

ENVIRONMENTAL SCOPING REPORT:

Specialist ecological study on the potential impacts of the proposed
Oyster Bay Wind Energy Facility Project, Eastern Cape

Prepared by

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DRAFT SCOPING REPORT: 2nd Draft



David Hoare Consulting cc
Biodiversity Assessments, Vegetation Description /
Mapping, Species Surveys

CONTROL SHEET FOR SPECIALIST REPORT

The table below lists the specific requirements for specialist studies, according to Regulation 33 of Government Notice No. R385 of 1996 EIA Regulations.

Activity	Yes	No	Comment
Details of:			
i. the person who prepared the report; and	√		
ii. the expertise of that person to carry out the specialist study or specialised process	√		
A declaration that the person is independent in a form as may be specified by the competent authority	√		
An indication of the scope of, and the purpose for which, the report was prepared	√		
A description of the methodology adopted in preparing the report or carrying out the specialised process	√		
A description of any assumptions made and any uncertainties or gaps in knowledge	√		
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment		√	To do in EIA
Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority		√	To do in EIA
A description of any consultation process that was undertaken during the course of carrying out the study		√	
A summary and copies of any comments that were received during any consultation process		√	
Any other information requested by the competent authority		√	

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 Oyster Bay Wind Energy Facility 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

Dr 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 (Pty) Ltd. 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 "Oyster Bay Wind Energy Facility." The project involves the establishment of a wind energy facility and associated infrastructure, including up to 80 wind turbines, an on-site substation, a 66 kV - 132 kV power line linking to Eskom's Melkhout substation, underground cables linking the turbines to the substation, workshop area and internal access roads to each turbine. The purpose of the EIA is to identify environmental impacts associated with the project.

In October 2010 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 study include:

- to provide a description of the affected environment;
- to provide a description of potential issues;
- to provide recommendations regarding the methodology to be adopted in assessing potentially significant impacts in the EIA phase (i.e. a Plan of Study for EIA).

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 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 to the north of the town of Oyster Bay near Humansdorp. A more detailed description of the study area is provided in a section below.

METHODOLOGY

The environmental study is to be 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 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 Data plant and animal species was 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 could 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.

Lists of threatened animal and bird species that have a geographical range that includes the study area were obtained from literature sources (Alexander & Marais 2007, Barnes 2000, 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 Data animals have very specific habitat requirements and the presence of these habitat characteristics within the study area were assessed;
- *Habitat status*: in the event that available habitat is considered suitable for these species, the status or ecological condition was assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Data species (especially wetland-related habitats where water-quality plays a major role); and
- *Habitat linkage*: movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to these surrounding habitats and adequacy of these linkages are assessed for the ecological functioning Red Data species within the study area.

For all threatened 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. fynbos), but detailed microhabitat requirements (e.g. mountain fynbos on shallow soils overlying Table Mountain 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 fynbos on shallow soils overlying Table Mountain sandstone);
- DEFINITE: species found in habitats on site.

Vegetation habitats of concern

The purpose of producing a vegetation habitat map was to provide information on the location of potentially sensitive features in the broad study area. Various provincial, regional or national level conservation planning studies have been undertaken in the area, e.g. the National Spatial Biodiversity Assessment (NSBA), Succulent Thicket Ecosystem Project (STEP), Eastern Cape Biodiversity Conservation Plan (ECBCP), and the mapped results from these were taken into consideration in compiling the vegetation habitat map.

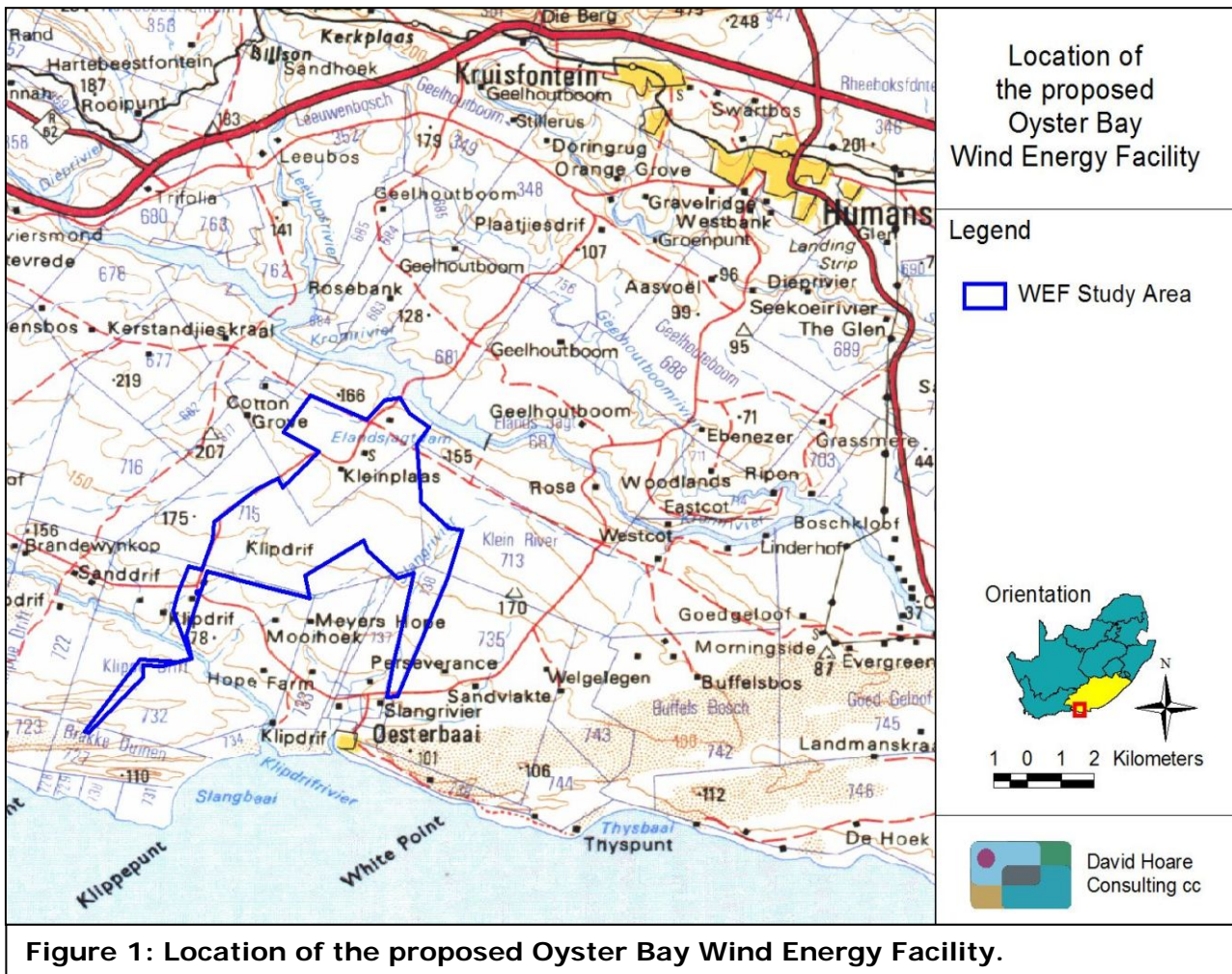
The general status of the vegetation of the study area was derived by updating the National Landcover data layer for this part of the study area (Fairbanks et al. 2000) using available satellite imagery and aerial photography. From this it could be determined which areas were transformed and no longer had primary vegetation.

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 unexpectedly located in an area.

Exclusions

The avifaunal assessment is excluded from this study and will be undertaken by a separate specialist.



DESCRIPTION OF STUDY AREA

Location

The study site is situated approximately 6 km north of Oyster Bay in the Eastern Cape Province and falls within the quarter degree grid 3424BA (Figure 1). St Francis Bay and Cape St Francis are approximately 14 km to the east-south-east of the site, Humansdorp is approximately 13 km to the north-east of the site and Jeffrey's Bay is approximately 23 km to the east of the site.

The farm portions on which the proposed wind energy facility would occur include the following: Portion 3 of the Farm Klein River 713, Portion 1, 2, 3, 4 and the Remainder of the Farm Rebok Rant 715, Portion 1 and 3 of the Farm Ou Werf 738, Portion 5 of the Farm Klippedrift 732, Portion 10 and Portion 12 of the Farm Kruis Fontein 681.

No alternative site is currently being considered for the proposed wind energy facility.

The study area is located slightly to the south of the N2 that links Port Elizabeth to George / Knysna. Access to the site is via the Oyster Bay road from Humansdorp. access to site can also be from the west, mainly on gravel / dirt track roads approaching the site. The site is therefore well-connected to a major route in this region. There is a main road running across the western side of the site from which local access roads lead onto the site.

The Melkhout substation is located off site near Humansdorp. This is a minimum of 20 km from the site.

Physiography and soils

The study site is located on the coastal plains south of the Cape Fold mountains in the Humansdorp region. The site is flat to undulating, the plains dissected by relatively shallow river valleys in which perennial or non-perennial streams are usually found. Most of the site is underlain by Table Mountain Group rocks, except in the southern part of the site closest to the coast, where vegetated sand dunes are found.

The study area is moderately sloping. The elevation varies from 30 to 180 m above sea level. The site slopes in general towards the coast, but slopes and topography are locally influenced by the various river valleys.

The site is on the watershed between the Krom and Klipdrif Rivers, both of which flow into the sea relatively close to the site. There are a number of small streams dissecting the landscape. The ones in the northern third of the site drain into the Krom River and the ones in the southern two-thirds of the site drain into the Klipdrif River. The Klipdrif River flows through the southern part of the site.

Detailed soil information is not available for broad areas of the Eastern Cape. As a surrogate, landtype data was used to provide a general description of soils in the study area (landtypes are areas with largely uniform soils, topography and climate). There are two landtypes in the study area, the Ha and Bb landtypes (Land Type Survey Staff, 1987). The Ha land type indicates land types in which deep grey regic sands of the Fernwood form occupy more than 80% of the area. The southern half of the site falls within this land type (MacVicar et al. 1974).

