

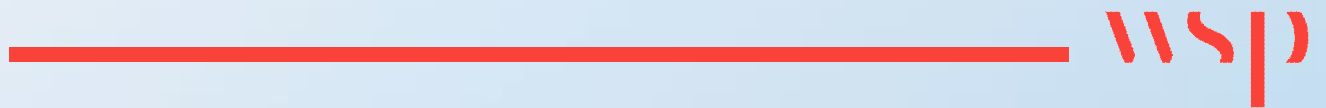
# Appendix H

SPECIALIST STUDIES



# Appendix H.1

TERRESTRIAL BIODIVERSITY  
ASSESSMENT



ENVIRONMENTAL IMPACT ASSESSMENT FOR  
THE PROPOSED DEVELOPMENT OF THE  
IGOLIDE WIND ENERGY FACILITY LOCATED  
NEAR FOCHVILLE, GAUTENG

---

TERRESTRIAL BIODIVERSITY AND SPECIES:  
SPECIALIST ASSESSMENT

---



<p><i>Report prepared for:</i> WSP Group Africa Contact person: Ashlea Strong/Jashmika Maharaj Tel. +27 011 361 1392 Mobile: 082 786 7819 / 081 401 8337 E-mail: Ashlea.Strong@wsp.com</p>	<p><i>Report prepared by:</i> Ekotrust cc 7 St George Street Lionviham, Somerset West, 7130 South Africa</p>
--	--

16 October 2023

# Contents

EXECUTIVE SUMMARY .....	i
SPECIALIST DECLARATION.....	viii
LIST OF FIGURES.....	x
LIST OF TABLES.....	xi
ACRONYMS .....	xii
GLOSSARY .....	xiii
GENERAL INFORMATION .....	xiv
TERMS OF REFERENCE .....	xv
LIMITATIONS, ASSUMPTIONS & UNCERTAINTIES .....	xvi
1. INTRODUCTION.....	1
2. APPROACH AND METHODOLOGY .....	2
3. REGULATORY FRAMEWORK .....	5
4. STUDY AREA .....	8
5. VEGETATION .....	14
6. ALIEN INVASIVE PLANT SPECIES .....	30
7. FLORA: CHECKLISTS AND RED-LISTED AND/OR PROTECTED SPECIES .....	32
8. FAUNA: CHECKLISTS AND RED-LISTED AND/OR PROTECTED SPECIES .....	36
9. CONSERVATION .....	40
10. ECOLOGICAL SENSITIVITY ANALYSIS: VEGETATION.....	44
11. SCREENING REPORT .....	49
12. ENVIRONMENTAL IMPACTS .....	53
13. ASSESSMENT OF SIGNIFICANCE OF ENVIRONMENTAL IMPACTS .....	55
14. LEGISLATIVE AND PERMIT REQUIREMENTS.....	74
15. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUT .....	77
16. FINAL SPECIALIST STATEMENT AND AUTHORISATION RECOMMENDATION.....	79
REFERENCES AND BIBLIOGRAPHY.....	82
APPENDIX A: DIFFERENTIAL TABLE OF THE VEGETATION.....	86
APPENDIX B: PLANT SPECIES LIST .....	90
APPENDIX C: FAUNA SPECIES LIST.....	101
APPENDIX D: SITE SENSITIVITY VERIFICATION .....	107
APPENDIX E: COMPLIANCE WITH THE TERRESTRIAL BIODIVERSITY PROTOCOL (GN 320, 20 MARCH 2020) .....	110
APPENDIX F: <i>CURRICULUM VITAE</i> OF SPECIALISTS.....	112

---

# EXECUTIVE SUMMARY

## Background

Igolide Wind (Pty) Ltd proposes to develop the Igolide Wind Energy Facility (WEF) (up to 100 MW) and its associated infrastructure near Fochville in Gauteng.

This report has been prepared in terms of the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted '*Procedures for the assessment and minimum criteria for reporting on identified environmental themes*' (Government Gazette 43110, No. 320, 20 March 2020 (NEMA 2020a). Note that this protocol replaces the requirements of Appendix 6 of the 2014 NEMA EIA Regulations.

*Note: This specialist assessment was commissioned on **25 October 2020** (between ENERTRAG and Ekotrust) prior to the gazetting of the 'Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species' and the 'Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant Species' (GG 43855 / GN R1150, 30 October 2020) (NEMA 2020b). We refer to the following in the gazetted procedures published on 30 October 2020: **"The requirements of these protocols will apply from the date of publication, except where the applicant provides proof to the competent authority that the specialist assessment affected by these protocols had been commissioned by the date of publication of these protocols in the Government Gazette, in which case Appendix 6 of the Environmental Impact Assessment Regulations, 2014, as amended, will apply to such applications."***

## Location, topography, climate, geology and soils

The Igolide site covers an area of 680 ha and is located northeast of Fochville on portions 14, 20 and RE/22 of the farm Kraalkop 147 IQ and portions 8, 57, 65 and 66 of the farm Leeuwpoort 356 IQ. The area falls within the West Rand District Municipality and the Merafong City Local Municipality in the province of Gauteng. The homestead on site is located at 26° 27' 04.2" S; 27° 30' 21.7" E. The site is characterised by grassland on the sloping plains and low hills, with bushveld patches on the rocky plains and koppies (ridges). The altitude ranges from 1500 m at the lowest point in the west up to approximately 1640 m at the highest point on the hill in the central part of the site. The site is drained from north to south on the western boundary by the Kraalkopspruit and its tributaries and by a stream in the east.

The mean annual rainfall in the region ranges from 613 mm at Fochville to 652 mm at the farm Leeuwpoort. The rainy season at Carltonville is predominantly from October to April when about 92% of the annual rainfall occurs. The mean annual temperature for Carltonville is 16.3°C with the extreme maximum and minimum temperatures 37.1°C and -9.5°C respectively.

Most of the site is underlain by andesite (Vh) while the northern part of the site consists of shale and hornfels (Vt). A small section in the southeast is underlain by shale and quartzite (Vs). The site covers two land types viz. the Ba and Fb Land Types.

## Vegetation and flora

The site falls in the Grassland Biome, but in two Bioregions, i.e. the northern section the site falls in the Central Bushveld Bioregion, while most of the site falls in the Mesic Highveld Grassland Bioregion. The site does not fall within any Centre of Plant Endemism. The site occurs in two vegetation types. i.e. the 'Vulnerable' Rand Highveld Grassland and the 'Least Concern' Gauteng Shale Mountain Bushveld.

Based on species composition, nine natural habitats (plant communities) as well as five man-made units were distinguished, described and mapped on the Igolide site. The Species of Conservation Concern (SCC) listed for the

region in the NewPosa database are *Khadia beswickii* (VU) and *Adromischus umbraticola* subsp. *umbraticola* (NT). These two species were not recorded on the Igolide site. Thirteen plant species are listed as protected in the region according to the GDARD (1983, 2014a). *Gladiolus permeabilis* was the only Schedule 11 protected species recorded on site (GDARD 1983). Two rare plant species could potentially occur on the Igolide site according to data provided by GDARDE (2011, C-Plan). They are *Cineraria austrotransvaalensis* and *Gnaphalium nelsonii*, both with a Near Threatened status. Neither species is listed in the NewPosa species list for the region or were recorded on site during the site survey.

No threatened or protected (ToPS) species (National Environmental Management: Biodiversity Act (Act No. 10 of 2004) is listed for the study area and none were found at the site. None of the thirteen CITES listed species were recorded during the site survey. No nationally protected tree species is listed for the site and none were recorded during the site visit. Eight endemic species are listed for the Rand Highveld Grassland, but none were recorded on the Igolide site.

### Alien invasive plant species

Forty-nine alien plant species were recorded on the Igolide site of which 21 are currently declared alien invasive species and 27 naturalised alien species (Appendic B). Another 46 alien species are listed by NewPosa for the region.

### Fauna

Note: Bird and bat checklists will be provided and discussed in the avifaunal and bat specialist assessments.

#### *Mammals*

The site falls within the distribution range of 85 terrestrial mammal species. Five IUCN threatened mammal species were listed for the environs of the Igolide site with the endangered Mountain reedbeek *Redunca fulvorufula* recorded on site. However, a large portion of the Igolide site at the time of the survey was a game farm and the species could have been introduced. The Screening Tool highlighted the Spotted-necked Otter *Hydrictis maculicollis* and the Maquassie Musk Shrew *Crocidura maquassiensis* for the region. Neither of them were recorded on site during the survey although they may occur in the region. The property (a game farm) has game-proof fencing and nine Schedule 2 Protected Game (GDARD 1983) and three Schedule 8 Problem Animals have been recorded on the Igolide site. The three Schedule 4 Protected Wild Animals (mammals) listed in the ADU database were not recorded on site. According to ToPS legislation (NEMBA 2007c), three mammal species are listed as Vulnerable and five species are Protected. The only ToPS-listed species recorded on site was the black wildebeest (*Connochaetes gnou*).

#### *Reptiles and frogs*

Forty-four reptile species are listed for the region. The list includes one IUCN threatened (Vulnerable) species, i.e. *Crocodylus niloticus* for the region. Provincially protected reptile species include 26 Schedule 2 Protected Game and 17 Schedule 5 snakes. The python *Python natalensis* is the only protected reptile species according to the ToPS list (NEMBA 2007c). The Giant Bull Frog *Pyxicephalus adspersus* is listed as Near Threatened and is also on the ToPS list as a protected species. However, all wetlands as well as a buffer (as specified by the aquatic specialist) around the wetland should be avoided by the development.

#### *Invertebrates*

Two Lepidopteran species listed by the Screening Tool are unlikely to occur on site because their host plant was not recorded on site. According to the RSA Red List, *Clonia uvarovi* (Orthoptera) is rated as Vulnerable. It inhabits tall woodland savanna, a habitat that is not present on site. Where the habitat on site has been described as bushveld it may be marginally suitable for the species. Other invertebrates are listed in Appendix C.

### Conservation

The study site is part of the NPAES (NPAES 2018). All turbines are located outside the NPAES. The site is located in

the Gauteng Shale Mountain Bushveld and Rand Highveld Grassland that are classified as "Least Concern" and "Vulnerable" respectively.

### Habitat sensitivity

A sensitivity model was applied to the **vegetation data** for each of the 13 habitats (plant communities) on site. Habitats 2, 5 and 7 (rocky outcrops, wetlands and watercourses respectively) were rated as of medium sensitivity and the remainder as low sensitivity. The proposed substation is not located in any sensitive habitat or CBA and could be used as the preferred site for the substation and BESS facility. The WEF infrastructure is currently located mostly in Habitat 4 (grassland) and all rocky hills, rocky outcrops (sheets) and drainage lines are avoided. The ten turbines are located in a habitat with a low vegetation sensitivity rating according to the model applied (Figure 7, Habitat 4).

Buffers are applicable to the development along the watercourses. A buffer zone of 32 m is usually applied to drainage lines, but the bat and aquatic specialists may apply wider buffer zones along these habitats. It is recommended that the buffer zones specified in the aquatic report are used as guideline.

### Screening Tool

The Screening Tool rated the sensitivity of the Plant Species Theme as medium and four species were highlighted as being of concern. None of the SCC highlighted by the Screening Tool were recorded on site.

The Screening Tool rated the sensitivity of the Animal Species Theme as medium. Eight animal species were highlighted by the Screening Tool for the region and include three bird species (refer to avifaunal specialist report), three invertebrate species and two mammal species. The 'Vulnerable' Maquassie Musk Shrew *Crocidura maquassiensis* and the Spotted-necked Otter *Hydrictis maculicollis* were not recorded on site. The two Lepidopteran species in the region (*Lepidochrysops praeterita* and *L. procera*) were not recorded and their host plant (*Ocimum obovatum*) was not encountered during the site survey. None of the Lepidopteran species highlighted by the Screening Tool are listed on the ADU database for the region. According to the RSA Red List, *Clonia uvarovi* (Orthoptera) is rated as Vulnerable. It inhabits tall woodland savanna (<http://speciesstatus.sanbi.org/assessment/last-assessment/4333/>), and no tall woodland savanna is present on site. Where the habitat on site has been described as bushveld it may be marginally suitable for the species.

The Screening Tool rated the sensitivity of the Relative Terrestrial Biodiversity Theme as very high based on the presence of CBAs, ESAs, NPAES and a vulnerable ecosystem. The study area is not located in a protected area. The study site is part of the NPAES (NPAES 2018). CBAs and ESAs are present on the site (CPlanV33\_1110\_ge 2017) and development within the CBAs should best be avoided. Turbines WTG04, WTG07 and WTG08 lie in ESAs and their positions may be reconsidered.

