

BASIC ASSESSMENT REPORT:

Specialist ecological study on the potential impacts of the proposed
Kabi Kimberley solar photovoltaic (PV) plant, Northern Cape

Prepared by

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BASIC ASSESSMENT REPORT: Final



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

REGULATIONS GOVERNING THIS REPORT

This report has been prepared in terms of the EIA Regulations promulgated under the *National Environmental Management Act* No. 107 of 1998 (NEMA). A Basic Assessment study is undertaken in accordance with Regulation 22 in terms of the EIA Regulations published in Government Notice (GN) R543 of 18 June 2010, in terms of Chapter 5 of Section 24(5) of the National Environmental Management Act (No. 107 of 1998).

Appointment of specialist

David Hoare of David Hoare Consulting cc was commissioned by Savannah Environmental (Pty) Ltd to provide specialist consulting services for the Basic Assessment for the proposed Kabi Kimberley photovoltaic solar plant near Kimberley in the Northern 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:

- 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 Kabi Energy (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 zero.

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 Kabi Energy (Pty) Ltd to undertake an application for environmental authorization through a Basic Assessment process for the proposed "Kabi Kimberley PV Solar Plant". The project involves the establishment of a renewable energy facility for power generation and its associated infrastructure, including an array of PV panels, foundations for the PV panels, underground cabling between PV panels, inverters, internal access roads, an overhead power line to link into the existing Eskom power grid, workshop area for maintenance and storage and perimeter security fencing. The purpose of the basic assessment is to identify environmental impacts associated with the project.

A Basic Assessment study is undertaken in accordance with Regulation 56 in terms of the EIA Regulations published in Government Notice (GN) R545 of 18 June 2010, in terms of Chapter 5 of Section 24(5) of the National Environmental Management Act (No. 107 of 1998). The objectives of an ecological specialist report for a basic assessment would be to determine the state of the environment associated with the proposed project and provide mitigation measures or recommendations to prevent / minimize negative environmental impacts and where relevant optimize potential positive environmental impacts. For a Basic Assessment, it is only necessary to provide a single report, unlike in a full EIA, where separate Scoping and Impact Assessment reports are required.

On 21 March 2011 David Hoare Consulting cc was appointed by Savannah Environmental (Pty) Ltd to undertake an ecological assessment of the study area. The specific terms of reference for the ecological study include:

- to provide a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project;
- to provide a description and evaluation of potential environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified;
- Direct, indirect and cumulative impacts of the identified issues must be evaluated in terms of the following criteria:
 - the **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected;
 - the **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international;
 - the **duration**, wherein it will be indicated whether the lifetime of the impact will be of a very short duration (0-1 years), short duration, medium-term (5-15 years), long term (> 15 years) or permanent.
 - The **magnitude**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
 - The **probability** of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1-5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly

probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

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

This report provides details of the results of the Basic Assessment ecology study. The findings of the study are based on a desktop assessment of the study area.

Study area

At a regional level the study area falls within the Northern Cape Province to the east of the town of Kimberley. A more detailed description of the study area is provided in a section below.

METHODOLOGY

The assessment is to be undertaken in a single phase. The objective of the 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 and then to briefly assess the potential impacts associated with the proposed project. 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 habitat map of the study area based on available maps, aerial photographs and database information, as well as information obtained from De Beers environmental division at Kimberley Mines.

Assessment philosophy

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

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

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

Species

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

Ecosystems

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

Processes

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

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

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

Plant and animal species of concern

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

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

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

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

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

- *Habitat requirements*: most Red 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 or protected organisms (flora and fauna) that occur in the general geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- MEDIUM: habitats on site match general habitat description for species (e.g. 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.

Habitats of concern

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

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

Limitations

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be unexpectedly located in an area.
- This study was based on a desktop assessment and interpretation of aerial photographs, but also included detailed site information obtained from De Beers environmental division at Kimberley Mines.

DESCRIPTION OF STUDY AREA

Location

The study site is situated 5 km to the north-east of Kimberley within the Northern Cape (Figure 1). The site falls within the quarter degree grid 2824DB. The proposed facility would occur on part of the remainder of the Farm Kenilworth Estate 71, which is located within the jurisdiction of the Sol Plaatje Local Municipality.

No alternative site is being considered for the proposed facility. The site was chosen because of the local topography, solar irradiation and access to the electricity grid via an existing Eskom powerline.

The study area is accessible from Kimberley via existing roads that connect directly to the N12 which runs through Kimberley northwards to Potchefstroom and then to Gauteng and southwards to George. There is a gravel access road running from the southern part of the site to connect to main roads nearby.

Topography

The topography of the study site is relatively gentle and slopes towards the north. The original elevation on site varies from 1181 to 1211 m above sea level. There is an artificial low hill in the centre of the site that is the remains of a tailings dump on site from previous mining activity on site. This dumped material rises to a height of 1232 m above sea level.

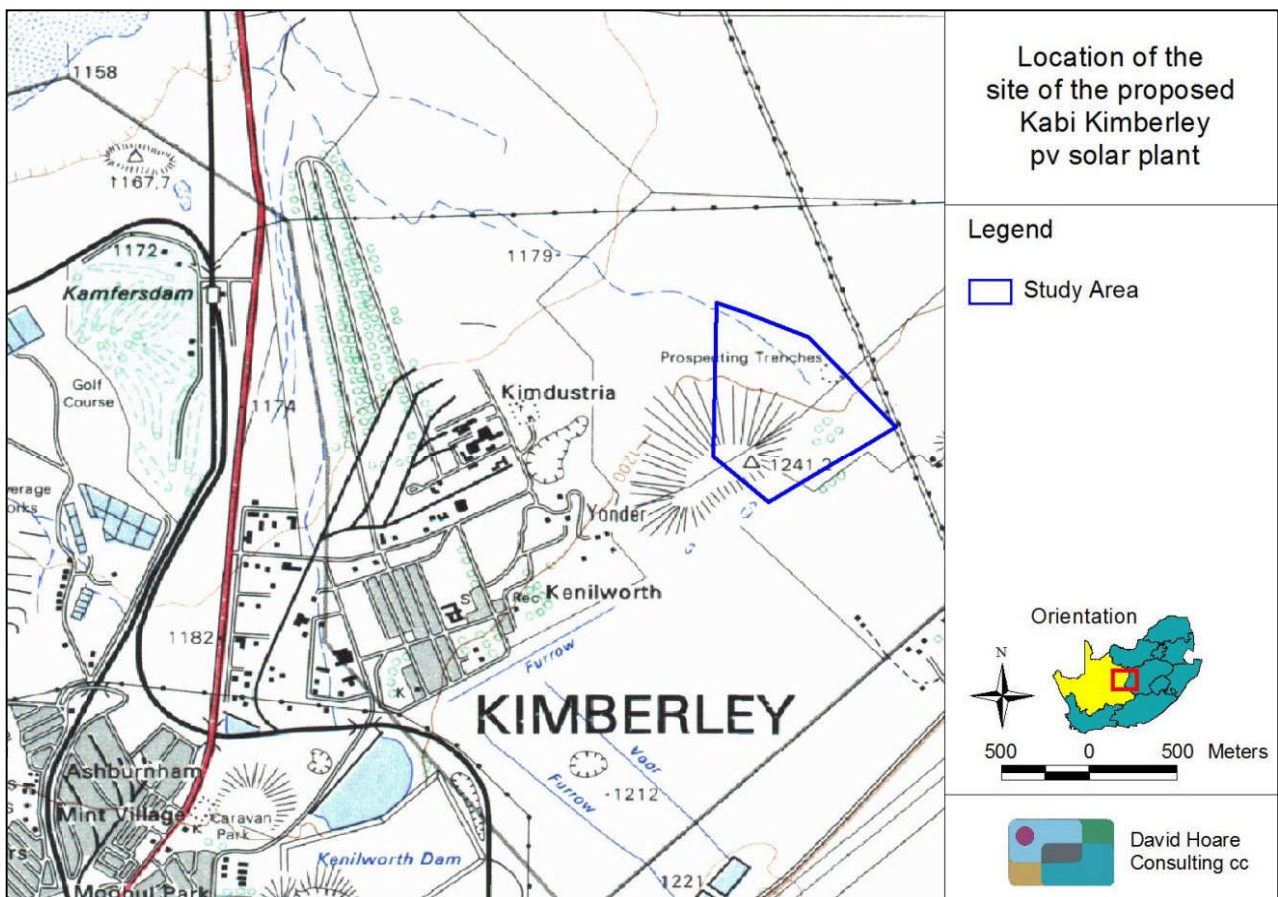


Figure 1: Location of the proposed PV Solar Power Plant

There is a single drainage line indicated on the Surveyor General's 1:50 000 topocadastral map of the site that starts in the north-eastern side and runs northwards (Figure 1), but due to mining activities on site, this is no longer visible on Google images of the site (Figure 2). There is a general area of erosion and runoff in the northern third of the site that has been canalized in places to direct it in a particular direction.

Land types and soils

Detailed soil information is not available for broad areas of the country. 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 is one land type in the study area, the Ae land type (Land Type Survey Staff, 1987).

The A-group of land types refer to yellow and red soils without water tables belonging to one or more of the following soil forms: Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly. The Ae landtype consists of red, high base status, > 300 mm deep soils and no dunes (MacVicar et al. 1974).

Soil patterns associated with this landtype have been largely masked by the presence of dumped material associated with previous mining activity on site.

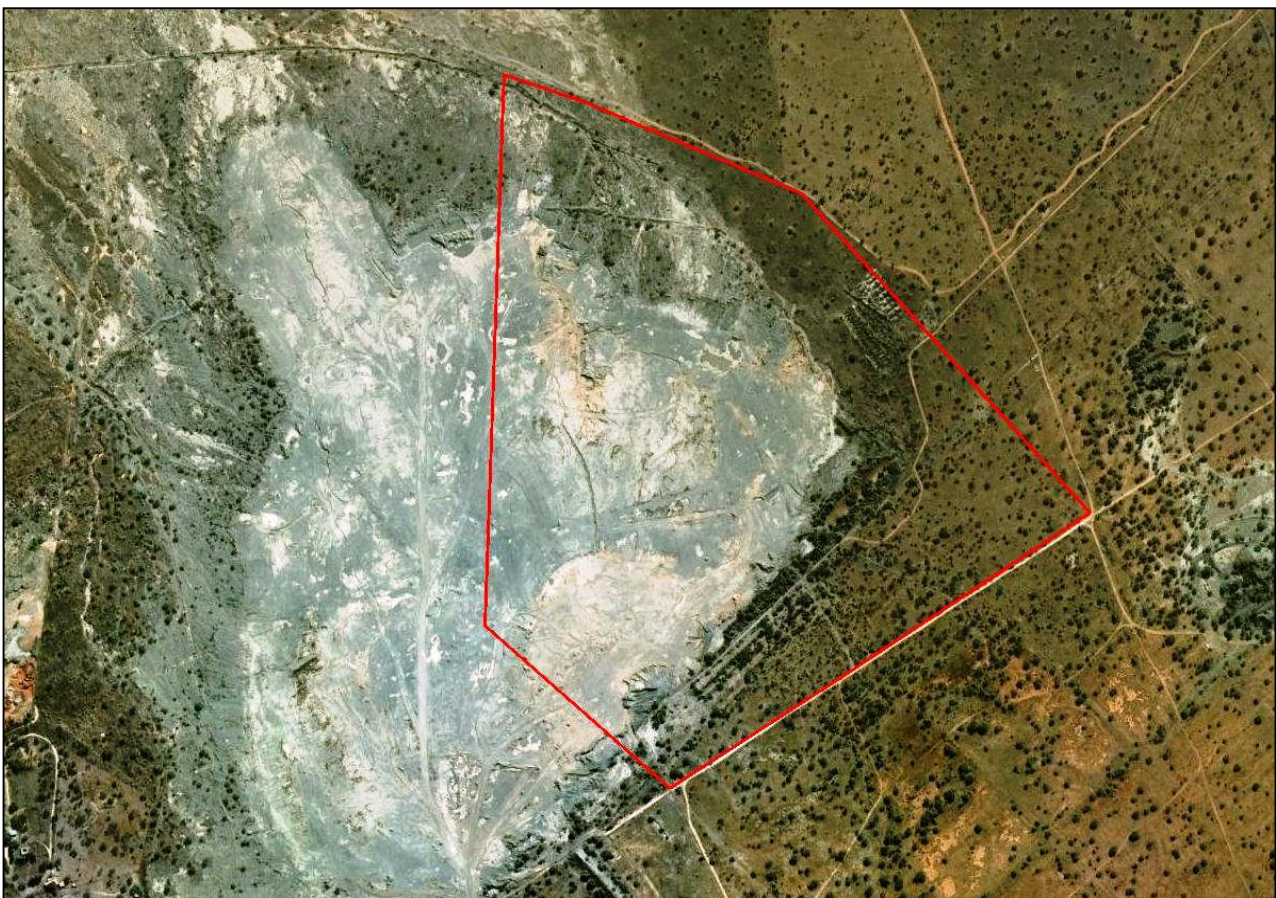


Figure 2: Google image of the site of the proposed PV solar plant

Climate

The climate is arid to semi-arid. Rainfall occurs from November to March, but peaks in mid- to late summer (February / March). Mean annual rainfall is approximately 380 mm per year (Dent et al. 1989). All areas with less than 400 mm rainfall are considered to be arid. The study area can therefore be considered to be arid.