The Bb land type indicates land in which red and/or yellow apedal soils (Hutton, Bainsvlei, Avalon, Glencoe and Pinedene forms) that are dystrophic and/or mesotrophic predominate over red and/or yellow apedal soils that are eutrophic, and in which red soils (mainly Hutton and Bainsvlei) are not widespread (MacVicar et al. 1974). The northern half of the site falls within this land type.

Climate

The study area has warm summers and mild winters. The average daily minima for the coldest months are above freezing. There are, on average, three days of frost per year. The proximity of the coast ameliorates all climate extremes, but the site is in the first range of low mountains inland of the coast and is therefore affected by the proximity of these mountains.

A weak bimodal pattern of rainfall exists in the study area with a slightly higher proportion of spring and autumn rainfall. Rainfall may, however, fall at any time of the year. The mean annual rainfall in the study area is estimated to be approximately 650 mm (Dent *et al.* 1989). In grasslands, all areas with less than 400 mm are considered to be arid grasslands. The study area can therefore be considered to be relatively moist.

Landuse and landcover of the study area

Landcover data for the area (Fairbanks et al. 2000) indicates that large parts of the site have been cultivated. There are, however, areas of remaining natural habitat that require ground-thruthing and further investigation. Google imagery of the site indicates that the landcover map erroneously describes significant areas of rocky shallow soils as cultivated when they are

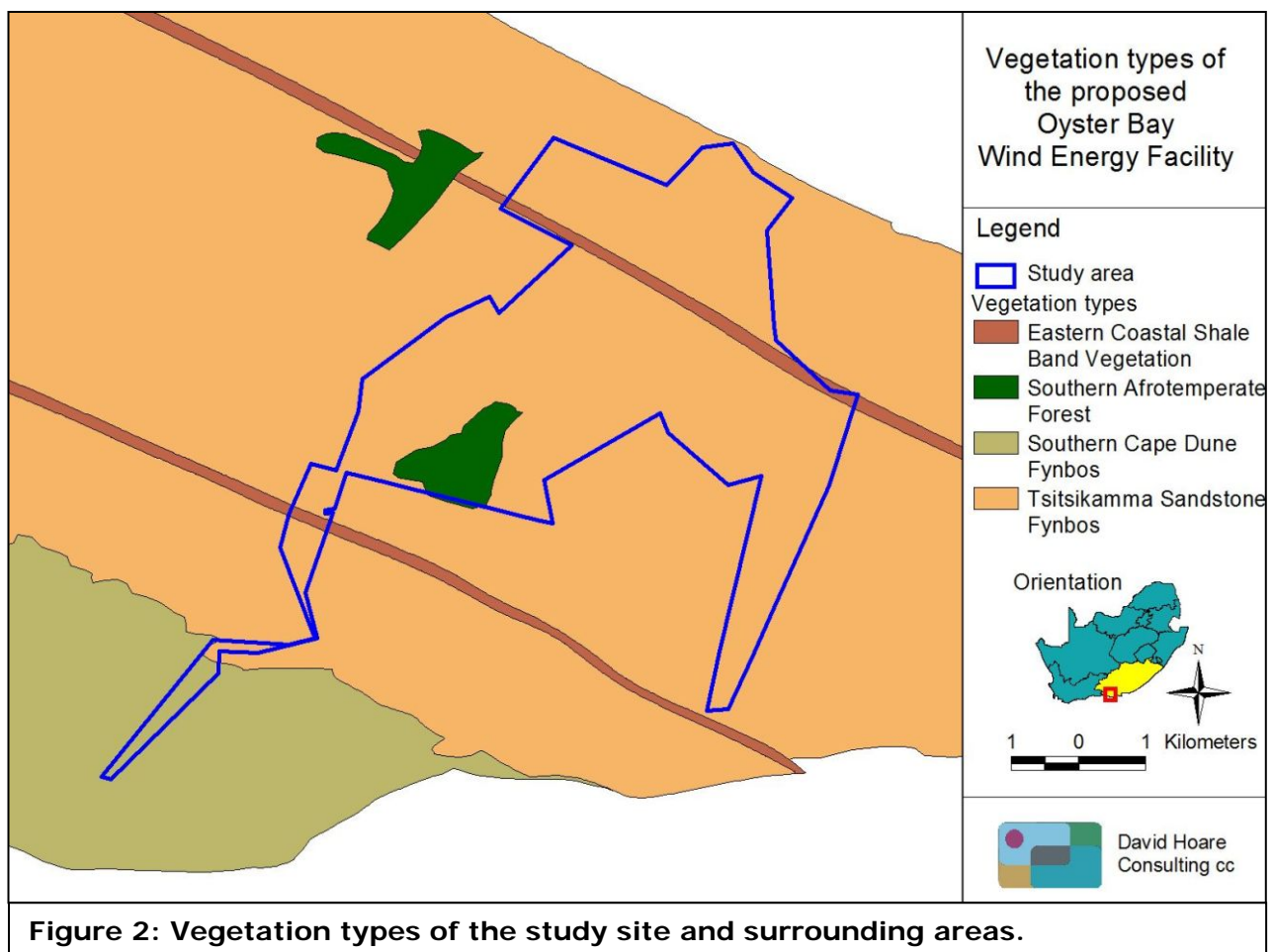
in fact natural. The natural parts of the landscape consist primarily of low grassy fynbos, thicket and woodland. Landcover and vegetation maps (see section below) indicate the presence of a forest patch in the centre of the site, but this appears from aerial imagery to resemble alien trees. The identity of this will have to be confirmed in the field in the EIA phase of the process.

Cultivated lands are scattered throughout the site.

Broad vegetation types

Vegetation may be described at various hierarchical levels from Biome, to broad Vegetation Type and down to Plant Community level associated with local habitat conditions. There are three general descriptions of the vegetation in the study area. Acocks (1953) published the first comprehensive description of the vegetation of South Africa, which was updated in 1988. This was followed by an attempted improvement (Low & Rebelo 1998) which became widely used due to the inclusion of conservation evaluations for each vegetation type, but is often less rigorous than Acocks's original publication. More recently, a detailed map of the country was produced (Mucina *et al.*, 2005). A companion guide to this map (Mucina & Rutherford 2006), containing up-to-date species information and a comprehensive conservation assessment of all vegetation types, has just been published. The classification of the vegetation according to the most recent publication is given below.

According to this most recent vegetation map of the country the study area falls primarily within one main vegetation type, i.e. ***Tsitsikamma Sandstone Fynbos***, which falls into the



Fynbos Biome. There are also small areas of three other vegetation types apparently occurring on site, namely *Eastern Coastal Shale Band Vegetation*, *Southern Afrotropical Forest* and *Southern Cape Dune Fynbos*.

Tsitsikamma Sandstone Fynbos is found along the Tsitsikamma Mountains from Uniondale to Cape St Francis (Rebello et al. 2006). This landscape consists of relatively low mountains with gentle to steep slopes. The vegetation type occurs on both the northern and southern slopes of the mountains. It is a medium-dense, tall proteoid shrubland over a dense, moderately tall ericoid-leaved shrubland (Rebello et al. 2006). This vegetation type occurs throughout the site under assessment (Figure 2).

Eastern Coastal Shale Band Vegetation occurs on the shale bands in the eastern Outeniqua, Langkloof, Tsitsikamma and Kareedouw Mountains and along the southern Cape coastal plains to around Oyster Bay (Rebello et al. 2006). These shale bands form narrow strips 80 - 200 m wide that are smooth and relatively flat. The vegetation type ranges from thicket to renosterveld and fynbos, including all structural types, although they are often grassy in character (Rebello et al. 2006). This vegetation type occurs in two narrow bands through the study area (Figure 2), both of which appear to have been transformed by cultivation.

Southern Afrotropical Forest occurs in Western Cape, Eastern Cape and Northern Cape, with the largest complex in the southern Cape along the narrow coastal strip between Humansdorp in the east and Mossel Bay (Mucina & Geldenhuys 2006). The vegetation type is a tall, multilayered afrotropical forest dominated by yellowwoods (*afrocarpus falcatus* and *Podocarpus latifolius*), *Ocotea bullata*, *Olea capensis* subsp. *macrocarpa*, *Pterocelastrus tricuspidatus*, *Platylophus trifoliatus*, *Cunonia capensis*, *Heeria argentea*, *Metrosideros angustifolia*, *Podocarpus elongatus* and *Rapanea melanophloeos* (Mucina & Geldenhuys 2006). This vegetation type occurs as a patch in the central part of the site (Figure 2).

Southern Cape Dune Fynbos occurs in the Western and Eastern Cape from Wilderness and Buffels Bay near Knysna to Oyster Bay (Rebello et al. 2006). The vegetation type occurs on the coastal dune cordons, often with steep slopes. It is a fynbos heath vegetation dominated by sclerophyllous shrubs with a rich restio undergrowth (Rebello et al. 2006). This vegetation type occurs in the extreme southern part of the site (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

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

ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

Tsitsikamma Sandstone Fynbos is classified in Mucina *et al.* (2006) as Vulnerable, with 40% conserved of a target of 23% and 33% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), does not list this vegetation type in any conservation category.

Eastern Coastal Shale Band Vegetation occurs is classified in Mucina *et al.* (2006) as Endangered, with 16% conserved of a target of 27% and 64% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists this vegetation type as Vulnerable.

Southern Afrotemperate Forest is classified in Mucina *et al.* (2006) as Least Threatened, with 60% conserved of a target of 34% and 3% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), does not list this vegetation type in any conservation category, but forest patches are protected under the National Forest Act (Act No. 84 of 1998).

Southern Cape Dune Fynbos is classified in Mucina *et al.* (2006) as Least Threatened, with 16% conserved of a target of 36% and 17% transformed (Mucina et al. 2006). The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), does not list this vegetation type in any conservation category.