The Freshwater Ecosystem Priority Areas (FEPAs) or water catchments are priority areas for conserving freshwater ecosystems and supporting sustainable use of water resources and upstream management areas. The FEPAs were not flagged by the Screening Tool.

### Environmental Impact Assessment

The key issue is that a sizeable portion of the site falls within a 'Vulnerable' national vegetation type, i.e. the Rand Highveld Grassland and a sizeable proportion of the proposed infrastructure (seven turbines) is located in this vegetation type.

The direct, indirect and cumulative impacts of the proposed development on the Terrestrial Biodiversity and Species were assessed based on the knowledge gained during the site visit and literature review. Each of the impacts is briefly described in Chapters 12 & 13 in terms of the nature; proposed mitigation measures; and the significance of

the impact without and with the mitigation measures applied. In this section the issues, risks and impacts associated with the project from a Terrestrial Biodiversity and Species viewpoint is presented. The methodology follows the guidelines provided by WSP.

*Potential impacts identified during construction, operational and decommissioning phases*

- Loss of vegetation/habitat
- The potential loss of threatened, protected, CITES listed and/or endemic plants/animals
- Loss of faunal habitat
- Direct faunal mortalities due to construction and increased traffic
- Increased dust deposition
- Increased human activity, noise and light levels
- Establishment of alien vegetation
- Increased water run-off and erosion
- Changes in animal behaviour
- Impact of road construction

*Cumulative impacts*

- Vegetation loss and habitat destruction
- Compromising integrity of CBAs, ESAs and NPAES
- Reduced ability to meet conservation obligations & targets
- Loss of landscape connectivity and disruption of broad-scale ecological processes

### Legislative and permit requirements

GDARDE is the regulatory authority in Gauteng for the issuing of permits for fauna, flora, hunting and CITES. The most important permit requirement is the permit that needs to be obtained for the removal of plant species protected in Gauteng. Legislative requirements also relate to the combatting of alien invasive species. Other aspects are summarised in Chapter 14.

### Key environmental mitigation and management actions proposed

The impacts and their mitigation are presented in Chapters 12 & 13, whereas the management objectives and actions as well as monitoring relating to the impacts and their mitigation are discussed in the Environmental Management Programme (see Chapter 15).

### Final specialist statement and authorisation recommendation

A brief summary of the most important considerations is provided below:

**Vegetation and flora:**

- **Vegetation types:** The Rand Highveld Grassland vegetation type is listed as “Vulnerable”, while the Gauteng Shale Mountain Bushveld vegetation type is listed as “Least Concern”.
- **Screening tool:** None of the SCC highlighted by the Screening Tool were recorded on site.
- **Threatened plant species:** No IUCN threatened or red listed plant species were encountered during the field survey.
- **Near Threatened plant species:** Two near threatened species, *Gnaphalium nelsonii* and *Cineraria austrotransvaalensis*, could potentially occur on site according to the Gauteng C-plan.
- **Protected plant species:** No CITES listed species, ToPS species or protected tree species were recorded on site.
- **Provincially protected species:** Only one provincially protected species with a Least Concern status, was recorded on site, i.e. *Gladiolus permeabilis* (Iridaceae).



- ☐ **Habitats:** Ten of the 13 habitats/vegetation units had a low vegetation sensitivity rating with three habitats/vegetation units rated as of medium sensitivity (streams, wetlands and rocky outcrops).
- ☐ **Statement:** Because none of the SCC highlighted by the Screening Tool were found on site, we suggest that the Plant Species Theme's site sensitivity is rated as **Low**.

***Fauna (excluding the bird and bat components):***

- ☐ **Threatened animal species:** The key faunal issue is the presence of the endangered mountain reedbeek. However, a large portion of the Igolide site at the time of the survey was a game farm and the species could have been introduced.
- ☐ **Screening tool:** None of the SCC highlighted by the Screening Tool were recorded on site.
- ☐ **Overall sensitivity of animal species theme:** This is rated as medium by the Screening Tool. Excluding the avifaunal component, we would suggest a **Low - Medium** sensitivity. If the suggested mitigation measures are followed the threatened animal species should not be negatively affected by the WEF.

***Conservation:***

- ☐ **Protected Areas:** The study area is not located in a protected area.
- ☐ **Vulnerable ecosystem:** The Rand Highveld Grassland vegetation type is listed as “Vulnerable” and covers a large portion of the site. Seven of the ten turbines are situated in this vegetation type.
- ☐ **National Protected Areas Expansion Strategy (NPAES):** The study site is part of the NPAES (NPAES 2018) and all turbines are located outside the NPAES.
- ☐ **Critical Biodiversity Areas (CBAs):** CBAs are present on the site (CPlanV33\_1110\_ge 2011) and development within the CBAs should best be avoided.
- ☐ **Ecological Support Areas (ESAs):** Turbines WTG04, WTG07 and WTG08 lie in ESAs and their positions may be reconsidered. The extent of the development is relatively small and will not have a negative impact on the functionality of the broader ESA. Thus no additional loss of ecological connectivity in relation to the broader landscape is likely.
- ☐ **Other Natural Areas (ONAs):** Seven of the 10 turbines are fully situated in ONAs.
- ☐ **Freshwater Ecosystem Priority Area (FEPA):** Two rivers cross the site with some wetlands delineated along the rivers. The development will avoid the wetlands. FEPAs were not highlighted by the Screening Tool.
- ☐ **Terrestrial Biodiversity Theme:** Although portions of the site qualify as CBAs and ESAs and parts have been included in the NPAES, a substantial portion of the site has been identified as ONAs (even when in the Vulnerable vegetation type). The development has been largely contained in the ONAs. In the Screening Tool the Terrestrial Biodiversity Theme allocated a Very High sensitivity to the entire site, which appears to disregard the portion of the site that does not qualify as CBA, ESA or NPAES and is ONA.

***Ecological processes, function and drivers:***

- ☐ Overall, it is unlikely that the development will contribute to the disruption of broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions.
- ☐ The disturbance caused by the construction of the WEF will create conditions favourable for invasion by alien species.
- ☐ Fire is an important driver of vegetation dynamics in the Grassland Biome and can occur when the fuel load is high. To avoid damage to the infrastructure, fire will have to be suppressed. If the grass layer is regularly mowed/brush cut, it should prevent grasses from becoming moribund in the absence of fire although mowing or brushcutting would reduce seed set.
- ☐ Grasslands have evolved under the grazing pressure from large ungulates. Mesic Highveld Grasslands are reasonably well adapted to grazing pressure under low to moderate stocking rates with adequate rest periods. The WEF development will still allow livestock or wildlife grazing.

**Significance of environmental impacts:**

Overall the significance of the environmental impacts was rated as low to very low, with cumulative impacts being rated as moderate before any mitigation. In summary:

- Since the development footprint is small, the loss of habitat or species will be limited.
- Since the turbine footprint is relatively small and spread across the site, the loss of prime habitat within the 'Vulnerable' Rand Highveld Grassland vegetation type can be constrained by well-planned positioning of the turbines. Vegetation clearance due to service roads generally has a larger impact than due to turbine locations, however since the roads will have a gravel surface animal movement should not be impaired. Furthermore, existing tracks should be preferred for upgrading to service roads. Beyond the permanent infrastructure footprint, environmental functions and processes should however, not be altered.
- The extent of clearing activities in the Rand Highveld Grassland vegetation type is small in relation to the remaining extent of the vegetation type and ecosystem threat status will not be affected.
- None of the habitats identified were rated as highly sensitive, and the overall impact per habitat type will be small.
- The impact on overall species and ecosystem diversity of the adjacent land will not be affected and the impact will be small.
- The impact on populations of threatened or protected species will be small if mitigation measures are applied.
- Depending on the type of fencing to be erected at some of the infrastructure, the WEF will contribute minimally to obstruction of animal movement.

## Key environmental mitigation and management actions proposed

- A walkthrough would be needed prior to construction to inform permit applications for protected plant species.
- Ensure that the placing of infrastructure takes the sensitivity mapping of the ecological assessment into account to avoid and reduce impacts on species and habitats of conservation concern.
- Demarcate all infrastructure sites clearly to avoid unnecessary clearance of the vegetation.
- Avoid or minimise impacts that could potentially affect animal behaviour.
- Trenches should not be left open for long periods of time. Trenches should be inspected regularly for the presence of trapped animals.
- Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns.
- Proper waste management procedures should be in place to avoid waste lying around and to remove all waste material from the site.
- Speed limits should be strictly adhered to.
- Dust control measures should be implemented.
- Permits have to be obtained for the removal of GDARDE protected species.
- Implement a monitoring program for the early detection of alien invasive plant species.
- Employ a control program to combat declared alien invasive plant species.

## Preferred infrastructure locations

## Access route:

- The access road is currently from an unnamed road to the east. The access road follows existing farm tracks more or less to the centre of the site. Although the road does cross a CBA2 (Important area) and ESAs it is acceptable because it follows an existing farm road.

## Turbines:

- Turbines WTG04, WTG07 and WTG08 lie in ESAs and where possible the number of turbines should be limited within the ESA.

- All other turbines are situated in ONAs.

Ancillary areas (On-site IPP substation, batching plant, construction camp, laydown):

- These ancillary areas fall in a 'Least Concern' ecosystem and outside of CBA2s, ESAs and NPAES.

Roads:

- The road network within CBAs (only CBA2s are present on site) and ESAs should be minimised.
- Wherever possible, existing roads should be used.
- The construction of a road should be done in the most environmentally sensitive manner possible.
- A suitably qualified person should plan, design and supervise the proper construction of roads to minimize the impact on the environment.
- Roads should be provided with run-off structures to reduce the risk of erosion.
- Proper road maintenance procedures should be in place.

Final specialist statement and authorisation recommendation

The low impact significance after mitigation and low sensitivity rating for many of the habitats means the project could go ahead without major constraints, provided the mitigation measures and management actions proposed to conserve protected fauna and flora on the site are applied. **We thus recommend authorisation of the project provided all mitigation measures are implemented.**

# SPECIALIST DECLARATION

This report has been prepared in terms of the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted 'Procedures for the assessment and minimum criteria for reporting on identified environmental themes' (Government Gazette 43110, No. 320, 20 March 2020 (NEMA 2020a). Note that these protocols replace the requirements of Appendix 6 of the 2014 NEMA EIA Regulations.

## Appointment of specialist

Ekotrust cc was originally commissioned by CSIR (EMS) Stellenbosch to provide an assessment on the terrestrial biodiversity and species of the Igolide Wind Energy Facility, located approximately 6 km northeast of Fochville, within the Merafong City Local Municipality in the Gauteng Province. However, **WSP Group Africa** was subsequently appointed as the new EAP for the project in 2023.

*Note: This specialist assessment was commissioned on **25 October 2020** (between ENERTRAG and Ekotrust) prior to the gazetting of the 'Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species' and the 'Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant Species' (GG 43855 / GN R1150, 30 October 2020) (NEMA 2020b). We refer to the following in the gazetted procedures published on 30 October 2020: "The requirements of these protocols will apply from the date of publication, except where the applicant provides proof to the competent authority that the specialist assessment affected by these protocols had been commissioned by the date of publication of these protocols in the Government Gazette, in which case Appendix 6 of the Environmental Impact Assessment Regulations, 2014, as amended, will apply to such applications."*

## Company profile:

Name of Company: Ekotrust cc  
 (Registration number: CK90/05465/23)  
 Sole Member: Dr Noel van Rooyen  
 Founding date: 1990

Ekotrust cc specialises in habitat evaluation, vegetation classification and mapping, floristic diversity assessments, rare species assessments, alien plant assessments and management, wildlife management, wildlife production and economic assessments, veld condition assessment, bush encroachment, fire management, carrying capacity, wildlife numbers and ratios.