Landuse and landcover of the study area

A landcover map of the study area (Fairbanks *et al.* 2000) indicates that the entire site consists of natural vegetation. This is incorrect. The Surveyor General's 1:50 000 topocadastral map of the site (Figure 1) indicates a large mound on site and prospecting trenches. Google imagery of the study area (Figure 2) shows that a significant part of the site is covered by dumped material associated with mining activities. Knowledge of the site shows that this tailings material is being reworked so the site has been cleared of the dump.

Broad vegetation types of the region

The study area falls within the Nama-Karoo Biome (Rutherford & Westfall 1986, Mucina & Rutherford 2006). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina *et al.* 2006). This map shows one vegetation type occurring within the study site, namely Kimberley Thornveld. No other vegetation type occurs anywhere within almost one kilometre of the site. The Kimberley Thornveld vegetation type is described in more detail below.

Kimberley Thornveld

This vegetation type occurs in the North-West, Free State and Northern Cape Provinces. Kimberley Thornveld is a vegetation type with a well-developed tree layer dominated by *Acacia erioloba*, *Acacia tortilis*, *Acacia karroo* and *Boscia albitrunca* occurring on the often slightly irregular plains of the region (Rutherford *et al.* 2006). Other important taxa include the trees and shrubs, *Acacia mellifera*, *Rhus lancea*, *Tarchonanthus camphoratus*, *Ehretia rigida*, *Euclea crispa*, *Grewia flava*, *Diospyros pallens*, *Lycium arenicola*, *Lycium hirsutum*, *Acacia hebeclada* and *Rhus tridactyla*, and the grasses, *Eragrostis lehmanniana*, *Aristida canescens*, *Aristida congesta* and others.

Conservation status of broad vegetation types

On the basis of a recently established approach used at national level by SANBI (Driver *et al.* 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its

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

original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 1, as determined by best available scientific approaches (Driver *et al.* 2005).

The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% of the ecosystem still remaining in a natural state (Driver *et al.* 2005). The vegetation type occurring in the study area (Table 2) is classified as Least Threatened (Driver *et al.* 2005; 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 national vegetation types that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the Draft Ecosystem List versus in the scientific literature. The vegetation type occurring on site is not listed in the Draft National List of Threatened Ecosystems (GN1477 of 2009).

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

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver <i>et al.</i> 2005; Mucina <i>et al.</i> , 2006	Draft Ecosystem List (NEMBA)
Kimberley Thornveld	16	2	17	Least Threatened	Not listed

Critical Biodiversity Areas have been identified for all municipal areas of the Northern Cape Province and are published on the SANBI website (bgis.sanbi.org). These maps identify no areas of concern in the current study area. This is consistent with patterns identified from other sources within the current scoping document.

Plant species of conservation concern

Lists of plant species of conservation concern 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. There are two species on this list, the tree *Acacia erioloba*, which is listed as Declining, and the succulent herb *Aloinopsis rubrolineata*, which is listed as Rare (see Table 3 for explanation of categories). A species is listed as declining when it does not meet any of the IUCN criteria for threatened (CR, EN, VU) or near threatened, but there are threatening processes causing a continuing decline in populations. A species is classified as rare when it meets any of the four South African criteria for rare, but is not exposed to any direct potential threat and does not meet any of the IUCN criteria for threatened (CR, EN, VU) or near threatened. There are, therefore, two plant species of lower conservation concern that are considered to have some likelihood of occurring on site.

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

Category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List / threatened
EN	Endangered	Red List / threatened
VU	Vulnerable	Red List / threatened
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	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

Protected plants

Plant species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) are listed in Appendix 5. There is one plant species that appears on this list that has been previously recorded in the grid in which the site is located (as listed in Appendix 4). This is *Harpagophytum procumbens* (devil's claw). This species is associated mainly with dry sandveld on deep Kalahari sand. It usually occupies plains, dune bases and interdunes. Soils are usually sandy but can be rocky. They are generally nutrient poor, often with lime. The soil conditions expected on site do not co-incide with the habitat requirements for this species and it is considered highly unlikely that it occurs on site. No plants have been seen on site.

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 *Acacia erioloba* (Camel Thorn, Kameeldoring) and *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi).

The tree *Acacia erioloba* occurs in dry woodland along watercourses in arid areas where underground water is present as well as on deep Kalahari sands. The species has been previously recorded in the grid in which the study area is located (see Appendix 4) and is listed as one of the characteristic species for Kimberley Thornveld, the vegetation type within which the site is located. The type of habitat still remaining on site is therefore suitable for this species. However, no individuals occur on site.

Boscia albitrunca occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. The species has been previously recorded in the grid in which the study area is located (see Appendix 4) and is listed as one of the characteristic species for Kimberley Thornveld, the vegetation type within which the site is located. The type of habitat still remaining on site is therefore suitable for this species. However, no individuals occur on site.

Threatened and protected animal species of the study area

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

area are discussed further.

There is one mammal species of low conservation concern that could occur in available habitats in the study area, namely the Brown Hyaena. This species is listed as near threatened (NT). This species may be found in a wide variety of habitats, including savanna, shrubland, grassland and urban areas. It is a scavenger. It is possible that this species occurs on site, but the site does not constitute important habitat for this species due to the small amount of remaining natural habitat.

There are thirteen bird species of conservation concern that have a geographical distribution that includes the site. However, the site is not considered to be important breeding or foraging habitat for any of these species, primarily because of the small area of remaining natural vegetation on site (less than 10 ha).

There are no amphibian species of conservation concern or protected amphibian species with a distribution that includes the study area.

There are no reptile species of conservation concern that have a distribution that includes the study area.

The species of potential concern for the site are therefore as follows:

- Brown Hyaena (NT),

Sensitivity assessment

The sensitivity assessment identifies those parts of the study area that could possibly have high conservation value or that may be sensitive to disturbance. Areas of potential sensitivity are shown in Figure 3. An explanation of the different sensitivity classes is given in Table 3.

Table 3: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity
VERY HIGH	Indigenous natural areas that are highly positive for the following: <ul style="list-style-type: none"> • <u>High</u> intrinsic biodiversity value (<u>high</u> species richness and/or turnover, presence of species of concern, unique ecosystems). • <u>Low</u> ability to respond to disturbance (low resilience, dominant species very old). • <u>High</u> conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • <u>High</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) • <u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)
HIGH	Indigenous natural areas that are moderately positive for the following: <ul style="list-style-type: none"> • <u>Moderate</u> intrinsic biodiversity value (<u>moderate</u> species richness and/or turnover, presence of species of concern). • <u>Moderate</u> ability to respond to disturbance (<u>moderate</u> resilience, dominant species of intermediate age). • <u>Moderate</u> conservation status (low proportion remaining intact, moderately fragmented, habitat for species that are at risk). • <u>Moderate</u> value ecological goods & services (e.g. water supply,

	erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). And may also be positive for the following: <ul style="list-style-type: none"> • <u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)
MEDIUM-HIGH	Indigenous natural areas that are positive for <u>one</u> or <u>two</u> of the factors listed above.
MEDIUM	Other indigenous natural areas in which factors listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation.
LOW	No natural habitat remaining.

The vegetation on site is largely transformed and/or degraded. Small remaining patches of natural vegetation are within a vegetation type not classified as having high conservation value, is not protected according to any legislation and is also not considered at a site scale to have particularly high intrinsic biodiversity value. These habitats are suitable for species of low conservation concern and protected species, although none of these species were recorded on site. These areas are, therefore classified as having MEDIUM sensitivity and conservation value (see Table 3). This means that the vegetation in these patches is natural, but does not contain any features of particular conservation concern.

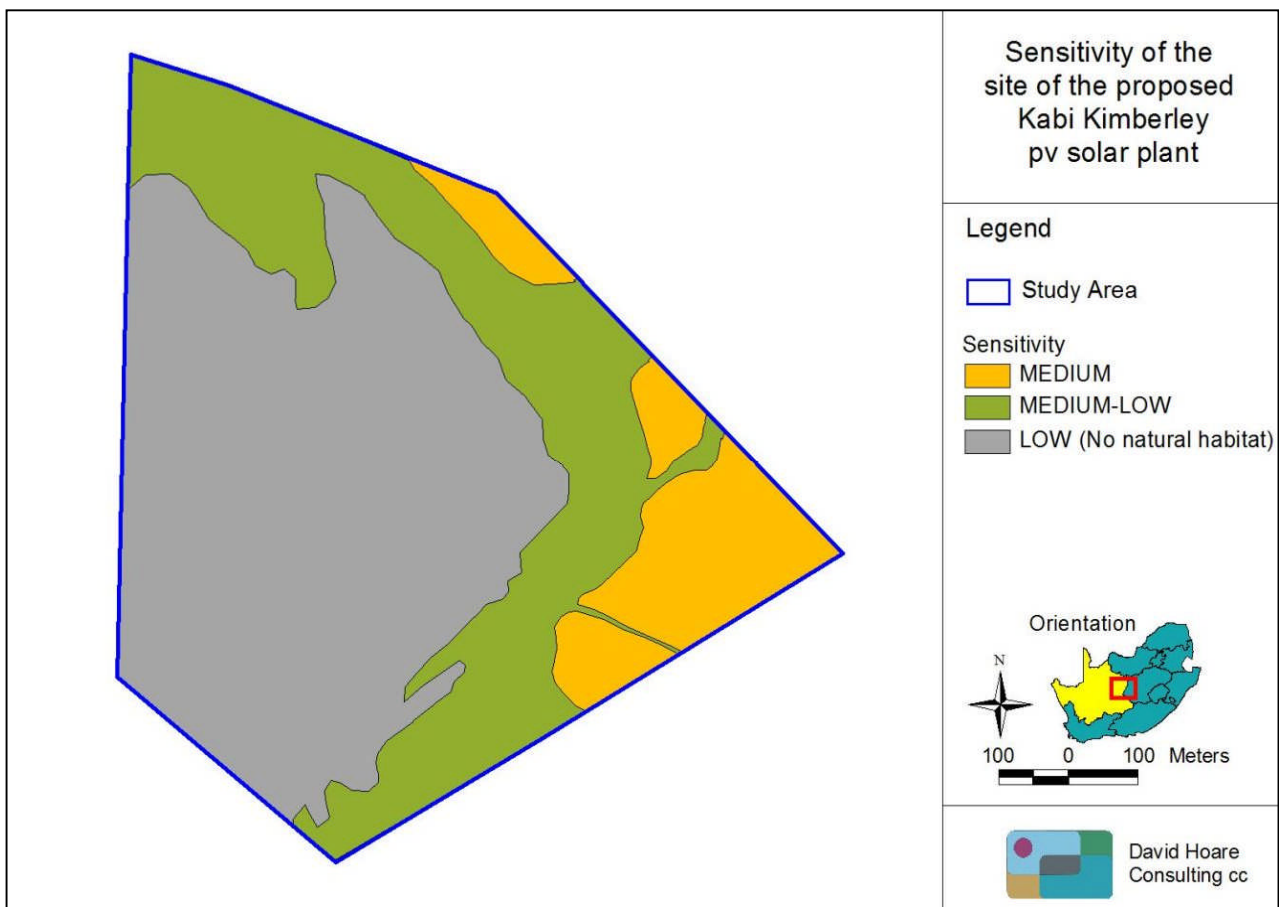


Figure 3: Sensitive areas of the study area.