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

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver <i>et al.</i> 2005; Mucina <i>et al.</i> , 2006	Draft Ecosystem List (NEMBA)
Tsitsikamma Sandstone Fynbos	23	40	33	Vulnerable	Not listed
Eastern Coastal Shale Band Vegetation	27	16	64	Endangered	Vulnerable
Southern Afrotemperate Forest	34	60	3	Least Threatened	Not listed
Southern Cape Dune Fynbos	36	16	17	Least Threatened	Not listed

The Cape Floristic Region

The study area occurs within the Cape Floristic Region (see Figure 3), which is recognised as 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 (CFR) 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 found in the Fynbos Biome, fynbos and renosterveld.

Permanent and complete transformation of habitat has affected 33% of the CFR hotspot, which includes the Oyster Bay site. 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 3) and, although the hotspot contains a wide variety of vegetation types, the study area contains a number of vegetation types that are typical of the areas of concern within the hotspot.

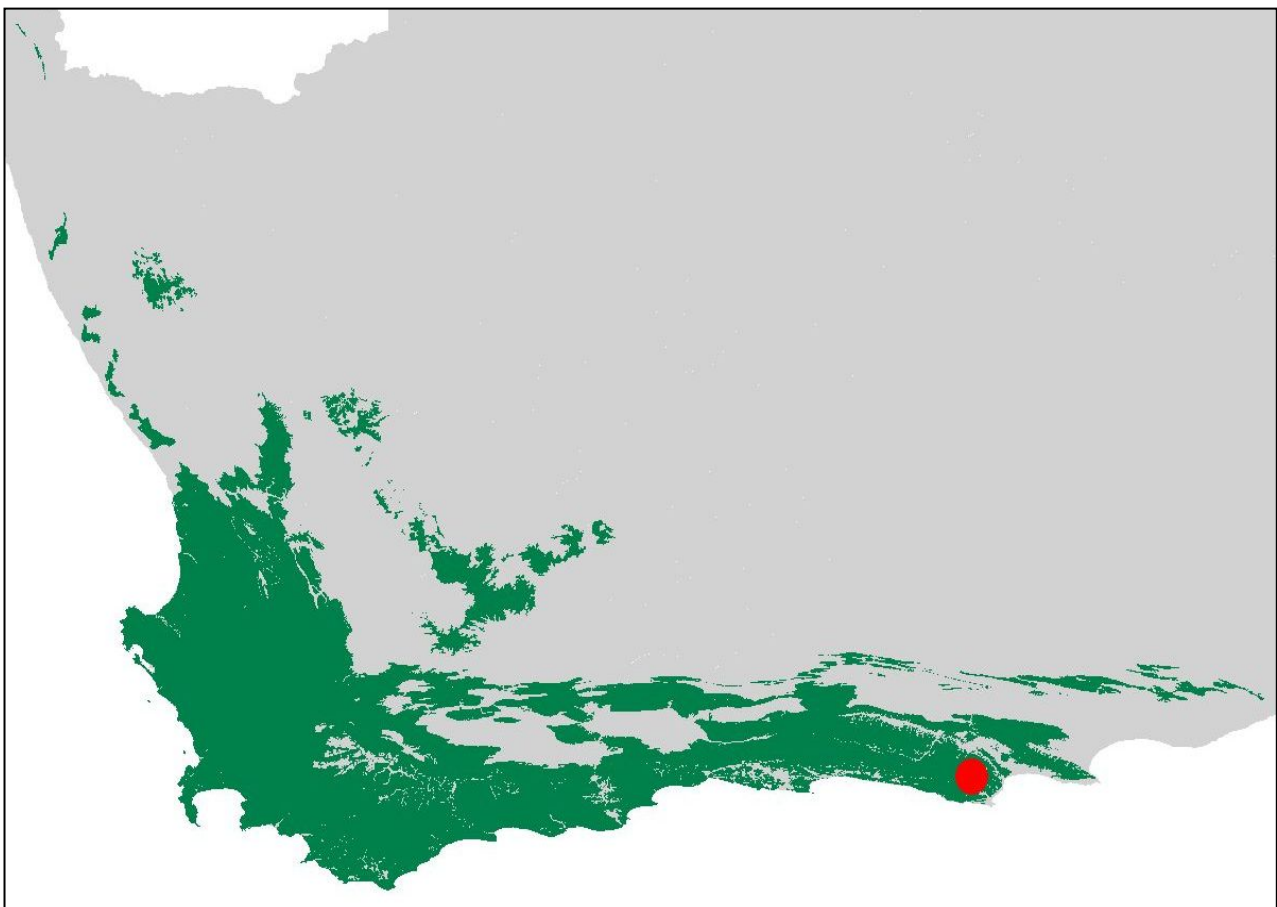


Figure 3: Relationship of the Fynbos Biome to the study area (red circle).

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. Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids are also listed.

The species on this list were evaluated to determine the likelihood of any of them occurring on site. Of the species that are considered to occur within the geographical area under consideration, there were ten species recorded in the quarter degree grid in which the study area is located that are listed on the Red List that could occur in habitats that are available in the study area. According to IUCN Ver. 3.1 (IUCN, 2001) two of these are listed as Endangered, six as Vulnerable and two as Near Threatened (see Table 3 for explanation of categories). All except two of these species are highly likely to occur on site; the site is at the locality where the species have been previously recorded or the species have been recorded just adjacent to the site in similar habitats.

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

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

Red List animal species of the study area

All Red List vertebrates (mammals, reptiles, amphibians, fish) 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 a number of mammal species of conservation concern that have a distribution that coincides with the study area. Only four of these are considered to have a possibility of occurring on site as a result of habitats available, i.e. the Brown Hyaena, the Fynbos golden mole and the Natal Long-fingered Bat, all listed as Near Threatened¹, and Duthie's Golden Mole, listed as vulnerable.

¹ Note that there are a number of species previously listed in a threatened category that, according to the IUCN, are now listed as Least Concern (see Appendix 2).

There are two reptile and no amphibian species of conservation concern that have a distribution that includes the study area and which could occur on site. The two reptile species are the Spotted Rock Snake (Rare) and the Yellow-bellied House Snake (Near Threatened). There are therefore no threatened (CR, EN or VU) reptile or amphibian species that are likely to occur on site (see Table 3 for explanation of conservation categories).

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 *Curtisia dentata*, *Ocotea bullata*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *Podocarpus latifolius* and *Sideroxylon inerme* subsp. *inerme*.

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. *Sideroxylon inerme* subsp. *inerme* usually only occurs in coastal areas, in dune thicket and forest, but may also occur on termitaria in bushveld.

Based on habitat preferences, any of these species could occur on or near the site. *Sideroxylon inerme* subsp. *inerme*, *Pittosporum viridiflorum*, *Podocarpus falcatus* and *Podocarpus latifolius* have been previously recorded in the grid in which the study site is located, as well as surrounding grids (see Appendix 4). If any of these species occur in the study area, the most likely places would be in the thicket in the drainage lines or in woodland or forest patches.

Other features of conservation concern

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

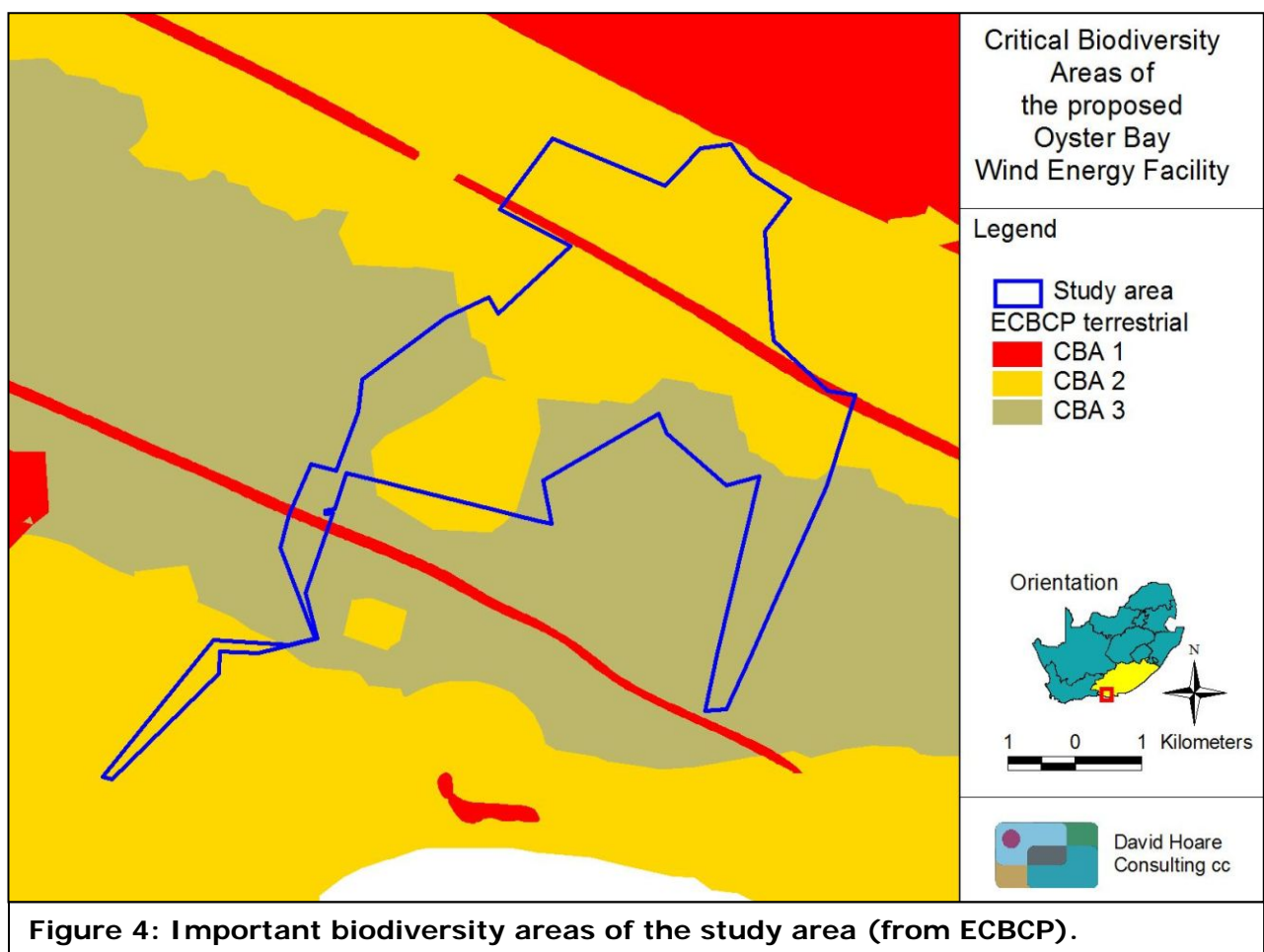
- Subtropical Thicket Ecosystem Programme (STEP)
- Succulent Karoo Ecosystems Programme (SKEP)
- National Spatial Biodiversity Assessment (NSBA)
- Eastern Cape Biodiversity Conservation Plan (ECBCP).

