

FAUNAL AND FLORAL DIVERSITY AND HABITAT ASSESSMENTS:

FOR THE PROJECT:

***Tshepo Solar Power Plant (Pty.) Ltd.
near Hotazel***

ON:

***THE REMAINING EXTENT OF THE FARM LONDON
NO. 275, REGISTRATION DIVISION KURUMAN,
NORTHERN CAPE PROVINCE.***

March 2016

Report prepared by:

ENVIRONMENT RESEARCH CONSULTING

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1 SPECIALIST INVESTIGATORS

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Highest tertiary qualification: M.Sc. *cum laude* (Phytosociology & Restoration Ecology)

Professional affiliation: SACNASP (reg. no. 400011/08)

Background & expertise:

I have been consulting as a professional ecologist, botanist and soil scientist since 2002. I gained valuable experience in the fields of vegetation classification, various restoration disciplines, faunal trapping, soil surveying and wetland surveying during my post graduate studies and later as fieldwork mentor for post graduate ecology students of the Northwest University, Potchefstroom Campus (2008 - 2014), on occasion for game ranch management students of the Tshwane University of Technology. As independent ecological consultant I have experience in various types of scientific floral and faunal studies in the grassland and savannah in Gauteng, North West, Limpopo, Mpumalanga, Free State, Eastern and Northern Cape. I have also on occasion performed vegetation studies in the KwaZulu-Natal savannah and Indian Ocean Coastal Belt, the Eastern Cape thicket, the Western Cape fynbos, Namaqualand, the Karoo and Swaziland. I have 13 years' experience in specialist biodiversity, soil and wetland studies and have performed numerous (at least 95) such studies since 2002. I have authored two and co-authored four scientific papers for various local scientific publications since 2004.

Secondary specialist investigator: Leon Kotze

Highest tertiary qualification: BSc (Conservation Ecology)

Professional affiliation: None

Background & expertise:

I am currently studying towards a M.Sc. in Small Mammal Ecology at the University of Witwatersrand and have captured, handled and recorded individual information for close to 500 small mammals to date. My highest qualification is a B.Sc. in Conservation Ecology (obtained at Stellenbosch University) in which Biome ecology and Zoology were my major subjects.

2 PROFESSIONAL DECLARATION

The specialist investigators responsible for conducting this particular specialist faunal and floral and habitat assessment declare that:

- We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP).

- At the time of conducting the study and compiling this report we did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in our professional capacity.
- Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favorable to the client/applicant, we will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public.
- We declare that there are no circumstances that may compromise our objectivity in performing this specialist investigation. We do not necessarily object to or endorse the proposed development, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data.
- We do not have any influence over decisions made by the governing authorities.
- Should we, at any point, consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.
- We undertake to disclose all material information in our possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by a competent authority to such a relevant authority and the applicant.
- We have expertise and experience in conducting specialist reports relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity.
- This document and all information contained herein are and will remain the intellectual property Benah Con cc (Environment Research Consulting) and the specialist investigator(s) responsible for conducting the study. This document, in its entirety or any portion thereof, may not be altered in any manner or form, for any purpose without the specific and written consent of the specialist investigator(s).
- We will comply with the Act, regulations and all other applicable legislation.
- All the particulars furnished in this document are true and correct.
- We realize that a false declaration is an offence in terms of Regulation 71 of NEMA and is punishable in terms of section 24F of the Act.



A.R. Götze (M.Sc.; *Pr.Sci.Nat.*)



Leon Kotze (B.Sc.)

3 EXECUTIVE SUMMARY

Based on the findings of this study it is the opinion of the specialist investigators that from a faunal, floral, and general ecological point of view, the proposed development on the preferred area is considered favourably, provided that due care is taken to minimise and properly mitigate all identified impacts.

Introduction & Site Description

This study aims to assess the impact that the development of a Photovoltaic Solar Power Plant, on farmland about 45 km northwest of the Northern Cape town of Kuruman and about 10 km southeast of Hotazel, will have on the faunal and floral diversity within the site concerned (development footprint of approximately 250ha - with one preferred- and one alternative site), with special reference to Threatened or Protected Species (ToPS). *Environment Research Consulting (ERC)* was contracted to conduct a biodiversity (faunal & floral) and general habitat assessment of a portion of the remaining portion the farm London 275 near Hotazel in the Northern Cape Province. This report presents the findings of a once off, summer assessment that was conducted over a three-day period from 06 to 08 March 2016.

The site falls within the Eastern Kalahari Bushveld Bioregion of the Savanna Biome (Rutherford et al. 2006). Livestock ranching dominates the immediate surrounds and mining activities are a prominent feature in the region (pers. obs.). Topography is more or less homogeneous throughout the study sites, with a slight increase in slope towards the north-western corner of the preferred site, accompanied by an increase in rockiness. There are three semi-permanent water bodies located on the farm. Both study sites are visibly transformed with the preferred site showing clearer signs of overgrazing than the alternative site. The preferred site has an abundance of trees and karroid shrubs, which is comparable to the northern half of the alternative site. The southern half of the alternative site is structurally more diverse with decent ground cover.

Faunal Assessment

Four small mammal trap lines (live trapping) were placed in three distinct habitat types on 300 m transects. Additionally, non-invasive walk transects were performed daily, documenting all animal sightings (including spoor and / or scat) in writing or by photographs. Drive transects, within the site, averaged in excess of 5 km per day and near similar distances was covered outside the study site daily.

Four murid species were captured during the study period. All four transects were successful, with mean trap success = 4.72%, and the min. / max. = 2 / 9. Twenty-four non-invasive walk transects were performed and at least two hours was spent inspecting the area surrounding each transect. Only Cape Porcupine (*Hystrix africaeaustralis*) scat was recorded during this effort.

Three mammal species and one reptile species were recorded during drive transect sampling.

According to literature research, and considering the bioregion, landscape and habitat characteristics, the plausible species richness of the study site is as indicated in Table A according to a ratio of total species vs. total protected and data deficient species.

Table A: Plausible species richness of the study site

Faunal type	Ratio = total species : total protected and data deficient species
Mammals	42 : 7
Reptiles	37 : 0
Amphibians	6 : 1
Insects	1

Literature research revealed that no animals were restricted or endemic to the area. Some species listed have a low likelihood of occurring within the site, but are nonetheless listed if their habits, habitat requirements and estimated distribution ranges agree with the study findings. For the most part of the year the likelihood of any amphibians occurring on the site is low but there is no doubt some species would gather at the pans after good rain. No physical record of the listed butterfly occurring in the site exists, but has been included due to the close proximity of the nearest record (i.e. Hotazel) and its “Data deficient” status. Furthermore, the species is endemic to the region and has habitat preferences corresponding with habitat characteristics of the alternative site.

Floristic & Habitat Assessment

A plotless sampling method was used to record floristic and general habitat data. Plant species observed in the study area during the time of the study were recorded and included in plant species lists. The floristic composition of each of the identified broad vegetation units and/or application area are described and discussed.

According to Mucina & Rutherford (2006) the study area falls in the Kuruman Thornveld vegetation type (SVk9). The habitat characteristics of the study area largely resemble the description given for SVk9. The areas studied (i.e. the preferred and alternative sites) differ slightly in terms of landscape features and habitat characteristics. The preferred site is mostly a flat sandy plain with shrubs and tall *Acacia erioloba* trees and is closest in its habitat description to SVk9. In its eastern and western corners, the preferred site rises slightly in its topographical character with rocky soils. Some linear tree lines are present and are presumably associated with geological features rather than being drainage lines – although on a satellite image they resemble

drainage lines. The alternative site is situated on slightly undulating terrain with rocky soils on the eastern side, becoming sandy westwards. Three non-perennial pans were observed on the preferred site, but no clearly defined drainage lines were recorded on either the preferred or alternative sites.

204 plant species are recorded on the POSA data base of SANBI for the relevant QDS 2723 AA and 2723 AC, the study area is situated in. This list contains species for at least two or three different vegetation types.

A total of 162 plant species (from 46 plant families and 123 genera) (Table B) were recorded in the study area during the time of the study and indicates moderate species diversity.

Table B: Summary of plant families, genera and species recorded in the study area

	Families	Genera	Species
ANGIOSPERMAE (seed plants):			
<i>Monocotyledonae:</i>	9	28	44
<i>Dicotyledonae:</i>	37	95	118
Total:	46	123	162

Four broad Vegetation Units (VU's) were recorded and are described in the sections below (Figure 8). The first VU is also split in to two sub-units based mainly on vegetation structure. The four VU's are:

- VU 1: *Acacia erioloba* woodland
 - VU 1a: Open woodland
 - VU 1b: Semi-closed linear woodlands
- VU 2: *Acacia mellifera* semi-closed rocky shrubland
- VU 3: *Acacia haematoxylon* open woodland
- VU 4: Non-perennial pans

18 plant species of specific conservation significance were recorded in the study area during the study period. One of these species is listed as a Threatened or Protected Species (ToPS) by the National Environmental Management: Biodiversity Act's (Act No. 10 of 2004) list of ToPS as published in Government Gazette no. 36375 of 16 April 2013 (NEMBA ToPS, 2013). Two are listed by Raimondo *et al* (2009) in the South African Red Data list as "Declining" species. Three tree species are included in the protected tree species list as published in the National Forests Act (Act no.84 of 1998) (NFA, 1998), and 15 of the 18 are listed as protected and one as specially protected by the Northern Cape Nature Conservation Act (Act no. 9 of 2009) (NCNCA, 2009).

Due to the high numbers of nationally protected trees (NFA, 1998) (i.e. *Acacia erioloba*, *A. haematoxylon* and *Boscia albitrunca*) the individual positions of these species were not individually geo-referenced during this study. Instead a number of belt transects were conducted in each different VU to determine the density at which these species occur in the study area and just beyond. 22 belt transects of 100 x 40 m (4000 m²) were conducted (15 in VU1, 4 in VU2 and 3 in VU3). All specimens of these species within the belt transect were counted and noted together with the height of each specimen. Differentiation was made between specimens higher than 2 m (> 2 m) and those shorter than 2 m but not less than 1 m (< 2 m = 1 m). Specimens shorter than 1 m were not counted.

During the study only one invasive alien plant species were recorded, i.e. the alien invasive woody species *Prosopis glandulosa* var. *torreyana*. Seven non-invasive herbaceous weeds were also recorded.

No ecosystems that are threatened and in need of protection according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) was recorded in or in the vicinity of the study area.

Impact Assessment

Based on an impact assessment it is evident that there are four expected impacts on the faunal, floral and general habitat ecology within the study area. Table C summarises the findings indicating the significance of the impact before mitigation and management takes place and the likely impact if mitigation and management takes place. From Table C it is evident that prior to management measures being put in place, the impacts are negative-medium or negative-high level impacts. If effective management takes place, all impacts will be reduced to lower level impacts.

Table C: A summary of the results from the impact assessments

Impact	Not mitigated / managed	Mitigated / managed
1. Loss of habitat for faunal and floral species	negative medium impact	negative low impact
2. Loss of indigenous faunal and floral species diversity	negative medium impact	negative low impact
3. Loss of faunal and floral species of conservation significance	negative high impact	negative medium to low impact
4. Degradation and/or destruction of natural pans.	negative medium impact	negative low impact

Due the destructive nature of the proposed development to the floristic diversity occurring in the directly affected area and the direct impact it will also have on the faunal diversity of the area on a local scale, the **no-go**

alternative will see the area stay in the current condition. The current impacts exerted on the area from an agricultural point of view (not assessed in this study) will remain and, depending on the management strategies employed by the land owner and natural climatic conditions, the current natural condition may improve or deteriorate in future.

A number of monitoring requirements are listed.

Concluding remarks

The low faunal and moderately high floristic species richness and density recorded would equate to a low impact to the regional diversity of plants, mammals, reptiles and amphibians. Although the number of protected faunal species possibly occurring on or in close proximity to the site is low, these deserve consideration.

When considering the different sites (preferred and alternative sites) that were investigated during this study, from a faunal, floral, wetland and general ecological point of view, it is concluded that the preferred site may be accepted for the proposed development.

4 INTRODUCTION

4.1 Background

Under the National Environmental Management Act (107 of 1998) any development that may cause significant damage to the natural environment is by law required to undergo stringent evaluation with the aim of reducing and mitigating the potential environmental impact (www.eia.org.za). This study aims to assess the impact that the development of a Photovoltaic Solar Power Plant, on farmland about 45 km northwest of the Northern Cape town of Kuruman and about 10 km southeast of Hotazel (Figure 1), will have on the faunal and floral diversity within the site concerned (development footprint of approximately 250ha (Figure 2), with special reference to Threatened or Protected Species (ToPS).

Environment Research Consulting (ERC) was contracted to conduct a biodiversity (faunal & floral) and general habitat assessment of a portion of the remaining portion the farm London 275 near Hotazel in the Northern Cape Province. This report presents the findings of a once off, summer assessment that was conducted over a three-day period from 06 to 08 March 2016.



Figure 1: Google earth image indicating the regional setting of the study area



Figure 2: Image indicating the preferred and alternative development sites

4.2 Terms of Reference & General Requirements

The scope of the assessment included the PV Solar Energy Facility and its associated structures and infrastructure (such as the power line and access route). The impacts associated with the power line and access route that run beyond the site are considered to be negligible since the actual footprints of disturbance of the power lines is confined to the pylon bases. Furthermore, the power line and access route are aligned with existing roads as far as possible to avoid any negative environmental impacts.

The following ToR and general requirements were supplied by the client:

Specialists in their field of expertise will consider baseline data and identify and assess impacts according to predefined rating scales – refer to attached method of assessment. Specialists will also suggest optional or essential ways in which to mitigate negative impacts and enhance positive impacts. Further, specialists will, where possible, take into consideration the cumulative effects associated with this and other projects which are either developed or in the process of being developed in the local area.

Specialists' reports must comply with Appendix 6 of GNR982 published under sections 24(5), and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and whereby the following are to be included:

- The details of:
 - the specialist who prepared the report; and
 - the expertise of that specialist to compile a specialist report including a curriculum vita;
- A declaration that the specialist is independent in a form as may be specified by the competent authority;
- An indication of the scope of, and the purpose for which, the report was prepared;
- The date and season of the site investigation and the relevance of the season to the outcome of the assessment;
- A description of the methodology adopted in preparing the report or carrying out the specialised process; the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;
- An identification of any areas to be avoided, including buffers;
- A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;
- A description of any assumptions made and any uncertainties or gaps in knowledge;
- A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;
- Any mitigation measures for inclusion in the EMP;
- Any conditions for inclusion in the environmental authorisation;
- Any monitoring requirements for inclusion in the EMP or environmental authorisation;
- A reasoned opinion-
 - as to whether the proposed activity or portions thereof should be authorised; and
 - if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMP, and where applicable, the closure plan;
- A description of any consultation process that was undertaken during the course of preparing the specialist report;
- A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
- Any other information requested by the competent authority.

In addition to the above, specialists were expected to:

- Review Scoping Reports, with specific reference to the Comments and Response Report to familiarize with all relevant issues or concerns relevant to their field of expertise;
- In addition to the impacts listed in the Scoping Report, identify any issue or aspect that needs to be assessed and provide expert opinion on any issue in their field of expertise that they deem necessary in order to avoid potential detrimental impacts;
- Assess the degree and extent of all identified impacts (including cumulative impacts) that the preferred project activity and its proposed alternatives, including that of the no-go alternative, may have;
- Identify and list all legislation and permit requirements that are relevant to the development proposal in context of the study;
- Reference all sources of information and literature consulted; and
- Include an executive summary to the report.

4.3 Aims of the study

- Provide a detailed fauna and flora habitat survey.
- Provide a detailed habitat survey of possible threatened or localised plant species and vertebrates.
- Take count and map the location (and provide coordinates) of any protected species or sensitive habitats found on site.
- Evaluate the conservation importance and significance of the site with special emphasis on the current status of threatened species.
- Record possible host plants or food plants of fauna such as butterflies.
- Conduct a literature investigation of possible species that may occur on site.
- Identify potential ecological impacts on fauna and flora that could occur as a result of the development.
- An assessment of the potential direct and indirect impacts resulting from the proposed development during the construction, operation and decommission phases.
- Make recommendations to reduce or minimise impacts, should the development be approved.
- Comment on plant species that can be utilized socially (medicine, food or other cultural or social purposes).

4.4 Assumptions and Limitations

- It was assumed that 3 trap days would be near sufficient for capturing a representative sample of small mammal diversity within the study site (the optimal period being 4 days) (Avenant & Cavallini 2007). The study area, however, was too large to sample thoroughly for either mammals or reptiles in the time available. Also, faunal observations during the midday heat were unlikely as temperatures ranged between 30°C and 40°C during the time of the study, evoking most animals to reduce activity and seek shelter. Detection was further constrained by the inherently cryptic and/or evasive nature of most wildlife.
- No attempt was made towards sampling Amphibia, due to the small amount of species possibly occurring on the site (Appendix A, Table 11-3) and the complete absence of permanent water bodies.
- Regarding the faunal species lists (Appendix A), it is important to note that distribution maps are often based on limited ecological knowledge and are thus not consistently reliable in predicting a species' occurrence (Hernandez et al. 2006; Newbold 2010). Furthermore, some uncertainty remains regarding the conservation priority for a great deal of southern African species as not all have been assessed and may classify as "Not evaluated" or "Data deficient".
- As no other insect conservation assessments are available I was limited to assessing only butterfly occurrence. In addition, Mecenero et al. (2013) found that butterfly research is lacking in the region concerned.
- It is assumed that plant species flowering only during specific times of the year could be confused with a very similar species of the same genus.
- Some plant species that emerge and bloom during another time of the year or under very specific circumstances may have been missed entirely.
- Due to the conditions encountered during the time of this study some species (faunal & floral) could only be identified up to genus level.
- All species included in the plant species list (Appendix B) were actually observed and recorded in the study area during the time of the study.
- No scientific data was collected or analyzed for the calculation of ecological veld condition. Any comments or observations made in this regard are based on observations, the expert knowledge and relevant professional experience of the specialist investigators.
- *ERC* reserves the right to amend this report, recommendations and/or conclusions at any stage should any additional or otherwise significant information come to light.

4.5 General Site Description

The study sites (S27° 14' 02.86" E23° 02' 51.11", alt. 1100 m) are about 45 km northwest of the Northern Cape town of Kuruman and about 10 km southeast of Hotazel and located next to the R31 between Kuruman and Hotazel. The site falls within the Eastern Kalahari Bushveld Bioregion of the Savanna Biome, with annual precipitation and temperature averaging 362 mm and 17.8 °C, respectively. The bioregion naturally includes xeric shrubland habitat (Rutherford et al. 2006). Livestock ranching dominates the immediate surrounds and mining activities are a prominent feature in the region (pers. obs.). Topography remains homogeneous throughout the sites, with a slight increase in slope towards the north-western corner of the preferred site, accompanied by an increase in rockiness. There are three semi-permanent water bodies located around the preferred site (note the indents in the white border, Figure 3). Farm houses are located close by and the rural settlement of Magobing was observed not far north of trap transect 4.

Both sites are visibly transformed with the preferred site showing clearer signs of overgrazing than the alternative site. The preferred site has an abundance of trees and karroid shrubs (See Figures 4 - 6), which is comparable to the northern half of the alternative site. The southern half of the alternative site is structurally more diverse with decent ground cover.