The features taken into account in order to evaluate sensitivity in the study area are the following:

1. Potential occurrence of populations of organisms of conservation concern or protected species, as follows:
 - a. Two plant species of low conservation concern;
 - b. Two protected tree species;
 - c. One protected plant species;
 - d. One mammal species of low conservation concern.

The approximate areas of habitats in different sensitivity classes is as follows:

Sensitivity class	Description	Area (hectares)
MEDIUM	Natural vegetation in moderate condition	8.2
MEDIUM-LOW	Degraded natural vegetation (areas that may have been natural in the past, but have been severely degraded by material from the mine tailings and activities due to mining).	18.3
LOW	Transformed areas (mine tailings)	33.5
	TOTAL	60.0

From this it can be seen that remaining natural vegetation on site consists of less than 10 hectares.

The ecological value of the site must also be put in perspective relative to surrounding areas. This site is part of the Mining Right area and has been extensively affected by mining activities. It is therefore not expected that this Basic Assessment study would reveal any particularly valuable features associated with the site. In contrast, areas to the north have been conserved by De Beers and form part of their game farm. These conserved areas have greater conservation value.

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 (according to Section 15(1)) ‘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’. GN 1042 provides a list of protected tree species (amends GN 1012).

Forests

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

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

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

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

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

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

Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species".

Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. According to Section 75 of the Act, "Control and eradication of listed invasive species":

- (1) Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
- (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
- (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

Government Notice No. 1477 of 2009: Draft National List of Threatened Ecosystems

Published under Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). This Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

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

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

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.

- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.

National Water Act

Wetlands, riparian zones and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

Any collection of water which the Minister may, by notice in the gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

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

Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

Northern Cape Nature Conservation Act, No. 9 of 2009

This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project:

- No person may hunt, import, export, transport, keep, possess, breed or trade in a specimen of a protected animal.
- Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property;
- Aquatic habitats may not be destroyed or damaged;
- The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species.

The Act provides lists of protected species for the Province.

Other Acts

Other Acts that may apply to biodiversity issues, but which are considered to not apply to the current site are as follows:

- Integrated Coastal Zone Management Act (Act No. 24 of 2008)
- National Environmental Management Protected Areas Act (Act No. 57 of 2003)
- Marine Living Resources Act (Act No. 18 of 1998)
- Sea Birds and Seals Protection Act (Act No. 46 of 1973)
- Mountain Catchment Areas Act (Act No. 63 of 1970)
- Lake Areas Development Act (Act No. 39 of 1975)

IDENTIFICATION OF RISKS AND POTENTIAL IMPACTS

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

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

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

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

A number of direct risks to ecosystems that would result from **construction** of the proposed solar energy facility are as follows:

- Clearing of land for construction.
- Construction of access roads.
- Placement of power lines, cables and water pipelines (if applicable).
- Establishment of borrow and spoil areas.
- Chemical contamination of the soil by construction vehicles and machinery.
- Operation of construction camps.
- Storage of materials required for construction.

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

- Maintenance of surrounding vegetation as part of management of the facility.

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 solar energy facilities on the ecological environment. The major expected negative impact will be due to loss of habitat which may have direct or indirect impacts on individual organisms.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)

Nature: Construction of infrastructure will lead to direct loss of vegetation. This will lead to localised or more extensive reduction in the overall extent of vegetation. There are factors that may aggravate this potential impact. For example, where this vegetation has already been stressed due to degradation and transformation at a regional level, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat and a change in the conservation status (current conservation situation). Consequences of the potential impact of loss of indigenous natural vegetation 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 widespread vegetation type on site is Kimberley Thornveld, which is classified as Least Threatened. The site is largely transformed and little natural vegetation will be affected. Some loss of natural habitat will occur (less than 10 ha), but this will be insignificant in comparison to the total area of the vegetation type concerned (1 951 249 ha).

Impact 2: Impacts on threatened plant species

Nature: 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 localised 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 chance of survival of the species.

There are very few threatened species listed for the area surrounding the site. There are two known plant species of lower conservation concern that have a geographic distribution that

includes the site. This includes one species classified as Declining and one as Rare. Neither of these are considered to be threatened or near threatened (do not meet any of the IUCN criteria for threatened (CR, EN, VU) or near threatened). There will therefore not be impacts on threatened or near threatened plant species. This impact is therefore not assessed further.

Impact 3: 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".

There are two protected tree species that have a geographical distribution that includes the study area and which have been previously recorded in the grid in which the site is located. These are *Boscia albitrunca* (shepherd's tree) and *Acacia erioloba* (camelthorn). Both of these species are also listed as characteristic species for the vegetation type in which the site is located. Neither species has been recorded on site and a recent survey found no individuals on site. This impact is therefore not assessed further.

Impact 4: Impacts on protected plant species

There are a number of plant species that are protected according to the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). In terms of Section 57 of the Act, "a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7". Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species".

One species that has a geographic distribution that includes the study area appear on this list: *Harpagophytum procumbens*. Based on soil information for the site and known habitat requirements for this species, it is considered highly unlikely that it occurs on site. This impact is therefore not assessed further.

Impact 5: Impacts on threatened animals

Nature: Threatened animal species are indirectly 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. Animals are generally mobile and, in most cases, can move away from a potential threat.

Threatened species include 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. 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. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

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

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

There is one mammal species of conservation concern that may make use of parts of the site for foraging. This is the Brown Hyaena, listed as Near Threatened. The species is also protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). Any activities on site that are "of a nature that may negatively impact on the survival of a listed threatened or protected species" would require a permit in terms of this Act. The Brown Hyaena may make use of remaining natural habitat on site for foraging, but no permanent populations of this species are likely to occur on site.

Impact 6: Impacts on wetlands and drainage areas

Nature: The site is in an arid area. There are no wetlands on site. An ephemeral drainage line is indicated on the Surveyor General's topocadastral map of the site, but mining activities have since wiped this feature out. Some erosion features and excavated channels occur on site that are associated with stormwater, but these are not considered to be wetland features according to the National Water Act. There will therefore not be impacts on wetlands or watercourses on site. This impact is therefore not assessed further.

Impact 7: Establishment and spread of declared weeds and alien invader plants

Major factors contributing to invasion by alien invader plants includes *inter alia* high disturbance (such as clearing for construction activities) and negative grazing practices (Zachariades *et al.* 2005). Exotic species are often more prominent near infrastructural disturbances than further away (Gelbard & Belnap 2003, Watkins *et al.* 2003). Consequences of this may include:

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

No concentrations of alien plants are known to occur on site. Potential weeds with a distribution centred on arid regions of the country include *Salsola kali*, *Atriplex lindleyi*, *Opuntia ficus-indica*, *Opuntia imbricata*, *Prosopis glandulosa*, *Prosopis velutina*, *Atriplex numularia*, and *Nicotiana glauca*. The shrub, *Prosopis glandulosa*, is potentially the most problematic. This species invades riverbeds, riverbanks and drainage lines in semi-arid and arid regions and has been recorded in high densities on the site. There is therefore the potential for alien plants to be a continuous problem on site in the absence of control measures.

ASSESSMENT 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 solar energy facilities on the ecological environment. The major expected negative impact will be due to loss of habitat which may have direct or indirect impacts on individual organisms.

Impacts are assessed for grouped components of infrastructure for the proposed pv solar plant, as follows:

1. solar array, substations, internal access roads and ancillary infrastructure (buildings), including laydown areas.
2. overhead power line to connect to Eskom overhead powerline.

Solar array, substation, roads and buildings

The pv solar array, laydown areas, substations, internal access roads and other required infrastructure will have an impact in terms of direct loss of habitat.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)

Duration: The impact will be permanent due to the fact that clearing of vegetation for construction purposes cannot be reversed.

Extent: The impact will occur at the site of the proposed facility, which is scored as local.

Magnitude: The potential magnitude of this impact will be small due to the small area of vegetation likely to be affected relative to the overall extent of the vegetation type concerned.

Probability: It is definite that there will be impacts on natural vegetation. There are some areas of natural vegetation that are indicated as occurring within the footprint of proposed infrastructure.

Potential significance: The significance of this impact could potentially be of medium significance (see table below).

Mitigation measures: No mitigation measures are required. The remaining natural vegetation on site is in poor condition and adjacent to existing disturbance. The significance score of medium is based on the fact that the impact will be permanent and will definitely occur. The remaining natural vegetation on site is, however, in poor condition and adjacent to existing disturbance.

Nature: Loss of habitat within indigenous natural vegetation		
	Without mitigation	With mitigation
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	small (1)	small (1)
Probability	Definite (5)	Definite (5)
Significance	medium (35)	medium (35)
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes

Can impacts be mitigated?	Not required
Mitigation: (1) None required.	
Cumulative impacts: None.	
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.	

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30-60 = medium, >60 = high.

Impact 5: Impacts on threatened animals

Duration: The only species of concern is the Brown Hyaena. The impact will be long-term due to the fact that disturbance on site is likely to lead to conditions in which the species of concern are less likely to return to the site or utilize it in future. Disturbance from construction may cause some animals to move away, but they could return to remaining habitat after construction has been completed.

Extent: The impact will occur at the site of the proposed facility.

Magnitude: Assuming that the Brown Hyaena occurs on site, the potential magnitude of this impact will be small on the species as a whole.

Probability: It is improbable that there will be impacts on populations of the Brown Hyaena. This is based on the fact that very little natural habitat remains on site and the fact that the Brown Hyaena forages over wide areas and is not restricted to one locality.

Potential significance: The significance of this impact could potentially be of low significance (see table below).

Mitigation measures: None required.

Nature: Impacts on threatened animals		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (1)	Small (1)
Probability	Improbable (2)	Improbable (2)
Significance	Low (12)	Low (12)
Status (positive or negative)	Negative	Negative
Reversibility	Reversible with effective rehabilitation	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Not required	
Mitigation: (1) None		
Cumulative impacts: Loss of indigenous natural vegetation, alien invasions may lead to additional impacts that will exacerbate this impact.		
Residual Impacts: None likely		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30-60 = medium, >60 = high.

Impact 7: Establishment and spread of declared weeds and alien invader plants

Duration: The impact will be long-term unless alien plants are controlled.

Extent: The impact will occur at the site of the proposed facility, but could spread into neighbouring areas.

Magnitude: The potential magnitude of this impact is potentially moderate for local ecosystems.

Probability: There is a moderate likelihood that alien species will spread on site in the absence of control measures. The probability is therefore scored as probable.

Potential significance: The significance of this impact could potentially be of medium significance (see table below).

Mitigation measures: Disturbance of indigenous vegetation must be kept to a minimum. Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank that would take decades to remove. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	With mitigation
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (5)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	Medium (33)	Low (18)
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	To some degree	
Mitigation:		
(1) Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area (2) Do not translocate soil stockpiles from areas with alien plants (3) Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (4) Establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts:		
Soil erosion, habitat loss may lead to additional impacts that will exacerbate this impact.		
Residual Impacts:		
Will probably be very low if control measures are effectively applied		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30-60 = medium, >60 = high.

Powerline

The proposed overhead powerline will be approximately 150 m long. The major potential impact of a powerline would be on birds. There would also be a small loss of habitat along the servitude and at the position of tower structures.

Impact 1: Impacts on indigenous natural vegetation (terrestrial)

Duration: The impact will be long-term. There will be a very small amount of clearing of vegetation for tower structures. Any other disturbance will be associated with construction traffic within the servitude, which should stabilize over the long-term.

Extent: The impact will occur at the site of the proposed powerline, which is scored as local.

Magnitude: The potential magnitude of this impact will be small due to the small area of vegetation likely to be affected relative to the overall extent of the vegetation type concerned.

Probability: It is highly probable that there will be impacts on natural vegetation.

Potential significance: The significance of this impact could potentially be of low significance (see table below).

Mitigation measures: No mitigation measures are required. The remaining natural vegetation on site is in poor condition and adjacent to existing disturbance.