## Specialist declaration

We, Noel van Rooyen and Gretel van Rooyen, as the appointed independent specialists, hereby declare that we:

- act as independent specialists in this application;
- perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report, as it relates to our specialist input/study, to be objective, true and correct within the framework of assumptions and limitations;

- do not have and will not have any business, financial, personal or other interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations 2014, and amendments 2017, Procedures for the assessment and minimum requirements for reporting on identified environmental themes in terms of Sections 24(5) (a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation, and any specific environmental management act (NEMA 2020);
- declare that there are no circumstances that may compromise our objectivity in performing such work;
- have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- will comply with the Act, Regulations and all other applicable legislation;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- have no vested interest in the proposed activity proceeding;
- undertake to disclose to the applicant and the competent authority 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 the competent authority; or the objectivity of any report, plan or document to be prepared by us for submission to the competent authority;
- all the particulars furnished by us in this form are true and correct; and
- realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

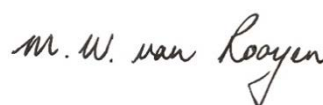
#### **Indemnity and conditions relating to this report:**

The observations, findings, recommendations and conclusions provided in the current report are based on the compilers' best scientific and professional knowledge and other available information. If new information should become available Ekotrust cc reserves the right to modify aspects of the report. This report (hard copy and/or electronic) must not be amended or extended without the prior written consent of the author. Furthermore, any recommendations, statements or conclusions drawn from or based on this report must make reference to the report. If these recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety (as an Appendix).

Although Ekotrust cc has exercised due care in preparing this report, it accepts no liability, and by receiving this document, the client indemnifies Ekotrust cc against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.



Signature of specialists:



Name of specialists: Dr N van Rooyen

Prof. MW van Rooyen

Date: 16 October 2023

16 October 2023

This report has been prepared in terms of the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted '*Procedures for the assessment and minimum criteria for reporting on identified environmental themes* (Government Gazette 43110, No. 320, 20 March 2020 (NEMA 2020a). Note that this protocol replaces the requirements of Appendix 6 of the 2014 NEMA EIA Regulations.

# LIST OF FIGURES

Figure 1: Topocadastral map of the Igolide site (Map 2627BC Westonaria 2010; 2627AD Carltonville 2010) .....	8
Figure 2: Google satellite image of the Igolide site.....	9
Figure 3: Climate diagram for Carltonville. ....	11
Figure 4: Geology of the Igolide site .....	12
Figure 5: Land types of the Igolide site .....	13
Figure 6: Vegetation types of the Igolide site. ....	15
Figure 7: Vegetation map of the Igolide site.....	16
Figure 8: Community 1 – grassland dominated by <i>Trachypogon spicatus</i> .....	17
Figure 9: Community 2: rocky outcrop characterised by <i>Searsia magalismontana</i> and <i>Selaginella dregei</i> . ....	18
Figure 10: Community 3: <i>Cymbopogon caesius</i> - <i>Elionurus muticus</i> rocky grassland .....	19
Figure 11: Community 4: <i>Hyparrhenia hirta</i> - <i>Eragrostis chloromelas</i> grassland.....	20
Figure 12: Community 5: <i>Eragrostis plana</i> - <i>Trisetopsis imberbis</i> wetlands/floodplains. ....	21
Figure 13: Community 6: <i>Vachellia karroo</i> - <i>Ehretia rigida</i> rocky bushveld on the plains and koppies .....	23
Figure 14: Community 7: <i>Salix babelonica</i> - <i>Phragmites australis</i> riverine vegetation.....	24
Figure 15: Community 8: floodplains characterised by <i>Hyparrhenia tamba</i> , <i>Asparagus laricinus</i> and <i>Senecio imornatus</i> .....	25
Figure 16: Community 9: <i>Eragrostus tef</i> - <i>Tagetes minuta</i> abandoned cropland .....	26
Figure 17: Community 10: grassland dominated by <i>Digitaria eriantha</i> .....	27
Figure 18: Community 11: <i>Eucalyptus camaldulensis</i> woodlots .....	27
Figure 19: Community 12: Hedge of <i>Pyracantha angustifolia</i> .....	28
Figure 20: Community 12: Lane of <i>Cedrus deodora</i> .....	28
Figure 21: Community 13: Dam in the Kraalkopspruit .....	29
Figure 22: Schematic representation of the relationship between the various IUCN Red List Categories. ....	32
Figure 23: NPAES map of the Igolide WEF site.....	40
Figure 24: Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and Other Natural Areas (ONAs) of the Igolide site and environs .....	42
Figure 25: Sensitivity map of the Igolide site. ....	48
Figure 26: Map and outcome of Plant Species Theme sensitivity generated by the Screening Tool. ....	49
Figure 27: Map and outcome of Animal Species Theme sensitivity generated by the Screening Tool. ....	50
Figure 28: Map and outcome of Relative Terrestrial Biodiversity Theme sensitivity generated by the Screening Tool.....	51
Figure 29: Schematic representation of the mitigation sequence/hierarchy. ....	57

# LIST OF TABLES

Table 1: Rainfall at some weather stations in the general environs of the Igolide site .....	10
Table 2: Mean, maximum and minimum rainfall (mm) and maximum rainfall in 24 hours at Carltonville: 26° 20' S; 27° 23' E; 1500 m (Weather Bureau 1998) .....	10
Table 3: Temperature data (°C) for Carltonville: 26° 20' S; 27° 23' E; 1500 m .....	11
Table 4: Cloud cover at 14:00 and percentage relative air humidity at 08:00 and 14:00 at Potchefstroom: 26° 44' S; 27° 04' E; 1350 m .....	12
Table 5: Sensitivity of the different plant communities (habitats) identified on site (see Figure 26).....	47
Table 6: Impact criteria and the scores applied .....	55
Table 7: Overall Impact Significance (Post Mitigation) .....	73

# ACRONYMS

AIS	Alien Invasive species
BA	Basic Assessment
BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CBD	Convention on Biodiversity
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
CSIR	Council for Scientific and Industrial Research
DFFE	Department of Forestry, Fisheries and the Environment
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIAr	Environmental Impact Assessment Report
EMPr	Environmental Management Plan Report
ESA	Ecological Support Area
IUCN	International Union for the Conservation of Nature
I&APs	Interested and Affected Parties
GDARD	Gauteng Department of Agriculture and Rural Development
GDARDE	Gauteng Department of Agriculture, Rural Development & Environment
GIS	Geographical Information System
NEMA	National Environmental Management Act
NEM:BA	National Environmental Management: Biodiversity Act
NPAES	National Protected Area Expansion Strategy
ONA	Other Natural Areas
PA	Protected Area
SEA	Strategic Environmental Assessment
SANBI	South African National Biodiversity Institute
ToPS	Threatened and Protected Species
ToR	Terms of Reference
WEF	Wind Energy Facility
WSP	WSP Group Africa



# GLOSSARY

Alien invasive species	Any species whose establishment and spread outside of its natural distribution range (i) threatens ecosystems, habitats or other species or has a demonstrable potential to threaten ecosystems, habitats or other species; and (ii) may result in economic or environmental harm or harm to human health.
Alternative	A possible course of action, in place of another, that would meet the same purpose and need (of the proposal). Alternatives can refer to any of the following, but are not limited to: alternative sites for development, alternative projects for a particular site, alternative site layouts, alternative designs, alternative processes and alternative materials.
Alluvium	Unconsolidated material deposited by flowing water
Biodiversity	The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. It includes diversity within species, between species and of ecosystems.
Category 1a Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the act, as a species that must be combatted or eradicated. Landowners are obliged to take immediate steps to control Category 1a species in compliance with sections 75(1), (2) and (3) of the Act. If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must combat or eradicate the listed invasive species in accordance with such a programme.
Category 1b Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the act, as species that must be controlled. If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must control the listed invasive species in accordance with such a programme.
Category 2 Listed Invasive Species	Species listed by notice in terms of section 70(1)(a) of the Act as species that require a permit to carry out a restricted activity specified in the Notice or an area specified in the permit, as the case may be. Permit-holders must ensure that specimens of the species do not spread outside of land or area specified in the Notice or permit.
Category 3 Listed Invasive Species	A species listed by notice in terms of section 70(1)(a) of the act, as species that are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of the Act, as specified in the Notice. However, a Category 3 Listed Invasive Species that occurs in riparian areas must be considered to be a Category 1b Listed Invasive Species and must be managed according to regulation 3.
Critical Biodiversity Areas	Areas required to meet biodiversity targets for ecosystems, species or ecological processes. CBAs are regarded as areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species.
Development	The building, erection, construction or establishment of a facility, structure or infrastructure, including associated earthworks or borrow pits, that is necessary for the undertaking of a listed or specified activity.
Development footprint	Any evidence of physical alteration as a result of the undertaking of any activity.
Ecological Support Areas	These are not essential for meeting biodiversity targets, but play an important role in supporting the functioning of Protected Areas or CBAs and are often vital for delivering ecosystem services. ESAs must be maintained in at least a functional and often natural state, but some limited habitat loss may be acceptable.
Endangered species	Any species of fauna and flora referred to in Appendix I and II of CITES (GDARD 1983).
Habitat	A place where a species or ecological community occurs naturally.
Indigenous vegetation	Vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Indigenous	A species that occurs, or has historically occurred, naturally in a free state in nature within the borders of the Republic, but excludes a species that has been introduced in the Republic as a result of human activity.
Introduced	In relation to a species, means the introduction by humans, whether deliberately or accidentally, of a species to a place outside the natural range or natural dispersal potential of that species;
Linear activity	An activity that is arranged in or extending along one or more properties and which affects the environment or any aspect of the environment along the course of the activity, and includes railways, roads, canals, channels, funiculars, pipelines, conveyor belts, cableways, power lines, fences, runways, aircraft landing strips, firebreaks and telecommunication lines.
Mitigate	The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action.
"No-Go" option	The "no-go" development alternative option assumes the site remains in its current state, i.e. there is no development in the proposed project area.
Problem Animals	An animal declared to be a problem animal listed in Schedule 8 (GDARD 1983).
Protected plants and specially protected plants	Any species of flora specified in Schedules 11 and 12 of the Ordinance (GDARD 1983).
Protected game, ordinary game and protected wild animals	Any species of wild animal specified in Schedule 2, 3 & 4 of the Ordinance (GDARD 1983).
Watercourse	Includes (a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, pan, lake or dam into which, or from which, water flows; and a reference to a watercourse includes, where relevant, its bed and banks.
Wetland	Land that is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

# GENERAL INFORMATION

**Study site:** Igolide Wind Energy Facility (WEF): Portions 14, 20 and RE/22 of the farm Kraalkop 147 IQ and portions 8, 57, 65 and 66 of the farm Leeuwpoort 356 IQ

**Proponent:** Igolide Wind (Pty) Ltd

**Approximate size of property:** 680 ha

**Environmental Assessment Practitioner (EAP):**

WSP Group Africa  
Building 1, Golder House, Maxwell Office Park  
Magwa Crescent West,  
Waterfall City, Midrand  
South Africa.  
Contact person: Ashlea Strong  
Tel. +27 11 361 1392  
Mobile: +27 82 786 7819  
E-mail: Ashlea.Strong@wsp.com

**Terrestrial Biodiversity and Species Assessment by:**

This specialist assessment was undertaken by Dr Noel van Rooyen and Prof. Gretel van Rooyen of Ekotrust cc. The *Curriculum Vitae* of the specialists are included in Appendix F of this assessment.

Dr Noel van Rooyen Pr.Sci.Nat., Reg. no. 401430/83 - Botanical Sciences  
Prof. Gretel van Rooyen Pr.Sci.Nat., Reg. no. 400509/14 – Ecological Sciences; LAKadSA, SAAB;

Address:

7 St George Street,  
Lionviham,  
Somerset West, 7130,

Mobile: 082 882 0886 (NvR)  
072 025 3386 (GvR)

e-mails:

noel@ekotrust.co.za  
gretel@ekotrust.co.za

# TERMS OF REFERENCE

The Scope of Work for the terrestrial biodiversity and ecology specialist study includes the following tasks:

- Compilation of a specialist study in adherence to:
  - o the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted *'Procedures for the assessment and minimum criteria for reporting on identified environmental themes'* (Government Gazette 43110, No. 320, 20 March 2020 (NEMA 2020a). Note that this protocol replaces the requirements of Appendix 6 of the 2014 NEMA EIA Regulations.
  - o any additional relevant legislation and guidelines that may be deemed necessary.
- The assessment should be based on existing information, national and provincial databases, SANBI mapping, professional experience and field work conducted.
- Undertake a site inspection to identify the site sensitivities, and verify them in terms of the National Web-Based Screening Tool (<https://screening.environment.gov.za/>).
- If needed, liaise with the South African National Biodiversity Institute (SANBI) to obtain information on sensitive species flagged in the National Web-Based Screening Tool (where species names are obscured / only numbered).
- Describe the terrestrial ecological features of the project area, with focus on features that are potentially impacted by the proposed project. The description should include the major habitat forms within the study site, giving due consideration to terrestrial ecology (flora and fauna), Species of Conservation Concern (SCC) or Protected Species.
- If applicable, specify development set-backs / buffers, and provide clear reasons for these recommendations.
- Map the sensitive ecological features within the proposed project area, showing any “no-go” areas (i.e. “very high” sensitivity).
- Provide input on the preferred infrastructure locations following the sensitivity analysis.
- Provide sensitive features spatial data in a useable GIS format (.kmz /.shp).
- Provide an assessment of direct, indirect and cumulative impacts associated with the proposed WEF, with and without mitigation.
- Address relevant concerns / comments raised by Interested and Affected Parties and Stakeholders, including the Competent Authority, during Public Participation Processes.
- Identify relevant legislative requirements and permits that may be required.
- Recommend mitigation measures, best practice management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts to be included in the Environmental Management Programme (EMPr).
- Update draft specialist study report after Environmental Assessment Practitioner (EAP) and client review (before public release) and after public review for submission to the Competent Authority for decision-making.
- Address any queries from the Competent Authority during the decision-making phase.

