis (Garab. ex R.Dahlgren) R.Dahlgren
Aspalathus nivea Thunb.
Aspalathus subtingens Eckl. & Zeyh.
Aspalathus teres Eckl. & Zeyh. ssp. *teres*
Asparagus aethiopicus L.
Asparagus burchellii Baker
Asparagus exuvialis Burch. forma *exuvialis*
Asparagus multiflorus Baker
Asparagus striatus (L.f.) Thunb.
Asparagus subulatus Thunb.
Atriplex lindleyi Moq. ssp. *inflata* (F.Muell.) Paul G.Wilson
Atriplex nummularia Lindl.
Atriplex semibaccata R.Br. var. *appendiculata* Aellen
Atriplex vestita (Thunb.) Aellen var. *appendiculata* Aellen
Avena sativa L.
Azolla filiculoides Lam.
Ballota africana (L.) Benth.
Berkheya sp.
Bidens pilosa L.
Boerhavia coccinea Mill. var. *coccinea*
Boophone disticha (L.f.) Herb.
Boscia oleoides (Burch. ex DC.) Toelken
Brachylaena elliptica (Thunb.) DC.
Brachystelma circinatum E.Mey.
Brunsvigia gregaria R.A.Dyer
Buddleja glomerata H.L.Wendl.
Buddleja saligna Willd.
Bulbine abyssinica A.Rich.
Bulbine frutescens (L.) Willd.

Cadaba aphylla (Thunb.) Wild
Canthium inerme (L.f.) Kuntze
Cassine peragua L. ssp. *peragua*
Centaurea calcitrapa L.
Ceropegia linearis E.Mey. ssp. *woodii* (Schltr.) H.Huber
Ceropegia zeyheri Schltr.
Chasmatophyllum musculinum (Haw.) Dinter & Schwantes
Cheilanthes contracta (Kunze) Mett. ex Kuhn
Cheilanthes parviloba (Sw.) Sw.
Chenopodium phillipsianum Aellen
Chionanthus peglerae (C.H.Wright) Stearn
Chironia baccifera L.
Chlorophytum crispum (Thunb.) Baker
Chrysanthemoides monilifera (L.) Norl. ssp. *pisifera* (L.) Norl.
Cirsium vulgare (Savi) Ten.
Cliffortia drepanoides Eckl. & Zeyh.
Cliffortia filifolia L.f.
Cliffortia linearifolia Eckl. & Zeyh.
Clutia brevifolia Sond.
Clutia laxa Eckl. ex Sond.
Clutia pulchella L. var. *pulchella*
Combretum caffrum (Eckl. & Zeyh.) Kuntze
Conium chaerophylloides (Thunb.) Sond.
Convolvulus bidentatus Bernh. ex C.Krauss
Corycium nigrescens Sond.
Cotyledon campanulata Marloth
Cotyledon velutina Hook.f.
Crassula capitella Thunb. ssp. *thyrsiflora* (Thunb.) Toelken
Crassula ericoides Haw. ssp. *ericoides*
Crassula expansa Dryand. ssp. *expansa*
Crassula muscosa L. var. *parvula* (Eckl. & Zeyh.) Toelken
Crassula nudicaulis L.
Crassula pellucida L. ssp. *brachypetala* (Drège ex Harv.) Toelken
Crassula rogersii Schönland
Crassula rupestris Thunb. ssp. *rupestris*
Crassula socialis Schönland
Crassula tetragona L. ssp. *robusta* (Toelken) Toelken
Cucumis zeyheri Sond.
Curtisia dentata (Burm.f.) C.A.Sm.
Cuscuta campestris Yunck.
Cussonia spicata Thunb.
Cussonia spicata Thunb.
Cyanotis speciosa (L.f.) Hassk.
Cynanchum gerrardii (Harv.) Liede
Cyperus difformis L.
Cyperus rubicundus Vahl
Cyphia sylvatica Eckl. var. *sylvatica*
Cyphia undulata Eckl.
Cyrtanthus contractus N.E.Br.
Delosperma sp.
Dietes grandiflora N.E.Br.
Digitaria sp.
Diheteropogon filifolius (Nees) Clayton
Diospyros dichrophylla (Gand.) De Winter
Diospyros lycioides Desf. ssp. *lycioides*
Diospyros lycioides Desf. ssp. *sericea* (Bernh.) De Winter
Diospyros scabrida (Harv. ex Hiern) De Winter var. *cordata* (E.Mey. ex A.DC.) De Winter

Diospyros whyteana (Hiern) F.White
Dipogon lignosus (L.) Verdc.