Nature: Loss of habitat within indigenous natural vegetation		
	Without mitigation	With mitigation
Extent	local (1)	local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	small (1)	small (1)
Probability	Highly probable (4)	Highly probable (4)
Significance	low (24)	low (24)
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: (1) None proposed.		
Cumulative impacts: Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact.		
Residual Impacts: Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30-60 = medium, >60 = high.

Impact 5: Impacts on threatened animals

Duration: The only species of concern is the Brown Hyaena. The impact will be long-term due to the fact that disturbance on site is likely to lead to conditions in which the species of concern are less likely to return to the site or utilize it in future. Disturbance from construction

may cause some animals to move away, but they could return to remaining habitat after construction has been completed.

Extent: The impact will occur at the site of the proposed powerline.

Magnitude: Assuming that the Brown Hyaena occurs on site, the potential magnitude of this impact will be small on the species as a whole.

Probability: It is highly improbable that there will be impacts on populations of the Brown Hyaena. This is based on the fact that very little natural habitat remains on site, the fact that the Brown Hyaena forages over wide areas and is not restricted to one locality and the fact that the proposed powerline is very short.

Potential significance: The significance of this impact could potentially be of low significance (see table below).

Mitigation measures: None proposed.

Nature: Impacts on threatened animals		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small (1)	Small (1)
Probability	Highly improbable (1)	Highly improbable (1)
Significance	Low (6)	Low (6)
Status (positive or negative)	Negative	Negative
Reversibility	Reversible with effective rehabilitation	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) None		
Cumulative impacts: Loss of indigenous natural vegetation, alien invasions may lead to additional impacts that will exacerbate this impact.		
Residual Impacts: None likely		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30-60 = medium, >60 = high.

Impact 7: Establishment and spread of declared weeds and alien invader plants

Duration: The impact will be long-term unless alien plants are controlled.

Extent: The impact will occur at the site of the proposed powerline and servitude, but could spread into neighbouring areas.

Magnitude: The potential magnitude of this impact is potentially moderate for local ecosystems.

Probability: There is a moderate likelihood that alien species will spread on site in the absence of control measures. The probability is therefore scored as probable.

Potential significance: The significance of this impact could potentially be of medium significance (see table below).

Mitigation measures: Disturbed areas should be rehabilitated as quickly as possible. Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil. Any alien plants must be immediately controlled to avoid establishment of a soil seed bank that would take decades to remove. An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	With mitigation
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (5)	Low (3)
Probability	Probable (3)	Improbable (2)
Significance	Medium (33)	Low (18)
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation:		
(1) Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area		
(2) Do not translocate soil stockpiles from areas with alien plants		
(3) Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove		
(4) Establish an ongoing monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts:		
Soil erosion, habitat loss may lead to additional impacts that will exacerbate this impact.		
Residual Impacts:		
Will probably be very low if control measures are effectively applied		

*Significance calculated as (magnitude+duration+extent) x probability. Significance: <30 = low, 30-60 = medium, >60 = high.

DISCUSSION AND CONCLUSIONS

The study area is largely transformed by previous mining activities and the deposition of the tailings dump on site. There are narrow strips of remaining natural vegetation on site, but these are also degraded to a large degree. Based on a formalised framework for determining sensitivity, transformed areas are classified as having LOW sensitivity and conservation value and degraded areas on site where there are still some indigenous species evident are classified as having MEDIUM-LOW sensitivity and conservation value. Remaining patches of natural vegetation are classified as having MEDIUM sensitivity and conservation value, which is the lowest class for vegetation still in a natural state (see Table 3 above).

There is one major vegetation types that occurs in the study area, namely Kimberley Thornveld. This vegetation type is classified as Least Threatened and also has a wide distribution and extent. Remaining areas of natural vegetation on the site is therefore not considered to have high conservation value or priority. The area of natural vegetation remaining on site is less than 10 ha.

Factors that may affect the ecological sensitivity of the site are the potential presence in the general area that includes the site of some plant and animal species of conservation concern, one species of protected plant and two species of protected tree. These are discussed below.

There are two plant species of low conservation concern that have a likelihood of occurring in available habitats in the broad study area that includes the site. These are *Acacia erioloba* (listed as Declining) and *Aloinopsis rubrolineata* (listed as Rare). The tree, *Acacia erioloba*, has a high probability of occurring within natural vegetation in this general area, whereas it has been evaluated that the succulent herb, *Aloinopsis rubrolineata*, has only a moderate probability of occurring there.

There are two protected tree species that have a geographical distribution that includes the study area and which have been previously recorded in the grid in which the site is located. These are *Boscia albitrunca* (shepherd's tree) and *Acacia erioloba* (camelthorn). Both of these species are also listed as characteristic species for the vegetation type in which the site is located. There is therefore a high probability that one or both of these species occurs in the area around the site within remaining natural vegetation. However, neither species occurs on site.

There is one plant species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) that could potentially occur on site. This is *Harpagophytum procumbens* (devil's claw). Based on soil information for the site and known habitat requirements for this species, it is considered unlikely that it occurs on site. No plants have been found on site.

There is one animal species of conservation concern that may occur in habitats within the broad study area, the Brown Hyaena, listed as Near Threatened. Due to the high mobility of the Brown Hyaena, development of the site is unlikely to have a significant negative impact on this species. A number of bird species also have a distribution that includes the site, but it was assessed that the site was not important breeding or foraging habitat for any of these species due to the small area of remaining vegetation on site (less than 10 ha) and the historic disturbance of the site.

A risk assessment was undertaken which identified seven main potential negative impacts on the ecological receiving environment. The significance of these impacts was assessed and it was determined that the significance of most of these impacts would be low (see Table 4 for a

summary of the significance of impacts). The potential impact of greatest significance is due to the potential spread of alien invasive plants. This can be controlled with suitable control measures.

Table 4: Summary of the significance of impacts for different infrastructure components before and after mitigation.

Impact on:	Solar array, roads and buildings		Overhead powerline	
	Without mitigation	With mitigation	Without mitigation	With mitigation
1. Natural vegetation	medium (35)	medium (35)	low (24)	low (24)
2. threatened plants	zero (0)	zero (0)	zero (0)	zero (0)
3. protected trees	zero (0)	zero (0)	zero (0)	zero (0)
4. protected plants	zero (0)	zero (0)	zero (0)	zero (0)
5. threatened animals	low (12)	low (12)	low (6)	low (6)
6. watercourses	zero (0)	zero (0)	zero (0)	zero (0)
7. alien plants	medium (33)	low (18)	medium (33)	low (18)

*Significance: <30 = low, 30-60 = medium, >60 = high.

MANAGEMENT PLAN

Control measures are only proposed for those impacts where mitigation measures are proposed to reduce the significance of impacts, i.e. some impacts are of low significance and thus no mitigation measures are proposed or no mitigation measures are possible or required.

OBJECTIVE: Control alien invasive plants

Project component/s	Any infrastructure or activity that will result in disturbance to natural areas
Potential Impact	Invasion of natural vegetation surrounding the site by declared weeds or invasive alien species
Activity/risk source	Construction, Inappropriate environmental management
Mitigation: Target/Objective	Target: no alien plants within project control area Time period: construction, operation

Mitigation: Action/control	Responsibility	Timeframe
(1) Avoid creating conditions in which alien plants may become established: <ol style="list-style-type: none"> a. Keep disturbance of indigenous vegetation to a minimum b. Rehabilitate disturbed areas as quickly as possible c. Do not import soil from areas with alien plants (2) Establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act) (3) Immediately control any alien plants that become established using registered control methods	Construction team, management (environmental officer)	Construction, Operation

Performance Indicator	No alien plant species present on the development site
Monitoring	<ul style="list-style-type: none"> • Ongoing monitoring of area by environmental control officer during construction • Ongoing monitoring of area by environmental manager during operation • Annual audit of project area and immediate surroundings by qualified botanist. If no species are detected, then this can be stated. If any alien invasive species are detected then the distribution of these should be mapped (GPS coordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants. The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. The environmental manager should be responsible for driving this process. Reporting frequency depends on legal compliance framework

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APPENDICES:

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

Sources: South African National Biodiversity Institute in Pretoria.

Family	Taxon	Status	Habitat	Likelihood of occurrence on site
MESEMBRYANTHEMACEAE	<i>Aloinopsis rubrolineata</i>	Rare	Eastern Cape, mostly near Graaff Reinet, but also collected once at Kimberley (exact locality unknown). A poorly known succulent, collected only a few times before. On shaly soils or in silty flats.	MEDIUM
FABACEAE	<i>Acacia erioloba</i>	Declining	Savanna, semi-desert and desert areas, deep sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops.	HIGH

* 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. *IUCN (3.1) Categories: VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NT = Near Threatened.

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

MAMMALS

Common name	Taxon	Habitat ¹	National status	Global status ²	Likelihood of occurrence
Black rhinoceros	<i>Diceros bicornis bicornis</i>	Wide variety of habitats, but currently only occurs in game reserves.	CR	CR	NONE , only occurs in game reserves
Brown hyaena	<i>Hyaena brunnea</i>	Wide variety of habitats, including savanna, shrubland, grassland and urban areas; scavenger	NT	NT	MEDIUM , overall geographical distribution includes this area, general habitat is suitable
Spotted-necked otter	<i>Lutra maculicollis</i>	Permanent, unsilted and unpolluted rivers, streams and freshwater lakes.	NT	LC	LOW , overall geographical distribution includes this area, but no suitable habitat on site
Honey badger	<i>Mellivora capensis</i>	Wide variety of habitats.	NT	LC	MEDIUM , overall geographical distribution includes this area, general habitat is suitable
Southern African hedgehog	<i>Atelerix frontalis</i>	Wide variety of habitats where there is ample ground cover. Avoids mesic habitats.	NT	LC	MEDIUM , overall geographical distribution includes this area, general habitat is suitable
Natal long-fingered bat	<i>Miniopterus natalensis</i>	Caves and sub-terranean habitats	NT	LC	LOW , overall geographical distribution includes this area, but no suitable habitat on site
Geoffroy's horseshoe bat	<i>Rhinolophus clivosus</i>	Caves and subterranean habitats; fynbos, shrubland, grassland, succulent and Nama-karoo; insectivore	NT	LC	LOW , overall geographical distribution includes this area, but no suitable habitat on site
Dent's horseshoe bat	<i>Rhinolophus denti</i>	Savanna, nama-Karoo, succulent Karoo, distribution follows rivers. Caves and subterranean habitats. Aerial insectivore.	NT	LC	LOW , overall geographical distribution includes this area, but no suitable habitat on site

¹Distribution and national status according to Friedmann & Daly 2004.

²Global status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 15 July 2011.

AMPHIBIANS

Common name	Species	Habitat	Status	Likelihood of occurrence
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	Widely distributed in southern Africa, mainly at higher elevations. Inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas; also utilises non-permanent vleis and shallow water on margins of waterholes and dams. Prefer sandy substrates although they sometimes inhabit clay soils.	NT ¹ LC ² Protected (NEMBA)	LOW , within known distribution range, but no suitable habitat occurs on site.

¹Status according to Minter et al. 2004.

²Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 15 July 2011.

REPTILES

Common name	Species	Habitat	Status ³	Likelihood of occurrence
none				

³Distribution according to Alexander & Marais 2007.

⁴Status according to Alexander & Marais 2007.