5 FAUNAL ASSESSMENT

5.1 Methodology

Before our initial visit, satellite images (Google Earth) of the site were studied and the different habitat types identified (uniform features from an aerial perspective). Upon arrival the sites were ground-truthed. The small mammal trap transects were then placed, at least one transect per habitat type, and each trap baited with a mixture of peanut-butter, oats, sunflower oil and marmite (Avenant & Cavallini 2007). Transects consisted of 30 traps, placed 10 m apart and were checked every morning at 08h00, again at 15h00 and were re-baited daily. Species, sex and reproductive status were recorded for each animal captured, although only species data has been reported here.

Non-invasive walk transects were performed daily, documenting all animal sightings (including spoor and / or scat) in writing or by photograph. Non-invasive walk transects were done along the small mammal trap transects (Figure 2). The area ahead of the observer was observed attentively, specifically for animals flushed from shelter, and stretched a minimum of 250 m. After each trap check a minimum of 20 minutes was designated to examining the environment around each transect, during which I would frequently investigate the area surrounding me with binoculars.



Figure 3: A local scale map. The black and white borders delineate the alternative and preferred (proposed development footprint) sites, respectively. The numbered red lines represent small mammal trap transects.

Drive transects were also conducted, twice per day, along the same 5 km route. Driving 20-40 km/h the driver would report any animal observed ahead of the vehicle and the passenger would record any animal seen in a 15 m belt to his side of the vehicle. The area surrounding the study site was also extensively travelled throughout the study period and sampled in a similar fashion. This method of sampling served to record the more conspicuous fauna (e.g. tortoises, large mammals and active snakes).

Species lists (Appendix A, Tables 11-1 to 11-4) were constructed using field guides, Red Data Books and Species Atlases (see 'References') complementarily. Only butterflies were considered in constructing an insect species list as they are the subject of the only existing South African insect conservation assessment. As far as information was available, species habitat requirements were also taken into account to substantiate the likelihood of their occurrence. Hence, veld condition (i.e. pristine or disturbed), vegetation structure and other habitat characteristics contributed to determining the likelihood of a species' occurrence.

No formal consultation process was conducted as part of this faunal study as it was not deemed necessary at the time of the study.

5.2 Results

The study period lasted 3 days and nights with no less than 8 hours spent on the site per day. One-hundred-and-twenty traps (30 traps per transect) were placed in three different habitat types and each transect measured approximately 300 m. Traps were removed following the third evening. In an effort to record landscape elements as well as faunal tracks and signs, extensive notes and photographs were taken throughout this period.



Figure 4: The direct surrounds of trap transect 1. The trees at the back represent a tree line along which the traps were placed.



Figure 5: The area surrounding trap transect 2.



Figure 6: The area south of trap transect 4. The bare soil in the foreground gives way to high rockiness in most of the surrounding area.



Figure 7: Vegetation in the southern half of the alternative site (see Figure 3).

5.2.1 Trap transects (Direct sampling)

Four Murid species were captured during the study period (excluding *Rhabdomys* spp, Appendix A, Table 11-1). All transects (Figure 2) were successful, with mean daily trap success (total successful captures / total traps placed / days sampled) = 4.72%, and the min. / max. animals captured on a single day = 2 / 9.

5.2.2 Walk transects (Indirect sampling)

Twenty-four non-invasive walk transects were performed and at least two hours was spent inspecting the area surrounding each transect. Only Cape Porcupine (*Hystrix africaeaustralis*) scat was recorded during this effort.

5.2.3 Drive transects (Indirect sampling)

Drive transects, within the site, averaged in excess of 5 km per day and near similar distances was covered outside the study site daily. Three mammal species (*Lepus capensis*, *Rhabdomys* spp and *Cynictis penicillata* (Appendix A, Table 11-1) were recorded along with one reptile species (*Psammobates oculifer*, Appendix A, Table 11-2).

5.2.4 Desktop Study

According to literature research, and considering the bioregion, landscape and habitat characteristics, the plausible species richness of the study site is as indicated in Table 5-1 according to the ratio of total species vs. total protected and data deficient species.

Table 5-1: Plausible species richness of the study site

Faunal type	Ratio = total species : total protected and data deficient species
Mammals	42 : 7
Reptiles	37 : 0
Amphibians	6 : 1
Insects	1

Literature research revealed that no animals were restricted or endemic to the area. Some species listed, for example Brown Hyaena (*Hyaena brunnea*) due to frequent human activity, have a low likelihood of occurring within the site, but are nonetheless listed if their habits, habitat requirements and estimated distribution ranges agree with the study findings. Greater Kudu (*Tragelaphus strepsiceros*) has been included as fencing rarely prevents them entering and exiting the site. For the most part of the year the likelihood of any amphibians occurring on the site is low but there is no doubt some species would gather at the pans after good rain. No physical record of the listed butterfly occurring in the site exists (Appendix A, Table 11-4), but has been included due to the

close proximity of the nearest record (i.e. Hotazel) and its “Data deficient” status. Furthermore, the species is endemic to the region and has habitat preferences corresponding with habitat characteristics of the alternative site.

6 FLORISTIC AND GENERAL HABITAT ASSESSMENT

6.1 Methodology

Prior to visiting the site, a list of species that could potentially occur at the site was downloaded from “Plants of Southern Africa” (POSA) on the South African Biodiversity Institute’s (SANBI) website at <http://posa.sanbi.org>. This list is provided at the quarter degree square (QDS) level of accuracy for the QDS 2723 AA and 2723 AC and included in Appendix B. At this broad scale, the list often includes many species that may not be found at the proposed site. However, any species of conservation concern will be indicated in the list and was researched before the site visit in order to know what species of conservation concern should be looked out for.

A visual reconnaissance of the study area was done before surveying commenced. Different homogenous vegetation units were identified and subsequently surveyed on foot and by vehicle in order to determine the floristic composition of each. The following data was recorded:

- All identifiable indigenous plant species (Appendix B) including red data or specially protected and also exotic plant species in each identified vegetation unit.
- General ecological and habitat data that may assist in the description of the floristic component of the study area.

A plotless sampling method was used to record data. Plant species observed in the study area during the time of the study were recorded and included in the plant species lists (Appendix B). The floristic composition of each of the identified broad vegetation units and/or application area are described and discussed. Plant species identification was done following the checklist of Germishuizen & Meyer (2003). Plant material was collected for identification purposes and where necessary the South African National Biodiversity Institute (SANBI) in Pretoria and other specialists were consulted in order to assist in plant species identification. All collected plant material will, if so requested by them, be donated to the South African National Herbarium of SANBI in Pretoria for inclusion into their extensive collection.

No formal consultation process was conducted as part of this floristic study as it was not deemed necessary at the time of the study.

6.2 General floristic and habitat information

According to Mucina & Rutherford (2006) the study area falls in the Kuruman Thornveld vegetation type (SVk9). The following description of SVk9 has been summarized from Mucina & Rutherford (2006):

Kuruman Thornveld

The Kuruman Thornveld vegetation type (SVk9) occurs in the North-West and Northern Cape Provinces on flats from the Postmasburg and Danielskuil area in the south extending via Kuruman to Tsineng and Dewar in the north. The area receives summer and autumn rainfall (MAP: 300 – 450 mm) and winters

are very dry. Summer temperatures reach an average of 35.9 degrees Celsius on average in January and winter nights average –3.3 degrees Celsius in June.

Geologically some Campbell Group dolomite and chert and mostly younger, superficial Kalahari Group sediments occurs. Locally, rocky pavements are also formed in places. Soils in the area are mostly of the Hutton form and consist of windblown red sand, which vary in depth from shallow to deep. Important land types are Ae, Ai, Ag and Ah.

The landscape and vegetation features of SVk9 consists of flat rocky plains and some sloping hills which support a well developed, closed shrub layer dominated by *Acacia mellifera* subsp. *detinens* and *Tarchonanthus camphoratus* and sometimes a well developed open tree layer dominated by *Acacia erioloba*. Important trees and tall shrubs are *Acacia erioloba*, *A. mellifera* subsp. *detinens*, *A. haematoxylon*, *A. hebeclada* subsp. *hebeclada*, *Boscia albitrunca*, *Grewia flava*, *Gymnosporia buxifolia*, *Lycium hirsutum* and *Tarchonanthus camphoratus*. Low shrubs and herbs that generally occur are *Elephantorrhiza elephantina*, *Dicoma schinzii*, *Monechma divaricatum*, *Gisekia africana*, *Gnidia polycephala*, *Harpagophytum procumbens* subsp. *procumbens*, *Helichrysum zeyheri*, *Hermannia comosa*, *Indigofera daleoides*, *Limeum fenestratum*, *Nolletia ciliaris*, *Pentzia calcarea*, *Plinthus sericeus*, *Seddera capensis*, *Tripteris aghillana* and *Vahlia capensis* subsp. *vulgaris*. Grasses of importance are *Aristida meridionalis*, *A. stipitata* subsp. *stipitata*, *Eragrostis lehmanniana*, *E. echinochloidea* and *Melinis repens*. Biogeographically important species include the small trees and tall shrubs *Acacia haematoxylon*, *A. luederitzii* var. *luederitzii* (Kalahari endemics) and *Terminalia sericea* (southernmost distribution in SA interior), the low shrub *Blepharis marginata*, the herb *Corchorus pinnatipartitus* and grass *Digitaria polyphylla* (all three Griqualand West endemics). One species endemic to SVk9, *Gnaphalium englerianum* also occurs.

The conservation status of SVk9 is Least Threatened. A conservation target of 16% is envisioned by conservation authorities, but to date no portion of SVk9 is statutorily conserved. Only 2% is totally transformed by mainly mining activities and settlements. This vegetation type resembles the description of Acocks' (1953) *Kalahari Thornveld and Shrub Bushveld* (VT 16) and also the description in Low and Rebelo (1996) of *Kalahari Plains Thorn Bushveld* (LR 30).

The habitat characteristics of the study area largely resemble the description given for SVk9 above. The areas studied (i.e. the preferred and alternative sites – see Figure 2) differ slightly in terms of landscape features and habitat characteristics. The preferred site is mostly a flat sandy plain with shrubs and tall *Acacia erioloba* trees and is closest in its habitat description to SVk9. In its eastern and western corners, the preferred site rises slightly in its topographical character with rocky soils. Some linear tree lines are present and are presumably associated with geological features rather than being drainage lines – although on a satellite image they resemble drainage lines. The alternative site is situated on slightly undulating terrain with rocky soils on the eastern side, becoming sandy westwards. Three non-perennial pans were observed on the preferred site, but no clearly defined drainage lines

were recorded on either the preferred or alternative sites. The pans are discussed under the description of the vegetation units under Vegetation Unit 4 and again in more detail under the section Delineation of Pans (section 7).

204 plant species are recorded on the POSA data base of SANBI for the relevant QDS 2723 AA and 2723 AC and is included in Appendix B, Table 12-6. Keep in mind that this list contains species at least two or three different vegetation types.

6.3 Floristic diversity recorded in the study area

A total of 162 plant species (from 46 plant families and 123 genera) (Table 6-1 & Appendix B, Table 12-1) were recorded in the study area during the time of the study and indicates moderate high species diversity. The woody layer (trees & shrubs) is represented by 17 woody species and the herbaceous layer is made up of 25 graminoids* and 120 herbaceous shrubs, dwarf shrubs, geophytes and other herbs. 95% (153 of 161) of the recorded plant species are indigenous to South Africa. From available literature (Pujol 1988; Pooley, 1998; Schmidt *et al* 2002; Shearing & Van Heerden 1994; Van Wyk *et al* 1997; Van Wyk & Gericke 2003) it was established that at least 53 of the recorded plant species in the study area are used for some or other social activities (medicinal, food/nourishment and/or cultural).

Table 6-1: Summary of plant families, genera and species recorded in the study area

	Families	Genera	Species
PTERIDOPHYTA (ferns):	0	0	0
GYMNOSPERMAE (Coniferous plants):	0	0	0
ANGIOSPERMAE (seed plants):			
<i>Monocotyledonae:</i>	9	28	44
<i>Dicotyledonae:</i>	37	95	118
Total:	46	123	162

During the survey, which was done on foot and by vehicle, only taxa that were identifiable during the time of the study were noted and included in the plant species lists in Appendix B (Tables 12-1 to 12-5). The possibility exists that some plant species that emerge and bloom during another time of the year or under very specific circumstances, or species that are locally rare could have been missed during the survey, but on the other hand, the specialist is convinced that the majority of the species occurring in the study area were identified and recorded. The mentioned species lists contain the plant family

* graminoids = grass like plants (grasses and sedges)

name and scientific and common names of all plant species that was observed in the study area during the time of the study. Also included is, where applicable, the status of a species, which provides information on endemism, red data status or exotic status. Information on whether a species is utilized for medicinal, cultural or nutritional uses is also provided in the mentioned species lists.

Appendix B, Table 12-1 presents the diversity of plant families, genera and species recorded in the study area. A check list of plant species recorded during this study is included in Tables 12-2 through 12-5 of Appendix B.

6.4 Description of Broad Vegetation Units in the Study Area

Four broad Vegetation Units (VU's) were recorded and are described in the sections below (Figure 8). The first VU is also split in to two sub-units based mainly on vegetation structure. The four VU's are:

- VU 1: *Acacia erioloba* woodland
 - VU 1a: Open woodland
 - VU 1b: Semi-closed linear woodlands
- VU 2: *Acacia mellifera* semi-closed rocky shrubland
- VU 3: *Acacia haematoxylon* open woodland
- VU 4: Non-perennial pans

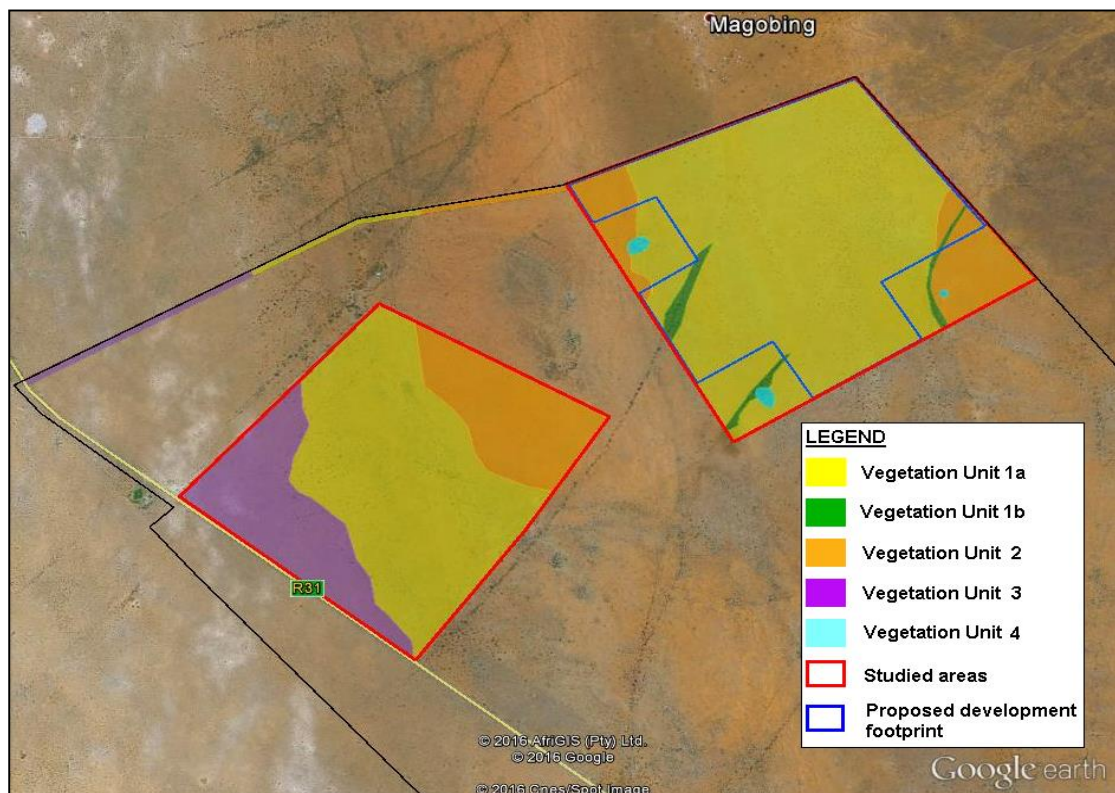


Figure 8: Image depicting the four vegetation units recorded in the study area

6.4.1 VU1: *Acacia erioloba* woodland

This VU (Figures 9 – 11) occurs only on both the preferred and alternative sites on flat terrain on deep sandy soils (VU1a) with virtually no rocks on the soil surface and also including some linear tree lines (VU1b). The vegetation is dominated by woody shrubs and trees. Three non-perennial pans were observed imbedded in VU1 of the preferred site. From an ecological point of view VU1 is in a moderate to poor veld condition. The grass cover is moderate to poor and some areas are seriously bush-encroached by *Rhigozum trichotomum* and *Acacia mellifera* subsp. *detinens*.

The dominant and other tree and woody shrub species in VU 1 are *Acacia erioloba*, *A. mellifera* subsp. *detinens*, *Boscia albitrunca*, *Grewia flava*, *Rhigozum trichotomum* and *Ziziphus mucronata*. Dominant graminoids are *Eragrostis trichophora*, *Schmidtia pappophoroides*, *Stipagrostis uniplumis*, *S. ciliata*, *Chloris virgata* and *Tragus berteronianus*. Herbaceous forbs and shrubs and dwarf shrubs that mostly occur in VU1 are *Heliotropium ciliatum*, *Cleome rubella*, *Gisekia africana*, *Limeum viscosum*, *Dipcadi* species, *Senna italica* subsp. *arachoides* and *Indigofera alternans*.

During the time of this study 93 plant species (87 indigenous; 6 exotic) were recorded in VU1. These included 13 woody species (1 exotic), 15 graminoids (0 exotic) and 75 herbaceous and dwarf shrubs and other forbs (6 exotic) were recorded. From available literature (Pujol 1988; Pooley 1998; Schmidt *et al* 2002; Shearing & Van Heerden 1994; Van Wyk *et al* 1997; Van Wyk & Gericke 2003), it was established that at least 35 of the plant species recorded in VU1 are to some extent utilized for some or other social activity or use (medicinal, nourishment/food, and/or cultural).

VU1a: Open *Acacia erioloba* woodland

VU1a is associated with the open flat plains areas of VU1 (Figure 9). Although some minor differences in floristic composition were observed, it mostly differs from VU1b in terms of the structure of the vegetation. Trees density is lower, although large patches of bush encroachment by *Rhigozum trichotomum* and *Acacia mellifera* subsp. *detinens* were recorded (Figure 10).

VU1b: Semi-closed linear woodlands

VU1b represents linear tree lines present in VU1 (Figure 11), which are presumably associated with geological features rather than being drainage lines – although on a satellite image they resemble drainage lines. Tree density is naturally higher than VU1a, but bush encroachment by the same two species as VU1a was also observed.



Figure 9: VU1a – portion of open *Acacia erioloba* woodland on the preferred site.



Figure 10: VU1a – seriously bush encroached portion of VU1a on the preferred site.



Figure 11: VU1b – portion of semi-closed linear woodlands (on the right of the picture) on the preferred site.

6.4.2 VU2: *Acacia mellifera* semi-closed rocky shrubland

As VU1, this vegetation unit (Figure 12) occurs on both the preferred and alternative sites on shallower sandy loam soils many surface rocks on slightly raised and sloping terrain. The vegetation is dominated by woody shrubs. From an ecological point of view VU2 is in a poor veld condition due to overgrazing in the past and high levels of bush encroachment by *Acacia mellifera* subsp. *detinens*. Grass cover is poor and even absent in large patches.