Disa sagittalis (L.f.) Sw.
Dolichos hastaeformis E.Mey.
Drimia anomala (Baker) Baker
Duvalia maculata N.E.Br.
Echium plantagineum L.
Ehretia rigida (Thunb.) Druce ssp. *rigida*
Elaeodendron zeyheri Spreng. ex Turcz.
Encephalartos longifolius (Jacq.) Lehm.
Eragrostis curvula (Schrad.) Nees
Eragrostis lehmanniana Nees var. *lehmanniana*
Eragrostis obtusa Munro ex Ficalho & Hiern
Erica deliciosa H.L.Wendl. ex Benth.
Erica demissa Klotzsch ex Benth. var. *demissa*
Erica nemorosa Klotzsch ex Benth.
Erica nutans J.C.Wendl.
Erica orientalis R.A.Dyer
Erica unilateralis Klotzsch ex Benth.
Eriocephalus ericoides (L.f.) Druce ssp. *ericoides*
Eriospermum bifidum R.A.Dyer
Eriospermum dregei Schönland
Euclea daphnoides Hiern
Euclea undulata Thunb.
Euphorbia cumulata R.A.Dyer
Euphorbia enopla Boiss. var. *enopla*
Euphorbia inermis Mill. var. *huttoniae* (N.E.Br.) A.C.White, R.A.Dyer & B.Sloane
Euphorbia inermis Mill. var. *inermis*
Euphorbia mauritanica L. var. *mauritanica*
Euphorbia meloformis Aiton ssp. *valida* (N.E.Br.) G.D.Rowley
Euphorbia micracantha Boiss.
Euryops anthemoides B.Nord. ssp. *anthemoides*
Faucaria felina (L.) Schwantes
Faucaria gratiae L.Bolus
Felicia filifolia (Vent.) Burt Davy ssp. *schlechteri* (Compton) Grau
Felicia muricata (Thunb.) Nees ssp. *muricata*
Ficus burtt-davyi Hutch.
Ficus ingens (Miq.) Miq.
Fissidens rufescens Hornsch.
Freesia corymbosa (Burm.f.) N.E.Br.
Galopina circaeoides Thunb.
Gasteria baylissiana Rauh
Gasteria bicolor Haw. var. *bicolor*
Gasteria bicolor Haw. var. *liliputana* (Poelln.) Van Jaarsv.
Gasteria pulchra (Aiton) Haw.
Geranium caffrum Eckl. & Zeyh.
Gladiolus permeabilis D.Delaroche ssp. *edulis* (Burch. ex Ker Gawl.) Oberm.
Gleichenia polypodioides (L.) Sm.
Gnaphalium vestitum Thunb.
Gnidia cuneata Meisn.
Gnidia deserticola Gilg
Gnidia racemosa Thunb.
Gomphocarpus cancellatus (Burm.f.) Bruyns
Grewia occidentalis L. var. *occidentalis*
Gymnosporia buxifolia (L.) Szyszyl.
Gymnosporia heterophylla (Eckl. & Zeyh.) Loes.
Gymnosporia nemorosa (Eckl. & Zeyh.) Szyszyl.

Gymnosporia polyacanthus (Sond.) Szyszyl. ssp. *polyacanthus*
Habenaria arenaria Lindl.
Haemanthus albiflos Jacq.
Haemanthus humilis Jacq. ssp. *humilis*
Haworthia angustifolia Haw. var. *altissima* M.B.Bayer
Haworthia aristata Haw.
Haworthia glauca Baker var. *glauca*
Haworthia reinwardtii (Salm-Dyck) Haw. var. *reinwardtii* forma *chalumnensis* (G.G.Sm.)
M.B.Bayer
Haworthia reinwardtii (Salm-Dyck) Haw. var. *riebeekensis* G.G.Sm.
Helichrysum anomalum Less.
Helichrysum asperum (Thunb.) Hilliard & B.L.Burt var. *apressifolium* (Moeser) Hilliard
Helichrysum litorale Bolus
Helichrysum petiolare Hilliard & B.L.Burt
Helichrysum umbraculigerum Less.
Hermannia conglomerata Eckl. & Zeyh.
Hermannia cuneifolia Jacq. var. *cuneifolia*
Hermannia linearifolia Harv.
Hermannia pulverata Andrews
Hermannia velutina DC.
Hesperantha bachmannii Baker
Hibiscus pusillus Thunb.
Holothrix parviflora (Lindl.) Rchb.f.