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:

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 three levels that occur within the study area and surroundings (Figure 4). The CBA 1 areas that fall within the study site are vegetation types of high conservation value, in this case Eastern Coastal Shale Band vegetation, classified as Endangered. The CBA 2 areas that fall within the study site are corridor areas, the forest patch and vegetation identified in the STEP project as being important (Southern Cape Dune Fynbos). The corridor areas are important for a number of reasons, including the maintenance of ecological processes. The CBA 3 areas that fall within the study site are vegetation types of conservation importance (in this case Tsitsikamma Sandstone Fynbos). Despite the Oyster Bay site falling into these CBAs the vegetation is largely transformed due to cattle and sheep farming.



Preliminary sensitivity assessment

The preliminary sensitivity assessment identifies at a high (regional) level those parts of the study area that have high conservation value or that may be sensitive to disturbance. Areas containing untransformed natural vegetation, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have low sensitivity. The information provided in the preceding sections was used to compile a preliminary 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 ECBCP assessment (see Figure 4), the Draft Ecosystem List and the fact that the site falls within the Cape Floristic Region;
2. perennial and non-perennial rivers and streams and wetlands: this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;
3. potential occurrence of populations of Red List organisms, including flora and fauna that have been evaluated as having a high chance of occurring within remaining natural habitats within the study area.
4. estuaries and estuarine habitats that occur off-site, but which may be affected by activities on site.

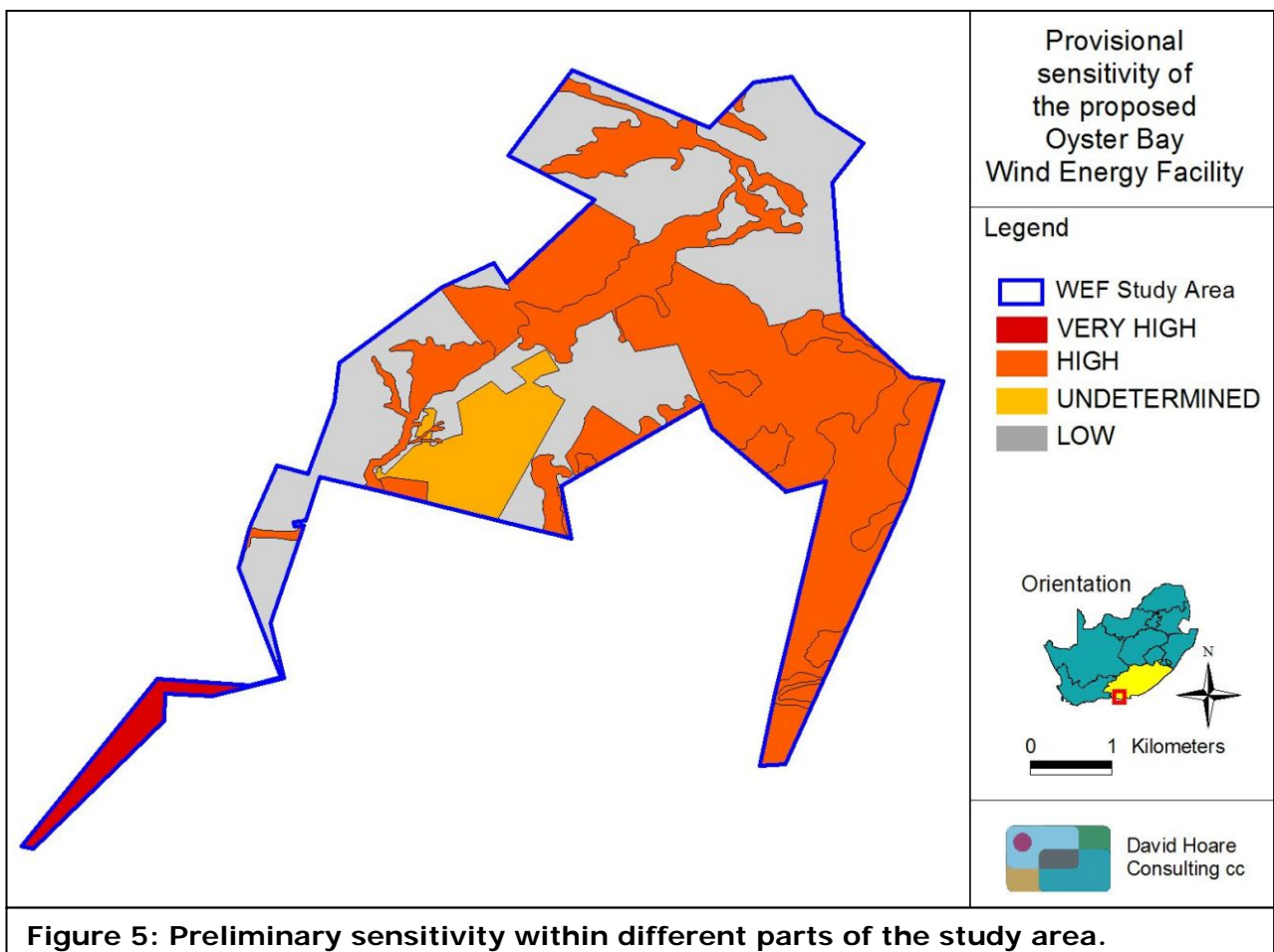


Figure 5: Preliminary sensitivity within different parts of the study area.

These factors have all been taken into account in mapping potentially sensitive areas within the study area. These are mapped in Figure 5. This map shows the remaining natural vegetation on site and wetlands and drainage lines to have HIGH sensitivity and conservation value (Figure 5). The area of vegetation dunes in the southern part of the site is classified as having VERY HIGH sensitivity and conservation value. The area in the centre of the site dominated by trees has been classified as UNDETERMINED (Figure 5), as some of the tree lines have been cut down and no longer exist (therefore the map could be outdated). This is due to the fact that the vegetation map (Mucina et al. 2006) indicates this area to be forest, but an interpretation of the aerial imagery shows stands of alien trees. The identity of this area will be determined in the field.

It is important to note that this ecological sensitivity assessment is based on a desktop study and that it identifies regional issues that apply to the site. The sensitivity assessment must be refined during fieldwork to be undertaken during the EIA phase of the project. The refinement will identify specific areas on site that are sensitive, taking the regional assessment into account.

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.

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.

Western Cape Nature Conservation Laws Amendment Act of 2000 (Act 3 of 2000)

In terms of Section 26 of this Act, "No person shall without a permit hunt or be in possession of any endangered wild animal or the carcass of any such animal". Schedule 2 of this Act provides a list of Protected Wild Animals.

Integrated Coastal Zone Management Act (Act No. 24 of 2008)

The purpose of the Act is to establish a system of integrated coastal and estuarine management in the Republic, including norms, standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and to ensure that development and the use of natural resources within the coastal zone is socially and economically justifiable and economically sustainable; to define rights and duties in relation to coastal areas; to determine the responsibilities of organs of state in relation to coastal areas; to prohibit incineration at sea; to control dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; to give effect to South Africa's international obligation in relation to coastal matters; and to provide for matters connected therewith. The Act provides for integrated management of the coastal zone and contains a number of Chapters dealing with various components. Those that may affect the current project are as follows:

- A coastal protection zone is defined in which development is restricted or controlled. A relatively arbitrary distance of 1000 m is defined in the act as constituting this coastal protection zone, but sections of the act (sections 26 to 29) set out procedures whereby the various coastal areas may be specifically demarcated on a case-by-case basis.
- Assessing the environmental impact of activities which may detrimentally affect the coastal zone will be done in terms of the general environmental impact assessment regulations which were promulgated in terms of Chapter 5 of NEMA. Section 63 of Act 24 of 2008 provides the factors and criteria which the competent authority must consider when issuing environmental authorisations for activities affecting the coastal zone.

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, for example, indigenous forest, thicket 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 WEF, 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.

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 wind-energy development may influence ecosystem structure and functioning—through direct impacts on individual organisms and through impacts on habitat structure and functioning. The most important potential negative ecological impacts of a WEF

are related to bird and bat mortality and loss of habitat. The most important positive environmental impact of a WEF is related to decreased dependency on coal power. Potential impacts are discussed in more detail below:

Impact 1: 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 to 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 is one Near Threatened bat species that could occur site or in the surrounding areas, the Natal Long-fingered Bat. This species is 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 the affected species and may affect migration routes of the species.

Potential significance: The suitability of the site for these species can only be assessed by assessing the habitat on site in some detail within the EIA phase of the process. However, due to the near threatened status of the species concerned, the long duration of the impact and the regional effect of the impact, it could potentially be of medium to high significance.

Impact 2: Impacts on other 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.

It has been evaluated that there are three mammal species of conservation concern that could potentially be affected by the proposed wind energy facility, i.e. the Brown Hyaena and the Fynbos Golden Mole, listed as Near Threatened, and Duthie's Golden Mole, listed as Vulnerable. In addition, there is one near threatened reptile species that has a distribution that includes the study area and which could occur on site, i.e. the Yellow-bellied House Snake.