# STATEMENTS, LIMITATIONS, ASSUMPTIONS AND UNCERTAINTIES

The following assumptions, limitations or uncertainties are listed regarding the evaluation of the impacts of the proposed Igolide project on the terrestrial biodiversity and ecology:

- The site visit was undertaken in January 2021 after the region had received good rains, thus the botanical assessment was conducted under favourable conditions.
- The area has been well collected in the past and the list of plant species that could potentially occur on site as obtained from the NewPosa database, is thus considered to provide a good representation of the potential flora on site. The NewPosa list was taken for an area far greater than the WEF site (grids 2627BC & 2627AD).
- Rare and threatened plant and animal species are generally uncommon and/or localised and the once-off survey may fail to locate such species.
- Rare plant species usually occur in specialised and localised habitats, thus special attention was given to these habitats. The list was supplemented by a list of SCC provided by GDARDE (2011) occurring on the farms in the immediate vicinity of the development.
- No aerial census, road census or trapping (either camera trapping or by way of Sherman traps) was conducted for fauna, since these methods generally provide an underrepresentation of the full faunal diversity within the limited timeframe available. Faunal lists were sourced from literature and the website of the Animal Demography Unit of the University of Cape Town.

# 1. INTRODUCTION

The proposed Igolide Wind Energy Facility (WEF) and its associated infrastructure near Fochville in Gauteng will be operated under a Special Purpose Vehicle (SPV), the Igolide Wind (Pty) Ltd (the “Proponent”). The proposed Project will be developed within a project area of approximately 680 hectares (ha). Within this project area, the extent of the Project footprint will be approximately 50 hectares (ha). The project is located approximately 6 km northeast of Fochville, within the Merafong City Local Municipality in the Gauteng Province of South Africa. The site location (centre point) is at 26° 27’ 2.44” S; 27° 30’ 58.82” E. The WEF comprises the following (full project description is given by the client):

- Ten wind turbine generators (WTGs) with a maximum capacity of up to 100 MW.
- Turbines with a hub height of up to 200 m, a rotor diameter of up to 200 m and tip height of up to 300 m.
- Foundation: Approximately 25 m diameter x 3 m deep. Volume to be excavated will be approximately 2 200m<sup>3</sup>, in sandy soils due to access requirements and safe slope stability requirements.
- Turbine hardstand areas of approximately 1 ha per turbine. Hardstand does not require concrete.
- A 33/132kV on-site IPP substation, including the Battery Energy Storage System (BESS), with a total footprint of up to 2.5 ha. The on-site IPP substation will consist of a high voltage substation yard to allow for multiple (up to 132kV) feeder bays and transformers, control building, telecommunication infrastructure, and other substation components, as required. A 500m buffer around the on-site IPP substation has been identified to ensure flexibility in routing the powerline.
- The BESS storage capacity will be up to 100 MW/400 megawatt-hour (MWh) with up to four hours of storage.
- Medium voltage collector system will comprise cables up to and including 33 kV connecting the turbines to the on-site IPP substation and will be laid underground except where a technical assessment suggests that overhead lines are required.
- Access and internal roads with a width of 8 - 10 m will provide access to each turbine, the BESS, on-site substation, step-down substation and laydown area. The width will increase up to 20 m for turning circle/bypass areas to allow for larger component transport. Existing access roads will be used where possible to minimise impact. Where required, the width of the existing roads will be widened to ensure the passage of vehicles.
- Temporary construction camp of up to 1 ha.
- A temporary laydown area of 2 - 3 ha is envisaged.
  - a. The Operation and Maintenance (O&M) building footprint is to be located near the on-site substation and will not exceed 0.5 ha. Typical areas include: Operations building – 20 m x 10 m = 200 m<sup>2</sup>; Workshop and stores area – of ~300 m<sup>2</sup>; and Refuse area for temporary waste storage and conservancy tanks to service ablution facility.
- The cement batching plant will have a footprint of 1 ha.
- Supporting infrastructure includes fencing, lighting, lightning protection, telecommunication infrastructure, stormwater channels, water pipelines, offices, gatehouse and security building.
- Grid (separate EA): A single or double circuit 132 kV overhead powerline and 132 kV switching station with a footprint of 1.5 ha (adjacent to the on-site IPP substation) to feed the electricity generated by the proposed WEF into Eskom’s Midas Main Transmission Substation via a 11 km overhead line.

Scoping and Environmental Impact Assessment processes are required for the proposed development of the Igolide WEF. As required in Part A of the Government Gazette 43110, GN 320, a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area.

This report presents the Specialist Terrestrial Biodiversity and Species Impact Assessment Report of the proposed Igolide site project. The scope, purpose and objectives of the report have essentially been summarised in the ToR.

## 2. APPROACH AND METHODOLOGY

### 2.1 Approach

The study commenced as a desktop study, followed by field-based surveys in January 2021. October to April is the main rainy season in the region when about 92% of the annual rainfall occurs, thus the site visits were undertaken at a favourable time.

The focus of the site visit was:

- to undertake a site sensitivity verification in order to confirm the current land use and environmental sensitivity as identified in the Screening Tool; and
- to conduct surveys (fauna and flora) of the Igolide site to identify sensitive habitats, to classify the vegetation into habitats (or plant communities), compile species lists and to search for Species of Conservation Concern (SCC). According to SANBI's (SANBI 2020) definition of SCC, these are species that have a high conservation importance in terms of preserving South Africa's high floristic and faunal diversity and include not only threatened species, but also those classified as Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD) ([www.redlist.SANBI.org](http://www.redlist.SANBI.org)).

Digital information was obtained from GDARDE (GDARDE 2011, C-Plan V3.3) confirming that the 2011 version of C-Plan was currently still the correct version, but that an update should be available by 2024. Hard copy and digital information from spatial databases, such as BGIS of the South African Biodiversity Institute (SANBI) for maps of Critical Biodiversity Areas, Protected Areas, Protected Area Expansion Strategy, Freshwater Ecosystem Priority Areas; the geological survey maps (2626 Wes-Rand); land type maps (2626 Wes-Rand); topocadastral maps (1:50 000 maps); vegetation types of SANBI (2006 – 2018); NewPosa database of SANBI; and databases of the Animal Demography Unit, University of Cape Town, as well literature were sourced to provide information on the environment and biodiversity of the study area.

Satellite images (Google Earth) were used to stratify the area into relatively homogeneous terrain/vegetation units. The vegetation survey consisted of visiting the mapped units and systematically recording plant species on site and estimating their cover. A total of 31 sample plots were surveyed on the Igolide site. Physical habitat features were also noted. During the site visit, digital photographs were taken and representative photographs of the different habitats are included in the report. The site was also surveyed for rare, threatened and/or endemic plant species during the site visit.

The animal site survey was limited to day-time visual assessments on site. Animal species presence on site was mainly attained by means of direct or indirect sighting methods (animals, spoor, burrows, scats, sounds), whilst traversing the site by vehicle or on foot. Red-listed species are generally uncommon and/or localised and the survey may have been insufficient to record their presence at or near the proposed development. Furthermore, the owner of the participating property was consulted regarding sightings of especially mammal species on the property. Please note the avifauna and bats were assessed in the avifaunal and bat specialist assessments and are not part of the current report.

### 2.2 Vegetation and flora

The plant species data were summarised in a phytosociological table (Appendix A) and nine plant communities and a further five habitats were identified, described and mapped. The term species is used here in a general sense to denote species, subspecies and varieties. The checklist of plant species in Appendix B was compiled from the

NewPosa database of the South African National Biodiversity Institute ([newposa.sanbi.org](http://newposa.sanbi.org)) and supplemented by own observations. The IUCN status, conservation and protected status of all plant species provided in Appendix B were determined from available literature and Acts, e.g. NewPosa database ([newposa.sanbi.org](http://newposa.sanbi.org)), and Red list database ([redlist.sanbi.org](http://redlist.sanbi.org)) of the South African National Biodiversity Institute; NEM:BA (2007c) (ToPS list); GDARD (1983), GDARDE (2011) and CITES (2023).

## 2.3 Fauna

Species lists (the term species is used here in a general sense to denote species, subspecies and varieties) of the faunal component were sourced from the Animal Demography Unit, University of Cape Town website ([www.adu.uct.ac.za](http://www.adu.uct.ac.za)) and consulting of other available databases and/or relevant literature, e.g. Leeming (2003), Skinner and Chimimba (2005), Alexander and Marais (2007), Mecenero *et al.* (2013), Bates *et al.* (2014), Child *et al.* (2016) and DEA (2016) to determine the diversity, conservation status and distribution of relevant faunal species (Appendix C). These species lists were supplemented by own observations and those observed by the landowner.

## 2.4 Sensitivity assessment

Based on the environmental features and the plant species encountered in the on-site survey, a sensitivity assessment of the vegetation of each habitat was done (Chapter 10). Sensitive features are presented spatially in GIS format (provided as a separate .kmz file).

## 2.5 Sources of information

### **Vegetation:**

- Vegetation types occurring in the area were obtained from Mucina & Rutherford (2006) and the revised national vegetation map produced by SANBI in 2018 (SANBI 2006-2018).
- Conservation status of the vegetation types was obtained from Mucina & Rutherford (2006) and the National List of Threatened Ecosystems (NEMA 2011, Skowno *et al.* 2019).
- Information on species endemic to a national vegetation type was obtained from Mucina & Rutherford (2006);
- The Igolide WEF does not occur in any Centre of Plant Endemism (Van Wyk & Smith 2001).
- A plant species checklist of the immediate region around the site (2627AD & 2627BC grids) was obtained from the NewPosa database of the South African National Biodiversity Institute (SANBI) and supplemented by own observations (Appendix B).
- The IUCN Red List Category for the plant species was extracted from the Threatened Species Programme as well as the NewPosa database of the South African National Biodiversity Institute (SANBI).
- GDARD (1983) was consulted to establish provincially specially protected and protected status of plant species including the GDARDE (2011) for rare plant species at and near the Igolide site (links provided by GDARDE).
- The National Protected tree list (NFA 2023) was consulted.

### **Fauna**

- Lists of mammals, reptiles, frogs, scorpions, (Scorpiones), spiders (Arachnida), butterflies (Lepidoptera), lacewings (Neuroptera), dung beetles (Scarabinae) and dragonflies (Odonata) were extracted from the Animal Demography Unit, University of Cape Town website (<http://ymus.adu.org.za>) and supplemented by information gathered in Bates *et al.* (2014) for reptiles; Skinner and Chimimba (2005) for mammals; and Mecenero *et al.* (2013) for butterflies (Appendix C).
- The IUCN Red List Category for the animal species was extracted from Child *et al.* (2016) for mammals;

Bates *et al.* (2014) for reptiles; and Mecenero *et al.* (2013) for butterflies. No IUCN Categories are however available for lacewings, dung beetles, spiders and scorpions.

- GDARD (1983) was consulted to establish provincially specially protected and protected status of animal species.
- The avifauna and bat components are reported on separately (see specialist reports).

#### **Other**

- The GDARDE (2011) was consulted for maps indicating CBAs and ESAs in the region of the Igolide site (links provided by GDARDE).
- The National Protected Areas Expansion Strategy (NPAES 2018) was consulted for possible inclusion of the site into the expansion strategy.
- National Freshwater Ecosystem Priority Areas (FEPA) was consulted for rivers and wetlands.

#### **Regulatory framework**

This report has been prepared in terms of the Environmental Impact Assessment (EIA) Regulations under the National Environmental Management Act (Act No. 107 of 1998) (NEMA 2014, 2017) and the gazetted Environmental Assessment Protocol of the NEMA EIA Regulations (2014, as amended), where applicable (Government Gazette 43110, No. 320, 20 March 2020).