The dominant woody species in VU2 is *Acacia mellifera* subsp. *detinens*, *Rhigozum trichotomum*, *Boscia albitrunca* and *Ehretia rigida*. Dominant graminoids are *Heteropogon contortus*, *Stipagrostis ciliata*, *Aristida meridionalis*, *Cymbopogon pospischilii*, *Eragrostis rigidior* and *Tragus berteronianus*. Herbaceous shrubs, dwarf shrubs and forbs include *Chascanum pinnatifidum*, *Aptosimum albomarginatum*, *Ledebouria undulata*, *Evolvulus alsinoides*, *Sida dregei*, *Seddera suffruticosa* and *Ceratotheca triloba*.

During the time of this study 80 plant species (79 indigenous, 1 exotic) were recorded in VU2. These included 12 woody species (1 exotic), 10 graminoids (none exotic) and 57 herbaceous and dwarf shrubs and other forbs (0 exotic) were recorded. It was established from available literature (Pujol 1988; Pooley 1998; Schmidt *et al* 2002; Shearing & Van Heerden 1994; Van Wyk *et*

al 1997; Van Wyk & Gericke 2003), that at least 27 of the plant species recorded in this VU are to some extent utilized for some or other social activity or use (medicinal, nourishment/food, and/or cultural).



Figure 12: VU2 – portion of *Acacia mellifera* semi-closed rocky shrubland with virtually no grass cover and high level of bush encroachment.

6.4.3 VU3: *Acacia haematoxylon* open woodland

This VU (Figure 13) occurs only on the alternative site on slightly undulating terrain on deep sandy soils with no rocks on the soil surface. The vegetation is dominated by woody shrubs and trees. Ecologically speaking VU3 is in a moderate to good veld condition with many high quality grazing plants available in the habitat. The grass cover is moderate to poor. Low levels of bush encroachment by *Acacia haematoxylon* were recorded.

The tree species *Acacia haematoxylon* totally dominates the woody cover in this VU. Other tree species and woody shrubs of significance are *Acacia erioloba*, *A. hebeclada*, *A. mellifera* subsp. *detinens*, *Lycium hirsutum*, *Tarchonanthus camphoratus* and *Grewia flava*. Dominant graminoids are *Schmidtia pappophoroides*, *Stipagrostis uniplumis*, *Eragrostis lehmanniana*, *Centropodia glauca* and *Bulbostylis hispidula*. Herbaceous forbs and shrubs that mostly occur in VU3 are *Elephantorrhiza elephantina*, *Senna italica* subsp. *arachoides*, *Gnidia polycephala*, *Heliotropium ciliatum*, *Gisekia africana*, *Merremia verecunda*, *Limeum viscosum*, *Requienia sphaerosperma* *Hermannia tomentosa* and *Tephrosia purpurea*.

During the time of this study 65 plant species (all indigenous) were recorded in VU3. These included 11 woody species (0 exotic), seven graminoids (none exotic) and 47 herbaceous and dwarf shrubs and other forbs (0 exotic) were

recorded. From available literature (Pujol 1988; Pooley 1998; Schmidt *et al* 2002; Shearing & Van Heerden 1994; Van Wyk *et al* 1997; Van Wyk & Gericke 2003), it was established that at least 25 of the plant species recorded in VU3 are to some extent utilized for some or other social activity or use (medicinal, nourishment/food, and/or cultural).



Figure 13: VU3 – portion of *Acacia haematoxylon* open woodland on the alternative site.

6.4.4 VU4: Non-perennial pans

This VU, consisting of three non-perennial pans (Figures 14 – 16), occur imbedded in VU1 in low lying areas where rainwater accumulates during wet seasons. These areas are not necessarily associated with clearly defined drainage lines. Soils are shallow sandy clays to sandy loam with some rocks on the soil surface. Structurally the vegetation is mostly dominated by grasses and forbs with a cover of trees and tall shrubs surrounding the pans. From an ecological point of view VU4 varies from a moderate to poor condition. The grass cover is fairly good in the pans, but poor in the directly surrounding areas.

The dominant tree species in VU4 are *Searsia lancea*, *Grewia flava*, *Ziziphus mucronata*, *Tarchonanthus camphoratus* and *Acacia mellifera*. The most significant graminoids are *Panicum impletum*, *P. lanipes*, *P. maximum*, *Eragrostis rotifer*, *Setaria verticillata*, *Leptochloa fusca*, *Cenchrus ciliaris* and *Chloris virgata*. The herbaceous shrubs and forbs that mostly occur are the indigenous *Vahlia capensis*, *Lotononis* species, *Euphorbia inaequilatera*, and the exotic *Gomphrena celosioides*, *Alternanthera sessilis* and *Schkuhria pinnata*.



Figure 14: VU4 – Pan 1.



Figure 15: VU4 – Pan 2.



Figure 16: VU4 – Pan 3.

VU4 is the least diverse in terms of floristic diversity compared to the other three described VU's. 42 plant species (37 indigenous, 5 exotic) were recorded in VU4. Eight are woody trees/shrubs (1 exotic), 15 are graminoids (none exotic) and 18 are dwarf and herbaceous shrubs and other forbs (5 exotic). It was also established from available literature (Pujol 1988; Pooley, 1998; Schmidt *et al* 2002; Shearing & Van Heerden 1994; Van Wyk *et al* 1997; Van Wyk & Gericke 2003), that at least eight of the recorded plant species in VU4 are to some extent utilized for some or other social activity or use (medicinal, nourishment/food, and/or cultural).

6.5 Red Data, Protected and Endemic Plant Species

18 plant species of specific conservation significance were recorded in the study area during the study period. One of these species is listed as a Threatened or Protected Species (ToPS) by the National Environmental Management: Biodiversity Act's (Act No. 10 of 2004) list of ToPS as published in Government Gazette no. 36375 of 16 April 2013 (NEMBA ToPS, 2013). Two are listed by Raimondo *et al* (2009) in the South African Red Data list as Declining species. Three tree species are included in the protected tree species list as published in the National Forests Act (Act no.84 of 1998) (NFA, 1998), and 15 of the 18 are listed as protected and one as specially protected

by the Northern Cape Nature Conservation Act (Act no. 9 of 2009) (NCNCA, 2009).

Table 6-2 lists the recorded ToPS, Red Data listed and protected species relative to the different vegetation units they were recorded in during the time of this study. In Appendix C, Table 13-1 a list appears with the coordinates of recorded protected plant species in the study area. Figure 14 shows the positions of the recorded specimens in relation to the different studied areas. More specimens of these species, which are not listed in Appendix C, do occur in the study area, but due to time constraints these could not be referenced during this study. **It is strongly advised** that once the exact position of development activities and infrastructure has been planned and finalized that a full population study of each affected area be done to determine the population size and extent of these and possibly other protected species within the study area and the relevant appropriate action is then taken.

Table 6-2: List of protected plant species recorded in the study area

Note: abbreviations used in Table 6-2 are as follows:

D – Declining (Raimondo *et al*, 2009); P(SA) – nationally protected tree species (NFA, 1998); P(NC) – provincially protected species (NCNCA, 2009); SP(NC) – provincially specially protected species (NCNCA, 2009); ToPS - threatened or protected species (NEMBA ToPS, 2013).

SPECIES NAME	FAMILY	GROWTH FORM	SPECIES STATUS	VEGETATION UNIT				
				1a	1b	2	3	4
<i>Acacia erioloba</i>	FABACEAE	Tree	D, P(SA)	X	X		X	
<i>Acacia haematoxylon</i>	FABACEAE	Tree	P(SA)				X	
<i>Aloe hereroensis</i> var. <i>hereroensis</i>	ASPHODELACEAE	Succulent shrub	P(NC)	X		X		
<i>Ammocharis coranica</i>	AMARYLLIDACEAE	Geophyte	P(NC)	X				
<i>Boophone disticha</i>	AMARYLLIDACEAE	Geophyte	D; P(NC)		X		X	
<i>Boscia albitrunca</i>	CAPPARACEAE	Tree	P(SA), P(NC)	X	X	X		X
<i>Duvalia</i> species	APOCYNACEAE	Succulent herb	P(NC)			X		
<i>Euphorbia</i> c.f. <i>mauritanica</i>	EUPHORBIACEAE	Succulent shrub	P(NC)	X				
<i>Gomphocarpus fruticosus</i> subsp. <i>fruticosus</i>	APOCYNACEAE	Herbaceous shrub	P(NC)	X		X		
<i>Harpagophytum procumbens</i> subsp. <i>procumbens</i>	PEDALIACEAE	Herb	TOPS, SP(NC)	X			X	
<i>Huernia longituba</i>	APOCYNACEAE	Succulent	P(NC)	X				
<i>Nerine laticoma</i>	AMARYLLIDACEAE	Geophyte	P(NC)	X		X		
<i>Orbea lutea</i> subsp. <i>lutea</i>	APOCYNACEAE	Succulent herb	P(NC)			X		
<i>Ornithogalum</i> c.f. <i>seineri</i>	HYACINTHACEAE	Geophyte	P(NC)	X				
<i>Ornithogalum</i> species	HYACINTHACEAE	Geophyte	P(NC)	X				
<i>Orphanthera jasminiflora</i>	APOCYNACEAE	Succulent creeper	P(NC)				X	
<i>Sarcostemma viminale</i> subsp. <i>viminale</i>	APOCYNACEAE	Succulent climber	P(NC)			X		

SPECIES NAME	FAMILY	GROWTH FORM	SPECIES STATUS	VEGETATION UNIT				
				1a	1b	2	3	4
<i>Tridentea marientalensis</i> subsp. <i>marientalensis</i>	APOCYNACEAE	Succulent herb	P(NC)		X			

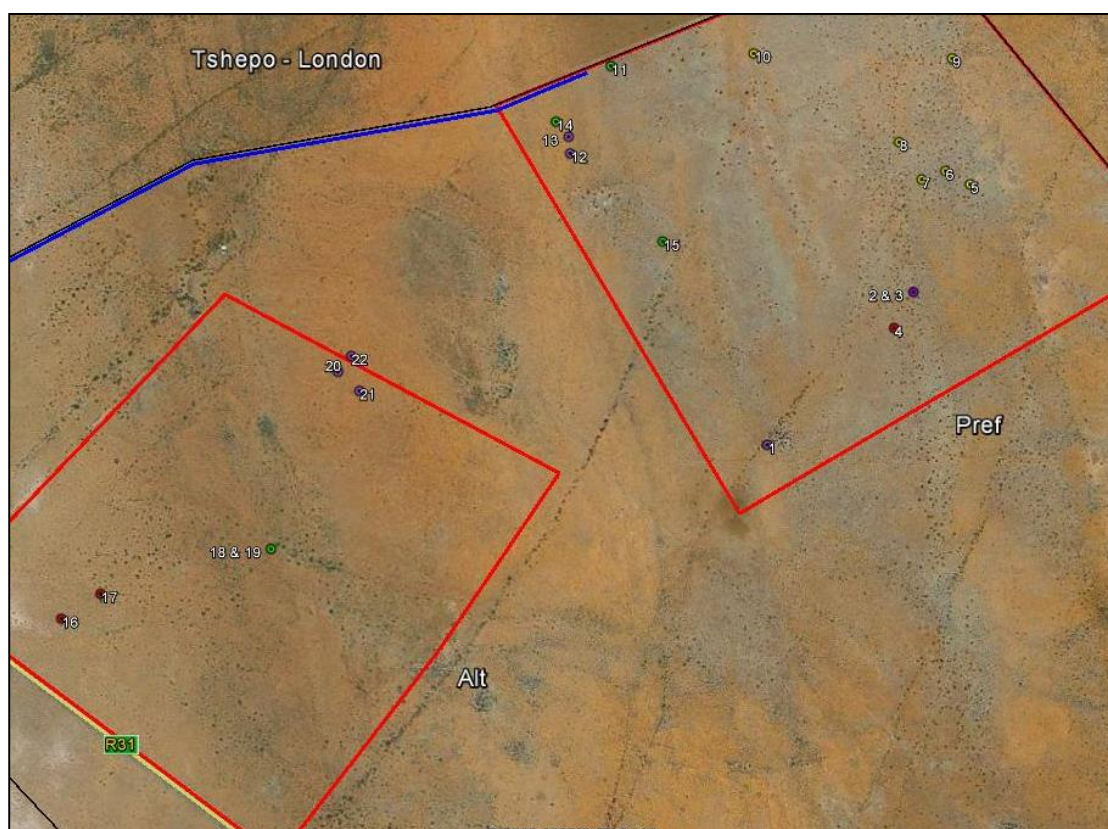


Figure 17: Recorded positions of some TopS, Red data or protected plant species in the study area

Note: The numbered labels on Figure 17 correspond to the serial number (S/N) in the first column of Table 13-1 of Appendix C.

Due to the high numbers of nationally protected trees (NFA, 1998) (i.e. *Acacia erioloba*, *A. haematoxylon* and *Boscia albitrunca*) the individual positions of these species were not individually geo-referenced during this study. Instead a number of belt transects were conducted in each different VU to determine the density at which these species occur in the study area and just beyond.

22 belt transects of 100 x 40 m (4000 m²) were conducted in the area (15 in VU1, 4 in VU2 and 3 in VU3) and only the numbers of the three nationally protected trees were considered. All specimens of these species within the belt transect were counted and noted together with the height of each specimen. Differentiation was made between specimens higher than 2 m (> 2 m) and those shorter than 2 m but not less than 1 m (< 2 m = 1 m).

Specimens shorter than 1 m were not counted. Table 6-3 gives a summary of the results of this survey. In Appendix C, Table 13-2 presents the results in detail.

An example for the interpretation of Table 6-3 is as follows: The total number of specimens of, for example, *Acacia erioloba* in VU1 is 5133. This number of specimens is the sum of the *A. erioloba* shrubs (1 to < 2 m) i.e. 1027, and the trees (> 2 m) i.e. 4107. The total calculated number of *A. erioloba* specimens to occur in the study area (290 ha preferred site + 250 ha alternative site) is 6691. To calculate the number of specimens of any one of the three species for any given surface area, one will take the surface area (in ha) and multiply it with the average species density/ha of the relevant species and VU.

Table 6-3: Protected tree species frequency, density/ha & number of specimens/VU

VU	VU area (ha)	Average species frequency (as counted on 4000 m ²)								
		<i>Acacia erioloba</i>			<i>Acacia haematoxylon</i>			<i>Boscia albitrunca</i>		
		1 to <2 m	>2 m	Total	1 to <2 m	>2 m	Total	1 to <2 m	>2 m	Total
1		1.1	4.3	5.3	0.0	0.0	0.0	0.7	1.9	2.6
2		0.8	0.5	1.3	0.0	0.0	0.0	0.8	0.8	1.5
3		4.0	4.0	8.0	43.7	5.0	48.7	0.0	0.0	0.0
Average species density / ha										
1		2.67	10.67	13.33	0.00	0.00	0.00	1.67	4.83	6.50
2		1.88	1.25	3.13	0.00	0.00	0.00	1.88	1.88	3.75
3		10.00	10.00	20.00	109.17	12.50	121.67	0.00	0.00	0.00
Number of specimens per VU										
1	385	1027	4107	5133	0	0	0	642	1861	2503
2	89	167	111	278	0	0	0	167	167	334
3	64	640	640	1280	6987	800	7787	0	0	0
	Total:			6691			7787			2836

6.6 Exotic Plant Species

During the study the alien invasive woody species *Prosopis glandulosa* var. *torreyana* was recorded in the study area. According to Hoffman *et al* (1999) (in Mucina & Rutherford, 2006) *P. glandulosa* is one of the 12 agriculturally most important invasive alien plants in South Africa. According to the Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA, 1983) in Henderson (2001) and the National Environmental Management Biodiversity Act's 2014 list of proposed weeds and invaders (NEMBA, 2014), this species is classified as an alien invader species. Seven uncategorized and non-invasive herbaceous weeds were also recorded.

Exotic plant species in the species lists (Appendix B: Tables 12-1 to 12-5) are preceded by an asterisk (*) and/or indicated by the letter "E" in the Species Status column in the case of uncategorized exotic species. In the case of

declared or proposed weeds or invaders the invasive status of the species, according to (CARA, 1983) (Table 6-4) and (NEMBA, 2014) (Table 6-5) are indicated in the Conservation Status column of the species lists in Appendix B as follows:

- C1 – declared weed category 1 (CARA, 1983).
- C2 – declared invader category 2 (CARA, 1983).
- C3 – declared invader category 3 (CARA, 1983).
- CX1, CX2 or CX3 – proposed weed or invader (CARA, 1983).
- N1b – NEMBA (2014) category 1b
- N2 – NEMBA (2014) category 2
- N3 – NEMBA (2014) category 3

Table 6-4: Description of the invasive status of exotic plant species according to Henderson (2001)

Invasive status (category)	Description
Declared weed (category 1) – C1 Proposed weed – CX1	<ul style="list-style-type: none"> • Prohibited on any land or water surface in South Africa. • Must be controlled or eradicated were possible (except in biological control reserves).
Declared invader (category 2) – C2 Proposed invader – CX2	<ul style="list-style-type: none"> • Allowed only in demarcated areas under controlled conditions. • Import of propagative material and trading allowed only by permit holders. • Outside demarcated areas, it must be controlled, or eradicated where possible (except in biological control reserves). • Prohibited within 30 m of the 1:50 year flood-line of watercourses or wetlands unless authorization is obtained.
Declared invader (category 3) – C3 Proposed invader – CX3	<ul style="list-style-type: none"> • No further plantings of these species are allowed (except with special permission). • Trade of propagative material is strictly prohibited. • Existing plants may remain but must be prevented from spreading. • Prohibited within 30 m of the 1:50 year flood-line of watercourses or wetlands, or as directed.

Table 6-5: Description of the invasive status of exotic plant species according to NEMBA (2014)

Invasive status (category)	Description

Invasive status (category)	Description
Category 1b – N1b	<ul style="list-style-type: none"> • Invasive species requiring compulsory control as part of an invasive species control program • Remove and destroy • These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management program • No permits will be issued
Category 2 – N2	<ul style="list-style-type: none"> • Invasive species regulated by area • A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants • No permits will be issued for these plants to exist in riparian zones
Category 3 – N3	<ul style="list-style-type: none"> • Invasive species regulated by activity • An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species • No permits will be issued for Cat 3 plants to exist in riparian zones

7 THREATENED AND PROTECTED ECOSYSTEMS

No ecosystems that are formerly listed as threatened and in need of protection according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) was recorded in or in the vicinity of the study area.

8 IMPACT ASSESSMENT

8.1 Assessment of expected impacts and relevant mitigation

The six tables in the section below (Tables 8-1 to 8-6) serve to summarize the significance of expected and potential impacts on the faunal, floral and habitat features occurring on or directly adjacent to the study area. A summary of expected construction, operational and decommissioning phase impacts are provided. No significant impacts are expected during the pre-construction phase. Tables 8-2 to 8-5 present the descriptions of impacts as well as impact assessments according to the method and rating system described in Table 8-1. In addition, Tables 8-2 to 8-5 also indicates mitigatory and management measures needed to minimize the expected ecological impacts.

Table 8-1: Rating system for the evaluation of impacts related to the proposed development

NATURE		
A brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by

		direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.