BIRDS

Common name	Species	Habitat	Status	Importance of site for species
Kori Bustard	<i>Ardeotis kori</i>	Semi-arid regions, within the 100 - 600 mm rainfall isohyet. Also occurs throughout dryer west, particularly in the Nama-Karoo. Diet consists of insects, reptiles, rodents and vegetable matter. Breeding peaks from October to January. In the semi-arid western parts of South Africa, favours tree-lined watercourses. Common to very common resident in study area.	VU ¹ LC ² Protected (NEMBA)	LOW, breeding, LOW, foraging
Ludwig's Bustard	<i>Neotis ludwigii</i>	This is a near-endemic to southern Africa, with its range centred on the Nama Karoo and Succulent Karoo biomes. It occurs in western grasslands of the Eastern Cape, but supposedly as a nonbreeding visitor. The most important threat to this species is collisions with overhead powerlines and telephone wires. It inhabits the open plains of the semi-arid Karoo and especially in areas where extensive sheep farming is prevalent. Uncommon resident in study area; edge of distribution range.	VU ¹ EN ² Protected (NEMBA)	LOW, breeding, LOW, foraging
Lappet-faced vulture	<i>Torgos tracheliotus</i>	Savanna to desert. Roosts in trees (usually pair together) at night. Nests is a large platform of sticks, up to 3 m diameter, 50-100 cm deep, lined with grass, hair and skin; on top of flat-topped tree or bush.	VU ¹ VU ² Protected (NEMBA)	LOW, breeding, LOW, foraging
Martial Eagle	<i>Polemaetus bellicosus</i>	The Martial Eagle is widespread but uncommon throughout South Africa and neighbouring countries. It tolerates a wide range of vegetation types, being found in open grassland, scrub, Karoo and woodland. It relies on large trees (and electricity pylons) to provide nest sites. It is found typically in flat country and is rarer in mountains and forests. One of the main reason it is declining is because of persecution on private land. Common resident in study area.	VU ¹ NT ² Protected (NEMBA)	LOW, breeding, LOW, foraging
Lesser Kestrel	<i>Falco naumanni</i>	Open grassveld, mainly on highveld, usually near towns or farms. Highly gregarious; roosts communally in thousands in tall trees, usually around human habitations, especially in towns. Common non-breeding migrant in study area.	VU	LOW, breeding, LOW, foraging
Tawny Eagle	<i>Aquila rapax</i>	Woodland and savanna to semi-arid savanna or grassland with scattered Acacia trees. Site on edge of range. Borderline uncommon resident in study area.	VU ¹ NT ² Protected (NEMBA)	LOW, breeding, LOW, foraging
White-backed Vulture	<i>Gyps africanus</i>	Savanna and bushveld. Roosts in trees at night, often rests on ground by day; drinks and bathes regularly at waterholes. Uncommon resident in study area.	VU ¹ NT ² Protected (NEMBA)	LOW, breeding, LOW, foraging
Yellow-billed Stork	<i>Mycteria ibis</i>	Mainly inland waters; rivers, dams, pans, floodplains, marshes; less often estuaries. Uncommon non-breeding migrant in study area.	NT	LOW, breeding, LOW, foraging
Secretarybird	<i>Sagittarius serpentarius</i>	Widespread across South Africa, occurring in savanna and open grassland from coastal regions to high altitudes, but avoids thick bush and forest. Sensitive to disturbance and high human population numbers - higher numbers usually found in conservation areas. Uncommon resident in study area.	NT	LOW, breeding, LOW, foraging
Lanner Falcon	<i>Falco biarmicus</i>	Widespread species, occurring in Afrotropics, Middle East and western Palearctic. Occurs in mountains or open country from semidesert to woodland and agricultural land; also cities (Durban, Harare). Common resident in study area.	NT	LOW, breeding, LOW, foraging
Marabou Stork	<i>Leptoptilos crumeniferus</i>	Open to semi-arid woodland, bushveld, fishing villages, rubbish tips, lake shores. Uncommon resident in study area.	NT	LOW, breeding, LOW, foraging

Common name	Species	Habitat	Status	Importance of site for species
Lesser Flamingo	<i>Phoenicopterus minor</i>	Larger brackish or saline inland and coastal waters. Common resident in study area.	NT	LOW, breeding, LOW, foraging
Peregrine Falcon	<i>Falco peregrinus</i>	Cliffs, mountains, steep gorges; may hunt over open grassland, farmland and forests; rarely enters cities to hunt pigeons. Uncommon resident or non-breeding migrant in study area.	NT	LOW, breeding, LOW, foraging

¹Status according to Barnes 2000.

²Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 15 July 2011.

Appendix 3: Animal species with a geographical distribution that includes the study area.

Notes:

1. Species of conservation concern are in red lettering.
2. Species protected according to the Western Cape Nature Conservation Laws Amendment Act of 2000 (Act 3 of 2000) marked with "P"
3. Species protected according to the National Environmental Management: Biodiversity Act of 2004 (Act 10 of 2000) marked with "N"

Mammals:

^PRed hartebeest
^PSpringbok
^P^NWhite rhinoceros
^P^NBlack wildebeest
^PBlue wildebeest
^PBlesbok
^P^NBlack rhinoceros
^PPlains zebra
^PKlipspringer
^PGemsbok
^PSteenbok
^PMountain reedbuck
^PCommon duiker
^PKudu
Rock hyrax
^P^NCape clawless otter
^PWater mongoose
Black-backed jackal
Caracal
^PYellow mongoose
^P^NBlack-footed cat
^PAfrican wild cat
^PSmall grey mongoose
^PSlender mongoose
^PSmall-spotted genet
^P^NBrown hyaena
^PStriped polecat
^P^NSpotted-necked otter
^P^NHoney badger
^PBat-eared fox
^PAfrican weasel
^PAardwolf
^PSuricate
^P^NCape fox
^PNatal long-fingered bat
^PCape serotine bat
^PEgyptian slit-faced bat
^PGeoffroy's horseshoe bat
^PDent's Horseshoe Bat
^PEgyptian free-tailed bat
^P^NSouth African hedgehog
^PReddish-grey musk shrew

^PCape/Desert hare
^PScrub/Savannah hare
^PSmith's red rock rabbit
Chacma baboon
^PNamaqua rock mouse
Common mole-rat
^PShort-tailed gerbil
^PHairy-footed gerbil
^PWoodland dormouse
^PPorcupine
^PLarge-eared mouse
^PMultimammate mouse
^PSpringhare
^PStriped mouse
^PPouched mouse
^PKreb's fat mouse
^PHighveld gerbil
^PBushveld gerbil
^PCape ground squirrel
^PRock elephant-shrew
^PAardvark

Reptiles:

^PCommon flap-necked chameleon
Puff adder
Horned adder
Cape cobra
Highveld garter snake
Boomslang
Kalahari sand snake
Crossed whip snake
Striped skaapsteker
Common tiger snake
Herald snake
Bicoloured quill-snouted snake
Brown house snake
Aurora house snake
^PMole snake
Common slug eater
Common wolf snake
Common egg-eater
Delalande's beaked blind snake
Bibron's blind snake

Peter's worm snake
 P Common ground agama
 P Distant's ground agama
 P Southern rock agama
 P Rock monitor
 P Water monitor
 P Spotted sandveld lizard
 P Namaqua sand lizard
 P Spotted sand lizard
 P Common rough-scaled lizard
 P Cape spade-snouted worm-lizard
 P Thin-tailed legless skink
 P Spotted-neck snake-eyed skink
 P Cape skink
 P Eastern striped skink
 P Kalahari tree skink
 P Variegated skink
 P Western rock skink
 P Karoo girdled lizard
 P Cape dwarf gecko
 P Bibron's tubercled gecko
 P Cape gecko
 P Marico gecko
 Marsh terrapin
 P Greater padloper
 P Leopard tortoise
 P Kalahari/serrated tent tortoise

Amphibians

P Bushveld rain frog
 P Guttural toad
 P Western olive toad
 P Raucus toad
 P Southern pygmy toad
 P Karoo toad
 P Bubbling kassina
 P Common platanna
 P Boettger's caco
 P Common river frog
 P Cape river frog
 P^N Giant bullfrog
 P Tremolo sand frog
 P Tandy's sand frog

Birds:

P Abdim's Stork
 P African Black Duck
 P African Fish Eagle
 P African Hoopoe
 P African Jacana
 P African Marsh Harrier
 P African Marsh Warbler
 P African Pied Wagtail

P African Rail
 P African Spoonbill
 P Alpine Swift
 P Anteating Chat
 P Ashy Tit
 P Baillon's Crake
 P Banded Martin
 P Barn Owl
 P Black Crake
 P Black Crow
 P Black Eagle
 P Black Egret
 P Black Harrier
 P Black Kite
 P^N **Black Stork, NT**
 P Black Swift
 P Blackbreasted Snake Eagle
 P Blackcheeked Waxbill
 P Blackchested Prinia
 P Blackcrowned Night Heron
 P Blackheaded Heron
 P Blacknecked Grebe
 P Blackshouldered Kite
 P Blacksmith Plover
 P Blacktailed Godwit
 P Blackthroated Canary
 P Blackwinged Pratincole
 P Blackwinged Stilt
 P Blue Crane
 P Blue Korhaan
 P Blue Waxbill
 P Bluecheeked Bee-eater
 P Bokmakierie
 P Booted Eagle
 P Bradfield's Swift
 P Brownhooded Kingfisher
 P Browthroated Martin
 P Brubru
 P Buffy Pipit
 P Burchell's Coucal
 P Burchell's Courser
 P Cape Bunting
 P Cape Canary
 P Cape Penduline Tit
 P Cape Reed Warbler
 P Cape Robin
 P Cape Shoveller
 P Cape Sparrow
 P Cape Teal
 P Cape Turtle Dove
 P^N **Cape Vulture, VU**
 P Cape Wagtail
 P Capped Wheatear

P Cardinal Woodpecker
 P Caspian Plover
 P Caspian Tern
 P Cattle Egret
 P Chat Flycatcher
 P Chestnutbacked Finchlark
 P Chestnutbanded Plover
 P Cloud Cisticola
 P Common Moorhen
 P Common Quail
 P Common Sandpiper
 P Common Waxbill
 P Crested Barbet
 P Crimsonbreasted Shrike
 P Crowned Plover
 P Curlew
 P Curlew Sandpiper
 P Dabchick
 P Darter
 P Desert Cisticola
 P Diederik Cuckoo
 P Doublebanded Courser
 P Dusky Sunbird
 P Eastern Clapper Lark
 P Egyptian Goose
 P Ethiopian Snipe
 P Eurasian Bee-eater
 P Eurasian Golden Oriole
 P Eurasian Marsh Harrier
 P Eurasian Nightjar
 P Eurasian Roller
 P Eurasian Swallow
 P Eurasian Swift
 P Fairy Flycatcher
 P Familiar Chat
 P Fantailed Cisticola
 P Fawncoloured Lark
 P Feral Pigeon
 P Fiscal Flycatcher
 P Fiscal Shrike
 P Forktailed Drongo
 P Fulvous Duck
 P Gabar Goshawk
 P Garden Warbler
 P Giant Eagle Owl
 P Giant Kingfisher
 P Glossy Ibis
 P Glossy Starling
 P Golden Bishop
 P Goldenbreasted Bunting
 P Goldentailed Woodpecker
 P Goliath Heron
 P Grassveld Pipit

P Great Crested Grebe
 P Great Reed Warbler
 P Great Sparrow
 P Great Spotted Cuckoo
 P Great White Egret
 P **Greater Flamingo, NT**
 P Greater Honeyguide
 P Greater Kestrel
 P Greater Striped Swallow
 P Greenbacked Heron
 P Greenshank
 P Grey Heron
 P Grey Hornbill
 P Greybacked Finchlark
 P Greyheaded Gull
 P Groundscraper Thrush
 P Gymnogene
 P Hadedda Ibis
 P Hamerkop
 P Helmeted Guineafowl
 P Horus Swift
 P Hottentot Teal
 P House Martin
 P House Sparrow
 P Icterine Warbler
 P Jackal Buzzard
 P Jacobin Cuckoo
 P Kalahari Robin
 P Karoo Chat
 P Karoo Robin
 P Karoo Thrush
 P Kimberley Pipit
 P Kittlitz's Plover
 P Knobbilled Duck
 P^N **Kori Bustard, VU**
 P Kurrichane Buttonquail
 P **Lanner Falcon, NT**
 P^N **Lappetfaced Vulture, VU**
 P Larklike Bunting
 P Laughing Dove
 P Lesser Blackbacked Gull
 P **Lesser Flamingo, NT**
 P Lesser Grey Shrike
 P Lesser Honeyguide
 P^N **Lesser Kestrel, VU**
 P Levillant's Cisticola
 P Lilacbreasted Roller
 P Little Bittern
 P Little Egret
 P Little Stint
 P Little Swift
 P Longbilled Crombec
 P Longtailed Pipit
 P Longtailed Widow