*Note: This specialist assessment was commissioned on **25 October 2020** (between ENERTRAG and Ekotrust) prior to the gazetting of the 'Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species' and the 'Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant Species' (GG 43855 / GN R1150, 30 October 2020) (NEMA 2020b). We refer to the following in the gazetted procedures published on 30 October 2020: **"The requirements of these protocols will apply from the date of publication, except where the applicant provides proof to the competent authority that the specialist assessment affected by these protocols had been commissioned by the date of publication of these protocols in the Government Gazette, in which case Appendix 6 of the Environmental Impact Assessment Regulations, 2014, as amended, will apply to such applications."***



## 3. REGULATORY FRAMEWORK

### 3.1 Introduction

The White Paper on the conservation and sustainable use of South Africa's biodiversity and the National Environmental Management Act (Act No. 107 of 1998) specifies that due care must be taken to conserve and avoid negative impacts on biodiversity and that the sustainable, equitable and efficient use of biological resources must be promoted. Various acts provide control over natural resources in terms of their conservation, the use of biological resources and avoidance of negative impacts on biodiversity. Some international conventions are also relevant to sustainable development.

### 3.2 Natural resources

Terrestrial and other ecosystems and their associated species are widely used for commercial, semi-commercial and subsistence purposes through both formal and informal markets. While some of this use is well managed and/or sustainable, much is thought to be unsustainable. "Use" in this case refers to direct use, such as collecting, harvesting, hunting and fishing for human consumption and production, as well as more indirect use such as ecotourism and wildlife ranching.

### 3.3 Convention on Biodiversity (CBD)

South Africa is a signatory to the United Nations Convention on Biological Diversity (CBD), which was ratified in 1995. The CBD requires signatory states to implement the objectives of the Convention, which are the conservation of biodiversity; the sustainable use of biological resources; and the fair and equitable sharing of benefits arising from the use of genetic resources. According to Article 14 (a) of the CBD, each Contracting Party, as far as possible and as appropriate, must introduce appropriate procedures, such as environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, to avoid or minimize these effects and, where appropriate, to allow for public participation in such procedures.

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

NEMA is the framework environmental management legislation, enacted as part of the government's mandate to ensure every person's constitutional right to an environment that is not harmful to his or her health or well-being. It is administered by the Department of Forestry, Fisheries and the Environment (DFFE), but several functions have been delegated to the provincial environment departments. One of the purposes of NEMA is to provide for cooperative environmental governance by establishing principles for decision-making on matters affecting the environment. The Act further aims to provide for institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state and to provide for the administration and enforcement of other environmental management laws.

The EIA Regulations Listing Notices of 2010 were repealed in 2014 and amended regulations and listings were published in 2014 and 2017 under the National Environmental Management Act (NEMA 2014, 2017). Listing Notice 1 (GRN No. 327), Listing Notice 2 (GRN No 325) and Listing Notice 3 (GRN No 324) of the 2017 Regulations list activities that may require Environmental Authorisation prior to commencement of an activity and identify competent authorities in terms of sections 24(2) and 24D of the Act.

Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA 1998, when applying for Environmental Authorisation were published in the Government Gazette 43110, No 320, 20 March 2020 and Government Gazette 43855 / GN R1150, 30 October 2020).

### 3.5 National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA)

As the principal national act regulating biodiversity protection, NEM:BA, which is administered by DFFE, is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. The term 'biodiversity', according to the Convention on Biodiversity (CBD), refers to the variability among living organisms from all sources including, *inter alia* terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity in genes, species and ecosystems.

#### **Threatened ecosystems**

Section 53 of NEM:BA lists the threatened status of ecosystems, i.e. critically endangered ecosystems, endangered ecosystems, and vulnerable ecosystems. The list of threatened ecosystems was published in 2011 (NEM:BA 2011). Thirty-four percent of South Africa's 440 terrestrial ecosystems are considered threatened. Of these, 5% are critically endangered (mostly in fynbos and forest biomes), 13% are endangered (mostly in the grassland and savanna biomes), and 16% are vulnerable (mostly in the fynbos and grassland biomes). The recent 2018 National Biodiversity Assessment (Skowno *et al.* 2019) includes the updated extent and status of threatened ecosystems, although not yet formally adopted under the NEM:BA.

#### **Threatened or Protected Species (ToPS) Regulations**

Section 56 of NEM:BA makes provision for the declaration of species which are of such high conservation value, national importance or are considered threatened that they need protection, i.e. critically endangered species, endangered species and vulnerable species. Lists of species that are threatened or protected, and associated activities that are prohibited and/or exempted from restriction were published in 2007 (NEMBA 2007c). Any proposed development involving one or more threatened or protected species and/or prohibited/restricted activities will require a permit in term of these Threatened or Protected Species (ToPS) Regulations.

#### **Alien and Invasive Species (AIS) Regulations**

Chapter 5 of NEM:BA provides for the protection of biodiversity from alien and invasive species. The act defines alien species and provides lists of invasive species in regulations. The Alien and Invasive Species (AIS) lists were published in Government Gazette No. 43726 of 18 September 2020 (NEM:BA 2020a). The Alien and Invasive Species (AIS) Regulations, in terms of Section 97(1) of NEM:BA, was subsequently published in Government Gazette No. 43735 of 25 September 2020 (NEM:BA 2020b).

In terms of the aforementioned legislation, the following categories of declared alien and invasive plants are recognised in South Africa (see Glossary for explanations):

1. Category 1a Listed Invasive Species
2. Category 1b Listed Invasive Species
3. Category 2 Listed Invasive Species
4. Category 3 Listed Invasive Species

### 3.6 The National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM:PAA)

NEM:PAA provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.

### 3.7 National Forests Act (Act No. 84 of 1998) (NFA)

The National Forest Act makes provision for the declaration of for example specially protected areas, forest nature reserves, forest wilderness areas and protected woodlands. The latest list of declared protected tree species in terms of the NFA was published in 2023 (NFA 2023). In terms of section 15(1) of this act, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. The competent authority responsible for considering and issuing the license will be the national Department of Forestry, Fisheries and the Environment (DFFE).

### 3.8 Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA)

The objectives of the Conservation of Agricultural Resources Act are to provide for the conservation of the natural agricultural resources by the maintenance of the production potential of the land; by combating and preventing erosion and weakening or destruction of the water resources; and by protecting natural vegetation and combating weeds and invader plants. In order to achieve the objectives, certain control measures are prescribed to which land users must comply. The activities mentioned relate to:

- the cultivation of virgin soil;
- the irrigation of land;
- the prevention or control of waterlogging or salinisation of land;
- the utilisation and protection of vleis, marshes and water courses;
- the regulation of the flow pattern of run-off water;
- the utilisation and protection of vegetation; and
- the restoration or reclamation of eroded land.

### 3.9 Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES is an international agreement to which countries adhere voluntarily. The aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The species covered by CITES are listed in three appendices reflecting the degree of protection that the species needs. Appendix I includes species that are threatened with extinction and trade in these species is permitted only in exceptional circumstances. Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. Appendix III lists species that are protected in at least one country that has asked other CITES parties for assistance in controlling the trade (Website: [www.cites.org](http://www.cites.org), accessed October 2020).

## 4. STUDY AREA

### 4.1 Location

The Igolide site covers an area of approximately 680 ha and is located northeast of Fochville on portions 14, 20 and RE/22 of the farm Kraalkop 147 IQ and portions 8, 57, 65 and 66 of the farm Leeuwpoot 356 IQ (Figures 1a, 1b & 2). The area falls within the West Rand District Municipality and the Merafong City Local Municipality in Gauteng province. The homestead on site is located at 26° 27' 04.2" S; 27° 30' 21.7" E.

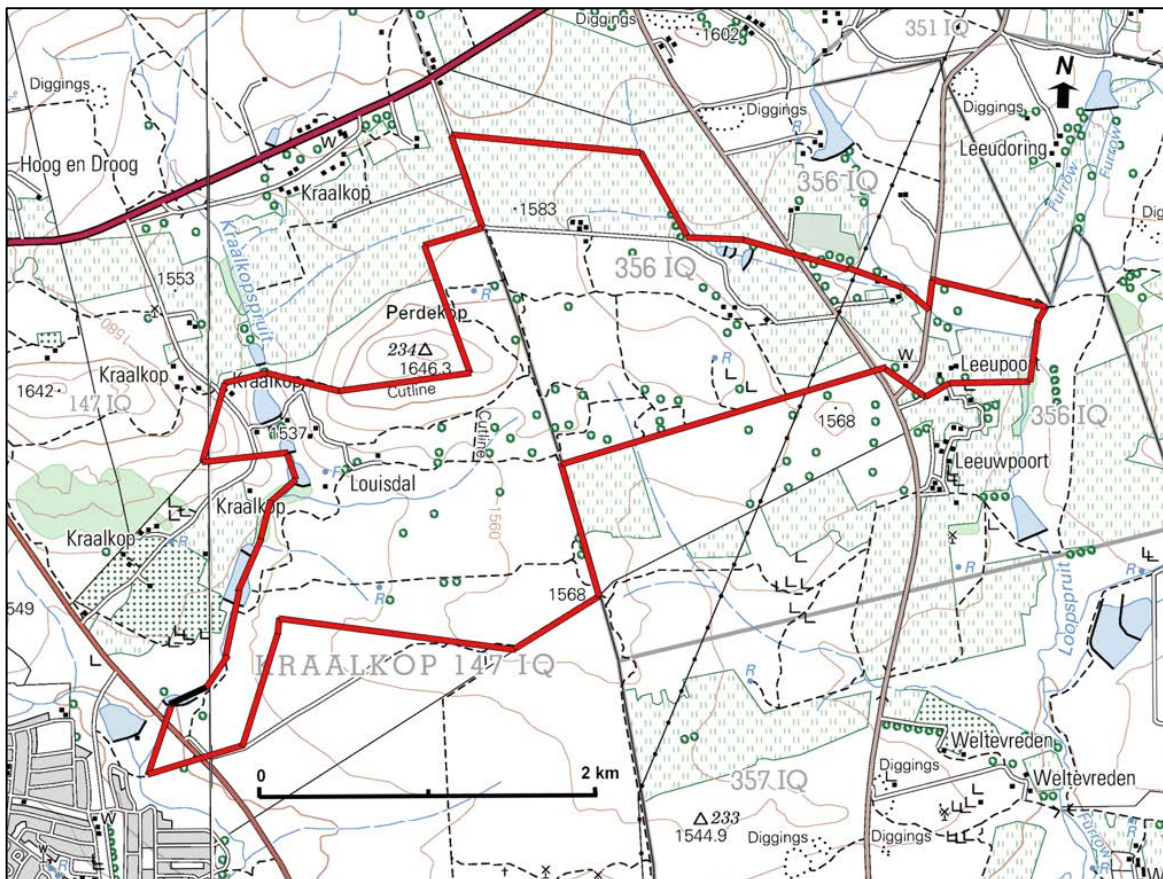


Figure 1: Topocadastral map of the Igolide WEF site (2627BC Westonaria 2010, 2627AD Carltonville 2010).