4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
<p>Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.</p> <p>The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.</p>		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

Table 8-2: Assessment of Impact 1: Loss of habitat for faunal and floral species

Impact	Construction phase	Operational phase	Decommissioning phase
<p><u>IMPACT 1:</u> Loss of habitat for faunal and floral species.</p>	<p>Site clearing and the removal of vegetation leading to loss of faunal & floral habitat.</p>	<p>Ongoing disturbance of soils with general operational activities leading to altered faunal & floral habitat.</p>	<p>Disturbance of soils as part of demolition activities may alter faunal & floral habitat.</p>
	<p>Site clearing and the disturbance of soils leading to increased erosion.</p>	<p>Increased run off from paved areas and access roads causing erosion in adjacent areas; Insufficient maintenance of runoff systems leading to erosion.</p>	<p>Disturbance of soils as part of demolition activities leading to increased erosion; Insufficient aftercare and maintenance leading to erosion.</p>
	<p>Compaction of soils by construction vehicles.</p>	<p>Ongoing compaction of soils by maintenance vehicles.</p>	<p>Compaction of soils by construction vehicles as part of demolition and rehabilitation activities.</p>
	<p>Movement of construction vehicles impacting on habitat through pollution by noise, fuel, oils, hydraulic fluids, etc.</p>	<p>Continued movement of vehicles in the area impacting on habitat through pollution by noise, fuel, oils, hydraulic fluids, etc.</p>	<p>Movement of construction vehicles as part of demolition and rehabilitation activities impacting on habitat through pollution by noise, fuel, oils, hydraulic fluids, etc.</p>

	Disturbance of the soil will transform the vegetation in the study area and create conditions favorable for the establishment of populations of alien and invader plant species as well as common weeds.	Lack of management of transformed habitat will create favorable conditions for the spread of populations of alien and invader plant species to neighboring natural habitats causing further transformation.	Ineffective rehabilitation of impacted areas and failure to implement a comprehensive alien weed control plan may lead to ongoing loss of habitat.
	With the development of any infrastructure the fragmentation of natural habitats can occur with the negative effect that the flow of ecosystem services (seed dispersal, pollination, exchanging of genes from one area to the next, etc.) may be interrupted having a negative long term effect on isolated fragments.	Solar panels trap solar energy, effectively altering the microclimate and habitat beneath them.	

Impact assessment:

Geographical Extent	Probability	Duration	Intensity / Magnitude	Reversibility	Irreplaceable loss of resources	Cumulative Effect	Significance
2	4	3	3	2	2	2	45 (negative medium impact)

Mitigation of Impact 1:

Injudicious and unnecessary destruction of natural vegetation, other than the footprint area of the proposed development, must be avoided at all cost.

To prevent the erosion of topsoil, management measures may include berms, soil traps, hessian curtains and storm water diversion away from areas susceptible to erosion. Water control structures should be constructed and well maintained to minimize erosion and to create a favorable habitat for the establishment of vegetation during the operation of the development and after decommissioning and rehabilitation.

Wherever possible, any soil that can serve as a growth medium for plants must be stripped and stockpiled for future landscaping and/or rehabilitation after or during the construction phase and should be used as soon as possible after “harvesting” to ensure that seed sources does not become worthless due to decomposition of the seed over time. It must be ensured that such topsoil stockpiles are located outside of any drainage lines and areas susceptible to erosion or siltation. Stockpiles should also be placed away from areas known to contain hazardous substances such as fuel.

All soils compacted as a result of construction activities falling inside the development footprint areas should be ripped and profiled after the construction phase. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all development and decommissioning phases to prevent loss of floral habitat.

Proliferation of alien and invasive species is expected within any disturbed areas. These species should be eradicated and controlled to prevent their spread beyond the development/ decommissioning footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled. A management plan and proper follow-up strategy for the prevention of the establishment and/or further spread of new populations of such species should be developed and enforced.

Vehicles should be well maintained to prevent oil and other chemically based materials to enter the area. Refueling points should be well managed and if any soils are contaminated, it should be stripped and disposed of at a registered hazardous waste dumping site.

After the construction phase and also during the decommissioning/rehabilitation phase, reseeded of indigenous grasses should be done in between the developed infrastructure and all affected areas to re-establish microclimates and niche habitats. These re-seeded areas should be well maintained during the operational phase.

Table 8-3: Assessment of Impact 2: Loss of indigenous faunal and floral species diversity

Impact		Construction phase		Operational phase		Decommissioning phase	
IMPACT 2: Loss of indigenous faunal and floral species diversity.		Site clearance and removal of vegetation for construction of infrastructure and access roads through natural areas leading to a loss of natural species diversity.		Ongoing edge effects from operating the SPP impacting on natural species diversity.		Disturbance of soils as part of demolition activities and ineffective rehabilitation of impacted areas further impacting on natural species diversity.	
		Proliferation of alien species may alter plant community structure. Failure to implement a comprehensive alien weed control plan leading to an increase in alien vegetation encroachment.		An increase in alien species leading to altered plant community structure and composition especially in neighboring habitats.		Ineffective rehabilitation of impacted areas and failure to implement a comprehensive alien weed control plan may lead to ongoing loss of natural species diversity.	
				Erosion and sedimentation as a result of operational activities leading to a loss of natural species diversity.		Continued erosion and sedimentation during closure and decommissioning leading to a loss of natural species diversity.	
Impact assessment:							
Geographical Extent	Probability	Duration	Intensity / Magnitude	Reversibility	Irreplaceable loss of resources	Cumulative Effect	Significance
2	2	4	2	4	3	2	34 (negative medium impact)

Mitigation of Impact 2:

An alien vegetation control plan has to be implemented in order to manage alien plant species occurring within the developed and surrounding area.

Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Removal of species should take place throughout the construction, operational, closure/decommissioning and rehabilitation/maintenance phases. Care should be taken with the choice of herbicides to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicides used. Proper training should be given to contractors/applicators to avoid spraying indigenous vegetation.

Landscaping with local indigenous species is preferable and could include forage and host plants required by pollinators.

After the construction phase and also during the decommissioning/rehabilitation phase, reseeded of local indigenous plant species should be done in between the developed infrastructure and all affected areas to re-establish plant species diversity, which in turn will create habitat for the return of faunal species, especially small mammals and invertebrates. These re-seeded areas should be well maintained during the operational phase.

To prevent the erosion of topsoil, management measures may include berms, soil traps, hessian curtains and storm water diversion away from areas susceptible to erosion. Water control structures should be constructed and well maintained to minimize erosion and to create a favorable habitat for the establishment of vegetation during the operation of the development and after decommissioning and rehabilitation.

Table 8-4: Assessment of Impact 3: Loss of faunal and floral species of conservation significance

Impact	Construction phase		Operational phase		Decommissioning phase		
<p>IMPACT 3: Loss of faunal and floral species of conservation significance.</p>	<p>Site clearance and removal of vegetation leading to a loss of any recorded and unrecorded species of conservation significance such as ToPS, Red Data Listed species, Protected species (nationally and/or provincially), plant species with medicinal or other cultural value.</p>		<p>An increase in alien plant species leading to loss of species of conservation significance such as ToPS, Red Data Listed species, Protected species (nationally and/or provincially), plant species with medicinal or other cultural value by outcompeting these species.</p>		<p>Ineffective rehabilitation of exposed and impacted areas and failure to implement a comprehensive alien weed control plan leading to ongoing loss of species of conservation significance.</p>		
			<p>Erosion and sedimentation as a result of operational activities leading to a loss of species of conservation significance.</p>		<p>Continued erosion and sedimentation during closure and decommissioning leading to a loss of species of conservation significance.</p>		
Impact assessment:							
Geographical Extent	Probability	Duration	Intensity / Magnitude	Reversibility	Irreplaceable loss of resources	Cumulative Effect	Significance
2	4	4	3	4	2	3	<p>57 (negative high impact)</p>

Mitigation of Impact 3:

According to SANBI's Guidelines for Environmental Impact Assessments (<http://redlist.sanbi.org/eiaguidelines.php>), *in situ* conservation of species of conservation significance is vital and is recommended as the only option for conserving species of conservation concern. *Ex situ* conservation, i.e. the removal of a subpopulation from its natural habitat to an artificial environment, a practice often termed "search and rescue", will result in the erosion of the inherent genetic diversity and characteristics of that species and increase its risk of extinction in the wild. Similarly, translocation of subpopulations is an unacceptable conservation measure. Translocations are expensive and rarely successful. Even if they are successful, translocated individuals may harm other species within the receiving environment, the translocated individuals may transmit pathogens and/or parasites, and translocation may result in rapid changes in the species itself.

In spite of the above point, if species of conservation significance, and more specifically plant species, are going to be destroyed due to the construction of the proposed development. It may be recommended that these species, especially geophytes, be located and "rescued" by transplanting specimens into a nursery or other safe site until they can be used during rehabilitation and/or landscaping.

Populations of species of conservation significance (ToPS, Red Data Listed species, Protected species (nationally and/or provincially), plant species with medicinal or other cultural value) occurring outside the areas that will be directly impacted by the proposed development needs to be actively conserved in order to conserve a viable, non-fragmented gene pool of these species in the local area.

If possible, developments that jeopardize any large populations of species of conservation significance should be planned in such a way as to avoid the populations and their habitat.

Any specimens of protected plant species known to occur in the vicinity of the development footprint and may potentially be impacted by the development activities, are to be fenced off for the duration of the activity. If these species fall within the development footprint special authorization is to be obtained from relevant conservation authorities for such species to be cut, disturbed, damaged or destroyed. Applications for such activities should be made to the responsible official within the relevant Northern Cape Nature Conservation Agency.

Table 8-5: Assessment of Impact 4: Degradation and/or destruction of natural pans.

Impact	Construction phase	Operational phase	Decommissioning phase
<p><u>IMPACT 4:</u> Degradation and/or destruction of natural pans.</p>	<p>Sedimentation of pans due to soil erosion as a result of construction activities nearby leading to a loss of natural functioning.</p>	<p>Sedimentation of pans due to soil erosion as a result of operational activities nearby leading to a loss of natural functioning.</p>	<p>Continued sedimentation during closure and decommissioning leading to a loss of natural functioning.</p>
	<p>The surface catchment area (size and quality) of the pans as well as the natural drainage of water to the pans could be negatively affected by construction activities. Water that will naturally flow from the surrounding areas that feed the pans and associated habitats may be cut off due to ditches, water runoff control structures, etc.</p>	<p>Natural drainage of water to the pans could be negatively affected by operational activities. Water that will naturally flow from the surrounding areas that feed the pans and associated habitats may be cut off due to ditches, water runoff control structures, etc.</p>	<p>Natural drainage of water to the pans could be negatively affected by post operational activities. Water that will naturally flow from the surrounding areas that feed the pans and associated habitats may be cut off due to ditches, water runoff control structures, etc.</p>
	<p>Environmentally harmful pollutants (fuel, oil, hydraulic fluids, cement, paint, turpentine, hydrochloric acid, cleaning chemicals, etc.) from the construction phase of the development may end up in the pans.</p>	<p>Environmentally harmful pollutants (fuel, oil, hydraulic fluids, cement, paint, turpentine, hydrochloric acid, cleaning chemicals, etc.) from the operational phase of the development may end up in the pans.</p>	<p>Environmentally harmful pollutants (fuel, oil, hydraulic fluids, cement, paint, turpentine, hydrochloric acid, cleaning chemicals, etc.) from the decommissioning phase of the development may end up in the pans.</p>

	Workers entering and using pan areas for inappropriate activities (dumping materials, depositing human and urine waste etc.) may negatively impact on the surface water resources and the general ecological health of the pans.	Workers entering and using pan areas for inappropriate activities (dumping materials, depositing human and urine waste etc.) may negatively impact on the surface water resources and the general ecological health of the pans.	Workers entering and using pan areas for inappropriate activities (dumping materials, depositing human and urine waste etc.) may negatively impact on the surface water resources and the general ecological health of the pans.				
	Proliferation of alien species may alter plant community structure. Failure to implement a comprehensive alien weed control plan leading to an increase in alien vegetation encroachment.	An increase in alien species leading to altered plant community structure and composition especially in neighboring habitats.	Ineffective rehabilitation of impacted areas and failure to implement a comprehensive alien weed control plan may lead to ongoing loss of natural species diversity.				
Impact assessment:							
Geographical Extent	Probability	Duration	Intensity / Magnitude	Reversibility	Irreplaceable loss of resources	Cumulative Effect	Significance
1	3	3	3	3	3	3	48 (negative medium impact)

Mitigation of impact 4:
<p>In terms of section 19 of the NWA (1998), owners / managers / people occupying land on which any activity or process undertaken which causes, or is likely to cause pollution or degradation of a water resource must take all reasonable measures to prevent any such disturbance from occurring, continuing or recurring. These measures may include measures to (inter alia):</p> <ul style="list-style-type: none"> • Cease, modify, or control any act or process causing the pollution/degradation. • Comply with any prescribed waste standard or management practice. • Contain or prevent the movement of pollutants or the source of degradation. • Remedy the effects of the pollution/degradation. • Remedy the effects of any disturbance to the bed and banks of a watercourse/wetland.
<p>Any construction activities in or within a delineated buffer zone of a water resource may only take place after the necessary water use license has been obtained.</p>
<p>Where possibility exists that a pan is close to a construction site, the pan should be fenced off to avoid unnecessary or unauthorized access to these areas.</p>
<p>During excavations, soil stockpiling should be as far as possible away from the pan edge to avoid siltation of pans from soil stock piles.</p>
<p>Construction machinery and vehicles may not be allowed to enter pans. Strictly no re-fueling of vehicles or machinery should be allowed to take place in any construction area close to a pan.</p>
<p>During and after construction it is important to take runoff control into serious consideration. Areas of exposed soil can easily erode and subsequently end up in the pans. After construction water runoff control is equally important in order to avoid polluted water to end up in the pans. A well designed storm water drainage system must be constructed in order to channel water, which may potentially be polluted, away from pan areas. Natural runoff from the natural terrestrial habitat surrounding the pans should however not be restricted unnecessarily.</p>
<p>The use of potential pollutants (paint, chemicals, etc.) during construction and operational phases must be strictly controlled and a high quality of management and supervision concerning such materials must be enforced, especially close to pan areas.</p>
<p>Sanitary facilities must be made available to construction workers working in or near to prevent urine and other human waste entering the pans.</p>

Populations of alien and invader plant species within as well as alongside the pan areas should be monitored on a regular basis and actions to eradicate these species at an early stage should be implemented.

According to the NWA (1998) part of the definition of pollution of water resources states that any physical alterations to a water resource, for example the excavation of a wetland / pan or changes to the morphology of such a water resource may be considered to be pollution. Activities which cause an alteration to the biological properties of a pan i.e. the fauna and flora contained within and supported by that water resource are therefore also considered to be a form of pollution.

Based on the above assessment it is evident that there are three expected impacts on the floral ecology within the study area. Table 8-6 summarises the findings indicating the significance of the impact before management takes place (as described in Tables 8-2 to 8-5) and the likely impact if management and mitigation takes place. From Table 8-6 it is evident that prior to management measures being put in place, the impacts are negative-medium or negative-high level impacts. If effective management takes place, all impacts will be reduced to low level impacts.

Table 8-6: A summary of the results from the impact assessments

Impact	Not mitigated / managed	Mitigated / managed
1. Loss of habitat for faunal and floral species	negative medium impact	negative low impact
2. Loss of indigenous faunal and floral species diversity	negative medium impact	negative low impact
3. Loss of faunal and floral species of conservation significance	negative high impact	negative medium to low impact
4. Degradation and/or destruction of natural pans.	negative medium impact	negative low impact

8.2 Assessment of the no-go alternative

Due to the destructive nature of the proposed development to the floristic diversity occurring in the directly affected area and the direct impact it will also have on the faunal diversity of the area on a local scale, the no-go alternative will see the area stay in the current condition. The current impacts exerted on the area from an agricultural point of view (not assessed in this study) will remain and, depending on the management strategies employed by the land owner and natural climatic conditions, the current natural condition may improve or deteriorate in future.

8.3 Monitoring requirements

From a floristic point of view, the following should be monitored during all phases of the proposed development:

- Floristic diversity of the development area as well as areas directly adjacent.
- Populations of ToPS, Red Data and other protected plant species on neighboring properties / areas must be assessed and monitored during all project phases.
- The removal of any ToPS, Red Data and other protected plant species must be well monitored and managed. Authorization, through a provincial and/or national permitting system, is to be obtained from relevant conservation authorities for such species to be cut, disturbed, damaged or destroyed.

From a faunal point of view, the following should be monitored:

- Faunal diversity of the areas directly adjacent to the development area.
- During construction any faunal species caught up in the midst of activities, which can be translocated to neighbouring open areas, such as tortoises, should be handled by trained professionals and strictly monitored.
- During the operational phase, as the floristic habitat recovers, the return of especially small mammals should be promoted as these species play an important role in the natural health of an ecosystem. This process can also be monitored by annual or bi-annual monitoring.

From a wetland / pans point of view the following should be monitored:

- All delineated pans in or adjacent to the development area should be treated as sensitive and need to be monitored from an ecological and hydrological point of view, throughout all project phases.
- Unnecessary movement of vehicles and persons in these areas should be strictly restricted and monitored.

- All aspects mentioned in the mitigation of impacts should be well monitored.

9 CONCLUDING REMARKS

The low faunal and moderately high floristic species richness and density recorded would equate to a low impact to the regional diversity of plants, mammals, reptiles and amphibians. Although the number of protected faunal species possibly occurring on or in close proximity to the site is low, these deserve consideration. It must be stressed that the short study period may affect the generation of a representative sample (see also 'Assumptions and Limitations'). We are nonetheless confident in the sampling methods employed as the methodology was designed with the study limitations in mind.

The loss of topsoil and fragmentation of natural habitats that is virtually unavoidable with any type of development, has a negative impact on the regional ecosystem as it disrupts the natural flow of ecosystem services and affects all fauna and flora that are dependent on those habitats. Linear ridges, water courses, wetlands, drainage lines, etc. are especially sensitive to and easily fragmented. A high conservation value is attributed to the plant communities and faunal assemblages of these areas as they contribute significantly to the biodiversity of a region. Care should be taken not to unnecessarily clear or destroy natural vegetation and where possible the rehabilitation of transformed areas and restoration of degraded natural veld should take place in order to improve the ecological health of the floristic component on the property. Development should therefore be planned in such a way that totally transformed areas are chosen for major developments and natural veld, even if it is already degraded and/or fragmented, is avoided as far as possible. A legitimate and well-designed rehabilitation plan must be set in place before mining commences and be strictly enforced on an on-going basis throughout the life of the mine and thereafter.

When considering the different sites (preferred and alternative sites) that were investigated during this study, from a faunal, floral, wetland and general ecological point of view, it is concluded that the preferred site may be accepted for the proposed development.