^PN Ludwig's Bustard, VU

- ^P Maccoa Duck
- ^P Malachite Kingfisher
- ^P Marabou Stork, NT**
- ^P Marico Flycatcher
- ^P Marsh Owl
- ^P Marsh Sandpiper
- ^P Martial Eagle, VU**
- ^P Masked Weaver
- ^P Melba Finch
- ^P Monotonous Lark
- ^P Montagu's Harrier
- ^P Mountain Chat
- ^P Namaqua Dove
- ^P Namaqua Sandgrouse
- ^P Natal Francolin
- ^P Neddicky
- ^P Old World Painted Snipe
- ^P Orange River Francolin
- ^P Orange River White-eye
- ^P Orangethroated Longclaw
- ^P Osprey
- ^P Ostrich
- ^P Pale Chanting Goshawk
- ^P Palewinged Starling
- ^P Palm Swift
- ^P Paradise Flycatcher
- ^P Paradise Whydah
- ^P Pearlbreasted Swallow
- ^P Peregrine Falcon, NT**
- ^P Pied Avocet
- ^P Pied Barbet
- ^P Pied Crow
- ^P Pied Kingfisher
- ^P Pied Starling
- ^P Pinkbilled Lark
- ^P Pintailed Whydah
- ^P Plainbacked Pipit
- ^P Pirit Batis
- ^P Purple Gallinule
- ^P Purple Heron
- ^P Pygmy Falcon
- ^P Quail Finch
- ^P Red Bishop
- ^P Redbacked Shrike
- ^P Redbilled Firefinch
- ^P Redbilled Quelea
- ^P Redbilled Teal
- ^P Redbilled Woodhoopoe
- ^P Redbreasted Swallow
- ^P Redcapped Lark
- ^P Redchested Cuckoo
- ^P Redcrested Korhaan

- ^P Redeyed Bulbul
- ^P Redeyed Dove
- ^P Redfaced Mousebird
- ^P Redheaded Finch
- ^P Redknobbed Coot
- ^P Reed Cormorant
- ^P Ringed Plover
- ^P Rock Bunting
- ^P Rock Kestrel
- ^P Rock Martin
- ^P Rock Pigeon
- ^P Ruff
- ^P Rufouscheeked Nightjar
- ^P Rufouseared Warbler
- ^P Rufousnaped Lark
- ^P Sabota Lark
- ^P Sacred Ibis
- ^P Sand Martin
- ^P Sanderling
- ^P Scalyfeathered Finch
- ^P Scimitarbilled Woodhoopoe
- ^P Secretarybird, NT**
- ^P Shafttailed Whydah
- ^P Shorttoed Rockthrush
- ^P Sicklewinged Chat
- ^P Sociable Weaver
- ^P South African Cliff Swallow
- ^P South African Shelduck
- ^P Southern Greyheaded Sparrow
- ^P Southern Pochard
- ^P Southern Yellowbilled Hornbill
- ^P Spikeheeled Lark
- ^P Spotted Dikkop
- ^P Spotted Eagle Owl
- ^P Spotted Flycatcher
- ^P Spurwinged Goose
- ^P Squacco Heron
- ^P Steelblue Widowfinch
- ^P Steppe Buzzard
- ^P Stonechat
- ^P Swainson's Francolin
- ^P Swallowtailed Bee-eater
- ^P Tawny Eagle, VU**
- ^P Temminck's Courser
- ^P Thickbilled Lark
- ^P Threebanded Plover
- ^P Threestreaked Tchagra
- ^P Titbabbler
- ^P Violeteared Waxbill
- ^P Wattled Starling
- ^P Whimbrel
- ^P Whiskered Tern
- ^P White Stork

- ^P Whitebacked Duck
- ^P Whitebacked Mousebird
- ^P^N **Whitebacked Vulture, VU**
- ^P Whitebreasted Cormorant
- ^P Whitebrowed Sparrowweaver
- ^P Whitefaced Duck
- ^P Whitefaced Owl
- ^P Whitefronted Bee-eater
- ^P Whiterumped Swift
- ^P Whitethroated Canary
- ^P Whitethroated Swallow

- ^P Whitewinged Korhaan
- ^P Whitewinged Tern
- ^P Willow Warbler
- ^P Wood Sandpiper
- ^P Yellow Canary
- ^P Yellow Wagtail
- ^P Yellowbellied Eremomela
- ^P Yellowbilled Duck
- ^P Yellowbilled Egret
- ^P Yellowbilled Kite
- ^P **Yellowbilled Stork, NT**

Appendix 4: List of protected tree species (National Forests Act).

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

Acacia erioloba and *Boscia albitrunca* have a geographical distribution that coincides with the study area.

Appendix 5: Checklist of plant species recorded during previous botanical surveys in the study area and surrounds.

(Species from quarter degree grid in which the site is located as well as surrounding grids in which similar vegetation is found)

Acacia erioloba E.Mey.

Acacia farnesiana (L.) Willd.
Acacia grandicornuta Gerstner
Acacia hebeclada DC. subsp. hebeclada
Acacia karroo Hayne
Acacia mellifera (Vahl) Benth. subsp. detinens (Burch.) Brenan
Acacia tortilis (Forssk.) Hayne subsp. heteracantha (Burch.) Brenan
Acanthosicyos naudinianus (Sond.) C.Jeffrey
Achyranthes aspera L. var. aspera
Acrotome inflata Benth.
Aerva leucura Moq.
Alchemilla elongata Eckl. & Zeyh. var. elongata
Aloe grandidentata Salm-Dyck
Aloe hereroensis Engl. var. hereroensis

Aloinopsis rubrolineata (N.E.Br.) Schwantes

Alternanthera pungens Kunth
Amaranthus deflexus L.
Amaranthus dinteri Schinz subsp. dinteri var. a
Amaranthus praetermissus Brenan
Amaranthus thunbergii Moq.
Amaranthus viridis L.
Amellus strigosus (Thunb.) Less. subsp. strigosus
Amellus tridactylus DC. subsp. tridactylus
Ammocharis coranica (Ker Gawl.) Herb.
Amphiglossa triflora DC.
Anthemis cotula L.
Anthepphora pubescens Nees
Antizoma angustifolia (Burch.) Miers ex Harv.
Aptenia cordifolia (L.f.) Schwantes
Aptosimum elongatum Engl.
Aptosimum indivisum Burch. ex Benth.
Aptosimum marlothii (Engl.) Hiern
Arctotheca calendula (L.) Levyns
Arctotis venusta Norl.
Argemone ochroleuca Sweet subsp. ochroleuca
Aristida adscensionis L.
Aristida congesta Roem. & Schult. subsp. barbicollis (Trin. & Rupr.) De Winter
Aristida congesta Roem. & Schult. subsp. congesta
Aristida meridionalis Henrard
Aristida mollissima Pilg. subsp. mollissima
Aristida scabrivalvis Hack. subsp. scabrivalvis
Aristida stipitata Hack. subsp. graciliflora (Pilg.) Melderis
Aristida stipitata Hack. subsp. spicata (De Winter) Melderis
Aristida vestita Thunb.
Asparagus bechuanicus Baker
Asparagus glaucus Kies
Asparagus laricinus Burch.
Asparagus suaveolens Burch.
Asplenium cordatum (Thunb.) Sw.
Atriplex erosa G.Brückn. & I.Verd.
Atriplex lindleyi Moq. subsp. inflata (F.Muell.) Paul G.Wilson
Atriplex rosea L.

Atriplex semibaccata R.Br. var. *appendiculata* Aellen
Atriplex suberecta I.Verd.
Atriplex vestita (Thunb.) Aellen var. *appendiculata* Aellen
Babiana hypogaea Burch.
Barleria rigida Nees
Bartramia compacta Hornsch. var. *compacta*
Berkheya pinnatifida (Thunb.) Thell. subsp. *pinnatifida*
Bidens biternata (Lour.) Merr. & Sherff
Blepharis integrifolia (L.f.) E.Mey. ex Schinz var. *integrifolia*
Brachiaria marlothii (Hack.) Stent
Brachystelma dimorphum R.A.Dyer subsp. *dimorphum*
Bryum argenteum Hedw.
Bryum torquescens Bruch ex De Not.
Buddleja saligna Willd.
Buglossoides arvensis (L.) I.M.Johnst.
Bulbine abyssinica A.Rich.
Bulbine asphodeloides (L.) Spreng.
Bulbostylis hispidula (Vahl) R.W.Haines subsp. *pyriformis* (Lye) R.W.Haines
Caesalpinia gilliesii (Wall. ex Hook.) D.Dietr.
Cenchrus ciliaris L.
Cenchrus incertus M.A.Curtis
Cerastium capense Sond.
Chaenostoma halimifolium Benth.
Chaenostoma patrioticum (Hiern) Kornhall
Chamaecrista biensis (Steyaert) Lock
Chascanum pinnatifidum (L.f.) E.Mey. var. *pinnatifidum*
Cheilanthes eckloniana (Kunze) Mett.
Cheilanthes hirta Sw. var. *hirta*
Chenopodium carinatum R.Br.
Chenopodium cristatum F.Muell.
Chenopodium glaucum L.
Chenopodium multifidum L.
Chenopodium opulifolium Schrad. ex W.D.J.Koch & Ziz var. *opulifolium*
Chenopodium schraderianum Roem. & Schult.
Chloris virgata Sw.
Chlorophytum fasciculatum (Baker) Kativu
Choritaenia capensis Benth.
Chrysocoma ciliata L.
Chrysocoma obtusata (Thunb.) Ehr.Bayer
Cineraria aspera Thunb.
Cineraria lyratiformis Cron
Cladophascum gymnomitrioides (Dixon) Dixon
Clematis brachiata Thunb.
Cleome angustifolia Forssk. subsp. *diandra* (Burch.) Kers
Cleome gynandra L.
Cleome monophylla L.
Cleome rubella Burch.
Coccinia rehmannii Cogn.
Coccinia sessilifolia (Sond.) Cogn.
Colchicum burkei (Baker) J.C.Manning & Vinn.
Colchicum melanthoides (Willd.) J.C.Manning & Vinn. subsp. *melanthoides*
Commelina africana L. var. *africana*
Commelina africana L. var. *barberae* (C.B.Clarke) C.B.Clarke
Commelina benghalensis L.
Commelina livingstonii C.B.Clarke
Commicarpus pentandrus (Burch.) Heimerl
Commiphora gracilifronsosa Dinter ex J.J.A.van der Walt

Convolvulus boedeckerianus Peter
Convolvulus multifidus Thunb.
Convolvulus ocellatus Hook.f. var. *ocellatus*
Convolvulus sagittatus Thunb.
Conyza bonariensis (L.) Cronquist
Conyza scabrida DC.
Corchorus asplenifolius Burch.
Coronopus integrifolius (DC.) Spreng.
Corrigiola litoralis L. subsp. *litoralis* var. *litoralis*
Cotula anthemoides L.
Cotula burchellii DC.
Crotalaria griquensis L.Bolus
Crotalaria lotoides Benth.
Crotalaria sphaerocarpa Perr. ex DC. subsp. *sphaerocarpa*
Cucumis heptadactylus Naudin
Cucumis myriocarpus Naudin subsp. *leptodermis* (Schweick.) C.Jeffrey & P.Halliday
Cucumis myriocarpus Naudin subsp. *myriocarpus*
Cucumis zeyheri Sond.
Cullen tomentosum (Thunb.) J.W.Grimes
Cuscuta appendiculata Engelm.
Cyanella lutea L.f.
Cymbopogon nardus (L.) Rendle
Cymbopogon pospischilii (K.Schum.) C.E.Hubb.
Cynanchum orangeanum (Schltr.) N.E.Br.
Cynanchum virens (E.Mey.) D.Dietr.
Cynodon dactylon (L.) Pers.
Cynodon incompletus Nees
Cyperus capensis (Steud.) Endl.
Cyperus fastigiatus Rottb.
Cyperus indecorus Kunth var. *decurvatus* (C.B.Clarke) Kük.
Cyperus laevigatus L.
Cyperus margaritaceus Vahl var. *margaritaceus*
Cyperus marlothii Boeck.
Cyperus rotundus L. subsp. *rotundus*
Cyperus usitatus Burch.
Cyphia stenopetala Diels
Cyphostemma hereroense (Schinz) Desc. ex Wild & R.B.Drumm.
Datura stramonium L.
Daubenya comata (Burch. ex Baker) J.C.Manning & A.van der Merwe
Denekia capensis Thunb.
Deverra burchellii (DC.) Eckl. & Zeyh.
Diandrochloa pusilla (Hack.) De Winter
Dianthus micropetalus Ser.
Dichanthium annulatum (Forssk.) Stapf var. *papillosum* (A.Rich.) de Wet & Harlan
Dichilus gracilis Eckl. & Zeyh.
Dicliptera leistneri K.Balkwill
Diclis petiolaris Benth.
Dicoma capensis Less.
Dicoma macrocephala DC.
Dicoma schinzii O.Hoffm.
Digitaria eriantha Steud.
Digitaria sanguinalis (L.) Scop.
Diospyros austro-africana De Winter var. *microphylla* (Burch.) De Winter
Diospyros lycioides Desf. subsp. *lycioides*
Dipcadi gracillimum Baker
Dipcadi marlothii Engl.
Dipcadi viride (L.) Moench