Huernia barbata (Masson) Haw. ssp. *barbata*
Hymenolepis indivisa (Harv.) Källersjö
Hypericum lalandii Choisy
Hypodiscus striatus (Kunth) Mast.
Hypoxis multiceps Buchinger ex Baker
Indigostrum argyraeum (Eckl. & Zeyh.) Schrire
Indigofera denudata L.f.
Indigofera disticha Eckl. & Zeyh.
Indigofera heterophylla Thunb.
Indigofera verrucosa Eckl. & Zeyh.
Ipomoea oenotheroides (L.f.) Raf. ex Hallier f.
Jamesbrittenia microphylla (L.f.) Hilliard
Jamesbrittenia sp.
Karoochloa curva (Nees) Conert & Türpe
Kedrostis africana (L.) Cogn.
Kiggelaria africana L.
Knowltonia cordata H.Rasm.
Lampranthus sp.
Lauridia tetragona (L.f.) R.H.Archer
Ledebouria sp.
Leptochloa fusca (L.) Kunth
Lessertia depressa Harv.
Leucadendron salignum P.J.Bergius
Leucas capensis (Benth.) Engl.
Leucospermum cuneiforme (Burm.f.) Rourke
Lotononis pumila Eckl. & Zeyh.
Loxostylis alata A.Spreng. ex Rchb.
Macledium spinosum (L.) S.Ortíz
Maerua cafra (DC.) Pax
Maytenus oleoides (Lam.) Loes.
Melasma sp.
Melolobium candicans (E.Mey.) Eckl. & Zeyh.
Merxmuellera disticha (Nees) Conert
Mesembryanthemum aitonis Jacq.

Mesembryanthemum crystallinum L.
 Mohria caffrorum (L.) Desv.
 Monechma spartioides (T.Anderson) C.B.Clarke
 Montinia caryophyllacea Thunb.
 Moraea speciosa (L.Bolus) Goldblatt
 Muraltia squarrosa (L.f.) DC.
 Mystroxylon aethiopicum (Thunb.) Loes. ssp. aethiopicum
 Nenax microphylla (Sond.) T.M.Salter
 Nicotiana glauca Graham
 Notobubon laevigatum (Aiton) Magee
 Nymania capensis (Thunb.) Lindb.
 Ocimum burchellianum Benth.
 Oedera genistifolia (L.) Anderb. & K.Bremer
 Oenothera stricta Ledeb. ex Link ssp. stricta
 Oldenburgia grandis (Thunb.) Baill.
 Olea europaea L. ssp. africana (Mill.) P.S.Green
 Ornithogalum conicum Jacq. ssp. conicum
 Ornithogalum dubium Houtt.
 Ornithogalum tenuifolium F.Delaroche ssp. tenuifolium
 Osyris compressa (P.J.Bergius) A.DC.
 Othonna capensis L.H.Bailey
 Pachycarpus dealbatus E.Mey.
 Panicum coloratum L. var. coloratum
 Panicum maximum Jacq.
 Pappia capensis Eckl. & Zeyh.
 Paspalum distichum L.
 Pavetta capensis (Houtt.) Bremek. ssp. capensis
 Peersia macradenia (L.Bolus) L.Bolus
 Pegolettia retrofracta (Thunb.) Kies
 Pelargonium parvirostre R.A.Dyer
 Pelargonium radens H.E.Moore
 Pelargonium reniforme Curtis
 Pelargonium reniforme Curtis ssp. velutinum (Eckl. & Zeyh.) Dreyer
 Pelargonium tetragonum (L.f.) L'Hér.
 Pentaschistis ampla (Nees) McClean
 Pentaschistis pallida (Thunb.) H.P.Linder
 Peristrophe cernua Hook. ex Nees
 Phylla axillaris Lam. var. axillaris
 Phylla paniculata Willd.
 Phyllanthus maderaspatensis L.
 Phyllobolus splendens (L.) Gerbaulet ssp. splendens
 Plectranthus laxiflorus Benth.
 Podocarpus falcatus (Thunb.) R.Br. ex Mirb.
 Polygala bowkeriae Harv.
 Polygala myrtifolia L. var. myrtifolia
 Polygala uncinata E.Mey. ex Meisn.
 Polygala virgata Thunb. var. virgata
 Polygonum sp.
 Portulacaria afra Jacq.
 Potamogeton pusillus L.
 Prenia radicans (L.Bolus) Gerbaulet
 Protea foliosa Rourke
 Protea lorifolia (Salisb. ex Knight) Fourc.