The Brown Hyaena is a mobile animal that is likely to avoid the site during construction and re-appear afterwards. This species is therefore unlikely to be affected by construction of the proposed infrastructure.

The two mole species are not mobile and, if they occur on site, are likely to be affected by the construction of infrastructure since they are largely unable to move away during construction and are dependent on habitat remaining intact. The Fynbos Golden Mole is found in lowland fynbos and Knysna forest, also in urban areas. It prefers sandy soils with a deep litter layer. The dune area in the southern part of the site is probable habitat for this species. Duthie's Golden Mole occurs in alluvial sand and sandy loam. The dune area in the southern part of the site is probable habitat for this species as well. The threatened status of this species (classified as vulnerable) and the narrow distribution of the species indicates that impacts on any populations could have a significant negative impact on the overall conservation status of the species.

The Yellow-bellied House Snake is unlikely to be able to move away during the construction phase, or is dependent on habitats on site remaining intact. This species, although listed as Near Threatened, occurs throughout a wide part of South Africa and is very unlikely to be significantly affected by the complete loss of the site, which constitutes a very small fraction of its potential overall range. This species is therefore unlikely to be affected by construction of the proposed infrastructure.

Extent: The impact will occur at the site of the proposed WEF. It could potentially have an effect at a more regional level, since it could affect entire populations of affected species, depending on the species.

Potential significance: The potential duration of the impact on these species is probably long-term to permanent due to the fact that potentially affected populations are likely to be completely displaced during construction. The suitability of the site for these species can only be assessed by assessing the habitat on site in some detail. However, due to the long duration and potentially high magnitude of the impact on potentially affected species, the impact is likely to be of high significance.

Impact 3: Impacts on 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 are eight Red List plant species that have a geographic distribution that includes the site and which have a high chance of occurring in the study area. This includes two species classified as Endangered, five as Vulnerable and one as Near Threatened. There is also one Vulnerable species and one Near Threatened species that have a medium probability of occurring on site. Most of the species that have a high probability of occurring on site would probably occur within the dune habitat in the southern part of the site.

Extent: The impact will occur at the site of the proposed WEF, but will have an impact at a global level, since it potentially affects the global status of a number of affected species that are in threatened categories. For plant populations, the location of infrastructure is critical.

Potential significance: The site is almost certain to harbour some or all of these species. Due to the conservation status and distribution of the species concerned and the regional effect of the impact, it could potentially be of very high 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(I)(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: *Curtisia dentata*, *Ocotea bullata*, *Pittosporum viridiflorum*, *Podocarpus falcatius*, *Podocarpus latifolius* and *Sideroxylon inerme* subsp. *inerme*. They all

occur primarily in forest or woodland habitat or in drainage lines. Based on the assessment of available habitat, *Sideroxylon inerme* is considered to be highly likely to occur on site and the remaining species could occur on site.

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

Potential significance: Two protected trees were assessed as possibly occurring on site, but there is not a high likelihood of this. Even if these species occur on site, it is likely to only be a small number of individuals. The possible presence of these species on site can only be assessed by assessing the habitat on site in some detail. *Sideroxylon inerme* is highly likely to occur on site and may be present in relatively large numbers in the woodland in the drainage lines. Due to the potentially large number of individuals that are likely to be affected, the impact could be of medium to high significance. 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: Impacts on indigenous natural vegetation (terrestrial)

Construction of infrastructure may lead to direct loss of vegetation. This will lead to localised or more extensive reduction in the overall extent of fynbos 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. 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 most common vegetation on site is classified as Vulnerable. The site also falls within the Cape Floristic Region and affects areas classified as important corridors or habitats in the ECBCP.

Extent: The impact will occur at the site of the proposed WEF, but will have an impact at a more regional level, since it potentially affects areas classified regionally as having high conservation value (i.e. Cape Floristic Region and a CBA2 and CBA1 of the ECBCP). The construction of up to a maximum of 80 wind turbines and associated infrastructure will possibly affect a significant proportion of natural vegetation on site.

Potential significance: The proportion of the site containing vegetation in a moderate to good condition needs to be established before this impact can be properly assessed. If the whole site is in pristine state, the potential significance of this impact could potentially be of high significance at a local (site) or regional scale.

Impact 6: Impacts on 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.

The site contains a number of streams and drainage lines in which wetlands occur. More importantly, one of the major wetland systems on site constitutes part of the catchment for two estuaries on the coast down stream of the site (the Klipdrif and Krom River estuaries).

Extent: The impact will occur at the site of the proposed WEF, 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. An understanding of the location of wetlands on the site could ensure that 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. Of greatest concern is the potential impact on the estuaries downstream of the site. The potential impact on these estuaries depends on the degree to which the catchment is affected by the proposed project.

Impact 7: Change in runoff and drainage patterns

Infrastructure and roads crossing landscapes cause local hydrological and erosion effects resulting in major peak-flow and sediment impacts (Forman & Alexander 1998). This may occur around construction sites, but also in areas where the infiltration rates of the landscape are changed due to an impermeable surface being constructed. Increased runoff associated with infrastructure may increase the rates and extent of erosion, reduce percolation and aquifer recharge rates, alter channel morphology and increase stream discharge rates. Consequences may include:

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

There are both steep slopes and wetlands potentially occurring on site and an estuary occurring downstream.

Extent: The impact will occur at the site of the proposed WEF, but may also affect downstream and down-slope areas. The potential impact may therefore occur at a scale of the site and surrounding areas.

Potential significance: The potential significance of this impact depends almost entirely on ecological processes and patterns that may be affected, should this impact take place. The potential significance therefore depends on a better understanding of the ecology of the site. The impact could potentially be of moderate to high significance, if the sensitivity of the affected systems that could be affected is taken into account. This is, however, tempered by the fact that the substrate on site is probably shallow soil over rock in many places, which would probably not erode very easily.

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

Major factors contributing to invasion by alien invader plants includes high disturbance. 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. A checklist of species previously recorded in the grid in which the site is located indicates that the following species are likely to invade the site, given the right conditions: *Acacia cyclops*, *Acacia saligna*, *Acacia mearnsii*, *Datura stramonium*, *Hakea sericea* and *Pinus pinaster*. The potential therefore exists for extensive and diverse invasion of the site. The habitats most likely to be affected are watercourses and fynbos.

Extent: The impact will occur at the site of the proposed WEF, but could potentially spread extensively into the surrounding landscape, depending on the habitat and the alien species that could potentially invade the site. 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

There are four vegetation type that occurs on site, namely *Tsitsikamma Sandstone Fynbos* (classified as Vulnerable) *Eastern Coastal Shale Band Vegetation* (classified as Endangered), *Southern Afrotropical Forest* (classified as Least Threatened) and *Southern Cape Dune Fynbos* (classified as Least Threatened). The vegetation on site has been classified at a Provincial level, through the Eastern Cape Biodiversity Conservation Plan (ECBCP), as having elevated conservation value. Some parts of the site are considered to have higher conservation value than others. The area is also within the Cape Floristic Region, one of the earth's 25 hotspots.

Other factors that may lead to parts of the study area having high ecological sensitivity are the potential presence of wetlands within the drainage lines on site, potential presence of erodible substrates and the potential presence of various plant and animal species of conservation concern, and protected trees. The actual presence of these features on site will have to be determined during detailed field surveys to be undertaken during the EIA phase of the project.

Drainage lines (wetlands) represent particularly vital natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as biological corridors, providing for movement between habitat patches. Both functions are potentially critical to conservation of biological diversity as the landscape becomes increasingly fragmented into smaller, more isolated patches (Rosenberg *et al.*, 1997).

The drainage lines on site drain into two main systems that lead to the sea via the Klipdrif and Krom Rivers. The site constitutes part of the catchment for these rivers. The mouths of the rivers have an estuary, which is considered to be very sensitive and is shown as having high conservation value and sensitivity in the ECBCP. The potential impacts of activities on site on these river systems need to be carefully managed. It is especially important that the estuaries are not affected by activities on site.

Other than protected ecosystems and threatened plant and animal species, forests and wetlands are both protected under national legislation (National Forests Act and National Wetlands Act respectively). Any impacts on these areas would require a permit from the relevant National Department. There are eight tree species that are protected under the National Forests Act that have a geographic distribution that includes this area (*Curtisia dentata*, *Ocotea bullata*, *Pittosporum viridiflorum*, *Podocarpus falcatus*, *Podocarpus latifolius*, *Prunus africana* and *Sideroxylon inerme* subsp. *inerme*) (Appendix 3), all of which have a moderate likelihood of occurring on site and one, *Sideroxylon inerme* (white milkwood), has a high likelihood of occurring on site. Any impacts on individuals of any of these species require a permit from the relevant National Department.

Parts of the site are still in natural condition or considered to be natural vegetation; while majority of the site is transformed due to agriculture. The condition of the vegetation will be determined during detailed field surveys to be undertaken during the EIA phase of the project. Any degraded areas on site are likely to be classified as having low sensitivity and conservation value, although few such areas could be discerned from aerial photography, and largely correlate with cultivated areas on the site.

There are ten plant species of conservation concern that could occur in available habitats in the study area, however some of the tree lines have been cut down and this requires ground truthing. This includes two species classified as Endangered, six as Vulnerable and two as Near Threatened. This is an unprecedented number of threatened plant species for which there is a

very high risk of them occurring on site. This is a critical ecological concern on this site. The area of dunes in the southern part of the site appears to be key habitat for many of these species, although there are some species that may occur in other localities on site.

There are five animal species of conservation concern that may occur in habitats within the study area or that may be affected by the proposed WEF. This includes one species classified as Vulnerable (VU) and four as Near Threatened. 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. The area of dunes in the southern part of the site appears to be key habitat for many of these species.