10 REFERENCES

10.1 Literature referred to in this report

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11 APPENDIX A: lists of faunal species that may occur in the study area

Table 11-1: Mammal species likely to occur on or in close proximity to the study site. Species **observed during the study period are included; along with the conservation status of each species (**protected** statuses have been highlighted)**

Order	Family	Common Name	Species Name	Conservation Status
Macroscelidea	Macroscelididae	Round-eared Sengi	<i>Macroscelides proboscideus</i>	Least concern
		Bushveld Sengi	<i>Elephantulus intufi</i>	Data deficient
Eulipotyphla	Erinaceidae	Southern African Hedgehog	<i>Atelerix frontalis</i>	Near threatened
Pholidota	Manidae	Ground Pangolin	<i>Smutsia temminckii</i>	Vulnerable
Lagomorpha	Leporidae	Cape Hare	<i>Lepus capensis</i>	Least concern
		Scrub Hare	<i>Lepus saxatilis</i>	Least concern
Rodentia	Sciuridae	Southern African Ground Squirrel	<i>Xerus inauris</i>	Least concern
	Pedetidae	Southern African Springhare	<i>Pedetes capensis</i>	Least concern
	Hystricidae	Cape Porcupine	<i>Hystrix africaeaustralis</i>	Least concern
	Muridae	Woosnam's Desert Mouse	<i>Zelotomys woosnami</i>	Least concern
		Pouched Mouse	<i>Saccostumus campestris</i>	Least concern
		Large-eared Mouse	<i>Malacothrix typica</i>	Least concern
		Cape Short-tailed Gerbil	<i>Desmodillus auricularis</i>	Least concern
		Pygmy Hairy-footed Gerbil	<i>Gerbillurus paeba</i>	Least concern
		Bushveld Gerbil	<i>Gerbilliscus leucogaster</i>	Data deficient
		Highveld Gerbil	<i>Gerbilliscus brantsii</i>	Least concern
		Namaqua Rock Mouse	<i>Micaelamys namaquensis</i>	Least concern
		Red Veld Rat	<i>Aethomys chrysophilus</i>	Least concern
		Four-striped	<i>Rhabdomys spp</i>	Least

		Grass Mouse		concern
		Black-tailed Tree Rat	<i>Thallomys nigricauda</i>	Least concern
		Southern Multimammate Mouse	<i>Mastomys Coucha</i>	Least concern
		Brant's Whistling Rat	<i>Parotomys brantsii</i>	Least concern
Carnivora	Canidae	Cape Fox	<i>Vulpes chama</i>	Least concern
		Bat-eared Fox	<i>Otocyon megalotis</i>	Least concern
		Black-backed Jackal	<i>Canis mesomelas</i>	Least concern
	Mustelidae	Honey Badger	<i>Mellivora capensis</i>	Near threatened
		African Striped Weasel	<i>Poecilogale albinucha</i>	Data deficient
		Striped Polecat	<i>Ictonyx striatus</i>	Least concern
	Herpestidae	Slender Mongoose	<i>Galerella sanguinea</i>	Least concern
		Yellow Mongoose	<i>Cynictis penicillata</i>	Least concern
		Suricate	<i>Suricata suricatta</i>	Least concern
	Viverridae	Small-spotted Genet	<i>Genetta genetta</i>	Least concern
	Hyaenidae	Brown Hyaena	<i>Hyaena brunnea</i>	Near threatened
		Aardwolf	<i>Proteles cristatus</i>	Least concern
	Felidae	African Wild Cat	<i>Felis silvestris cafra</i>	Least concern
		Small Spotted Cat	<i>Felis nigripes</i>	Least concern
		Caracal	<i>Caracal caracal</i>	Least concern
		Leopard	<i>Panthera pardus</i>	Least concern
Tubulidentata	Orycteropodidae	Aardvark	<i>Orycteropus afer</i>	Least concern
Cetartiodactyla	Bovidae	Greater Kudu	<i>Tragelaphus strepsiceros</i>	Least concern
		Steenbok	<i>Raphicerus campestris</i>	Least concern
		Common Duiker	<i>Sylvicapra grimmia</i>	Least concern

Table 11-2: Reptile species likely to occur on or in close proximity to the study site. Species **observed during the study period are included; along with the conservation status of each species (**protected** statuses have been highlighted)**

Order	Family	Common Name	Species Name	Conservation Status
Testudines	Testudinidae	Serrated Tent Tortoise	<i>Psammobates oculifer</i>	Least concern
		Leopard Tortoise	<i>Stigmochelys pardalis</i>	Least concern
Squamata	Gekkonidae	Common Giant Gecko	<i>Chondrodactylus angulifer angulifer</i>	Least concern
		Kalahari Ground Gecko	<i>Colopus wahlbergii wahlbergii</i>	Least concern
		Cape Gecko	<i>Pachydactylus capensis</i>	Least concern
		Common Barking Gecko	<i>Ptenopus garrulus garrulus</i>	Least concern
	Amphisbaenidae	Pestle-tailed Worm Lizard	<i>Dalophia pistillum</i>	Least concern
		Maurice's Worm Lizard	<i>Monopeltis mauricei</i>	Least concern
	Lacertidae	Bushveld Lizard	<i>Heliobolus lugubris</i>	Least concern
		Savanna Lizard	<i>Meroles squamulosus</i>	Least concern
		Spotted Desert Lizard	<i>Meroles suborbitalis</i>	Least concern
		Spotted Sandveld Lizard	<i>Nucras intertexta</i>	Least concern
		Spotted Sand Lizard	<i>Pedioplanis lineocellata lineocellata</i>	Least concern
		Namaqua Sand Lizard	<i>Pedioplanis namaquensis</i>	Least concern
	Scincidae	Kgalagadi Legless Skink	<i>Acontias kgalagadi kgalagadi</i>	Least concern
		Western Three-striped Skink	<i>Trachylepis occidentalis</i>	Least concern
		Speckled Sand Skink	<i>Trachylepis punctulata</i>	Least concern
		Kalahari Tree Skink	<i>Trachylepis spilogaster</i>	Least concern
		Variiegated Skink	<i>Trachylepis variegata</i>	Least concern

	Varanidae	Southern Rock Monitor	<i>Varanus albigularis albigularis</i>	Least concern
	Chamaeleonidae	Common Flap-neck Chameleon	<i>Chamaeleo dilepis dilepis</i>	Least concern
	Agamidae	Western Ground Agama	<i>Agama aculeata aculeata</i>	Least concern
		Southern Rock Agama	<i>Agama atra</i>	Least concern
	Leptotyphlopidae	Peter's Thread Snake	<i>Leptotyphlops scutifrons</i>	Least concern
	Viperidae	Puff Adder	<i>Bitis arietans arietans</i>	Least concern
	Lamprophiidae	Bibron's Stiletto Snake	<i>Atractaspis bibronii</i>	Least concern
		Duerden's Stiletto Snake	<i>Atractaspis duerdeni</i>	Least concern
		Bicoloured Quill-snouted Snake	<i>Xenocalamus bicolor bicolor</i>	Least concern
		Common House Snake	<i>Boaedon capensis</i>	Least concern
		Cape Wolf Snake	<i>Lycophidion capense capense</i>	Least concern
		Fork-marked Sand Snake	<i>Psammophis trinasalis</i>	Least concern
		Sundevall's Shovel-snout	<i>Prosymna sundevalli</i>	Least concern
		Mole Snake	<i>Pseudaspis cana</i>	Least concern
	Elapidae	Common Shield Cobra	<i>Aspidelaps scutatus scutatus</i>	Least concern
		Cape Cobra	<i>Naja nivea</i>	Least concern
	Colubridae	Boomslang	<i>Dispholidus typus</i>	Least concern
		Eastern Tiger Snake	<i>Telescopus semiannulatus semiannulatus</i>	Least concern

Table 11-3: Amphibian species likely to occur on or in close proximity to the study site. Species **observed during the study period are included; along with the conservation status of each species (**protected** statuses have been highlighted)**

Order	Family	Common Name	Species Name	Conservation Status
Anura	Bufonidae	Guttural Toad	<i>Amietophrynus gutturalis</i>	Least concern
	Hyperoliidae	Bubbling Kassina	<i>Kassina senegalensis</i>	Least concern
	Pyxicephalidae	Boettger's Caco	<i>Cacosternum boettgeri</i>	Least concern
		Giant Bullfrog	<i>Pyxicephalus adspersus</i>	Near threatened
		Tremolo Sand Frog	<i>Tomopterna cryptotis</i>	Least concern
		Tandy's Sand Frog	<i>Tomopterna tandyi</i>	Least concern

Table 11-4: **Protected butterfly species likely to occur on or in close proximity to the site.**

Order	Family	Common Name	Species Name	Conservation Status
Lepidoptera	Lycaenidae	Griqua Black Pie	<i>Tuxentius melaena griqua</i>	Data deficient

12 APPENDIX B: lists of plant families, genera and species recorded in the study area

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Abbreviations used in Tables 12-2 to 12-5 are declared as follows:

Under the column SPECIES STATUS:

ToPS	Threatened or Protected Species (NEMBA ToPS, 2013)
D	Red data – Declining (Raimondo et al, 2009)
P(SA)	Protected nationally (NFA, 1998)
P(NC)	Protected in Northern Cape Province (NCNCA, 2009)
SP(NC)	Specially Protected in Northern Cape Province (NCNCA, 2009)
E	Exotic – No formal invasive category – non-invasive weed
N2	Exotic – Category 2 (NEMBA 2014)
C2	Exotic – Declared invader category 2 (Henderson 2001)

NOTE: All exotic plant taxa are preceded by an asterisk (e.g. **Ricinus communis*) in the species lists of Appendix B (Tables 12-1 to 12-5).

Under the column SOCIAL USE:

F	–	Food/nourishment
M	–	Medicinal
C	–	Cultural

Table 12-1: Plant Families and Genera recorded in the study area

FAMILY	No. of families	No. of genera per family	GENUS	No. of species per genus	No. of species per genus in VU				
					1a	1b	2	3	4
ANGIOSPERMAE									
MONOCOTYLEDONAE									
AMARYLLIDACEAE	1	3	<i>Ammocharis</i>	1	1				
			<i>Boophone</i>	1		1		1	
			<i>Nerine</i>	1	1		1		
ASPARAGACEAE	1	1	<i>Asparagus</i>	3	2	3	2	2	
ASPHODELACEAE	1	1	<i>Aloe</i>	1	1		1		
COMMELINACEAE	1	1	<i>Commelina</i>	2	1			1	
CYPERACEAE	1	1	<i>Bulbostylis</i>	1			1	1	
DRACAENACEAE	1	1	<i>Sansevieria</i>	1	1				
ERIOSPERMACEAE	1	1	<i>Eriospermum</i>	2	1	1	1	1	
HYACINTHACEAE	1	3	<i>Dipcadi</i>	3	2	2	2	1	
			<i>Ledebouria</i>	2	1		2	1	
			<i>Ornithogalum</i>	2	2				
POACEAE	1	15	<i>Aristida</i>	2	1	1	2	1	
			<i>Cenchrus</i>	1	1	1	1	1	1
			<i>Centropodia</i>	1				1	
			<i>Chloris</i>	1	1				1
			<i>Cymbopogon</i>	1	1		1		
			<i>Echinochloa</i>	1					1
			<i>Eragrostis</i>	5	3	2	2	1	3
			<i>Heteropogon</i>	1			1		1
			<i>Leptochloa</i>	1					1
			<i>Panicum</i>	3		1			3
			<i>Schmidtia</i>	1	1	1	1	1	
			<i>Setaria</i>	1		1			1
			<i>Sporobolus</i>	1		1			1
			<i>Stipagrostis</i>	2	2	1	1	2	1
			<i>Tragus</i>	1	1	1	1		1
			<i>Urochloa</i>	1	1	1			
Sub-Total:	9	27		44	25	18	20	15	15
DICOTYLEDONAE									
ACANTHACEAE	1	2	<i>Barleria</i>	1	1		1		
			<i>Blepharis</i>	1	1				
AIZOACEAE	1	1	<i>Plinthus</i>	1				1	

FAMILY	No. of families	No. of genera per family	GENUS	No. of species per genus	No. of species per genus in VU				
					1a	1b	2	3	4
AMARANTHACEAE	1	5	<i>*Achyranthes</i>	1		1			
			<i>*Alternanthera</i>	1					1
			<i>*Gomphrena</i>	1					1
			<i>Kyphocarpa</i>	1			1		
			<i>Pupalia</i>	1		1	1		
ANACARDIACEAE	1	1	<i>Searsia</i>	1					1
APOCYNACEAE	1	8	<i>Duvalia</i>	1			1		
			<i>Gomphocarpus</i>	1	1		1		
			<i>Huernia</i>	1	1				
			<i>Orbea</i>	1			1		
			<i>Orthanthera</i>	1				1	
			<i>Pergularia</i>	1	1	1	1		
			<i>Sarcostemma</i>	1			1		
			<i>Tridentea</i>	1		1			
ASTERACEAE	1	9	<i>*Bidens</i>	1		1			
			<i>Dicoma</i>	2	1	1	1	1	
			<i>Felicia</i>	2			1	1	
			<i>Geigeria</i>	1	1	1	1	1	1
			<i>Kleinia</i>	1	1		1		
			<i>Pteronia</i>	1			1		
			<i>*Schkuhria</i>	1		1			1
			<i>*Tagetes</i>	1		1			1
			<i>Tarchonanthus</i>	1	1	1	1	1	
BIGNONIACEAE	1	1	<i>Rhigozum</i>	1	1	1	1	1	
BORAGINACEAE	1	2	<i>Ehretia</i>	1	1	1	1	1	
			<i>Heliotropium</i>	2	2	1	2	1	1
CAPPARACEAE	1	3	<i>Boscia</i>	1	1	1	1		1
			<i>Cadaba</i>	1	1		1		
			<i>Cleome</i>	2	2	2	1		
CHENOPODIACEAE	1	2	<i>*Chenopodium</i>	1		1			
			<i>Salsola</i>	1	1				
CONVOLVULACEAE	1	5	<i>Convolvulus</i>	1				1	
			<i>Evolvulus</i>	1			1		
			<i>Ipomoea</i>	1	1	1	1	1	
			<i>Merremia</i>	1				1	
			<i>Seddera</i>	1			1		
CRASSULACEAE	1	1	<i>Kalanchoe</i>	1	1		1		
CUCURBITACEAE	1	4	<i>Acanthosicyos</i>	1	1			1	

FAMILY	No. of families	No. of genera per family	GENUS	No. of species per genus	No. of species per genus in VU				
					1a	1b	2	3	4
			<i>Citrullus</i>	1	1	1		1	
			<i>Cucumis</i>	1	1	1	1	1	
			<i>Trochomeria</i>	1	1	1		1	
EBENACEAE	1	2	<i>Diospyros</i>	1	1			1	1
			<i>Euclea</i>	1			1		
EUPHORBIACEAE	1	4	<i>Acalypha</i>	1	1				
			<i>Euphorbia</i>	2	2			1	1
			<i>Jatropha</i>	1	1				
			<i>Phyllanthus</i>	2	2	2	1	2	1
FABACEAE	1	11	<i>Acacia</i>	4	3	3	2	4	2
			<i>Elephantorrhiza</i>	1	1			1	
			<i>Hoffmannseggia</i>	1				1	
			<i>Indigofera</i>	2	2	2		1	
			<i>Lotononis</i>	1					1
			<i>*Prosopis</i>	1			1		1
			<i>Requienia</i>	1				1	
			<i>Rhynchosia</i>	1		1			1
			<i>Senna</i>	1	1	1		1	
			<i>Sphenostylis</i>	1	1			1	
			<i>Tephrosia</i>	2	1	1	2	1	
GISEKIACEAE	1	1	<i>Gisekia</i>	1	1			1	1
ILLECEBRACEAE	1	1	<i>Pollichia</i>	1	1	1	1	1	
LAMIACEAE	1	2	<i>Becium</i>	1			1		
			<i>Leucas</i>	1			1		
MALVACEAE	1	4	<i>Abutilon</i>	1		1	1		
			<i>Hibiscus</i>	3			3		
			<i>Pavonia</i>	1	1	1			
			<i>Sida</i>	1			1		
MOLLUGINACEAE	1	3	<i>Corbichonia</i>	1			1		1
			<i>Limeum</i>	3	2	2	1	1	
			<i>Mollugo</i>	1	1				1
PEDALIACEAE	1	3	<i>Ceratotheca</i>	1		1	1		
			<i>Harpagophytum</i>	1	1			1	
			<i>Sesamum</i>	1	1	1	1	1	1
POLYGALACEAE	1	1	<i>Polygala</i>	2			2		
POLYGONACEAE	1	1	<i>Oxygonum</i>	2				2	
PORTULACACEAE	1	2	<i>Portulaca</i>	2			1		1
			<i>Talinum</i>	2	2		1	1	

FAMILY	No. of families	No. of genera per family	GENUS	No. of species per genus	No. of species per genus in VU				
					1a	1b	2	3	4
RHAMNACEAE	1	1	<i>Ziziphus</i>	1	1	1	1		1
RUBIACEAE	1	1	<i>Kohautia</i>	1		1		1	1
SCROPHULARIACEAE	1	2	<i>Aptosimum</i>	1	1		1	1	
			<i>Peliostomum</i>	1	1				
SOLANACEAE	1	2	<i>Lycium</i>	2	2	2	2	1	1
			<i>Solanum</i>	2	2	1	2	1	
STERCULIACEAE	1	3	<i>Hermannia</i>	2	1	1	1	2	
			<i>Melhania</i>	1			1		
			<i>Waltheria</i>	1			1		1
THYMELAEACEAE	1	1	<i>Gnidia</i>	1				1	
TILIACEAE	1	1	<i>Grewia</i>	1	1	1		1	1
VAHLIACEAE	1	1	<i>Vahlia</i>	1					1
VERBENACEAE	1	1	<i>Chascanum</i>	1	1	1	1		
VIOLACEAE	1	1	<i>Hybanthus</i>	1	1			1	
VITACEAE	1	1	<i>Cyphostemma</i>	1	1				
ZYGOPHYLLACEAE	1	1	<i>Tribulus</i>	2	1	1	1	2	
Sub-Total:	37	95		118	63	47	60	50	27
Total:	46	122		162	88	65	80	65	42

Table 12-2: Woody Species – ANGIOSPERMAE – Dicotyledonae

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT					
			AFRIKAANS	ENGLISH			1a	1b	2	3	4	
ANACARDIACEAE	<i>Searsia lancea</i> L.f.	Tree	Karee	Karee		C						X
ASTERACEAE	<i>Tarchonanthus camphoratus</i> L.	Tree	Wildekanferbos	Wild camphor bush		M	X	X	X	X		
BIGNONIACEAE	<i>Rhigozum trichotomum</i> Burch.	Tree	Driedoring				X	X	X	X		
BORAGINACEAE	<i>Ehretia rigida</i> (Thunb.) Druce subsp. <i>rigida</i>	Tree	Deurmekaarbos	Puzzle-bush		F/C	X	X	X	X		
CAPPARACEAE	<i>Boscia albitrunca</i> (Burch.) Gilg & Gilg-Ben.	Tree	Witgat	Shepherd's Tree	P(SA), P(NC)	M/F/C	X	X	X			X
CAPPARACEAE	<i>Cadaba aphylla</i> (Thunb.) Wild	Tree / shrub	Swartstormbos / Gifhoutjie	Leafless Cadaba		M	X		X			
EBENACEAE	<i>Diospyros lycioides</i> Desf.	Tree	Bloubos	Bluebush		M/F/C	X			X	X	
EBENACEAE	<i>Euclea crispa</i> (Thunb.) Gürke	Tree / shrub	Blougwarrie	Blue Guarri		M/F			X			
FABACEAE	<i>Acacia erioloba</i> E.Mey.	Tree	Kameeldoring	Camel Thorn	D, P(SA)	M/F/C	X	X		X		
FABACEAE	<i>Acacia haematoxylon</i> Willd.	Tree	Vaalkameeldoring	Grey Camel Thorn	P(SA)					X		
FABACEAE	<i>Acacia hebeclada</i> DC. subsp. <i>hebeclada</i>	Tree	Trassiedoring	Candle Thorn			X	X	X	X	X	
FABACEAE	<i>Acacia mellifera</i> (Vahl) Benth. subsp. <i>detinens</i> (Burch.) Brenan	Tree	Swarthaak	Black Thorn		M/C	X	X	X	X	X	
FABACEAE	* <i>Prosopis glandulosa</i> Torr. var. <i>torreyana</i> (Benson) Johnst.	Tree	*Heuningprosopis	*Honey Mesquite	C2 / N2				X			X
RHAMNACEAE	<i>Ziziphus mucronata</i> Willd. subsp. <i>mucronata</i>	Tree	Blinkblaar-wag-'n-bietjie	Buffalo-thorn		M/F/C	X	X	X			X
SOLANACEAE	<i>Lycium cinereum</i> Thunb.	Shrub	Kleinkriedoring / Slangbessie	Small Honey-thorn		C	X	X	X	X	X	