Drimia intricata (Baker) J.C.Manning & Goldblatt
Drimia physodes (Jacq.) Jessop
Drimia sanguinea (Schinz) Jessop
Duthieastrum linifolium (E.Phillips) M.P.de Vos
Echinochloa colona (L.) Link
Echinochloa crus-galli (L.) P.Beauv.
Echinochloa holubii (Stapf) Stapf
Ehretia alba Retief & A.E.van Wyk
Ehretia rigida (Thunb.) Druce subsp. *rigida*
Ehrharta calycina Sm.
Elephantorrhiza elephantina (Burch.) Skeels
Eleusine coracana (L.) Gaertn. subsp. *africana* (Kenn.-O'Byrne) Hilu & de Wet
Elionurus muticus (Spreng.) Kunth
Enneapogon cenchroides (Licht. ex Roem. & Schult.) C.E.Hubb.
Enneapogon scoparius Stapf
Eragrostis barrelieri Daveau
Eragrostis bicolor Nees
Eragrostis biflora Hack. ex Schinz
Eragrostis chloromelas Steud.
Eragrostis cilianensis (All.) Vignolo ex Janch.
Eragrostis curvula (Schrad.) Nees
Eragrostis echinochloidea Stapf
Eragrostis gummiflua Nees
Eragrostis homomalla Nees
Eragrostis lehmanniana Nees var. *lehmanniana*
Eragrostis mexicana (Hornem.) Link subsp. *virescens* (J.Presl.) S.D.Koch & Sánchez Vega
Eragrostis nindensis Ficalho & Hiern
Eragrostis obtusa Munro ex Ficalho & Hiern
Eragrostis pallens Hack.
Eragrostis pilosa (L.) P.Beauv.
Eragrostis porosa Nees
Eragrostis superba Peyr.
Eragrostis tef (Zuccagni) Trotter
Eragrostis trichophora Coss. & Durieu
Eragrostis truncata Hack.
Eragrostis x pseud-obtusa De Winter
Eriocephalus ambiguus (DC.) M.A.N.Müll.
Eriocephalus karooicus M.A.N.Müll.
Eriospermum porphyrium Archibald
Erucastrum griquense (N.E.Br.) O.E.Schulz
Erythrina zeyheri Harv.
Euclea crispa (Thunb.) Gürke subsp. *ovata* (Burch.) F.White
Euphorbia bergii A.C.White, R.A.Dyer & B.Sloane
Euphorbia duseimata R.A.Dyer
Euphorbia fusca Marloth
Euphorbia inaequilatera Sond. var. *inaequilatera*
Euphorbia mixta N.E.Br.
Euphorbia rectirama N.E.Br.
Euryops asparagoides (Licht. ex Less.) DC.
Euryops subcarnosus DC. subsp. *vulgaris* B.Nord.
Falkia oblonga Bernh. ex C.Krauss
Felicia fascicularis DC.
Felicia filifolia (Vent.) Burt Davy subsp. *filifolia*
Felicia muricata (Thunb.) Nees subsp. *muricata*
Fingerhuthia africana Lehm.
Frankenia pulverulenta L.
Funaria hygrometrica Hedw.

Galenia portulacacea Fenzl
Galenia procumbens L.f.
Galenia prostrata G.Schellenb.
Galenia pubescens (Eckl. & Zeyh.) Druce
Galeomma stenolepis (S.Moore) Hilliard
Gazania jurineifolia DC. subsp. *jurineifolia*
Gazania krebsiana Less. subsp. *arctotoides* (Less.) Roessler
Geigeria burkei Harv. subsp. *diffusa* (Harv.) Merxm.
Geigeria filifolia Mattf.
Geigeria ornativa O.Hoffm. subsp. *ornativa*
Gethyllis transkarooica D.Müll.-Doblies
Gisekia pharnacioides L. var. *pharnacioides*
Gladiolus orchidiflorus Andrews
Gladiolus permeabilis D.Delaroche subsp. *edulis* (Burch. ex Ker Gawl.) Oberm.
Gnaphalium confine Harv.
Gnidia polycephala (C.A.Mey.) Gilg
Gomphocarpus fruticosus (L.) Aiton f. subsp. *fruticosus*
Gomphocarpus tomentosus Burch. subsp. *tomentosus*
Gomphostigma virgatum (L.f.) Baill.
Gomphrena celosioides Mart.
Grewia flava DC.
Grielum humifusum Thunb. var. *humifusum*
Gymnosporia buxifolia (L.) Szyszyl.
Harpagophytum procumbens* (Burch.) DC. ex Meisn. subsp. *procumbens
Hebenstretia integrifolia L.
Helichrysum arenicola M.D.Hend.
Helichrysum argyrosphaerum DC.
Helichrysum cerastioides DC. var. *cerastioides*
Helichrysum dregeanum Sond. & Harv.
Helichrysum lineare DC.
Helichrysum lucilioides Less.
Helichrysum zeyheri Less.
Heliophila minima (Stephens) Marais
Heliotropium ciliatum Kaplan
Heliotropium curassavicum L.
Heliotropium lineare (A.DC.) Gürke
Heliotropium nelsonii C.H.Wright
Hemarthria altissima (Poir.) Stapf & C.E.Hubb.
Hermannia bicolor Engl. & Dinter
Hermannia comosa Burch. ex DC.
Hermannia erodioides (Burch. ex DC.) Kuntze
Hermannia linearifolia Harv.
Hermannia modesta (Ehrenb.) Mast.
Hermannia tomentosa (Turcz.) Schinz ex Engl.
Hermstaedtia odorata (Burch.) T.Cooke var. *odorata*
Herniaria erckertii Herm. subsp. *erckertii*
Hertia pallens (DC.) Kuntze
Heteropogon contortus (L.) Roem. & Schult.
Hibiscus marlothianus K.Schum.
Hibiscus pusillus Thunb.
Hirpicium echinus Less.
Hypertelis salsoloides (Burch.) Adamson var. *salsoloides*
Indigastrum argyraeum (Eckl. & Zeyh.) Schrire
Indigofera alternans DC. var. *alternans*
Indigofera arrecta Hochst. ex A.Rich.
Indigofera daleoides Benth. ex Harv. var. *daleoides*
Indigofera filipes Benth. ex Harv.

Indigofera rhytidocarpa Benth. ex Harv. subsp. *rhytidocarpa*
Indigofera vicioides Jaub. & Spach var. *vicioides*
Ipomoea bolusiana Schinz
Ipomoea oenotheroides (L.f.) Raf. ex Hallier f.
Ischyrodon lepturus (Taylor) Schelpe
Isolepis sepulcralis Steud.
Jamesbrittenia albiflora (I.Verd.) Hilliard
Jamesbrittenia atropurpurea (Benth.) Hilliard subsp. *atropurpurea*
Jasminum angulare Vahl
Juncus exsertus Buchenau
Juncus rigidus Desf.
Justicia orchioides L.f. subsp. *glabrata* Immelman
Kalanchoe paniculata Harv.
Kedrostis africana (L.) Cogn.
Kleinia longiflora DC.
Kohautia cynanchica DC.
Kyllinga alba Nees
Kyphocarpa angustifolia (Moq.) Lopr.
Lactuca inermis Forssk.
Laggera decurrens (Vahl) Hepper & J.R.I.Wood
Lantana mearnsii Moldenke var. *latibracteolata* Moldenke
Lantana rugosa Thunb.
Lappula heteracantha Ledeb.
Lasiopogon glomerulatus (Harv.) Hilliard
Ledebouria marginata (Baker) Jessop
Ledebouria undulata (Jacq.) Jessop
Lepidium africanum (Burm.f.) DC. subsp. *divaricatum* (Aiton) Jonsell
Lessertia depressa Harv.
Lessertia pauciflora Harv. var. *pauciflora*
Leucas capensis (Benth.) Engl.
Limeum arenicolum G.Schellenb.
Limeum argute-carinatum Wawra ex Wawra & Peyr. var. *argute-carinatum*
Limeum fenestratum (Fenzl) Heimerl var. *fenestratum*
Limeum sulcatum (Klotzsch) Hutch. var. *sulcatum*
Limeum viscosum (J.Gay) Fenzl subsp. *viscosum* var. *macrocarpum* Friedrich
Limeum viscosum (J.Gay) Fenzl subsp. *viscosum* var. *viscosum*
Limosella maior Diels
Lithospermum cinereum A.DC.
Litogyne gariepina (DC.) Anderb.
Lobelia dregeana (C.Presl) A.DC.
Lobelia thermalis Thunb.
Lophiocarpus polystachyus Turcz.
Lotononis listii Polhill
Lotononis marlothii Engl.
Lycium arenicola Miers
Lycium cinereum Thunb.
Lycium ferocissimum Miers
Lycium hirsutum Dunal
Lycium horridum Thunb.
Lycium pilifolium C.H.Wright
Lycium pumilum Dammer
Lycium villosum Schinz
Massonia jasminiflora Burch. ex Baker
Medicago laciniata (L.) Mill. var. *laciniata*
Medicago polymorpha L.
Melhania prostrata DC.
Melinis repens (Willd.) Zizka subsp. *grandiflora* (Hochst.) Zizka

Melinis repens (Willd.) Zizka subsp. *repens*
Melolobium calycinum Benth.
Melolobium candicans (E.Mey.) Eckl. & Zeyh.
Melolobium canescens Benth.
Melolobium microphyllum (L.f.) Eckl. & Zeyh.
Menodora africana Hook.
Mentha longifolia (L.) Huds. subsp. *capensis* (Thunb.) Briq.
Merremia verecunda Rendle
Microchloa kunthii Desv.
Microloma armatum (Thunb.) Schltr. var. *armatum*
Microloma armatum (Thunb.) Schltr. var. *burchellii* (N.E.Br.) Bruyns
Mimulus gracilis R.Br.
Mollugo cerviana (L.) Ser. ex DC. var. *cerviana*
Momordica balsamina L.
Monsonia angustifolia E.Mey. ex A.Rich.
Monsonia burkeana Planch. ex Harv.
Moraea pallida (Baker) Goldblatt
Moraea polystachya (Thunb.) Ker Gawl.
Nemesia fruticans (Thunb.) Benth.
Nemesia lilacina N.E.Br.
Nicotiana glauca Graham
Nidorella resedifolia DC. subsp. *resedifolia*
Nolletia arenosa O.Hoffm.
Nolletia ciliaris (DC.) Steetz
Nothoscordum borbonicum Kunth
Nuxia gracilis Engl.
Ocimum americanum L. var. *americanum*
Oenothera indecora Cambess.
Olea europaea L. subsp. *africana* (Mill.) P.S.Green
Oligomeris dipetala (Aiton) Turcz. var. *dipetala*
Oncosiphon piluliferum (L.f.) Källersjö
Orbea lutea (N.E.Br.) Bruyns subsp. *lutea*
Orbea verrucosa (Masson) L.C.Leach
Ornithogalum flexuosum (Thunb.) U.& D.Müll.-Doblies
Ornithoglossum dinteri K.Krause
Oropetium capense Stapf
Orthanthera jasminiflora (Decne.) Schinz
Osteospermum leptolobum (Harv.) Norl.
Osteospermum muricatum E.Mey. ex DC. subsp. *muricatum*
Osteospermum spinescens Thunb.
Othonna auriculifolia Licht. ex Less.
Otoptera burchellii DC.
Oxalis corniculata L.
Oxalis depressa Eckl. & Zeyh.
Oxalis pes-caprae L. var. *pes-caprae*
Oxygonum alatum Burch. var. *alatum*
Panicum coloratum L. var. *coloratum*
Panicum stapfianum Fourc.
Pavonia burchellii (DC.) R.A.Dyer
Pegolettia retrofracta (Thunb.) Kies
Pelargonium minimum (Cav.) Willd.
Peliostomum leucorrhizum E.Mey. ex Benth.
Peliostomum origanoides E.Mey. ex Benth.
Pellaea calomelanos (Sw.) Link var. *calomelanos*
Pentarrhinum insipidum E.Mey.
Pentzia calcarea Kies
Pentzia globosa Less.