A risk assessment was undertaken which identified eight main potential impacts on the ecological receiving environment. The significance of these impacts will be assessed during the EIA phase after collection of relevant field data. The identified potential negative impacts are the following (with potential significance without mitigation measures given in brackets):

1. Impacts on bats (MEDIUM to HIGH).
2. Impacts on threatened animals (HIGH).
3. Impacts on threatened plants (VERY HIGH).
4. Impacts on protected tree species (LOW).
5. Impacts on indigenous natural vegetation (HIGH).
6. Impacts on wetlands and estuary (HIGH).
7. Change in runoff and drainage patterns (MEDIUM to HIGH).
8. Establishment and spread of declared weeds and alien invader plants (HIGH).

Summary of proposed EIA methodology

The following assessments will be done during the EIA phase in order to properly assess potential impacts on the ecological receiving environment by the proposed WEF:

- The presence and distribution of wetlands and drainage lines on site will be confirmed. This will be done primarily using aerial photograph interpretation, but will be confirmed in the field using topographic and floristic indicators.
- Searches will be undertaken in the thicket in the drainage lines to determine whether any protected trees occur on site or not. The species that is likely to occur on site is *Sideroxylon inerme*, but other species may also occur.
- The presence of species of concern will be evaluated during the EIA phase. This will 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 will be paid to those species classified as threatened (VU, EN or CR) or Critically Rare, including eight plant species (*Erica glumiflora*, *Erica zeyheriana*, *Bobartia macrocarpa*, *Disa lugens* var. *lugens*, *Rapanea gilliana*, *Satyrium princeps*, *Pentaschistis longipes* and *Selago rotundifolia*) and one animal species, Duthie's Golden Mole. There are also a number of plant and animal species classified as Near Threatened that could occur on site, including the plants, *Pauridia minuta* and *Protea coronata*, and the animals, the Brown Hyaena, the Natal Long-fingered Bat, the Fynbos Golden mole and the Yellow-bellied House Snake.

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Appendix 1: Plant species of conservation importance that have historically been recorded in the study area.

*IUCN (3.1) Categories:

VU = Vulnerable

EN = Endangered

CR = Critically Endangered

NT = Near Threatened

Table A: Threatened, Near Threatened and Declining plant species that have been previously recorded in the study area

Taxon	Habitat	Global IUCN (3.1) category*	Likelihood of occurrence
<i>Osteospermum pterigoideum</i>	Low sandstone slopes near Humansdorp.	EN	LOW , previously recorded 18 miles W of Humansdorp
<i>Gasteria nitida</i> var. <i>armstrongii</i>	Coastal renosterveld of lower Gamtoos valley. Old river bed.	CR	LOW , previously recorded 10 km W of Gamtoos River.
<i>Dioscorea elephantipes</i>	Rocky (quartzites and shales) east facing hillsides. In this region it is found in the Gamtoos River valley. In wooded kloof, Duineveld, Slang River. (1877)	Declining	LOW
<i>Erica glumiflora</i>	Stabilised sand dunes, often on calcrete (limestone) near coast. Wilderness to East London.	VU	HIGH , previously recorded at Klipdrift
<i>Erica zeyheriana</i>	Remnant lowland grassy fynbos on sand, Oyster Bay to Port Elizabeth. Previously recorded at: <ul style="list-style-type: none"> • Slang Rivier, duine veld • West of Oyster bay, north of Beacon 97. Deep acid soil. Hump in ploughed fields. Locally abundant. • W of Oyster Bay, NW of Beacon 97. Fixed dunes, deep acid sand, short fynbos on S side. • Dunes west of Oyster Bay. Klippe Drift 722. Low ridge SSW of farmstead. S 34°08.753' x E 24°34.035'. 	VU	HIGH , previously recorded adjacent to site in similar habitat
<i>Pauridia minuta</i>	Langebaan to Riversdale. Previously recorded at: <ul style="list-style-type: none"> • N of Mpofu Dam & W of road from Humansdorp to the dam wall, situated close to the entrance gate to the dam property. DWAF property • 34°05'03.6" S; 24°41'31.0" E • 11 MI. W. OF HUMANSDORP 	NT	HIGH , previously recorded just to north-east of site in habitat similar to that found on site
<i>Bobartia macrocarpa</i>	Flat open grassy patches, Kareedouw to Grahamstown. Previously recorded at Kruisfontein on road verge	VU	HIGH , previously recorded on or just adjacent to central part of site.

Taxon	Habitat	Global IUCN (3.1) category*	Likelihood of occurrence
	near Kromhout Farm near Oyster Bay. 34° 07'S, 24° 37'E. Cultivated land, grazed, disturbed. Grassy Fynbos. Remnant on road verge, very little habitat left.		
Rapanea gilliana	From Kliprivier Mouth, or Slangbaai, (just west of Cape St Francis) to Port Alfred. Coastal sand dunes. Duineveld scrub on coast. Slangbaai.	EN	HIGH , previously recorded from Slangbaai in dune habitat that is found in southern part of site.
Disa lugens var. lugens	Found in acidic as well as alkaline sands. Sea level to 1450 m. Found on coastal lowlands as well as mountain slopes and plateaus. Cape Peninsula to Cathcart, mountains and coast. Previously found near Oyster Bay in the vicinity of White Point.	EN	HIGH , previously recorded from Oyster Bay in dune habitat that is found in southern part of site.
Satyrium princeps	Restricted coastal distribution between Wilderness in the southern Cape to Port Alfred in the Eastern Cape, seldom above altitudes of 150 m. Amongst bushes in open places on fixed dunes close to the shoreline. Previously found at Klipdrift. 34°07'52"S 24°33'27"E	VU	HIGH , previously recorded 4 km west of site in dune habitat similar to that found in the southern part of the site.
Pentaschistis longipes	Restricted to stabilized sand dunes around Humansdorp, usually near trees. Previously found at Brakkeeduine near Oyster Bay. 34°10'16"S 24°39'46"E	VU	HIGH , previously recorded from Oyster Bay in dune habitat that is the same as that found in southern part of site.
Protea coronata	Cape Peninsula to Kouga centres of endemism. A variety of habitats, but especially Shale and Granite Fynbos in moist, south-facing situations. WITTE ELS BOSCH	NT	MEDIUM , suitable habitat may occur on site.
Selago rotundifolia	Knysna to Port Elizabeth, grassy fynbos flats and possibly also forest margins. Previously found near Klipdrift.	VU	MEDIUM , previously recorded from Klipdrift and suitable habitat may occur in southern part of site.

* 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: Vertebrate species Of conservation concern with a geographical distribution that includes the current study area.

(included are species previously listed, but currently considered to be Least Concern)

MAMMALS

Common name	Order/ Family	Taxon	Habitat ¹	Status ²	Likelihood of occurrence
ARTIODACTYLA / PERISSODACTYLA					
Oribi	Artiodactyla / Bovidae	<i>Ourebia ourebi</i>	Open grasslands with gentle topography at lower altitudes. Mosaic of tall and short grasses required to meet resting and feeding requirements.	LC, (was EN)	MEDIUM , previously recorded in grid to south-east
Blue duiker	Artiodactyla / Bovidae	<i>Philantomba monticola</i>	Coastal and afromontane forests as well as coastal thickets, selective forager in litter and fruits	LC, (was VU)	MEDIUM , previously recorded in grid to south
CARNIVORA					
Brown hyena	Carnivora / Hyaenidae	<i>Hyaena brunnea</i>	Savanna, urban areas, scavenger	NT	MEDIUM , previously recorded in neighbouring grid.
Honey badger	Carnivora / Mustelidae	<i>Mellivora capensis</i>	Wide variety of habitats. Probably only in natural habitats.	LC, (was NT)	HIGH , previously recorded in 3 neighbouring grids
African weasel	Carnivora / Mustelidae	<i>Poecilogale albinucha</i>	Moist grassland or woodland with more than 700 mm rainfall per year and where flourishing populations of small rodents occur. Grassland, scrub woodland. The distribution range of this animal covers the west coast of South Africa from Garies southward into the western Cape coastal belt, east and north-east Northern Cape, and all other provinces	LC, (was DD)	MEDIUM , not previously recorded in grids, but overall geographical distribution includes this area.
CHIROPTERA					
Lesser woolly bat	Chiroptera / Vespertilionidae	<i>Kerivoula lanosa</i>	Afromontane and riparian forest. Insectivore.	LC, (was NT)	MEDIUM , not previously recorded in grid, but overall geographical distribution includes this area.
Lesser long-fingered bat	Chiroptera / Vespertilionidae	<i>Miniopterus fraterculus</i>	Savanna, shrubland Afromontane and coastal forest. Cave-dwelling aerial insectivore	LC, (was NT)	MEDIUM , not previously recorded in grid, but overall geographical distribution includes this area.
Natal long-fingered bat	Chiroptera / Vespertilionidae	<i>Miniopterus natalensis</i>	Caves and sub-terranean habitats in Fynbos, savanna, woodland, succulent and Nama Karoo, grassland; cave-dwelling aerial insectivore.	NT	HIGH , previously recorded in neighbouring grid to north.
Temminck's hairy bat	Chiroptera / Vespertilionidae	<i>Myotis tricolor</i>	Caves in forests, shrubland, savanna, grassland, mountains; cave-dwelling aerial insectivore.	LC, (was NT)	MEDIUM , site within distribution range, but no