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT				
			AFRIKAANS	ENGLISH			1a	1b	2	3	4
SOLANACEAE	<i>Lycium hirsutum</i> Dunal	Shrub	Rivierkareedoring / Wolwedoring				X	X	X		
TILIACEAE	<i>Grewia flava</i> DC.	Tree	Fluweelrosyntjie	Velvet Raisin		F/C	X	X		X	X

Table 12-3: Graminoids – ANGIOSPERMAE – Monocotyledonae

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT				
			AFRIKAANS	ENGLISH			1a	1b	2	3	4
CYPERACEAE	<i>Bulbostylis hispidula</i> (Vahl) R.W.Haines subsp. <i>pyriformis</i> (Lye) R.W.Haines	Herb, cyperoid		Veld Bulrush					X	X	
POACEAE	<i>Aristida congesta</i> Roem. & Schult. subsp. <i>Congesta</i>	Grass	Katstertsteekgras	Tassel Three-awn			X	X	X		
POACEAE	<i>Aristida meridionalis</i> Henrard	Grass	Langbeensteekgras	Giant Three-awn					X	X	
POACEAE	<i>Cenchrus ciliaris</i> L.	Grass	Bloubuffelgras	Foxtail Buffalo Grass			X	X	X	X	X
POACEAE	<i>Centropodia glauca</i> (Nees) Cope	Grass	Gha-gras	Gha Grass						X	
POACEAE	<i>Chloris virgata</i> Sw.	Grass	Witpluim-chloris	Feather-top chloris			X				X
POACEAE	<i>Cymbopogon pospischilii</i> (K.Schum.) C.E. Hubb.	Grass	Smalblaar- terpentyngras	Narrow-leaved Turpentine Grass			X		X		
POACEAE	<i>Echinochloa holubii</i> (Stapf) Stapf	Grass	Kalahari Watergras	Kalahari Water Grass							X
POACEAE	<i>Eragrostis biflora</i> Hack. ex Schinz	Grass	Skadu-eragrostis	Shade Eragrostis				X			X
POACEAE	<i>Eragrostis lehmanniana</i> Nees var. <i>lehmanniana</i>	Grass	Knietjiesgras	Lehmann's Love Grass		C	X			X	
POACEAE	<i>Eragrostis rigidior</i> Pilg.	Grass	Breë Krulblaar	Broad Curly-leaf			X		X		

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT				
			AFRIKAANS	ENGLISH			1a	1b	2	3	4
POACEAE	<i>Eragrostis rotifer</i> Rendle	Grass	Reëngras	Pearly Love Grass							X
POACEAE	<i>Eragrostis trichophora</i> Coss. & Durieu	Grass	Harige Pluimgras	Hairy Love Grass			X	X	X		X
POACEAE	<i>Heteropogon contortus</i> (L.) Roem. & Schult.	Grass	Assegaaigras	Spear Grass					X		X
POACEAE	<i>Leptochloa fusca</i> (L.) Kunth	Grass	Kuilgras	Swamp Grass							X
POACEAE	<i>Panicum impeditum</i> Launert	Grass									X
POACEAE	<i>Panicum lanipes</i> Mez	Grass	Wolvoet-panicum								X
POACEAE	<i>Panicum maximum</i> Jacq.	Grass	Buffelsgras	Guinea Grass				X			X
POACEAE	<i>Schmidtia pappophoroides</i> Steud.	Grass	Sandkweek	Sand Quick			X	X	X	X	
POACEAE	<i>Setaria verticillata</i> (L.) P.Beauv.	Grass	Klitsgras	Bur Bristle Grass				X			X
POACEAE	<i>Sporobolus fimbriatus</i> (Trin.) Nees	Grass	Fynsaadgras	Dropseed Grass				X			X
POACEAE	<i>Stipagrostis ciliata</i> (Desf.) De Winter var. <i>capensis</i> (Trin. & Rupr.) De Winter	Grass	Langbeen-boesmangras	Tall Bushman Grass			X			X	
POACEAE	<i>Stipagrostis uniplumis</i> (Licht.) De Winter var. <i>uniplumis</i>	Grass	Blinkblaar-boesmangras	Silky Bushman Grass			X	X	X	X	X
POACEAE	<i>Tragus berteronianus</i> Schult.	Grass	Kousklits	Carrot-seed Grass			X	X	X		X
POACEAE	<i>Urochloa mosambicensis</i> (Hack.) Dandy	Grass	Bosveldbeesgras	Bushveld Signal Grass			X	X			

Table 12-4: Herbaceous Shrubs & Forbs – ANGIOSPERMAE – Monocotyledonae

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT					
			AFRIKAANS	ENGLISH			1a	1b	2	3	4	
AMARYLLIDACEAE	<i>Ammocharis coranica</i> (Ker-Gawl.) Herb.	Geophyte	Seeroogblom / Berglelie	Ground Lily	P(NC)	M	X					
AMARYLLIDACEAE	<i>Boophone disticha</i> (L.f.) Herb.	Herb, geophyte	Kopseerblom / Gifbol	Poison Bulb	D; P(NC)	M/C		X			X	
AMARYLLIDACEAE	<i>Nerine laticoma</i> (Ker Gawl.) T.Durand & Schinz	Geophyte			P(NC)	M	X			X		
ASPARAGACEAE	<i>Asparagus bechuanicus</i> Baker	Herbaceous shrub						X	X	X		
ASPARAGACEAE	<i>Asparagus cooperi</i> Baker	Herbaceous shrub	Katbos				X	X				
ASPARAGACEAE	<i>Asparagus nelsii</i> Schinz	Herbaceous shrub	Sandveldkatbos			F	X	X	X	X		
ASPHODELACEAE	<i>Aloe hereroensis</i> Engl. var. <i>hereroensis</i>	Succulent shrub	Sandaalwyn / Vlake-aalwyn		P(NC)		X			X		
COMMELINACEAE	<i>Commelina africana</i> L. var. <i>lancispatha</i> C.B.Clarke	Herb	Geeleendagsblom	Yellow Commelina		M	X					
COMMELINACEAE	<i>Commelina erecta</i> L.	Herb	Blouselblommetjie	Blue Commelina							X	
DRACAENACEAE	<i>Sansevieria aethiopica</i> Thunb.	Geophyte	Skoonma-se-tong	Mother-in-law's Tongue		M/C	X					
ERIOSPERMACEAE	<i>Eriospermum</i> species	Geophyte					X	X	X			
ERIOSPERMACEAE	<i>Eriospermum flagelliforme</i> (Baker) J.C.Manning	Geophyte									X	
HYACINTHACEAE	<i>Dipcadi</i> c.f. <i>gracillimum</i> Baker	Geophyte	Ouma-se-groottoon							X	X	
HYACINTHACEAE	<i>Dipcadi platyphyllum</i> Baker	Geophyte	Breëblaar-skaamblommetjie	Crinkle-leaved Dipcadi			X	X	X			
HYACINTHACEAE	<i>Dipcadi</i> species	Geophyte					X	X				
HYACINTHACEAE	<i>Ledebouria revoluta</i> (L.f.) Jessop	Geophyte		Common Ledebouria		M/C				X		

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT					
			AFRIKAANS	ENGLISH			1a	1b	2	3	4	
HYACINTHACEAE	<i>Ledebouria undulata</i> (Jacq.) Jessop	Geophyte				M	X		X	X		
HYACINTHACEAE	<i>Ornithogalum</i> c.f. <i>seineri</i> (Engl. & K.Krause) Oberm.	Geophyte			P(NC)		X					
HYACINTHACEAE	<i>Ornithogalum</i> species	Geophyte			P(NC)		X					

Table 12-5: Herbaceous Shrubs & Forbs – ANGIOSPERMAE – Dicotyledonae

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT					
			AFRIKAANS	ENGLISH			1a	1b	2	3	4	
ACANTHACEAE	<i>Barleria rigida</i> Nees	Dwarf shrub	Skerpioendissel	Scorpion Thistle			X		X			
ACANTHACEAE	<i>Blepharis integrifolia</i> (L.f.) E.Mey. ex Schinz	Herb	Rankklits				X					
AIZOACEAE	<i>Plinthus</i> c.f. <i>sericeus</i> Pax	Dwarf shrub	Sandganna								X	
AMARANTHACEAE	* <i>Achyranthes aspera</i> L. var. <i>aspera</i>	Herb	*Langklits / Haak-en-steek-klitsbossie	*Burrweed / Chaff Flower	E	M		X				
AMARANTHACEAE	* <i>Alternanthera sessilis</i> (L.) DC.	Herb			E							X
AMARANTHACEAE	* <i>Gomphrena celosioides</i> Mart.	Herb	*Mierbossie	*Batchelor's Button	E							X
AMARANTHACEAE	<i>Kyphocarpa angustifolia</i> (Moq.) Lopr.	Herb							X			
AMARANTHACEAE	<i>Pupalia lappacea</i> (L.) A.Juss. var. <i>lappacea</i>	Herb, climber	Bosklits	Forest Burr				X	X			
APOCYNACEAE	<i>Duvalia</i> species	Succulent herb	Klein Aasblom	Small Carrion Flower	P(NC)				X			
APOCYNACEAE	<i>Gomphocarpus fruticosus</i> (L.) Aiton f. subsp. <i>fruticosus</i>	Herbaceous shrub	Melkbos / Balbossie	Milkweed	P(NC)		X		X			

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT					
			AFRIKAANS	ENGLISH			1a	1b	2	3	4	
APOCYNACEAE	<i>Huernia longituba</i> N.E.Br.	Succulent			P(NC)		X					
APOCYNACEAE	<i>Orbea lutea</i> (N.E.Br.) Bruyns subsp. <i>lutea</i>	Succulent herb	Geelaasblom / Kopseerblom	Yellow Carrion Flower	P(NC)				X			
APOCYNACEAE	<i>Orthanthera jasminiflora</i> (Decne.) Schinz	Succulent creeper	Sandmelktou	Jasmine Creeper	P(NC)	F					X	
APOCYNACEAE	<i>Pergularia daemia</i> (Forssk.) Chiov. var. <i>daemia</i>	Herb, climber		Trellis Vine		M	X	X	X			
APOCYNACEAE	<i>Sarcostemma viminale</i> (L.) R.Br. subsp. <i>viminale</i>	Succulent climber	Melktou /Wolfsmelk	Caustic Vine	P(NC)	M			X			
APOCYNACEAE	<i>Tridentea marientalensis</i> (Nel) L.C.Leach subsp. <i>Marientalensis</i>	Succulent herb	Kopseer		P(NC)	F		X				
ASTERACEAE	* <i>Bidens bipinnata</i> L.	Herb	*Spaanse knapsekêrel	*Spanish Blackjack	E	F		X				
ASTERACEAE	<i>Dicoma capensis</i> Less.	Herb	Karmedik			M	X	X			X	
ASTERACEAE	<i>Dicoma</i> species	Herb							X			
ASTERACEAE	<i>Felicia filifolia</i> (Vent.) Burtt Davy subsp. <i>Filifolia</i>	Dwarf shrub	Draaibossie	Needle-leafed Felicia							X	
ASTERACEAE	<i>Felicia muricata</i> (Thunb.) Nees subsp. <i>muricata</i>	Herb	Bloublommetjie			M/C			X			
ASTERACEAE	<i>Geigeria ornativa</i> O.Hoffm.	Herb	Vermeerbos				X	X	X	X	X	X
ASTERACEAE	<i>Kleinia longiflora</i> DC.	Succulent shrub	Sambokbos			M	X		X			
ASTERACEAE	<i>Pteronia viscosa</i> Thunb.	Dwarf shrub	Gombossie						X			
ASTERACEAE	* <i>Schkuhria pinnata</i> (Lam.) Cabrera	Herb	*Kleinkakiebos	*Dwarf Marigold	E			X				X
ASTERACEAE	* <i>Tagetes minuta</i> L.	Herb	*Kakiebos	*Khaki Weed	E			X				X
BORAGINACEAE	<i>Heliotropium ciliatum</i> Kaplan	Herb					X	X	X	X		
BORAGINACEAE	<i>Heliotropium</i> species	Herb					X		X			X

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT				
			AFRIKAANS	ENGLISH			1a	1b	2	3	4
CAPPARACEAE	<i>Cleome monophylla</i> L.	Herb	Rusperbossie	Spindlepod		M/C/F	X	X			
CAPPARACEAE	<i>Cleome rubella</i> Burch.	Herb	Mooinoientjie	Pretty Lady			X	X	X		
CHENOPODIACEAE	* <i>Chenopodium carinatum</i> R.Br.	Herb	*Groenhondebossie	*Green Goosefoot	E			X			
CHENOPODIACEAE	<i>Salsola</i> species	Dwarf shrub					X				
CONVOLVULACEAE	<i>Convolvulus ocellatus</i> Hook.f. var. <i>ocellatus</i>	Herb, climber								X	
CONVOLVULACEAE	<i>Evolvulus alsinoides</i> (L.) L.	Herb		Blue Haze		M			X		
CONVOLVULACEAE	<i>Ipomoea bolusiana</i> Schinz subsp. <i>bolusiana</i>	Herb / dwarf shrub		Narrow-leaved Pink Ipomoea		F	X	X	X	X	
CONVOLVULACEAE	<i>Merremia verecunda</i> Rendle (1)	Herb, climber								X	
CONVOLVULACEAE	<i>Seddera suffruticosa</i> (Schinz) Hallier f.	Herb							X		
CRASSULACEAE	<i>Kalanchoe paniculata</i> Harv.	Succulent herb	Hasia-oor / Krimpsiektebos	Large Orange Kalanchoe			X		X		
CUCURBITACEAE	<i>Acanthosicyos naudinianus</i> (Sond.) C.Jeffrey	Prostrate herb	Gemsbok-komkommer	Gemsbok Cucumber		M/F	X			X	
CUCURBITACEAE	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	Herb, climber	Karkoer / Tsamma	Tsamma		F/C	X	X		X	
CUCURBITACEAE	<i>Cucumis zeyheri</i> Sond.	Herb, climber	Wildekommommer	Wild Cucumber		M/F	X	X	X	X	
CUCURBITACEAE	<i>Trochomeria debilis</i> (Sond.) Hook.f.	Herb, climber	Laloentjie				X	X		X	
EUPHORBIACEAE	<i>Acalypha indica</i> L.	Herb / Dwarf shrub					X				
EUPHORBIACEAE	<i>Euphorbia inaequilatera</i> Sond. var. <i>inaequilatera</i>	Herb	Rooi-opslag	Smooth Creeping Milkweed			X			X	X
EUPHORBIACEAE	<i>Euphorbia</i> c.f. <i>mauritanica</i> L.	Succulent shrub	Geelmelkbos / Gifmelkbos		P(NC)		X				

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT					
			AFRIKAANS	ENGLISH			1a	1b	2	3	4	
EUPHORBIACEAE	<i>Jatropha erythropoda</i> Pax & K.Hoffm.	Herbaceous shrub	Rooikambro				X					
EUPHORBIACEAE	<i>Phyllanthus loandensis</i> Welw. ex Müll.Arg.	Herb					X	X			X	
EUPHORBIACEAE	<i>Phyllanthus maderaspatensis</i> L.	Herb	Skilpadbossie				X	X	X	X	X	
FABACEAE	<i>Elephantorrhiza elephantina</i> (Burch.) Skeels	Dwarf shrub	Baswortel	Dwarf Elephant-root		M/C	X				X	
FABACEAE	<i>Hoffmannseggia burchellii</i> (DC.) Benth. Ex Oliv. subsp. <i>Burchellii</i>	Dwarf shrub, herb									X	
FABACEAE	<i>Indigofera alternans</i> DC. var. <i>alternans</i>	Herb	Skaapertjie / Klipertjie				X	X			X	
FABACEAE	<i>Indigofera charlieriana</i> Schinz var. <i>charlieriana</i>	Herb					X	X				
FABACEAE	<i>Lotononis</i> species	Herb										X
FABACEAE	<i>Requienia sphaerosperma</i> DC.	Herb									X	
FABACEAE	<i>Rhynchosia totta</i> (Thunb.) DC. var. <i>totta</i>	Herb, climber				F		X				X
FABACEAE	<i>Senna italica</i> Mill. subsp. <i>arachoides</i> (Burch.) Lock	Herb	Elandsertjie	Eland's Pea		M	X	X			X	
FABACEAE	<i>Sphenostylis angustifolia</i> Sond.	Herb	Wilde-ertjie	Wild sweetpea		M	X				X	
FABACEAE	<i>Tephrosia purpurea</i> (L.) Pers.	Herb		Silver Tephrosia			X	X	X	X		
FABACEAE	<i>Tephrosia</i> species	Herb							X			
GISEKIACEAE	<i>Gisekia africana</i> (Lour.) Kuntze var. <i>africana</i>	Herb					X				X	X
ILLECEBRACEAE	<i>Pollichia campestris</i> Ait.	Herbaceous shrub	Teesuikerbossie	Waxberry / Barley Sugar Bush		F	X	X	X	X		
LAMIACEAE	<i>Becium angustifolium</i> (Benth.) N.E.Br.	Herb							X			

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT				
			AFRIKAANS	ENGLISH			1a	1b	2	3	4
LAMIACEAE	<i>Leucas capensis</i> (Benth.) Engl.	Herb / shrub							X		
MALVACEAE	<i>Abutilon</i> c.f. <i>angulatum</i> (Guill. & Perr.) Mast. var. <i>angulatum</i>	Herb						X	X		
MALVACEAE	<i>Hibiscus</i> c.f. <i>engleri</i> K.Schum.	Herb	Wildehibiskus	Wild Hibiscus					X		
MALVACEAE	<i>Hibiscus pusillus</i> Thunb.	Herb		Dwarf Hibiscus		C			X		
MALVACEAE	<i>Hibiscus sidiformis</i> Baill.	Herb							X		
MALVACEAE	<i>Pavonia burchellii</i> (DC.) R.A.Dyer	Herb		Dainty Pavonia			X	X			
MALVACEAE	<i>Sida dregei</i> Burt Davy	Herb	Verdompsterk						X		
MOLLUGINACEAE	<i>Corbichonia decumbens</i> (Forssk.) Exell	Herb							X		X
MOLLUGINACEAE	<i>Limeum fenestratum</i> (Fenzl) Heimerl var. <i>fenestratum</i>	Herb					X	X			
MOLLUGINACEAE	<i>Limeum sulcatum</i> (Klotzsch) Hutch var. <i>sulcatum</i>	Herb	Kloosaarbossie						X		
MOLLUGINACEAE	<i>Limeum viscosum</i> (J.Gay) Fenzl subsp. <i>viscosum</i> var. <i>viscosum</i>	Herb	Kloosaarbossie				X	X		X	
MOLLUGINACEAE	<i>Mollugo cerviana</i> (L.) Ser. ex DC. var. <i>cerviana</i>	Herb		Thread-stem Carpetweed			X				X
PEDALIACEAE	<i>Ceratotheca triloba</i> (Bernh.) Hook.f.	Herb	Wildevingerhoedjie	Wild Foxglove		M		X	X		
PEDALIACEAE	<i>Harpagophytum procumbens</i> (Burch.) DC. ex Meisn. subsp. <i>procumbens</i>	Herb	Duiwelsklou / Ghamaghoe	Devil's Claw / Grapple Plant	TOPS, SP(NC)	M/C	X			X	
PEDALIACEAE	<i>Sesamum triphyllum</i> Welw. ex Asch. var. <i>triphyllum</i>	Herb	Wildsesesam	Wild Sesame		F	X	X	X	X	X
POLYGALACEAE	<i>Polygala hottentotta</i> Presl.	Herb		Small Purple Broom		M/C			X		
POLYGALACEAE	<i>Polygala leptophylla</i> Burch.	Dwarf shrub				M			X		