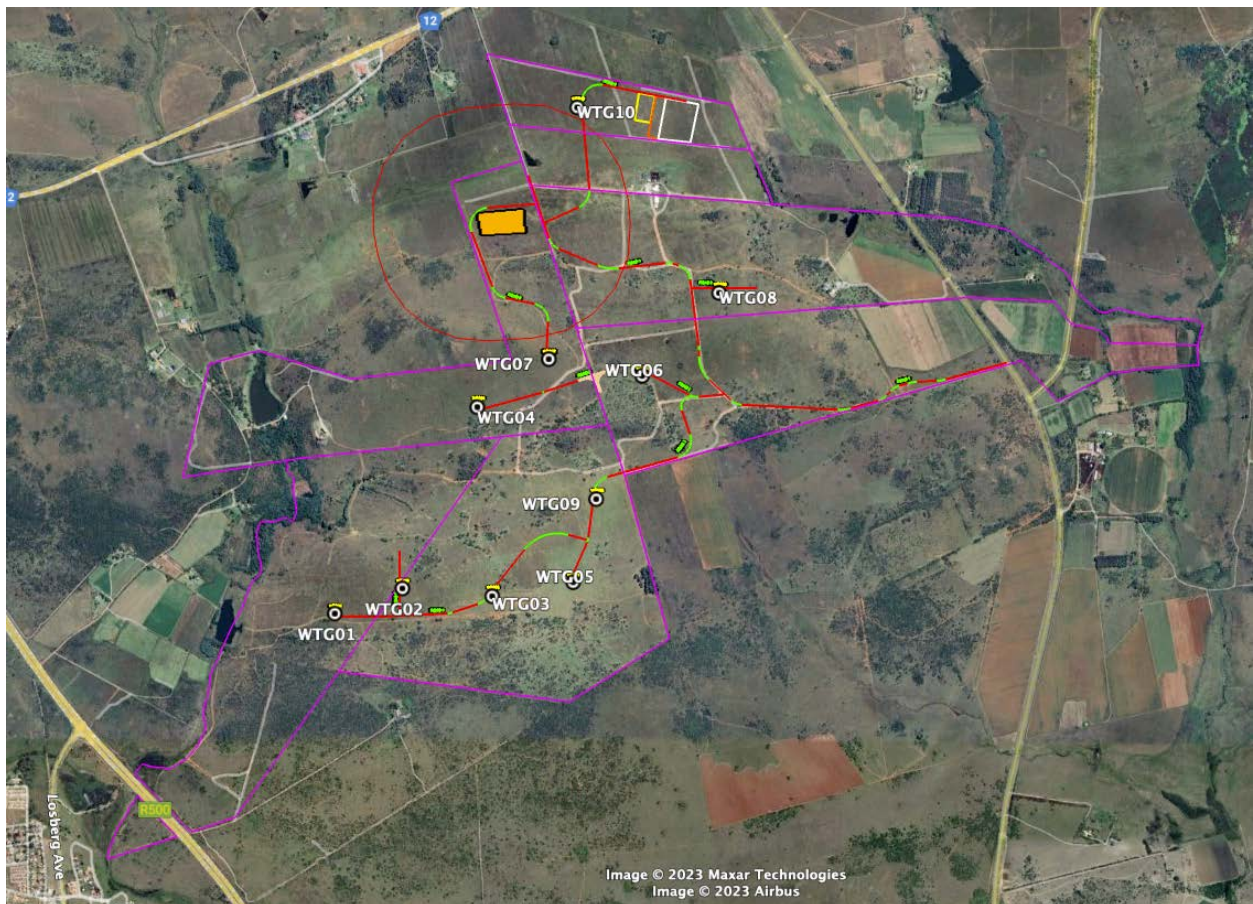


Figure 2: Google image of the Igolide WEF site with proposed roads and location of 10 turbines indicated (WTG01 – WTG10). Orange rectangle = on-site IPP substation/BESS; red/white/yellow rectangles = other ancillary areas (batching plant, construction camp and laydown).

## 4.2 Terrain morphology and drainage

The site is characterised by grassland on the sloping plains and low hills, with bushveld patches on the rocky plains and koppies (ridges). The altitude ranges from 1500 m at the lowest point in the west up to approximately 1620 m at the highest point on the hill in the central part of the site (Figure 1).

The site is drained from north to south on the western boundary by the Kraalkopspruit and its tributaries and by a stream in the east.

## 4.3 Climate

### 4.3.1 Regional climate (Mucina & Rutherford 2006)

The site falls in a strongly seasonal summer-rainfall, warm-temperate region, with very dry winters. The mean annual precipitation of the Rand Highveld Grassland is 654 mm (range from 570 mm in the west to 730 mm in the east) with a peak in rainfall in January. The annual precipitation coefficient of variation is 25%. Mean annual potential evaporation is 1926 mm, while the mean annual soil moisture stress is 73%. Mean annual temperature is 14.7°C and frost is frequent in winter with a mean of 32 days per annum.

### 4.3.2 Rainfall

The mean annual rainfall in the region ranges from 613 mm at Fochville to 652 mm at the farm Leeuwpoort (Table 1). The mean annual rainfall as measured at Carltonville is 646 mm (Table 2, Figure 3). The total annual rainfall at Carltonville during dry and wet years respectively may range from 421 mm to 1109 mm, indicating a high variation in the annual rainfall and therefore a rainfall scenario that is highly unpredictable. The rainy season at Carltonville is predominantly from October to April when about 92% of the annual rainfall occurs. December and January are the wettest months and the driest period is from June to August, when less than 10 mm of rain per month is recorded (Figure 3). Maximum rainfall measured over a 24-hour period at Carltonville was 159 mm, recorded in December. The highest monthly rainfall recorded was 272 mm, measured in January.

Table 1: Rainfall at some weather stations in the general environs of the Igolide site (Weather Bureau 1998)

Month	Mean Annual Rainfall (mm)				
	Fochville	Leeuwpoort	Carltonville	Potchefstroom	Elandsfontein
Jan	110	117	119	119	107
Feb	74	87	73	83	95
Mar	83	85	77	78	85
Apr	41	43	58	61	32
May	20	23	13	15	20
June	7	7	6	7	7
July	6	8	4	4	9
Aug	6	6	8	10	8
Sep	18	18	20	20	18
Oct	55	57	66	55	52
Nov	93	97	93	85	80
Dec	98	97	109	94	105
Year	613	652	646	631	618

Table 2: Maximum rainfall (mm) in 24 hours, highest maximum and lowest monthly minimum rainfall at Carltonville: 26° 20' S; 27° 23' E; 1500 m (Weather Bureau 1998)

Month	Rainfall (mm)			
	Mean (month)	24 h max	Max per month	Min per month
Jan	119	71	272	44
Feb	73	111	204	29
Mar	77	79	204	3
Apr	58	72	201	7
May	13	33	75	0
June	6	21	35	0
July	4	29	29	0
Aug	8	35	81	0
Sep	20	45	90	0
Oct	66	102	169	8
Nov	93	73	216	24
Dec	109	159	252	46
Year	646	159	1109	421

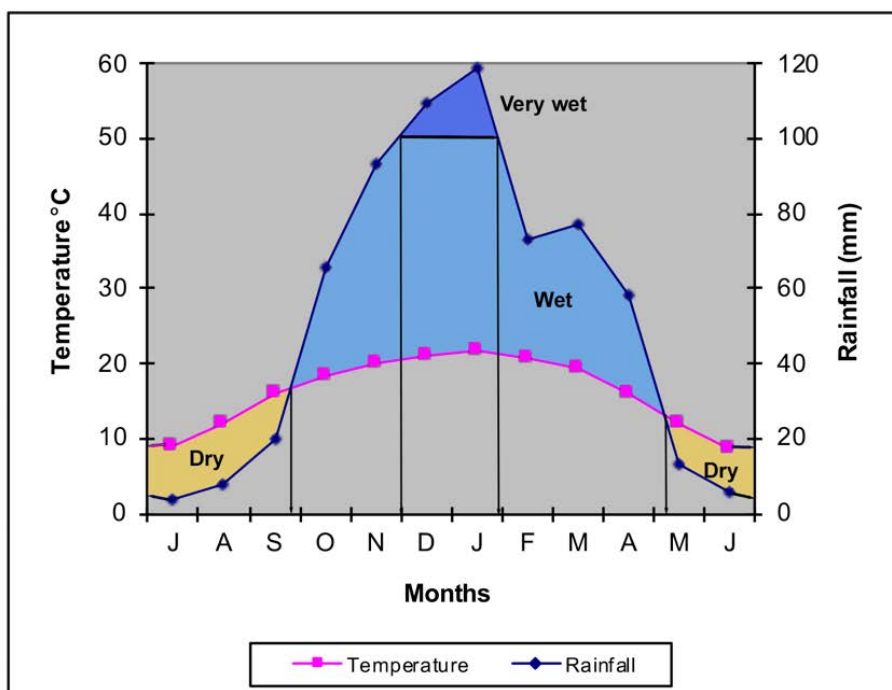


Figure 3: Climate diagram for Carltonville. Months on X-axis are from July to June. When the rainfall curve is below the temperature curve it indicates a dry period and when the monthly rainfall is higher than 100 mm it indicates a very wet period.

#### 4.3.3 Temperature

The mean annual temperature for Carltonville is 16.3°C (Table 3) with the extreme maximum and minimum temperatures 37.1°C and -9.5°C respectively. The mean daily maximum for January is 27.9°C and for July it is 18.4°C, whereas the mean daily minimum for January is 16.5°C and for July it is 7.9°C. Frost may occur anytime from April to October.

Table 3: Temperature data (°C) for Carltonville: 26° 20' S; 27° 23' E; 1500 m (Weather Bureau 1998)

	Temperature (°C)												Year
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Max	27.8	27.2	26.1	23.1	20.7	17.8	18.4	21.1	24.5	25.9	26.6	27.6	23.9
*Ext. Max	37.1	35.2	33.7	31.8	29.2	24.4	24.8	27.6	32.6	34.7	35	35.2	37.1
Min	16.5	16.9	14.5	9.8	8.8	3.5	7.9	8.7	8.4	11.5	8.8	15.1	3.5
*Ext. Min	7.5	5.5	2.0	-1.2	-5.6	-9.0	-8.8	-9.5	-3.3	-0.7	2.8	1.2	-9.5
Mean	21.6	20.9	19.5	15.9	12.1	8.7	9.0	11.9	16.1	18.4	20.0	21.1	16.3

Max = mean daily maximum temperature for the month

\*Ext. Max = extreme maximum temperature recorded per month

Min = mean daily minimum temperature for the month

\*Ext. Min = extreme minimum temperature recorded per month

Mean = mean monthly temperature for each month and for the year

#### 4.3.4 Cloudiness and relative air humidity

At Potchefstroom, the cloud cover at 14:00 is the highest from November to March (4.5 – 4.8 eights) and the lowest in June, July and August (1.3 – 1.6 eights) (Table 4). The highest mean relative air humidity (%) at 08:00 occurs during

the autumn and winter months (March to July; 80 – 84%) and the lowest relative air humidity at 14:00 (27 - 28%) occurs in spring (August and September) (Weather Bureau 1998).

Table 4: Cloud cover at 14:00 and percentage relative air humidity at 08:00 and 14:00 at Potchefstroom: 26° 44' S; 27° 04' E; 1350 m (Weather Bureau 1988, 1998)

	Cloud (0-8)	Relative air humidity %	
	14:00	08:00	14:00
Jan	4.8	72	44
Feb	4.5	77	45
Mar	4.5	80	44
Apr	2.9	82	41
May	2.2	82	34
June	1.6	84	33
July	1.3	80	31
Aug	1.5	70	28
Sept	2.4	62	27
Oct	4.0	63	33
Nov	4.7	66	39
Dec	4.6	68	40
Year	3.3	74	37

#### 4.4 Geology

The geology of the site is depicted in the 1:250 000 geological map 2626 West Rand (Figure 4). Most of the site is underlain by andesite (Vh) of the Hekpoort Formation, Pretoria Group, Transvaal Sequence. The northern part of the site consists of shale and hornfels (Vt) of the Timeball Hill Formation, Pretoria Group, Transvaal Sequence. A small section in the southeast is underlain by shale and quartzite (Vs) of the Strubenskop Formation, Pretoria Group, Transvaal Sequence.

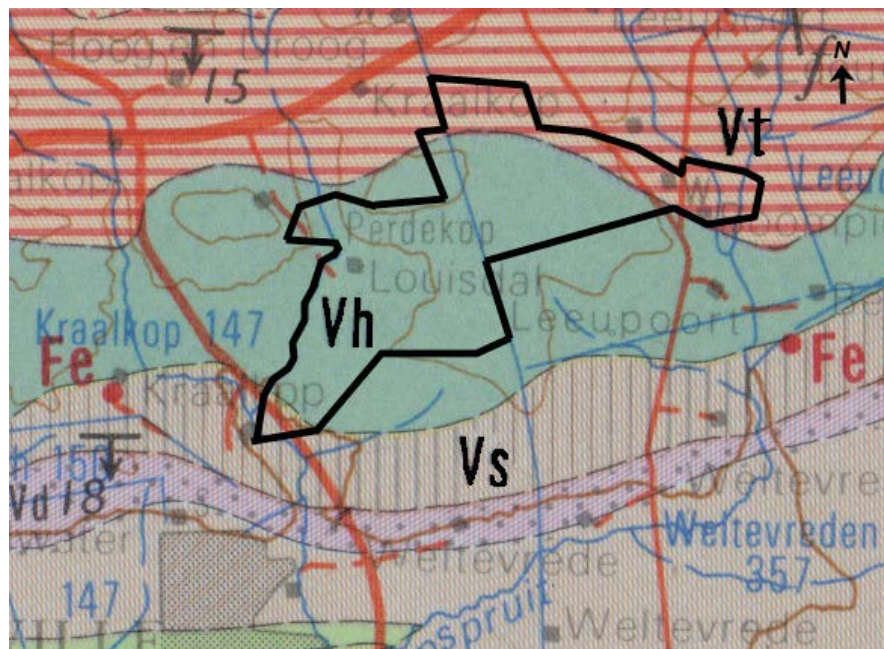


Figure 4. Geology of the Igolide site (2626 West Rand, Geological Survey 1986). Vh = andesite; Vs = shale and quartzite; Vt = shale and hornfels.