Common name	Order/ Family	Taxon	Habitat ¹	Status ²	Likelihood of occurrence
					records in grid or neighbouring grids.
Cape horseshoe bat	Chiroptera / Rhinolophidae	<i>Rhinolophus capensis</i>	Caves and subterranean habitats; fynbos, shrubland and Nama-karoo in western and south-western parts of South Africa	LC, (was NT)	MEDIUM , not previously recorded in grid, but overall geographical distribution includes this site & recorded in grid to north.
Geoffroy's horseshoe bat	Chiroptera / Rhinolophidae	<i>Rhinolophus clivosus</i>	Caves and subterranean habitats; fynbos, shrubland, grassland, succulent and Nama-karoo; insectivore	LC, (was NT)	MEDIUM , not previously recorded in grid, but overall geographical distribution includes this site & recorded in grid to north.
Swinny's horseshoe bat	Chiroptera / Rhinolophidae	<i>Rhinolophus swinnyi</i>	Caves, oldmines and subterranean habitats; roosts singly or in groups of up to five; in south of its range it appears to be associated with Afromontane forest.	LC, (was EN)	LOW , not previously recorded nearby, overall distribution does not include this area, but published data indicates that there is a possibility of it occurring in the southern Cape
INSECTIVORA					
Fynbos golden mole	Insectivora / Chrysochloridae	<i>Amblysomus corriae</i>	Lowland fynbos and Knysna forest, also in urban areas. Prefers sandy soils with deep litter layer.	NT	HIGH , at eastern edge of distribution, recorded in neighbouring grid, substrate properties on site suitable for this species.
Hottentott's Golden Mole	Insectivora / Chrysochloridae	<i>Amblysomus hottentotus</i>	Subterranean habitats; mainly Eastern Cape and KwaZulu-Natal; savanna, grassland and fynbos.	LC, (was DD)	MEDIUM , at western edge of distribution, previously recorded in neighbouring grid (to north-east)
Duthie's Golden Mole	Insectivora / Chrysochloridae	<i>Chlorotalpa duthieae</i>	Alluvial sand and sandy loam	VU (was LC)	HIGH , previously recorded in grid and neighbouring grid to west, substrate properties on site suitable for this species.
Reddish-grey musk shrew	Insectivora / Soricidae	<i>Crocidura cyanea</i>	Wide variety of habitats. Nocturnal, terrestrial.	LC, (was DD)	MEDIUM , not previously recorded in grids, but overall geographical

Common name	Order/ Family	Taxon	Habitat ¹	Status ²	Likelihood of occurrence
					distribution includes this area.
Greater musk shrew	Insectivora / Soricidae	<i>Crocidura flavescens</i>	Wide variety of habitats, but favours some cover. Also urban areas, disturbed areas.	LC, (was DD)	MEDIUM , not previously recorded in grids, but overall geographical distribution includes this area.
Forest shrew	Insectivora / Soricidae	<i>Myosorex varius</i>	Wide variety of vegetation types, usually primary. Terrestrial habitats adjacent to wetlands; forest	LC, (was DD)	MEDIUM , not previously recorded in grids, but overall geographical distribution includes this area.
Least dwarf shrew	Insectivora / Soricidae	<i>Suncus infinitesimus</i>	Terrestrial, nocturnal	LC, (was DD)	MEDIUM , not previously recorded in grids, but overall geographical distribution includes this area.
Woodland mouse	Insectivora / Soricidae	<i>Grammomys dolichurus</i>	Riverine forest, thickets and woodland, terrestrial, arboreal	LC, (was DD)	MEDIUM , not previously recorded in grids, but 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 09 November 2010.

AMPHIBIANS

Common name	Species	Habitat	Status ²	Likelihood of occurrence
Eastern Leopard Toad	<i>Amietophrynus pardalis</i>	Thornveld and open savanna in the Eastern Cape. Breed in open water and forage some distance from the water.	Declining	LOW , within distribution range, but habitats on site not suitable.

²Status according to du Preez & Carruthers 2009.

REPTILES

Common name	Species	Habitat ³	Status	Likelihood of occurrence
Spotted rock snake	<i>Lampophis guttatus</i>	Rocky habitats under exfoliating rock flakes and in narrow rock crevices.	Rare ³	MEDIUM , within overall distribution range and habitats may be available on site.
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 ⁴	MEDIUM , previously recorded in neighbouring grid, within overall distribution range and habitats may be available on site.

³Status according to Branch 1988.

⁴Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 09 November 2010.

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 gymnhorrhiza</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 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 namaquensis</i>	<i>Philenoptera violacea</i> (<i>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>	

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

Appendix 4: Checklist of plant species recorded during previous botanical surveys in the quarter degree in which the study area is located and the immediately adjacent grid to the south.

Acacia saligna (Labill.) H.L.Wendl.
Acalypha capensis (L.f.) Prain & Hutch.
Acroceras macrum Stapf
Acrolophia micrantha (Lindl.) Pfitzer
Adenocline pauciflora Turcz.
Agapanthus praecox Willd. ssp. *praecox*
Agathosma apiculata G.Mey.
Agathosma dielsiana Schltr. ex Dummer
Agathosma hirta (Lam.) Bartl. & H.L.Wendl.
Agathosma ovata (Thunb.) Pillans
Albuca cf. *nelsonii* N.E.Br.
Anchusa capensis Thunb.
Anthospermum spathulatum Spreng. ssp. *uithenagense* Puff
Arctotheca populifolia (P.J.Bergius) Norl.
Arctotis discolor (Less.) Beauverd
Aristea bakeri Klatt
Aristea ensifolia J.Muir bis
Aspalathus biflora E.Mey. ssp. *biflora*
Aspalathus chortophila Eckl. & Zeyh.
Aspalathus ciliaris L.
Aspalathus collina Eckl. & Zeyh. ssp. *collina*
Aspalathus hispida Thunb. ssp. *hispida*
Aspalathus spinosa L. ssp. *spinosa*
Aspalathus subtingens Eckl. & Zeyh.
Astephanus zeyheri Turcz.
Avena fatua L.
Avena sativa L.
Babiana patersoniae L.Bolus
Berzelia abrotanoides (L.) Brongn.
Bobartia macrocarpa Strid
Bobartia orientalis J.B.Gillett ssp. *orientalis*
Bonatea speciosa (L.f.) Willd.
Brachypodium flexum Nees
Bromus catharticus Vahl
Brunsvigia striata (Jacq.) Aiton
Buddleja salviifolia (L.) Lam.
Bulbine frutescens (L.) Willd.
Cannomois scirpoides (Kunth) Mast.
Canthium spinosum (Klotzsch) Kuntze
Carissa macrocarpa (Eckl.) A.DC.
Cassine parvifolia Sond.
Cenia sp.
Centella asiatica (L.) Urb.
Ceratandra grandiflora Lindl.
Cestrum laevigatum Schltld.
Chaenostoma cordatum (Thunb.) Benth.
Chaenostoma polyanthum Benth.
Chaetacanthus aff. *setiger* (Pers.) Lindl.
Chasmanthe aethiopica (L.) N.E.Br.

Chironia baccifera L.
Chironia melampyrifolia Lam.
Cliffortia burchellii Stapf
Cliffortia stricta Weim.
Clutia affinis Sond.
Coleonema pulchellum I.Williams
Conicosia pugioniformis (L.) N.E.Br. ssp. *muii* (N.E.Br.) Ihlenf. & Gerbaulet
Conyza bonariensis (L.) Cronquist
Cotula coronopifolia L.
Crassula ericoides Haw. ssp. *ericoides*
Crassula expansa Dryand. ssp. *filicaulis* (Haw.) Toelken
Crassula spathulata Thunb.
Cussonia spicata Thunb.
Cyperus sphaerospermus Schrad.
Cyrtanthus clavatus (L'Hér.) R.A.Dyer
Cyrtanthus loddigesianus (Herb.) R.A.Dyer
Dasispermum suffruticosum (P.J.Bergius) B.L.Burtt
Dicliptera extenta S.Moore
Dierama pendulum (L.f.) Baker
Dioscorea elephantipes (L'Hér.) Engl.
Diosma hirsuta L.
Disa chrysostachya Sw.
Disa lugens Bolus var. *lugens*
Disa racemosa L.f.
Drosanthemum candens (Haw.) Schwantes
Ehrharta calycina Sm.
Ehrharta rupestris Nees ex Trin. ssp. *tricostata* (Stapf) Gibbs Russ.
Ehrharta villosa J.H.Schult. var. *maxima* Stapf
Elegia fistulosa Kunth
Elionurus muticus (Spreng.) Kunth
Epilobium hirsutum L.
Epischoenus quadrangularis (Boeck.) C.B.Clarke
Eragrostis capensis (Thunb.) Trin.
Eragrostis chloromelas Steud.
Erica canaliculata Andrews
Erica cerinthoides L. var. *cerinthoides*
Erica chloroloma Lindl.
Erica copiosa J.C.Wendl. var. *copiosa*
Erica curviflora L.
Erica curviflora L. var. *curviflora*
Erica deliciosa H.L.Wendl. ex Benth.
Erica diaphana Spreng.
Erica discolor Andrews var. *discolor*
Erica glandulosa Thunb. ssp. *fourcadei* (L.Bolus) E.G.H.Oliv. & I.M.Oliv.
Erica glandulosa Thunb. ssp. *glandulosa*
Erica glumiflora Klotzsch ex Benth.
Erica gracilis J.C.Wendl.
Erica leucopelta Tausch var. *leucopelta*
Erica maesta Bolus var. *maesta*
Erica pectinifolia Salisb.
Erica pectinifolia Salisb. var. *pectinifolia*
Erica peltata Andrews
Erica simulans Dulfer var. *simulans*