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT				
			AFRIKAANS	ENGLISH			1a	1b	2	3	4
POLYGONACEAE	<i>Oxygonum delagoense</i> Kuntze	Herb	Menssuuring	Salt-of-the-tortoise		M/F				X	
POLYGONACEAE	<i>Oxygonum</i> c.f. <i>sinuatum</i> (Hochst. & Steud. ex Meisn.) Dammer	Herb	Dubbeltjie							X	
PORTULACACEAE	<i>Portulaca kermesina</i> N.E.Br.	Succulent							X		
PORTULACACEAE	<i>Portulaca quadrifida</i> L.	Succulent	Porslein	Purslane / Pigweed							X
PORTULACACEAE	<i>Talinum caffrum</i> (Thunb.) Eckl. & Zeyh.	Succulent herb	Ystervarkwortel	Porcupine Root		M/F	X		X		
PORTULACACEAE	<i>Talinum crispatum</i> Dinter ex Poelln.	Succulent herb	Wildevygjie			M/F	X			X	
RUBIACEAE	<i>Kohautia caespitosa</i> Schinizl. Subsp. <i>brachyloba</i> (Sond.) D.Mantell	Herb						X		X	X
SCROPHULARIACEAE	<i>Aptosimum albomarginatum</i> Marloth & Engl.	Dwarf shrub	Koegab				X		X	X	
SCROPHULARIACEAE	<i>Peliostomum leucorrhizum</i> E.Mey. ex Benth.	Dwarf shrub	Springbokkos / Karooviooltjie	Veld Violet			X				
SOLANACEAE	<i>Solanum incanum</i> L.	Herbaceous shrub	Bitterappel	Bitter Apple		M	X		X		
SOLANACEAE	<i>Solanum supinum</i> Dunal var. <i>supinum</i>	Herb					X	X	X	X	
STERCULIACEAE	<i>Hermannia modesta</i> (Ehrenb.) Mast.	Herb					X	X		X	
STERCULIACEAE	<i>Hermannia tomentosa</i> (Turcz.) Schinz ex Engl.	Herbaceous shrub							X	X	
STERCULIACEAE	<i>Melhaniania rehmannii</i> Szyszyl.	Herb							X		
STERCULIACEAE	<i>Waltheria indica</i> L.	Herb	Meidebossie						X		X
THYMELAEACEAE	<i>Gnidia polycephala</i> (C.A.Mey.) Gilg	Herb	Januariebos							X	

FAMILY	SPECIES NAME	GROWTH FORM	COMMON NAME		SPECIES STATUS	SOCIAL USE	VEGETATION UNIT					
			AFRIKAANS	ENGLISH			1a	1b	2	3	4	
VAHLIACEAE	<i>Vahlia capensis</i> (L.f.) Thunb. subsp. <i>vulgaris</i> Bridson var. <i>linearis</i> E. Mey. ex. Bridson	Herb										X
VERBENACEAE	<i>Chascanum pinnatifidum</i> (L.f.) E.Mey.	Herb					X	X	X			
VIOLACEAE	<i>Hybanthus</i> c.f. <i>densifolius</i> Engl.	Herb		Lady's Slipper			X				X	
VITACEAE	<i>Cyphostemma segmentatum</i> (C.A.Sm.) J.J.M. van der Merwe	Succulent, scrambler				M	X					
ZYGOPHYLLACEAE	<i>Tribulus terrestris</i> L.	Herb	Dubbeltjie	Devil's Thorn			X	X	X	X		
ZYGOPHYLLACEAE	<i>Tribulus zeyheri</i> Sond. subsp. <i>zeyheri</i>	Herb	Grootblomdubbeltjie	Devil's Thorn							X	

Table 12-6: Species list downloaded from POSA (<http://posa.sanbi.org>) on March 31, 2016, 2:29 pm for QDS 2723 AA and 2723 AC

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
ACANTHACEAE	<i>Barleria irritans</i> Nees	LC	No	Dwarf shrub, herb	Perennial
ACANTHACEAE	<i>Blepharis integrifolia</i> (L.f.) E.Mey. ex Schinz var. <i>integrifolia</i>	LC	No	Herb	Perennial
ACANTHACEAE	<i>Glossochilus burchellii</i> Nees	LC	No	Herb	Perennial
ACANTHACEAE	<i>Hypoestes forskoolii</i> (Vahl) R.Br.	LC	No	Herb	Perennial
ACANTHACEAE	<i>Justicia puberula</i> Immelman	LC	No	Dwarf shrub, herb	Perennial
ACANTHACEAE	<i>Monechma divaricatum</i> (Nees) C.B.Clarke	LC	No	Shrub, suffrutex	Perennial
AIZOACEAE	<i>Plinthus karooicus</i> I.Verd.	LC	No	Dwarf shrub	Perennial
AIZOACEAE	<i>Galenia meziana</i> K.Müll.	LC	No	Dwarf shrub	Perennial
AIZOACEAE	<i>Plinthus sericeus</i> Pax	LC	No	Dwarf shrub	Perennial
AIZOACEAE	<i>Tetragonia calycina</i> Fenzl	LC	No	Dwarf shrub, succulent	Perennial

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
AIZOACEAE	<i>Trianthema parvifolia</i> E.Mey. ex Sond. var. <i>parvifolia</i>	LC	No	Herb, succulent	Annual
AMARANTHACEAE	* <i>Gomphrena celosioides</i> Mart.	Not Evaluated	No	Herb	Perennial
AMARANTHACEAE	<i>Hermbstaedtia odorata</i> (Burch.) T.Cooke var. <i>odorata</i>	LC	No	Herb	Perennial
AMARANTHACEAE	<i>Kyphocarpa angustifolia</i> (Moq.) Lopr.	LC	No	Herb	Annual
AMARANTHACEAE	<i>Pupalia lappacea</i> (L.) A.Juss. var. <i>lappacea</i>	LC	No	Herb	Annual
AMARANTHACEAE	<i>Sericorema remotiflora</i> (Hook.f.) Lopr.	LC	No	Herb	Perennial
AMARANTHACEAE	<i>Sericorema sericea</i> (Schinz) Lopr.	LC	No	Herb	Annual
ANACARDIACEAE	<i>Searsia tridactyla</i> (Burch.) Moffett	LC	No	Shrub, tree	Perennial
ANACARDIACEAE	<i>Searsia lancea</i> (L.f.) F.A.Barkley	LC	No	Shrub, tree	Perennial
APIACEAE	<i>Deverra burchellii</i> (DC.) Eckl. & Zeyh.	LC	No	Shrub	Perennial
APIACEAE	<i>Berula thunbergii</i> (DC.) H.Wolff	LC	No	Herb, hydrophyte	Perennial
APOCYNACEAE	<i>Microlooma armatum</i> (Thunb.) Schltr. var. <i>burchellii</i> (N.E.Br.) Bruyns	LC	No	Dwarf shrub, shrub	Perennial
APOCYNACEAE	<i>Raphionacme velutina</i> Schltr.	LC	No	Geophyte, herb, succulent	Perennial
ASPARAGACEAE	<i>Asparagus laricinus</i> Burch.	LC	No	Shrub	Perennial
ASPARAGACEAE	<i>Asparagus retrofractus</i> L.	LC	No	Scrambler, shrub	Perennial
ASPARAGACEAE	<i>Asparagus exuvialis</i> Burch. forma <i>exuvialis</i>	Not Evaluated	No	Shrub	Perennial
ASPARAGACEAE	<i>Asparagus nelsii</i> Schinz	LC	No	Shrub	Perennial
ASPARAGACEAE	<i>Asparagus suaveolens</i> Burch.	LC	No	Shrub	Perennial
ASTERACEAE	<i>Dicoma macrocephala</i> DC.	LC	No	Herb	Perennial
ASTERACEAE	<i>Dicoma schinzii</i> O.Hoffm.	LC	No	Herb	Perennial
ASTERACEAE	<i>Gazania krebsiana</i> Less. subsp. <i>arctotoides</i> (Less.) Roessler	LC	No	Herb	Perennial
ASTERACEAE	<i>Geigeria ornativa</i> O.Hoffm. subsp. <i>ornativa</i>	LC	No	Herb	Annual (occ. perennial)
ASTERACEAE	<i>Amellus tridactylus</i> DC. subsp. <i>arenarius</i> (S.Moore) Rommel	LC	No	Herb	Annual
ASTERACEAE	* <i>Aster squamatus</i> (Spreng.) Hieron.	Not Evaluated	No	Herb	Annual

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
ASTERACEAE	<i>Felicia fascicularis</i> DC.	LC	No	Shrub	Perennial
ASTERACEAE	<i>Felicia namaquana</i> (Harv.) Merxm.	LC	No	Herb	Annual
ASTERACEAE	<i>Geigeria filifolia</i> Mattf.	LC	No	Herb	Annual (occ. perennial)
ASTERACEAE	<i>Kleinia longiflora</i> DC.	LC	No	Shrub, succulent	Perennial
ASTERACEAE	<i>Osteospermum muricatum</i> E.Mey. ex DC. subsp. <i>muricatum</i>	LC	No	Herb	Perennial
ASTERACEAE	* <i>Pseudognaphalium luteo-album</i> (L.) Hilliard & B.L.Burt		No	Herb	Annual
ASTERACEAE	<i>Pulicaria scabra</i> (Thunb.) Druce	LC	No	Herb	Annual
BORAGINACEAE	<i>Heliotropium nelsonii</i> C.H.Wright	LC	No	Herb	Perennial
BORAGINACEAE	<i>Heliotropium strigosum</i> Willd.	LC	No	Herb	Annual (occ. perennial)
CAMPANULACEAE	<i>Wahlenbergia androsacea</i> A.DC.	LC	No	Herb	Annual
CAPPARACEAE	<i>Cleome angustifolia</i> Forssk. subsp. <i>diandra</i> (Burch.) Kers	LC	No	Herb	Perennial
CARYOPHYLLACEAE	<i>Pollichia campestris</i> Aiton	LC	No	Herb	Perennial
CARYOPHYLLACEAE	* <i>Spargularia media</i> (L.) C.Presl	Not Evaluated	No	Herb	Perennial
CELASTRACEAE	<i>Gymnosporia buxifolia</i> (L.) Szyszyl.	LC	No	Shrub, tree	Perennial
CELASTRACEAE	<i>Putterlickia saxatilis</i> (Burch.) M.Jordaan	LC	No	Shrub	Perennial
CHENOPODIACEAE	<i>Atriplex semibaccata</i> R.Br. var. <i>appendiculata</i> Aellen	LC	No	Dwarf shrub	Annual (occ. perennial)
CHENOPODIACEAE	* <i>Chenopodium ambrosioides</i> L.	Not Evaluated	No	Herb	Annual
CHENOPODIACEAE	<i>Salsola rabieana</i> I.Verd.	LC	No	Dwarf shrub, shrub	Perennial
COLCHICACEAE	<i>Ornithoglossum vulgare</i> B.Nord.	LC	No	Geophyte (fern)	Perennial
COMBRETACEAE	<i>Terminalia sericea</i> Burch. ex DC.	LC	No	Tree	Perennial
COMMELINACEAE	<i>Commelina livingstonii</i> C.B.Clarke	LC	No	Herb	Perennial
CONVOLVULACEAE	<i>Convolvulus ocellatus</i> Hook.f. var. <i>ocellatus</i>	LC	No	Herb	Perennial
CONVOLVULACEAE	<i>Ipomoea obscura</i> (L.) Ker Gawl. var. <i>obscura</i>	LC	No	Herb	Perennial
CONVOLVULACEAE	<i>Seddera capensis</i> (E.Mey. ex Choisy) Hallier f.	LC	No	Suffrutex	Perennial

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
CONVOLVULACEAE	<i>Xenostegia tridentata</i> (L.) D.F.Austin & Staples subsp. <i>angustifolia</i> (Jacq.) Lejoly & Lisowski	LC	No	Herb	Perennial
CONVOLVULACEAE	<i>Evolvulus alsinoides</i> (L.) L.	LC	No	Herb	Annual (occ. perennial)
CUCURBITACEAE	<i>Acanthosicyos naudinianus</i> (Sond.) C.Jeffrey	LC	No	Herb, succulent	Perennial
CUCURBITACEAE	<i>Corallocarpus triangularis</i> Cogn.	LC	No	Climber, herb, succulent	Perennial
CUCURBITACEAE	<i>Cucumis myriocarpus</i> Naudin subsp. <i>myriocarpus</i>	LC	No	Herb	Annual
CUCURBITACEAE	<i>Coccinia rehmannii</i> Cogn.	LC	No	Climber, herb, succulent	Perennial
CUCURBITACEAE	<i>Trochomeria debilis</i> (Sond.) Hook.f.	LC	No	Climber, herb, succulent	Perennial
CYPERACEAE	<i>Bulbostylis burchellii</i> (Ficalho & Hiern) C.B.Clarke	LC	No	Cyperoid, herb, mesophyte	Perennial
CYPERACEAE	<i>Bulbostylis hispidula</i> (Vahl) R.W.Haines subsp. <i>pyriformis</i> (Lye) R.W.Haines	LC	No	Cyperoid, herb, mesophyte	Annual
CYPERACEAE	<i>Cyperus margaritaceus</i> Vahl var. <i>margaritaceus</i>	LC	No	Cyperoid, herb, mesophyte	Perennial
CYPERACEAE	<i>Cyperus marlothii</i> Boeckeler	LC	No	Cyperoid, herb, mesophyte	Perennial
CYPERACEAE	<i>Bolboschoenus maritimus</i> (L.) Palla	LC	No	Cyperoid, emergent hydrophyte, helophyte, herb	Perennial
CYPERACEAE	<i>Cyperus longus</i> L. var. <i>tenuiflorus</i> (Rottb.) Boeck.	LC	No	Cyperoid, helophyte, herb	Perennial
CYPERACEAE	<i>Scirpoides dioeca</i> (Kunth) Browning	LC	No	Cyperoid, herb, mesophyte	Perennial
ELATINACEAE	<i>Bergia anagalloides</i> E.Mey. ex Fenzl	LC	No	Herb	Annual
EUPHORBIACEAE	<i>Euphorbia inaequilatera</i> Sond. var. <i>inaequilatera</i>	LC	No	Dwarf shrub, herb	Annual
EUPHORBIACEAE	<i>Euphorbia duseimata</i> R.A.Dyer	LC	No	Dwarf shrub, succulent	Perennial

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
EUPHORBIACEAE	<i>Euphorbia pseudotuberosa</i> Pax	LC	No	Dwarf shrub, succulent	Perennial
EUPHORBIACEAE	<i>Euphorbia wilmaniae</i> Marloth	LC	No	Dwarf shrub, succulent	Perennial
EUPHORBIACEAE	<i>Tragia dioica</i> Sond.	LC	No	Dwarf shrub, herb	Perennial
FABACEAE	<i>Elephantorrhiza elephantina</i> (Burch.) Skeels	LC	No	Dwarf shrub, shrub, suffrutex	Annual (occ. perennial)
FABACEAE	<i>Indigofera alternans</i> DC. var. <i>alternans</i>	LC	No	Herb	Perennial
FABACEAE	<i>Rhynchosia confusa</i> Burt Davy	Not Evaluated	No	Climber, herb	Perennial
FABACEAE	<i>Rhynchosia totta</i> (Thunb.) DC. var. <i>totta</i>	LC	No	Climber, herb	Perennial
FABACEAE	<i>Rhynchosia venulosa</i> (Hiern) K.Schum.	Not Evaluated	No	Climber, herb	Perennial
FABACEAE	<i>Tephrosia burchellii</i> Burt Davy	LC	No	Herb	Annual (occ. perennial)
FABACEAE	<i>Tephrosia longipes</i> Meisn. subsp. <i>longipes</i> var. <i>longipes</i>	LC	No	Dwarf shrub, herb, shrub	Annual (occ. perennial)
FABACEAE	<i>Tephrosia purpurea</i> (L.) Pers. subsp. <i>leptostachya</i> (DC.) Brummitt var. <i>leptostachya</i>	LC	No	Herb	Annual (occ. perennial)
FABACEAE	<i>Acacia karroo</i> Hayne	LC	No	Shrub, tree	Perennial
FABACEAE	<i>Crotalaria griquensis</i> L.Bolus	LC	No	Herb	Perennial
FABACEAE	<i>Indigofera daleoides</i> Benth. ex Harv. var. <i>daleoides</i>	LC	No	Herb	Perennial
FABACEAE	<i>Melolobium microphyllum</i> (L.f.) Eckl. & Zeyh.	LC	No	Dwarf shrub, shrub	Perennial
FABACEAE	<i>Otoptera burchellii</i> DC.	LC	No	Climber, herb, shrub	Perennial
FABACEAE	<i>Pomaria lactea</i> (Schinz) B.B.Simpson & G.P.Lewis	LC	No	[No lifeform defined]	[No lifecycle defined]
GISEKIACEAE	<i>Gisekia africana</i> (Lour.) Kuntze var. <i>pedunculata</i> (Oliv.) Brenan	Not Evaluated	No	Herb	Annual (occ. perennial)
GISEKIACEAE	<i>Gisekia pharnacioides</i> L. var. <i>pharnacioides</i>	LC	No	Herb	Annual
HYACINTHACEAE	<i>Dipcadi viride</i> (L.) Moench	LC	No	Geophyte	Perennial