 Protea repens (L.) L.
 Pseudocrossidium crinitum (Schultz) R.H.Zander
 Psilocaulon articulatum (Thunb.) N.E.Br.
 Psora crenata (Taylor) Reinke

Psoralea oligophylla Eckl. & Zeyh.
 Psydrax obovata (Eckl. & Zeyh.) Bridson ssp. obovata
 Pteridium aquilinum (L.) Kuhn ssp. aquilinum
 Pterocelastrus tricuspidatus (Lam.) Walp.
 Pterogoniadelphus assimilis (Müll.Hal.) Ochyra & Zijlstra
 Pteronia adenocarpa Harv.
 Pteronia anisata B.Nord.
 Pteronia incana (Burm.) DC.
 Pteronia paniculata Thunb.
 Ptychomitrium crispatum (Hedw.) A.Jaeger
 Ramalina celastri (Spreng.) Krog & Swinscow ssp. celastri
 Rapistrum rugosum (L.) All.
 Restio sejunctus Mast.
 Rhodocoma capensis Steud.
 Rhodocoma fruticosa (Thunb.) H.P.Linder
 Rhoiacarpos capensis (Harv.) A.DC.
 Rhoicissus tridentata (L.f.) Wild & R.B.Drumm. ssp. tridentata
 Rhombophyllum dolabriforme (L.) Schwantes
 Robsonodendron eucleiforme (Eckl. & Zeyh.) R.H.Archer
 Rosenia humilis (Less.) K.Bremer
 Ruschia sp.
 Salvia stenophylla Burch. ex Benth.
 Sansevieria aethiopica Thunb.
 Schizoglossum linifolium Schltr. var. linifolium
 Schkuhria pinnata (Lam.) Kuntze ex Thell.
 Schotia latifolia Jacq.
 Scolopia mundii (Eckl. & Zeyh.) Warb.
 Searsia fastigata (Eckl. & Zeyh.) Moffett
 Searsia lancea (L.f.) F.A.Barkley
 Searsia longispina (Eckl. & Zeyh.) Moffett
 Searsia pallens (Eckl. & Zeyh.) Moffett
 Searsia pyroides (Burch.) Moffett var. pyroides
 Searsia rehmanniana (Engl.) Moffett var. glabrata (Sond.) Moffett
 Searsia tomentosa (L.) F.A.Barkley
 Searsia undulata (Jacq.) T.S.Yi, A.J.Mill. & J.Wen
 Selago geniculata L.f.
 Senecio angustifolius (Thunb.) Willd.
 Senecio linifolius L.
 Senecio oederiifolius DC.
 Senecio variabilis Sch.Bip.
 Sideroxylon inerme L. ssp. inerme
 Solanum mauritianum Scop.
 Solanum tomentosum L. var. tomentosum
 Sorghum halepense (L.) Pers.
 Sporobolus fimbriatus (Trin.) Nees
 Stapeliopsis pillansii (N.E.Br.) Bruyns
 Struthiola argentea Lehm.
 Sutherlandia frutescens (L.) R.Br.
 Tarchonanthus littoralis P.P.J.Herman
 Tephrosia capensis (Jacq.) Pers. var. capensis
 Thesium sp.
 Thoracosperma nanum N.E.Br.
 Trachyandra affinis Kunth
 Trachyandra giffenii (F.M.Leight.) Oberm.
 Trachypogon spicatus (L.f.) Kuntze
 Trichodiadema mirabile (N.E.Br.) Schwantes
 Trichostomum brachydontium Bruch

Trichostomum unguiculatum (Mitt.) R.H.Zander
Trimeria trinervis Harv.
Tritonia disticha (Klatt) Baker ssp. rubrolucens (R.C.Foster) M.P.de Vos
Tritonia gladiolaris (Lam.) Goldblatt & J.C.Manning
Tritonia securigera (Aiton) Ker Gawl.
Tritonia securigera (Aiton) Ker Gawl. ssp. securigera
Tulbaghia cernua Avé-Lall.
Tulbaghia nutans Vosa
Urginea sp.
Vepris lanceolata (Lam.) G.Don
Vicia hirsuta (L.) Gray
Viscum capense L.f. ssp. hoolei Wiens
Viscum rotundifolium L.f.
Wahlenbergia albens (Spreng. ex A.DC.) Lammers
Withania somnifera (L.) Dunal
Xanthoria parietina (L.) Th.Fr. forma parietina
Zehneria scabra (L.f.) Sond. ssp. scabra
Zygophyllum gilfillanii N.E.Br.