Erica sparrmanii L.f.
Erica speciosa Andrews
Erica tenella Andrews var. *tenella*
Erica thamnoides E.G.H.Oliv.
Erica uberiflora E.G.H.Oliv.
Erica zeyheriana (Klotzsch) E.G.H.Oliv.
Eriocephalus africanus L. var. *paniculatus* (Cass.) M.A.N.Müll., P.P.J.Herman & Kolberg
Eriospermum dielsianum Poelln. ssp. *molle* P.L.Perry
Euclea racemosa Murray ssp. *macrophylla* (E.Mey. ex A.DC.) F.White
Felicia amelloides (L.) Voss
Felicia echinata (Thunb.) Nees
Ficinia deusta (P.J.Bergius) Levyns
Ficus sur Forssk.
Fuirena hirsuta (P.J.Bergius) P.L.Forbes
Gasteria acinacifolia (J.Jacq.) Haw.
Gasteria nitida (Salm-Dyck) Haw. var. *armstrongii* (Schönland) Van Jaarsv.
Gazania rigens (L.) Gaertn. var. *uniflora* (L.f.) Roessler
Geissorhiza heterostyla L.Bolus
Gerbera cordata (Thunb.) Less.
Gladiolus involutus D.Delaroche
Gladiolus permeabilis D.Delaroche ssp. *permeabilis*
Grewia occidentalis L. var. *occidentalis*
Gymnosporia nemorosa (Eckl. & Zeyh.) Szyszyl.
Harveya capensis Hook.
Harveya purpurea (L.f.) Harv. ex Hook. ssp. *purpurea*
Hebenstretia robusta E.Mey.
Helichrysum anomalum Less.
Helichrysum asperum (Thunb.) Hilliard & B.L.Burtt var. *comosum* (Sch.Bip.) Hilliard
Helichrysum aureum (Houtt.) Merr. var. *monocephalum* (DC.) Hilliard
Helichrysum crispum (L.) D.Don
Helichrysum cymosum (L.) D.Don ssp. *cymosum*
Helichrysum gymnocomum DC.
Helichrysum herbaceum (Andrews) Sweet
Helichrysum litorale Bolus
Helichrysum rosum (P.J.Bergius) Less. var. *arcuatum* Hilliard
Helichrysum spiralepis Hilliard & B.L.Burtt
Helichrysum teretifolium (L.) D.Don
Helichrysum tinctum (Thunb.) Hilliard & B.L.Burtt
Heliophila glauca Burch. ex DC.
Hermannia althaeoides Link
Hermannia sp.
Hermannia velutina DC.
Hibiscus diversifolius Jacq. ssp. *diversifolius*
Hibiscus trionum L.
Hypodiscus argenteus (Thunb.) Mast.
Indigofera denudata L.f.
Indigofera erecta Thunb.
Indigofera heterophylla Thunb.
Indigofera poliotes Eckl. & Zeyh.
Indigofera stricta L.f.
Indigofera verrucosa Eckl. & Zeyh.
Isolepis cf. *striata* (Nees) Kunth
Isolepis marginata (Thunb.) A.Dietr.

Isolepis natans (Thunb.) A.Dietr.
Jamesbrittenia microphylla (L.f.) Hilliard
Jamesbrittenia sp.
Juncus kraussii Hochst. ssp. *kraussii*
Juncus lomatophyllus Spreng.
Kedrostis nana (Lam.) Cogn. var. *nana*
Koeleria capensis (Steud.) Nees
Lampranthus sp.
Laporteia peduncularis (Wedd.) Chew ssp. *peduncularis*
Laurembergia repens (L.) P.J.Bergius ssp. *brachypoda* (Welw. ex Hiern) Oberm.
Lauridia tetragona (L.f.) R.H.Archer
Laurophyllus capensis Thunb.
Lessertia kensitii L.Bolus
Leucospermum cuneiforme (Burm.f.) Rourke
Limonium scabrum (Thunb.) Kuntze var. *corymbulosum* (Boiss.) R.A.Dyer
Limonium scabrum (Thunb.) Kuntze var. *scabrum*
Linum aethiopicum Thunb.
Lolium multiflorum Lam.
Lolium temulentum L.
Manulea obovata Benth.
Merxmullera cincta (Nees) Conert ssp. *cincta*
Metalasia muricata (L.) D.Don
Micranthus alopecuroides (L.) Rothm.
Monopsis acrodon E.Wimm.
Monopsis simplex (L.) E.Wimm.
Monsonia emarginata (L.f.) L'Hér.
Moraea tricuspidata (L.f.) G.J.Lewis
Morella cordifolia (L.) Killick
Morella quercifolia (L.) Killick
Muraltia alopecuroides (L.) DC.
Muraltia ericaefolia DC.
Muraltia squarrosa (L.f.) DC.
Nemesia sp.
Nerine peersii W.F.Barker
Nymphaea nouchali Burm.f. var. *zanzibariensis* (Casp.) Verdc.
Oedera capensis (L.) Druce
Olea capensis L. ssp. *capensis*
Olea exasperata Jacq.
Oplismenus hirtellus (L.) P.Beauv.
Oplismenus undulatifolius (Ard.) Roem. & Schult.
Ornithogalum tenuifolium F.Delaroche ssp. *tenuifolium*
Osteospermum pterigoideum Klatt
Osyris compressa (P.J.Bergius) A.DC.
Otholobium stachyerum (Eckl. & Zeyh.) C.H.Stirt.
Othonna quinquentata Thunb.
Oxalis imbricata Eckl. & Zeyh. var. *violacea* R.Knuth
Panicum proliferum Lam.
Passerina montivaga C.L.Bredenkamp & A.E.van Wyk
Passerina rigida Wikstr.
Pauridia minuta (L.f.) T.Durand & Schinz
Pelargonium alchemilloides (L.) L'Hér.
Pelargonium candicans Spreng.
Pelargonium pulverulentum Colvill ex Sweet

Pelargonium radulifolium (Eckl. & Zeyh.) Steud.
 Penaea cneorum Meerb. ssp. gigantea R.Dahlgren
 Penaea cneorum Meerb. ssp. lanceolata R.Dahlgren
 Pentaschistis ampla (Nees) McClean
 Pentaschistis heptamera (Nees) Stapf
 Pentaschistis longipes Stapf
 Pentaschistis pallida (Thunb.) H.P.Linder
 Persicaria attenuata (R.Br.) Soják ssp. africana K.L.Wilson
 Phyllica abietina Eckl. & Zeyh.
 Phyllica axillaris Lam. var. microphylla (Eckl. & Zeyh.) Pillans
 Phyllica gnidioides Eckl. & Zeyh.
 Phyllica litoralis (Eckl. & Zeyh.) D.Dietr.
 Phyllopodium sp.
 Phylohydrax carnosa (Hochst.) Puff
 Pimpinella sp.
 Plectranthus laxiflorus Benth.
 Poa annua L.
 Podalyria cuneifolia Vent.
 Podocarpus falcatus (Thunb.) R.Br. ex Mirb.
 Podocarpus latifolius (Thunb.) R.Br. ex Mirb.
 Polygala ericaefolia DC.
 Polygala myrtifolia L. var. myrtifolia
 Polygala refracta DC.
 Polygala wittebergensis Compton
 Prismaecarpus campanuloides (L.f.) Sond. var. campanuloides
 Protea coronata Lam.
 Protea eximia (Salisb. ex Knight) Fourc.
 Protea neriifolia R.Br.
 Protea tenax (Salisb.) R.Br.
 Psoralea affinis Eckl. & Zeyh.
 Psoralea arborea Sims
 Psoralea repens L.
 Psydrax obovata (Eckl. & Zeyh.) Bridson ssp. obovata
 Pterocelastrus tricuspidatus (Lam.) Walp.
 Pterygodium alatum (Thunb.) Sw.
 Pterygodium volucris (L.f.) Sw.
 Ranunculus multifidus Forssk.
 Rapanea gilliana (Sond.) Mez
 Rhodocoma fruticosa (Thunb.) H.P.Linder
 Rhoiacarpos capensis (Harv.) A.DC.
 Roella spicata L.f. var. burchellii Adamson
 Romulea dichotoma (Thunb.) Baker
 Rubus fruticosus L.
 Rumex acetosella L. ssp. angiocarpus (Murb.) Murb.
 Rumex crispus L.
 Rumex sagittatus Thunb.
 Ruschia sp.
 Salvia africana-lutea L.
 Samolus porosus (L.f.) Thunb.
 Satyrium acuminatum Lindl.
 Satyrium parviflorum Sw.
 Satyrium princeps Bolus
 Scabiosa albanensis R.A.Dyer

Scabiosa columbaria L.
Scaevola plumieri (L.) Vahl
Schotia afra (L.) Thunb. var. *afra*
Searsia glauca (Thunb.) Moffett
Searsia laevigata (L.) F.A.Barkley var. *laevigata* forma *laevigata*
Searsia lucida (L.) F.A.Barkley forma *scoparia* (Eckl. & Zeyh.) Moffett
Secamone alpini Schult.
Selago canescens L.f.
Selago corymbosa L.
Selago rotundifolia L.f.
Senecio burchellii DC.
Senecio carnosus Thunb.
Senecio glastifolius L.f.
Senecio madagascariensis Poir.
Senecio oederiifolius DC.
Senna multiglandulosa (Jacq.) H.S.Irwin & Barneby
Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. *sphacelata*
Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. *torta* (Stapf) Clayton
Solanum aggerum Dunal
Spiloxene serrata (Thunb.) Garside var. *serrata*
Sporobolus africanus (Poir.) Robyns & Tournay
Stoebe plumosa (L.) Thunb.
Struthiola argentea Lehm.
Struthiola macowanii C.H.Wright
Sutherlandia frutescens (L.) R.Br.
Syncarpha milleflora (L.f.) B.Nord.
Tephrosia capensis (Jacq.) Pers.
Tetragonia decumbens Mill.
Tetragonia sp.
Thamnochortus sp.
Themeda triandra Forssk.
Thesium penicillatum A.W.Hill
Thesium virgatum Lam.
Thinopyrum distichum (Thunb.) A.Löve
Trachyantha affinis Kunth
Tribolium hispidum (Thunb.) Desv.
Tribolium uniolae (L.f.) Renvoize
Trifolium burchellianum Ser. ssp. *burchellianum*
Tristachya leucothrix Trin. ex Nees
Tulbaghia violacea Harv. var. *violacea*
Ursinia scariosa (Aiton) Poir. ssp. *scariosa*
Vellereophyton vellereum (R.A.Dyer) Hilliard
Villarsia capensis (Houtt.) Merr.
Virgilia divaricata Adamson
Viscum capense L.f. ssp. *hoolei* Wiens
Wachendorfia thyrsiflora Burm.
Watsonia pillansii L.Bolus
Zantedeschia aethiopica (L.) Spreng.
Zehneria scabra (L.f.) Sond. ssp. *scabra*