Pentzia lanata Hutch.
Pentzia quinquefida (Thunb.) Less.
Pentzia viridis Kies
Persicaria hystriacula (J.Schust.) Soják
Phragmites australis (Cav.) Steud.
Phyllanthus maderaspatensis L.
Phyllanthus parvulus Sond. var. *parvulus*
Piранthus decipiens (N.E.Br.) Bruyns
Plagiochasma rupestre (J.R.& G.Forst.) Steph. var. *rupestre*
Plinthus karooicus I.Verd.
Plinthus sericeus Pax
Poa annua L.
Pogonarthria squarrosa (Roem. & Schult.) Pilg.
Pollichia campestris Aiton
Polygala hottentotta C.Presl
Polygala leptophylla Burch. var. *leptophylla*
Polygala seminuda Harv.
Polygonum aviculare L.
Polygonum plebeium R.Br.
Polypogon monspeliensis (L.) Desf.
Portulaca kermesina N.E.Br.
Portulaca quadrifida L.
Potamogeton crispus L.
Potamogeton pectinatus L.
Prosopis glandulosa Torr. var. *glandulosa*
Prosopis velutina Wooton
Pseudognaphalium luteo-album (L.) Hilliard & B.L.Burttt
Pseudoschoenus inanis (Thunb.) Oteng-Yeb.
Psilocaulon articulatum (Thunb.) N.E.Br.
Psilocaulon coriarium (Burch. ex N.E.Br.) N.E.Br.
Psilocaulon granulicaule (Haw.) Schwantes
Psora decipiens (Hedw.) Hoffm.
Pterodiscus speciosus Hook.
Ptychomitrium crispatum (Hedw.) A.Jaeger
Puccinellia acroxantha C.A.Sm. & C.E.Hubb.
Pupalia lappacea (L.) A.Juss. var. *lappacea*
Putterlickia pyracantha (L.) Szyszyl.
Ranunculus multifidus Forssk.
Ranunculus rionii Lager
Raphionacme velutina Schltr.
Rapistrum rugosum (L.) All.
Rhigozum obovatum Burch.
Rhigozum trichotomum Burch.
Rhynchosia confusa Burttt Davy
Rhynchosia holosericea Schinz
Riccia cavernosa Hoffm. emend. Raddi
Riccia simii Perold
Riocreuxia burchellii K.Schum.
Rorippa fluviatilis (E.Mey. ex Sond.) Thell. var. *caledonica* (Sond.) Marais
Rosenia humilis (Less.) K.Bremer
Salix mucronata Thunb. subsp. *mucronata*
Salsola aphylla L.f.
Salsola calluna Fenzl ex C.H.Wright
Salsola denudata Botsch.
Salsola exalata Botsch.
Salsola geminiflora Fenzl ex C.H.Wright
Salsola glabrescens Burttt Davy

Salsola kali L.
Salsola rabieana I. Verd.
Salvia disermas L.
Salvia stenophylla Burch. ex Benth.
Salvia verbenaca L.
Scabiosa columbaria L.
Scadoxus puniceus (L.) Friis & Nordal
Schinus molle L.
Schismus barbatus (Loefl. ex L.) Thell.
Schizocarpus nervosus (Burch.) Van der Merwe
Schkuhria pinnata (Lam.) Kuntze ex Thell.
Schmidtia kalahariensis Stent
Schmidtia pappophoroides Steud.
Scirpoides dioecus (Kunth) Browning
Searsia lancea (L.f.) F.A. Barkley
Searsia pyroides (Burch.) Moffett var. *pyroides*
Searsia tridactyla (Burch.) Moffett
Sebaea exigua (Oliv.) Schinz
Sebaea pentandra E. Mey. var. *pentandra*
Seidelia triandra (E. Mey.) Pax
Selago geniculata L.f.
Selago mixta Hilliard
Selago welwitschii Rolfe var. *australis* Hilliard
Senecio burchellii DC.
Senecio consanguineus DC.
Senecio inaequidens DC.
Senecio windhoekensis Merxm.
Senna italica Mill. subsp. *arachoides* (Burch.) Lock
Sericorema remotiflora (Hook.f.) Lopr.
Sesamum capense Burm.f.
Sesbania notialis J.B. Gillett
Setaria pumila (Poir.) Roem. & Schult.
Setaria verticillata (L.) P. Beauv.
Sisymbrium burchellii DC. var. *burchellii*
Solanum capense L.
Solanum lichtensteinii Willd.
Solanum supinum Dunal var. *supinum*
Sonchus oleraceus L.
Sorghum halepense (L.) Pers.
Spergularia rubra (L.) J. & C. Presl
Sphaeralcea bonariensis (Cav.) Griseb.
Sporobolus albicans (Nees ex Trin.) Nees
Sporobolus coromandelianus (Retz.) Kunth
Sporobolus discosporus Nees
Sporobolus fimbriatus (Trin.) Nees
Sporobolus ludwigii Hochst.
Stachys hyssopoides Burch. ex Benth.
Stachys spathulata Burch. ex Benth.
Stapelia gettliffei R. Pott
Stapelia gigantea N.E. Br.
Stenostelma capense Schltr.
Stipagrostis namaquensis (Nees) De Winter
Stipagrostis obtusa (Delile) Nees
Stipagrostis uniplumis (Licht.) De Winter var. *neesii* (Trin. & Rupr.) De Winter
Stipagrostis uniplumis (Licht.) De Winter var. *uniplumis*
Suaeda fruticosa (L.) Forssk.
Sutherlandia frutescens (L.) R. Br.

Talinum arnotii Hook.f.
Talinum caffrum (Thunb.) Eckl. & Zeyh.
Tamarix ramosissima Ledeb.
Tarchonanthus camphoratus L.
Targionia hypophylla L.
Tephrosia burchellii Burttt Davy
Thalictrum minus L.
Themeda triandra Forssk.
Thesium hystricoides A.W.Hill
Thesium hystrix A.W.Hill
Titanopsis calcarea (Marloth) Schwantes
Trachyandra burkei (Baker) Oberm.
Trachyandra laxa (N.E.Br.) Oberm. var. *rigida* (Suess.) Roessler
Trachyandra saltii (Baker) Oberm. var. *saltii*
Tragopogon porrifolius L.
Tragus berteronianus Schult.
Tragus koelerioides Asch.
Tragus racemosus (L.) All.
Trianthera parvifolia E.Mey. ex Sond. var. *parvifolia*
Tribulus terrestris L.
Tribulus zeyheri Sond. subsp. *zeyheri*
Trichodesma angustifolium Harv. subsp. *angustifolium*
Trichodiadema pomeridianum L.Bolus
Tricholaena monachne (Trin.) Stapf & C.E.Hubb.
Trichoneura grandiglumis (Nees) Ekman
Trichostomum brachydontium Bruch
Tridentea gemmiflora (Masson) Haw.
Tripteris aghillana DC. var. *aghillana*
Triraphis purpurea Hack.
Trochomeria debilis (Sond.) Hook.f.
Troglophyton capillaceum (Thunb.) Hilliard & B.L.Burttt subsp. *capillaceum*
Urochloa panicoides P.Beauv.
Vahlia capensis (L.f.) Thunb. subsp. *capensis*
Vahlia capensis (L.f.) Thunb. subsp. *vulgaris* Bridson var. *linearis* E.Mey. ex Bridson
Verbena officinalis L.
Viscum rotundifolium L.f.
Wahlenbergia androsacea A.DC.
Wahlenbergia denticulata (Burch.) A.DC. var. *denticulata*
Wahlenbergia denticulata (Burch.) A.DC. var. *transvaalensis* (Adamson) W.G.Welman
Wahlenbergia meyeri A.DC.
Wahlenbergia nodosa (H.Buek) Lammers
Xanthium spinosum L.
Xanthium strumarium L.
Zaluzianskya venusta Hilliard
Zannichellia palustris L.
Ziziphus mucronata Willd. subsp. *mucronata*
Zygophyllum incrustatum E.Mey. ex Sond.
Zygophyllum microcarpum Licht. ex Cham. & Schltldl.
Zygophyllum simplex L.

**Appendix 6: Species protected under the National Environmental Management:
Biodiversity Act, 2004 (Act 10 of 2004)**
(as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Reptilia

Loggerhead sea turtle
Leatherback sea turtle
Hawksbill sea turtle

Aves

Wattled crane
Blue swallow
Egyptian vulture
Cape parrot

Mammalia

Riverine rabbit
Rough-haired golden mole

Flora

Adenium swazicum
Aloe pillansii
Diaphanathe millarii
Dioscorea ebutsniorum
Encephalartos aemulans
Encephalartos brevifoliolatus
Encephalartos cerinus
Encephalartos dolomiticus
Encephalartos heenanii
Encephalartos hirsutus
Encephalartos inopinus
Encephalartos latifrons
Encephalartos middelburgensis
Encephalartos nubimontanus
Encephalartos woodii

ENDANGERED SPECIES

Reptilia
Green turtle
Giant girdled lizard
Olive ridley turtle
Geometric tortoise

Aves

Blue crane
Grey crowned crane
Saddle-billed stork
Bearded vulture
White-backed vulture
Cape vulture
Hooded vulture

Pink-backed pelican
Pel's fishing owl
Lappet-faced vulture

Mammalia

Robust golden mole
Tsessebe
Black rhinoceros
Mountain zebra
African wild dog
Gunning's golden mole
Oribi
Red squirrel
Four-toed elephant-shrew

Flora

Angraecum africana
Encephalartos arenarius
Encephalartos cupidus
Encephalartos horridus
Encephalartos laevifolius
Encephalartos lebomboensis
Encephalartos msinganus
Jubaeopsis caffra
Siphonochilus aethiopicus
Warburgia salutaris
Newtonia hilderbrandi

VULNERABLE SPECIES

Aves

White-headed vulture
Tawny eagle
Kori bustard
Black stork
Southern banded snake eagle
Blue korhaan
Taita falcon
Lesser kestrel
Peregrine falcon
Bald ibis
Ludwig's bustard
Martial eagle
Bataleur
Grass owl

Mammalia

Cheetah
Samango monkey
Giant golden mole
Giant rat
Bontebok
Tree hyrax

Roan antelope
Pangolin
Juliana's golden mole
Suni
Large-eared free-tailed bat
Lion
Leopard
Blue duiker

Flora

Aloe albida
Encephalartos cycadifolius
Encephalartos Eugene-maraisii
Encephalartos ngovanus
Merwillia plumbea
Zantedeschia jucunda

PROTECTED SPECIES

Amphibia

Giant bullfrog
African bullfrog

Reptilia

Gaboon adder
Namaqua dwarf adder
Smith's dwarf chameleon
Armidillo girdled lizard
Nile crocodile
African rock python

Aves

Southern ground hornbill
African marsh harrier
Denham's bustard
Jackass penguin

Mammalia

Cape clawless otter
South African hedgehog
White rhinoceros
Black wildebeest
Spotted hyaena
Black-footed cat
Brown hyaena
Serval
African elephant
Spotted-necked otter
Honey badger
Sharpe's grysbok
Reedbuck
Cape fox

Flora

Adenia wilmsii
Aloe simii
Clivia mirabilis
Disa macrostachya
Disa nubigena
Disa physodes
Disa procera
Disa sabulosa
Encephelartos altensteinii
Encephelartos caffer
Encephelartos dyerianus
Encephelartos frederici-guilielmi
Encephelartos ghellinckii
Encephelartos humilis
Encephelartos lanatus
Encephelartos lehmannii
Encephelartos longifolius
Encephelartos natalensis
Encephelartos paucidentatus
Encephelartos princeps
Encephelartos senticosus
Encephelartos transvenosus
Encephelartos trispinosus
Encephelartos umbeluziensis
Encephelartos villosus
Euphorbia clivicola
Euphorbia meloformis
Euphorbia obesa
Harpagophytum procumbens
Harpagophytum zeyherii
Hoodia gordonii
Hoodia currorii
Protea odorata
Stangeria eriopus