## 4.5 Land types

Land types denote areas that display a marked degree of uniformity with respect to terrain form, soil pattern and climate. A terrain unit within a land type is any part of the land surface with homogeneous form and slope. The site covers two land types consisting of the Ba and Fb Land Types (Figure 5). The Ba land type is classified as a plinthic catena where upland duplex and marginalitic soils are rare. The soils are dystrophic and/or mesotrophic, with red soils occurring widespread. The Fb land type is dominated by Glenrosa and/or Mispah soil forms where lime is rare or absent in the upland soils, but generally present in low-lying soils.

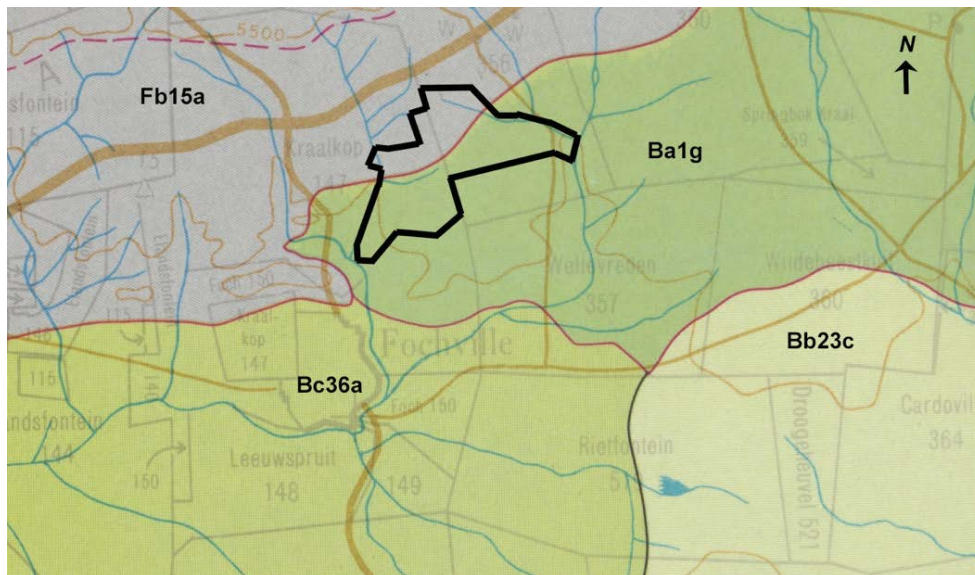


Figure 5. Land Types of the Igolide WEF site (2626 West Rand, Land Type Series 1979).

## 5. VEGETATION

### 5.1 Introduction

The site falls in the Grassland Biome, but in two Bioregions, i.e. the northern section of the site falls in the Central Bushveld Bioregion, while the remainder of the site falls in the Mesic Highveld Grassland Bioregion. The site does not fall within any Centre of Plant Endemism according to Van Wyk and Smith (2001).

### 5.2 Broad-scale vegetation types

#### *Rand Highveld Grassland (Gm 11)*

Most of the site is located in the Rand Highveld Grassland (Gm 11) (Figure 6) (Mucina & Rutherford 2006, SANBI 2018 revision). This vegetation type is heterogeneous and geographically disjunct. It covers a highly variable landscape with sloping plains and ridges elevated over the undulating surrounding plains. The vegetation comprises a species-rich sour grassland alternating with shrubland on rocky outcrops. The rocky hills support woody species such as *Senegalia caffra*, *Celtis africana*, *Protea caffra* and *Searsia* spp. Dwarf shrubs include *Seriphium plumosum* and *Searsia magalismontana*. The grass layer is characterised by *Eragrostis chloromelas*, *Diheteropogon amplexans*, *Loudetia simplex*, *Setaria sphacelata*, *Themeda triandra*, *Trachypogon spicatus* and *Tristachya rehmannii*. Common herbs include *Justicia anagalloides*, *Acalypha angustata*, *Helichrysum nudifolium*, *Nidorella hottentotica* and *Selago densiflora*.

Endemic taxa include *Melanospermum rudolfii*, *Polygala spicata*, *Anacampteros subnuda* subsp. *lubersii*, *Frithia humilis*, *Crassula arborescens* subsp. *undulatifolia*, *Delosperma purpureum*, *Encephalartos lanatus* and *E. middelburgensis*.

Although the conservation status of this vegetation type was listed as “Endangered” by Mucina & Rutherford (2006) it is listed as “Vulnerable” by NEMA (2011) and Skowno *et al.* (2019). Only 1.8% is statutorily conserved and almost half has been transformed mostly by cultivation, plantations and urbanisation (Skowno *et al.* 2019).

#### *Gauteng Shale Mountain Bushveld (SVcb 10):*

This vegetation type covers the northern parts of the Igolide site (Figure 6). The unit is characterised by low, broken ridges varying in steepness and with a high surface rock cover. The vegetation is a short (3–6 m tall) semi-open bushveld dominated by a variety of woody species including *Senegalia caffra*, *Dombeya rotundifolia*, *Vachellia karroo*, *Celtis africana*, *Combretum molle*, *Englerophytum magalismontanum*, *Protea caffra*, *Searsia magalismontana*, *Cussonia spicata*, *Zanthoxylum capense*, *Vangueria infausta*, *Ziziphus mucronata*, *Ancylobotrys capensis*, *Euclea crispa*, *Ehretia rigida*, *Diospyros lycioides* and *Grewia occidentalis*. The grass layer is characterised by *Hyparrhenia dregeana*, *Cymbopogon caesius*, *Cymbopogon pospischilii* and *Eragrostis curvula*. The conspicuous forbs include *Maclidium zeyheri*, *Helichrysum nudifolium*, *Helichrysum rugulosum*, *Hermannia lancifolia*, *Senecio venosus* and *Hilliardiella elaeagnoides*. In rocky areas the ferns *Cheilanthes hirta* and *Pellaea calomelanos* are prominent.

Although the conservation status of this vegetation type was listed as “Vulnerable” by Mucina & Rutherford (2006) it is listed as “Least Concern” by NEMA (2011) and Skowno *et al.* (2019). About 4.9% is statutorily conserved and more than 20% has been transformed mostly by cultivation, plantations, mines and quarries and urbanisation (Skowno *et al.* 2018).

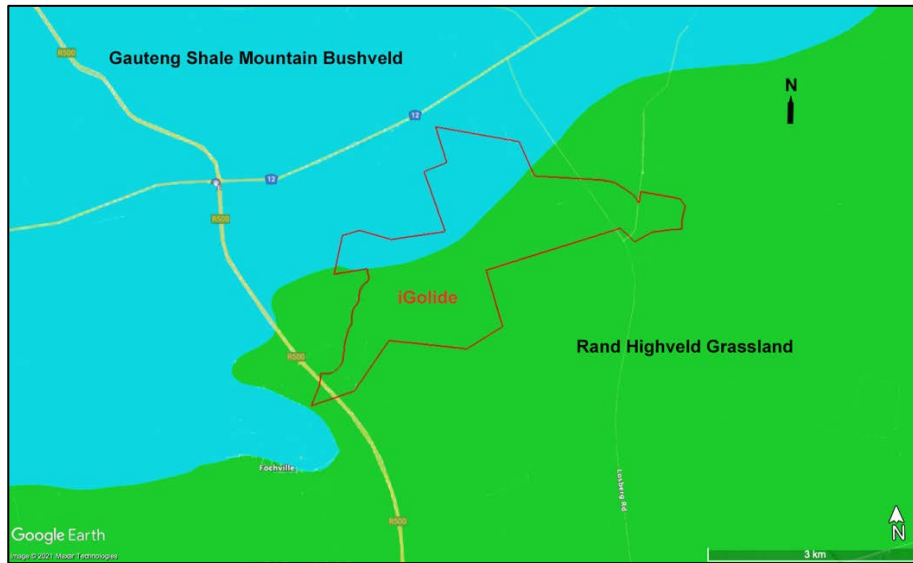
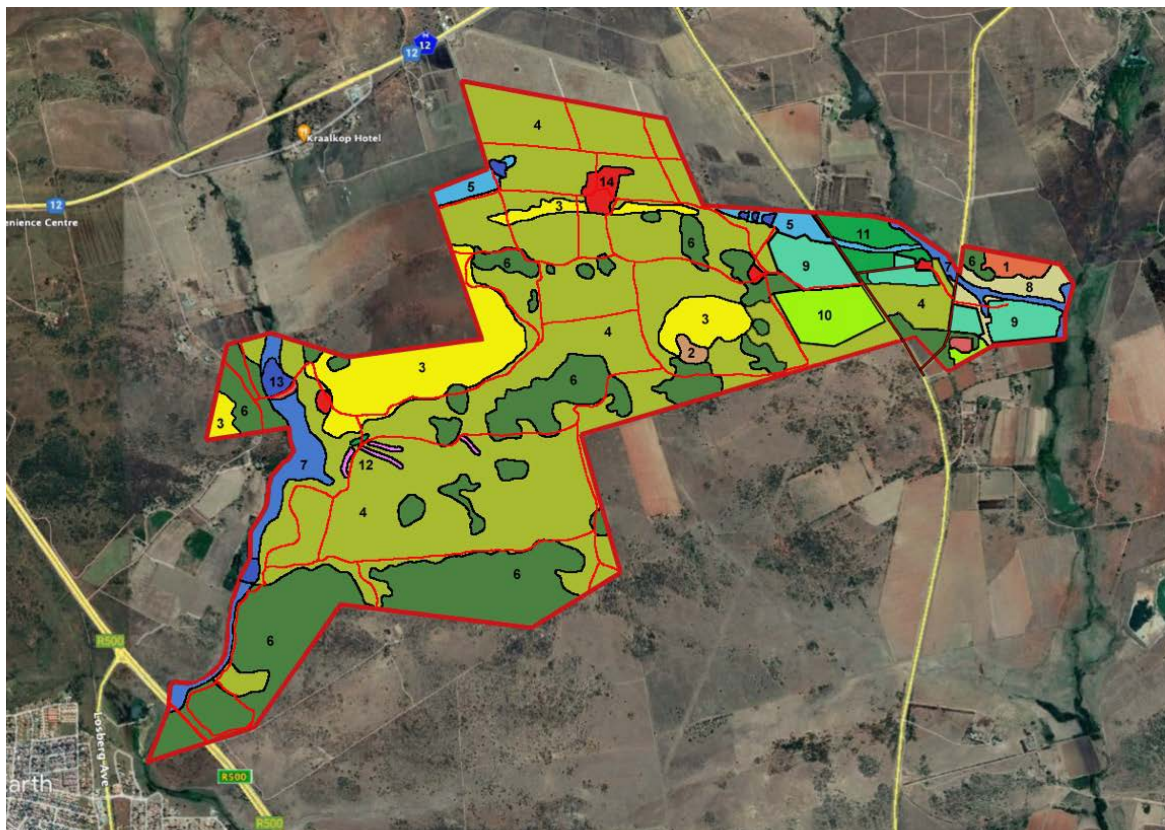


Figure 6. Vegetation types in the region of the Igolide site (SANBI 2006-2018).