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
HYACINTHACEAE	<i>Dipcadi marlothii</i> Engl.	LC	No	Geophyte	Perennial
HYACINTHACEAE	<i>Ledebouria apertiflora</i> (Baker) Jessop	LC	No	Geophyte	Perennial
IRIDACEAE	<i>Babiana hypogaea</i> Burch.	LC	No	Geophyte, herb	Perennial
JUNCEAE	<i>Juncus rigidus</i> Desf.	LC	No	Helophyte, herb	Perennial
LAMIACEAE	<i>Leucas capensis</i> (Benth.) Engl.	LC	No	Dwarf shrub	Perennial
LAMIACEAE	<i>Stachys spathulata</i> Burch. ex Benth.	LC	No	Herb	Perennial
LAMIACEAE	<i>Ocimum americanum</i> L. var. <i>americanum</i>	LC	No	Herb	Perennial
LAMIACEAE	<i>Ocimum filamentosum</i> Forssk.	LC	No	Herb	Perennial
LOBELIACEAE	<i>Lobelia thermalis</i> Thunb.	LC	No	Herb	Perennial
MALVACEAE	<i>Abutilon austro-africanum</i> Hochr.	LC	No	Dwarf shrub	Perennial
MALVACEAE	<i>Grewia flava</i> DC.	LC	No	Shrub	Perennial
MALVACEAE	<i>Hibiscus ludwigii</i> Eckl. & Zeyh.	LC	No	Herb, shrub	Perennial
MALVACEAE	<i>Hibiscus pusillus</i> Thunb.	LC	No	Herb	Perennial
MALVACEAE	<i>Melhania burchellii</i> DC.	LC	No	Herb	Perennial
MALVACEAE	<i>Melhania virescens</i> (K.Schum.) K.Schum.	LC	No	Dwarf shrub	Perennial
MALVACEAE	<i>Sida chrysantha</i> Ulbr.	LC	No	Dwarf shrub	Perennial
MALVACEAE	<i>Sida cordifolia</i> L. subsp. <i>cordifolia</i>	LC	No	Dwarf shrub	Annual (occ. perennial)
MALVACEAE	<i>Hermannia comosa</i> Burch. ex DC.	LC	No	Herb	Perennial
MALVACEAE	<i>Hermannia modesta</i> (Ehrenb.) Mast.	LC	No	Dwarf shrub, herb	Perennial
MALVACEAE	<i>Hermannia tomentosa</i> (Turcz.) Schinz ex Engl.	LC	No	Herb	Perennial
MALVACEAE	<i>Hibiscus engleri</i> K.Schum.	LC	No	Herb	Perennial
MALVACEAE	<i>Hibiscus fleckii</i> Gürke	LC	No	Herb	Perennial
MALVACEAE	<i>Hibiscus micranthus</i> L.f. var. <i>micranthus</i>	LC	No	Herb, shrub	Perennial
MALVACEAE	<i>Sida ovata</i> Forssk.	LC	No	Dwarf shrub, herb	Annual (occ. perennial)
MOLLUGINACEAE	<i>Limeum aethiopicum</i> Burm.f. var. <i>intermedium</i> Friedrich	Not Evaluated	No	[No lifeform defined]	[No lifecycle defined]
MOLLUGINACEAE	<i>Limeum viscosum</i> (J.Gay) Fenzl subsp. <i>transvaalense</i> Friedrich	LC	No	Herb	Annual

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
MONTINIACEAE	<i>Montinia caryophyllacea</i> Thunb.	LC	No	Shrub	Perennial
PHYLLANTHACEAE	<i>Phyllanthus maderaspatensis</i> L.	LC	No	Herb	Annual (occ. perennial)
PHYLLANTHACEAE	<i>Phyllanthus parvulus</i> Sond. var. <i>garipensis</i> (E.Mey. ex Drège) Radcl.-Sm.	LC	No	Dwarf shrub, herb	Perennial
PHYLLANTHACEAE	<i>Phyllanthus parvulus</i> Sond. var. <i>parvulus</i>	LC	No	Dwarf shrub, herb	Perennial
POACEAE	<i>Andropogon chinensis</i> (Nees) Merr.	LC	No	Graminoid	Perennial
POACEAE	<i>Andropogon schirensis</i> Hochst. ex A.Rich.	LC	No	Graminoid	Perennial
POACEAE	<i>Anthephora argentea</i> Gooss.	LC	No	Graminoid	Perennial
POACEAE	<i>Aristida congesta</i> Roem. & Schult. subsp. <i>congesta</i>	LC	No	Graminoid	Perennial
POACEAE	<i>Aristida meridionalis</i> Henrard	LC	No	Graminoid	Perennial
POACEAE	<i>Aristida stipitata</i> Hack. subsp. <i>spicata</i> (De Winter) Melderis	LC	No	Graminoid	Perennial
POACEAE	<i>Aristida vestita</i> Thunb.	LC	No	Graminoid	Perennial
POACEAE	<i>Brachiaria nigropedata</i> (Ficalho & Hiern) Stapf	LC	No	Graminoid	Perennial
POACEAE	<i>Cenchrus ciliaris</i> L.	LC	No	Graminoid	Perennial
POACEAE	<i>Cymbopogon pospischilii</i> (K.Schum.) C.E.Hubb.	Not Evaluated	No	Graminoid	Perennial
POACEAE	<i>Cynodon dactylon</i> (L.) Pers.	LC	No	Graminoid	Perennial
POACEAE	<i>Digitaria polyphylla</i> Henrard	LC	No	Graminoid	Perennial
POACEAE	<i>Elionurus muticus</i> (Spreng.) Kunth	LC	No	Graminoid	Perennial
POACEAE	<i>Enneapogon cenchroides</i> (Licht. ex Roem. & Schult.) C.E.Hubb.	LC	No	Graminoid	Annual (occ. perennial)
POACEAE	<i>Enneapogon scoparius</i> Stapf	LC	No	Graminoid	Perennial
POACEAE	* <i>Eragrostis barrelieri</i> Daveau	Not Evaluated	No	Graminoid	Annual
POACEAE	<i>Eragrostis biflora</i> Hack. ex Schinz	LC	No	Graminoid	Annual
POACEAE	<i>Eragrostis curvula</i> (Schrud.) Nees	LC	No	Graminoid	Perennial
POACEAE	<i>Eragrostis lehmanniana</i> Nees var. <i>lehmanniana</i>	LC	No	Graminoid	Perennial
POACEAE	<i>Eragrostis nindensis</i> Ficalho & Hiern	LC	No	Graminoid	Perennial

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
POACEAE	<i>Eragrostis pallens</i> Hack.	LC	No	Graminoid	Perennial
POACEAE	<i>Eragrostis rigidior</i> Pilg.	LC	No	Graminoid	Perennial
POACEAE	<i>Eragrostis trichophora</i> Coss. & Durieu	LC	No	Graminoid	Perennial
POACEAE	<i>Fingerhuthia africana</i> Lehm.	LC	No	Graminoid	Perennial (occ. annual)
POACEAE	<i>Heteropogon contortus</i> (L.) Roem. & Schult.	LC	No	Graminoid	Perennial
POACEAE	* <i>Lamarckia aurea</i> (L.) Moench	Not Evaluated	No	Graminoid	Annual
POACEAE	<i>Leptochloa fusca</i> (L.) Kunth	LC	No	Graminoid	Perennial
POACEAE	<i>Melinis repens</i> (Willd.) Zizka subsp. <i>repens</i>	LC	No	Graminoid	Annual (occ. perennial)
POACEAE	<i>Panicum coloratum</i> L. var. <i>coloratum</i>	LC	No	Graminoid	Perennial
POACEAE	<i>Panicum maximum</i> Jacq.	LC	No	Graminoid	Perennial
POACEAE	<i>Pogonarthria squarrosa</i> (Roem. & Schult.) Pilg.	LC	No	Graminoid	Perennial (occ. annual)
POACEAE	<i>Schmidtia pappophoroides</i> Steud.	LC	No	Graminoid	Perennial
POACEAE	<i>Setaria verticillata</i> (L.) P.Beauv.	LC	No	Graminoid	Annual
POACEAE	<i>Sporobolus fimbriatus</i> (Trin.) Nees	LC	No	Graminoid	Perennial
POACEAE	<i>Stipagrostis uniplumis</i> (Licht.) De Winter var. <i>uniplumis</i>	LC	No	Graminoid	Perennial (occ. annual)
POACEAE	<i>Tragus berteronianus</i> Schult.	LC	No	Graminoid	Annual
POACEAE	<i>Tragus racemosus</i> (L.) All.	LC	No	Graminoid	Annual
POACEAE	<i>Trichoneura grandiglumis</i> (Nees) Ekman	LC	No	Graminoid	Perennial
POACEAE	<i>Urochloa panicoides</i> P.Beauv.		No	Graminoid	Annual
POACEAE	<i>Urochloa stolonifera</i> (Gooss.) Chippind.	LC	No	Graminoid	Perennial
POACEAE	<i>Anthephora pubescens</i> Nees	LC	No	Graminoid	Perennial
POACEAE	<i>Brachiaria marlothii</i> (Hack.) Stent	LC	No	Graminoid	Annual (occ. perennial)
POACEAE	<i>Coelachyrum yemenicum</i> (Schweinf.) S.M.Phillips	LC	No	Graminoid	Perennial
POACEAE	<i>Digitaria eriantha</i> Steud.	LC	No	Graminoid	Perennial

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
POACEAE	<i>Enneapogon desvauxii</i> P.Beauv.	LC	No	Graminoid	Annual (occ. perennial)
POACEAE	<i>Eragrostis echinochloidea</i> Stapf	LC	No	Graminoid	Perennial
POACEAE	<i>Eustachys paspaloides</i> (Vahl) Lanza & Mattei	LC	No	Graminoid	Perennial
POACEAE	<i>Oropetium capense</i> Stapf	LC	No	Graminoid	Perennial
POACEAE	<i>Sporobolus acinifolius</i> Stapf	LC	No	Graminoid	Perennial
POACEAE	<i>Sporobolus ioclados</i> (Trin.) Nees	LC	No	Graminoid	Perennial
POACEAE	<i>Stipagrostis obtusa</i> (Delile) Nees	LC	No	Graminoid	Perennial
POACEAE	<i>Triraphis andropogonoides</i> (Steud.) E.Phillips	LC	No	Graminoid	Perennial
POLYGALACEAE	<i>Polygala leptophylla</i> Burch. var. <i>armata</i> (Chodat) Paiva	LC	No	Dwarf shrub	Perennial
PORTULACACEAE	<i>Portulaca hereroensis</i> Schinz	LC	No	Herb, succulent	Annual
PORTULACACEAE	<i>Portulaca kermesina</i> N.E.Br.	LC	No	Herb, succulent	Annual (occ. perennial)
RHAMNACEAE	<i>Helinus spartioides</i> (Engl.) Schinz ex Engl.	LC	No	Dwarf shrub	Perennial
SANTALACEAE	<i>Thesium hystricoides</i> A.W.Hill	LC	No	Dwarf shrub, parasite, shrub	Perennial
SANTALACEAE	<i>Thesium hystrix</i> A.W.Hill	LC	No	Dwarf shrub, parasite, shrub	Perennial
SCROPHULARIACEAE	<i>Aptosimum albomarginatum</i> Marloth & Engl.	LC	No	Dwarf shrub	Perennial
SCROPHULARIACEAE	<i>Jamesbrittenia atropurpurea</i> (Benth.) Hilliard subsp. <i>atropurpurea</i>	LC	No	Dwarf shrub, shrub	Perennial
SCROPHULARIACEAE	<i>Aptosimum elongatum</i> Engl.	LC	No	Dwarf shrub	Perennial
SCROPHULARIACEAE	<i>Aptosimum junceum</i> (Hiern) Philcox	LC	No	Dwarf shrub, shrub	Perennial
SCROPHULARIACEAE	<i>Aptosimum lineare</i> Marloth & Engl. var. <i>lineare</i>	LC	No	Dwarf shrub	Perennial
SCROPHULARIACEAE	<i>Peliostomum leucorrhizum</i> E.Mey. ex Benth.	LC	No	Dwarf shrub	Perennial
SOLANACEAE	<i>Solanum burchellii</i> Dunal	LC	No	Dwarf shrub, shrub	Perennial
SOLANACEAE	<i>Solanum lichtensteinii</i> Willd.	LC	No	Dwarf shrub, shrub	Perennial
SOLANACEAE	<i>Solanum tomentosum</i> L. var. <i>tomentosum</i>	LC	No	Dwarf shrub, herb, shrub	Perennial
SOLANACEAE	* <i>Datura stramonium</i> L.	Not Evaluated	No	Herb, shrub	Annual

Family	Species	Threat status	SA Endemic	Growth forms	Lifecycle
SOLANACEAE	<i>Lycium cinereum</i> Thunb.	LC	No	Dwarf shrub, shrub	Perennial
SOLANACEAE	<i>Lycium hirsutum</i> Dunal	LC	No	Dwarf shrub, shrub	Perennial
SOLANACEAE	<i>Lycium pilifolium</i> C.H.Wright	LC	No	Dwarf shrub, shrub	Perennial
SOLANACEAE	<i>Solanum catombelense</i> Peyr.	LC	No	Dwarf shrub, shrub	Perennial
VAHLIACEAE	<i>Vahlia capensis</i> (L.f.) Thunb. subsp. <i>vulgaris</i> Bridson var. <i>linearis</i> E.Mey. ex Bridson	LC	No	Herb	Annual (occ. perennial)
VERBENACEAE	<i>Chascanum hederaceum</i> (Sond.) Moldenke var. <i>hederaceum</i>	LC	No	Herb	Perennial
VERBENACEAE	<i>Chascanum pinnatifidum</i> (L.f.) E.Mey. var. <i>pinnatifidum</i>	LC	No	Herb	Perennial
VERBENACEAE	<i>Lantana rugosa</i> Thunb.	LC	No	Shrub	Perennial
ZYGOPHYLLACEAE	<i>Tribulus excrucians</i> Wawra		No	Dwarf shrub, shrub	Biennial
ZYGOPHYLLACEAE	<i>Tribulus terrestris</i> L.	LC	No	Herb	Annual
ZYGOPHYLLACEAE	<i>Tribulus zeyheri</i> Sond. subsp. <i>zeyheri</i>	LC	No	Dwarf shrub, herb	Perennial

13 APPENDIX C: Recorded positions of red data or protected species

Table 13-1: Coordinates of some recorded ToPS, red data and protected plant species

Note: The numbered labels on Figure 17 (p. 35) correspond to the serial number (S/N) in the first column of Table 13-1.

S/N	SPECIES	Coordinates		No of Specimens
		S	E	
Preferred Site				
1	<i>Tridentea marientalensis</i> subsp. <i>marientalensis</i>	27° 14' 09.8"S	23° 03' 20.4"E	1
2	<i>Huernia longituba</i>	27° 13' 51.5"S	23° 03' 40.1"E	1
3	<i>Huernia longituba</i>	27° 13' 50.3"S	23° 03' 39.4"E	1
4	<i>Harpagophytum procumbens</i> subsp. <i>procumbens</i>	27° 13' 55.8"S	23° 03' 37.5"E	3
5	<i>Nerine laticoma</i>	27° 13' 38.6"S	23° 03' 47.7"E	±150
6	<i>Nerine laticoma</i>	27° 13' 37.0"S	23° 03' 44.4"E	±250
7	<i>Nerine laticoma</i>	27° 13' 38.0"S	23° 03' 41.2"E	±200
8	<i>Nerine laticoma</i>	27° 13' 33.5"S	23° 03' 38.2"E	±100
9	<i>Nerine laticoma</i>	27° 13' 23.5"S	23° 03' 45.3"E	±250
10	<i>Nerine laticoma</i>	27° 13' 22.8"S	23° 03' 18.6"E	±50
11	<i>Ammocharis coranica</i>	27° 13' 24.3"S	23° 02' 59.3"E	±10
12	<i>Orbea lutea</i> subsp. <i>lutea</i>	27° 13' 34.8"S	23° 02' 53.8"E	1
13	<i>Duvalia</i> species	27° 13' 32.8"S	23° 02' 53.6"E	1
14	<i>Ammocharis coranica</i>	27° 13' 31.0"S	23° 02' 51.9"E	1
15	<i>Ammocharis coranica</i>	27° 13' 45.4"S	23° 03' 06.3"E	5
Alternative Site				
16	<i>Harpagophytum procumbens</i> subsp. <i>procumbens</i>	27° 14' 30.7"S	23° 01' 44.9"E	±15
	<i>Boophone disticha</i>			3
17	<i>Harpagophytum procumbens</i> subsp. <i>procumbens</i>	27° 14' 27.7"S	23° 01' 50.2"E	±5
18	<i>Ammocharis coranica</i>	27° 14' 22.3"S	23° 02' 13.3"E	±20
19	<i>Boophone disticha</i>	27° 14' 25.7"S	23° 02' 14.6"E	2
20	<i>Duvalia</i> species	27° 14' 01.0"S	23° 02' 22.4"E	2
21	<i>Duvalia</i> species	27° 14' 03.3"S	23° 02' 25.3"E	2
22	<i>Duvalia</i> species	27° 13' 59.1"S	23° 02' 24.2"E	2

Table 13-2: Calculations of protected tree density in the study area

Veg Unit	Transect No.	Species frequency (as counted on 4000 m ²)								
		<i>Acacia erioloba</i>			<i>Acacia haematoxylon</i>			<i>Boscia albitrunca</i>		
		1 to <2 m	>2 m	Total	1 to <2 m	>2 m	Total	1 to <2 m	>2 m	Total
1 (385ha)	1	0	3	3	0	0	0	0	6	6
	2	3	11	14	0	0	0	0	2	2
	3	0	3	3	0	0	0	0	2	2
	4	0	3	3	0	0	0	0	0	0
	5	0	10	10	0	0	0	1	7	8
	6	0	5	5	0	0	0	1	5	6
	7	0	4	4	0	0	0	1	0	1
	8	2	2	4	0	0	0	3	3	6
	9	3	12	15	0	0	0	2	2	4
	10	3	4	7	0	0	0	1	1	2
	11	1	1	2	0	0	0	0	0	0
	12	1	0	1	0	0	0	0	0	0
	13	1	3	4	0	0	0	0	0	0
	14	0	1	1	0	0	0	1	0	1
	15	2	2	4	0	0	0	0	1	1
	Ave:	1.1	4.3	5.3	0.0	0.0	0.0	0.7	1.9	2.6
2 (89ha)	1	0	0	0	0	0	0	0	1	1
	2	1	0	1	0	0	0	1	2	3
	3	2	1	3	0	0	0	1	0	1
	4	0	1	1	0	0	0	1	0	1
		Ave:	0.8	0.5	1.3	0.0	0.0	0.0	0.8	0.8
3 (64ha)	1	0	2	2	49	5	54	0	0	0
	2	10	5	15	41	9	50	0	0	0
	3	2	5	7	41	1	42	0	0	0
		Ave:	4.0	4.0	8.0	43.7	5.0	48.7	0.0	0.0
Species density / ha										
1 (385ha)	1	0	7.5	7.5	0	0	0	0	15	15
	2	7.5	27.5	35	0	0	0	0	5	5
	3	0	7.5	7.5	0	0	0	0	5	5
	4	0	7.5	7.5	0	0	0	0	0	0
	5	0	25	25	0	0	0	2.5	17.5	20
	6	0	12.5	12.5	0	0	0	2.5	12.5	15
	7	0	10	10	0	0	0	2.5	0	2.5
	8	5	5	10	0	0	0	7.5	7.5	15
	9	7.5	30	37.5	0	0	0	5	5	10
	10	7.5	10	17.5	0	0	0	2.5	2.5	5
	11	2.5	2.5	5	0	0	0	0	0	0
	12	2.5	0	2.5	0	0	0	0	0	0

Veg Unit	Transect No.	Species frequency (as counted on 4000 m ²)								
		<i>Acacia erioloba</i>			<i>Acacia haematoxylon</i>			<i>Boscia albitrunca</i>		
		1 to <2 m	>2 m	Total	1 to <2 m	>2 m	Total	1 to <2 m	>2 m	Total
	13	2.5	7.5	10	0	0	0	0	0	0
	14	0	2.5	2.5	0	0	0	2.5	0	2.5
	15	5	5	10	0	0	0	0	2.5	2.5
	Ave:	2.67	10.67	13.33	0.00	0.00	0.00	1.67	4.83	6.50
2 (89ha)	1	0	0	0	0	0	0	0	2.5	2.5
	2	2.5	0	2.5	0	0	0	2.5	5	7.5
	3	5	2.5	7.5	0	0	0	2.5	0	2.5
	4	0	2.5	2.5	0	0	0	2.5	0	2.5
	Ave:	1.88	1.25	3.13	0.00	0.00	0.00	1.88	1.88	3.75
3 (64ha)	1	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0
	Ave:	10.00	10.00	20.00	109.17	12.50	121.67	0.00	0.00	0.00
Number of specimens per VU										
1		1027	4107	5133	0	0	0	642	1861	2503
2		167	111	278	0	0	0	167	167	334
3		640	640	1280	6987	800	7787	0	0	0
	Total:			6691			7787			2836