### 5.3 Description of habitats (plant communities)

Based on species composition, nine natural habitats (plant communities) were distinguished, described and mapped on the Igolide site (Figure 7). A further five man-made units were also distinguished (Figure 7):

1. *Trachypogon spicatus* grassland
2. *Melinis repens* - *Selaginella dregei* rocky grassland
3. *Cymbopogon caesius* - *Elionurus muticus* rocky grassland
4. *Hyparrhenia hirta* - *Eragrostis chloromelas* grassland
5. *Eragrostis plana* - *Trisetopsis imberbis* wetlands/floodplains
6. *Vachellia karroo* - *Ehretia rigida* rocky bushveld
7. *Salix babylonica* - *Phragmites australis* riverine vegetation
8. *Hyparrhenia tamba* floodplains
9. *Eragrostis tef* - *Tagetes minuta* abandoned cropland
10. Planted pasture (*Digitaria eriantha*)
11. *Eucalyptus camaldulensis* plantations (degraded)
12. Hedges (*Robinia* sp., *Pyracantha* sp., *Cedrus* sp., *Searsia pyroides*)
13. Dams
14. Habitation/infrastructure



## Legend

- |    |  |
|----|--|
| 1  | Trachypogon spicatus grassland                                     |
| 2  | Melinis repens - Selaginella dregei rocky grassland                |
| 3  | Cymbopogon caesius - Elionurus muticus rocky grassland             |
| 4  | Hyparrhenia hirta - Eragrostis chloromelas grassland               |
| 5  | Eragrostis plana - Trisetopsis imberbis wetlands/floodplains       |
| 6  | Vachellia karroo - Ehretia rigida rocky bushveld                   |
| 7  | Salix babylonica - Phragmites australis riverine vegetation        |
| 8  | Hyparrhenia tamba floodplains                                      |
| 9  | Eragrostis tef - Tagetes minuta abandoned cropland                 |
| 10 | Planted pasture (Digitaria eriantha)                               |
| 11 | Eucalyptus camaldulensis plantations (degraded)                    |
| 12 | Hedges (Robinia sp., Pyracantha sp., Cedrus sp., Searsia pyroides) |
| 13 | Dams   |
| 14 | Habitation/infrastructure  |

Figure 7: Vegetation map of the Igolide site.

#### Habitat 1. *Trachypogon spicatus* grassland

This grassland covers a small area of the Igolide site and occurs on the plains near the eastern boundary (Figures 7 & 8). Surface rocks and gravel are absent and the deep, red, well-drained clayloam soils are derived from shale. This habitat resembles a planted pasture on cropland, however it is dominated by a rather unpalatable grass species *Trachypogon spicatus*. No trees or shrubs were noted in this habitat.

The diagnostic species of this habitat (community) is *Trachypogon spicatus* (species group 1, Appendix A).

- Dwarf shrubs cover 2% of the habitat and are represented by *Seriphium plumosum*.
- The grass layer is well developed and covers approximately 95% of the area. The dominant grass species is *Trachypogon spicatus*, with *Hyparrhenia hirta*, *Eragrostis chloromelas*, *Digitaria eriantha* and *Themeda triandra* occurring at low densities.
- Herbaceous species have a mean canopy cover of less than 2%. The most common species include

*Hilliardiella elaeagnoides* and *Helichrysum coriaceum*.

- No alien invasive plant species were recorded.



Figure 8: Habitat 1 – grassland dominated by *Trachypogon spicatus*.

Threatened (red listed) and/or protected species recorded in plant community 1:

IUCN list:	None
NEM:BA (ToPS):	None
NFA:	None
GDARD:	None
CITES:	None
Endemic species:	None

**Habitat 2.** *Melinis repens* - *Selaginella dregei* rocky grassland

This small rocky outcrop habitat occurs in the southeastern part of the site (Figures 7 & 9). Surface rocks cover 50–75% of the area with gravel covering 10–30% of the soil surface. The shallow, well-drained, red, loamy soils are derived from andesite.

The diagnostic species of this habitat (community) include *Searsia magalismsontana*, *Selaginella dregei*, *Cyanotis speciosa*, *Oldenlandia herbacea* and *Oropetium capense* (species group 2, Appendix A).

- Trees (>3 m) have a mean canopy cover of less than 1% and are characterised by *Searsia leptodictya*.
- Shrubs cover on average 4% of the area and the most prominent species are *Searsia rigida*, *Diospyros lycioides*, *Euclea crispa* and *Zanthoxylum capense*.
- Dwarf shrubs cover 2% of the habitat and include *Searsia magalismsontana* and *Lippia scaberrima*.
- The grass layer is poorly developed and covers approximately 20% of the area. The dominant grass species include *Cymbopogon caesius*, *Melinis repens* and *Microchloa caffra*. Other grass species are *Oropetium capense*, *Eragrostis gummiflua*, *Setaria sphacelata*, *Aristida congesta* subsp. *congesta*, *Cynodon dactylon* and *Eragrostis chloromelas*.
- Herbaceous species have a mean canopy cover of approximately 12%. The most common species include the ferns *Selaginella dregei* and *Pellaea calomelanos* and other forbs such as *Cyanotis speciosa*, *Hermannia transvaalense*, *Oldenlandia herbacea*, *Sphedamnocarpus pruriens*, *Selago densiflora* and *Monsonia angustifolia*.

- No alien invasive plant species were recorded.



Figure 9. Habitat 2: rocky outcrop (sheets) characterised by *Searsia magalismontana* and *Selaginella dregei*.

Threatened (red listed) and/or protected species recorded in plant community 2:

IUCN list:	None
NEM:BA (ToPS):	None
NFA:	None
GDARD:	<i>Gladiolus permeabilis</i>
CITES:	None
Endemic species:	None

**Habitat 3.** *Cymbopogon caesius* - *Elionurus muticus* rocky grassland

This rocky grassland occurs in the central parts of the site (Figures 7 & 10). Surface rocks cover 10–50% of the area, with a mean cover of 16%. Gravel covers from < 10% up to 30% of the soil surface with a mean of 12% cover. The shallow to intermediately deep, well-drained, red to red-brown, loam to sandy loam soils are derived from andesite.

The diagnostic species of this habitat (community) include *Indigofera hiliaris*, *Elionurus muticus*, *Brachiaria serrata*, *Scabiosa columbaria* and *Striga elegans* (species group 3, Appendix A).

- Tall trees (>6 m) have a mean canopy cover of less than 1% and are characterised by *Celtis africana*.
- Trees (>3 – 6 m) have a mean canopy cover of 1% and are characterised by *Vachellia karroo*, *Searsia leptodictya* and *Searsia pyroides*.
- Shrubs cover on average 1% of the area and the most prominent species are *Diospyros lycioides*, *Searsia rigida*, *Euclea crispa* and *Zanthoxylum capense*.
- Dwarf shrubs cover 2% of the habitat and include *Lippia scaberrima*, *Solanum lichtensteinii*, *Seriphium plumosum*, *Asparagus suaveolens*, *Asparagus laricinus* and *Ziziphus zeyheriana*.
- The grass layer is well developed and covers approximately 87% of the area. The dominant grass species include *Cymbopogon caesius*, *Setaria sphacelata* and *Eragrostis chloromelas*. Other common grass species include *Elionurus muticus*, *Brachiaria serrata*, *Microchloa caffra*, *Trachypogon spicatus*, *Melinis repens*, *Themeda triandra* and *Hyparrhenia hirta*.
- Herbaceous species have a mean canopy cover of approximately 6%. The most common species include *Indigofera hiliaris*, *Scabiosa columbaria*, *Striga elegans*, *Helichrysum rugulosum*, *Selago densiflora*, *Arctotis*

*arctotoides*, *Plantago lanceolata*, *Tephrosia capensis* and *Hermannia depressa*.

- The following alien invasive plant species were recorded: *Solanum sisymbriifolium*, *Verbena brasiliensis*, *Xanthium spinosum* and *Pyracantha angustifolia*.



Figure 10. Habitat 3: *Cymbopogon caesius* - *Elionurus muticus* rocky grassland.

Threatened (red listed) and/or protected species recorded in plant community 3:

IUCN list:	None
NEM:BA (ToPS):	None
NFA:	None
GDARD:	<i>Gladiolus permeabilis</i>
CITES:	None
Endemic species:	None

**Habitat 4.** *Hyparrhenia hirta* - *Eragrostis chloromelas* grassland

This natural grassland/old field grassland covers most of the site (Figures 7 & 11). The old field grasslands are most probably older than 10 years. Surface rocks and gravel are mostly absent from the area. The intermediate to deep, well-drained, orange-brown to red, loam to clayloam soils are derived from andesite.

The diagnostic species in this habitat (community) include *Sida rhombifolia*, *Aristida bipartita*, *Hermannia depressa* and *Nidorella anomala* (species groups 5, 6 & 9, Appendix A).

- Tall trees (>6 m) have a mean canopy cover of less than 1% and are characterised by *Vachellia karroo*.
- Trees (>3 – 6 m) and shrubs have a mean canopy cover of about 1% and are characterised by *Vachellia karroo* and *Searsia pyroides*.
- Dwarf shrubs cover less than 1% of the habitat and include *Asparagus larinicus*, *Solanum lichtensteinii*, *Lippia scaberrima* and *Seriphium plumosum*.
- The grass layer is well developed and covers up to a 98% of the area. The dominant grass species is *Hyparrhenia hirta*. Other common grass species include *Eragrostis chloromelas*, *Themeda triandra*, *Eragrostis plana*, *Cynodon dactylon*, *Eragrostis gummiflua*, *Paspalum dilatatum* and *Aristida congesta*.
- Herbaceous species have a mean canopy cover of approximately 7%. The most common species include the ferns and other forbs such as *Arctotis arctotoides*, *Selago densiflora*, *Plantago lanceolata*, *Conyza podocephala*, *Lactuca inermis*, *Helichrysum nudifolium*, *Helichrysum rugulosum*, the naturalised aliens

*Erigeron sumatrensis* and *Richardia brasiliensis* and the alien invasive *Verbena bonariensis*.

- The following alien invasive plant species were recorded: *Verbena brasiliensis* and *Verbena bonariensis*.

a.



b.



Figure 11 (a & b): Habitat 4: *Hyparrhenia hirta* - *Eragrostis chloromelas* grassland.

Threatened (red listed) and/or protected species recorded in plant community 4:

IUCN list: None  
 NEM:BA (ToPS): None  
 NFA: None  
 GDARD: None  
 CITES: None  
 Endemic species: None

**Habitat 5.** *Eragrostis plana* - *Trisetopsis imberbis* wetlands/floodplains

This wetland grassland occurs in the northwest and eastern parts of the site (Figures 7 & 12). Surface rocks and gravel are absent from this habitat. The deep, poorly drained, dark clayloam to clayey soils are alluvial in origin.



a.



b.



Figure 12 (a & b): Habitat 5: *Eragrostis plana* - *Trisetopsis imberbis* wetlands/floodplains.

The diagnostic species in this habitat (community) include *Trisetopsis imberbis*, *Andropogon eucomis*, *Panicum schinzii* and *Eragrostis rotifer* (species group 7, Appendix A).

- Trees (>3 m) have a mean canopy cover of less than 1% and are characterised by *Vachellia karroo*, *Salix babylonica* and *Searsia pyroides*.
- Shrubs cover on average 1% of the area and the most prominent species is *Diospyros lycioides*.
- Dwarf shrubs cover 1% of the habitat and include *Asparagus larcinus*.
- The grass layer is well developed and covers up to a 100% of the area. Dominant grass species are *Paspalum dilatatum*, *Eragrostis plana*, *Hyparrhenia hirta* and *Eragrostis gummiflua*. Other common grass species are *Cynodon dactylon*, *Trisetopsis imberbis*, *Andropogon eucomis*, *Panicum schinzii* and *Eragrostis rotifer*.
- Herbaceous species have a mean canopy cover of approximately 5%. The most common species include the sedges *Kyllinga erecta*, *Cyperus rupestris* and *Cyperus esculentus* and other forbs such as *Berkheya radula*, *Plantago lanceolata*, *Arctotis arctotoides*, *Selago densiflora* and the alien invasive *Verbena bonariensis*.
- The following alien invasive plant species were recorded: *Eucalyptus camaldulensis*, *Cirsium vulgare*, *Verbena brasiliensis* and *Verbena bonariensis*.

Threatened (red listed) and/or protected species recorded in plant community 5:

IUCN list:	None
NEM:BA (ToPS):	None
NFA:	None
GDARD:	None
CITES:	None
Endemic species:	None

**Habitat 6.** *Vachellia karroo* - *Ehretia rigida* rocky bushveld

This rocky bushveld occurs widespread across the site on rocky plains and koppies (Figures 7 & 13). Rocky structures are present in some areas indicating human occupation in the past. Surface rocks are absent on some of the plains, but cover up to 50% of the rocky outcrops (koppies), with a mean cover of 15%. Gravel is mostly absent, but covers < 10% of some of the sites, with a mean of 3% cover. The shallow to intermediately deep, well-drained, red soils are derived from andesite.

The diagnostic species of this habitat (community) include *Ehretia rigida*, *Searsia leptodictya*, *Gymnosporia polyacantha*, *Senegalia caffra*, *Senegalia hereroensis*, *Digitaria eriantha* and *Glandularia aristigera* (species group 11, Appendix A).

- Tall trees (>6 m) have a mean canopy cover of 7% and are characterised by *Senegalia caffra*, *Senegalia hereroensis*, *Vachellia karroo* and *Celtis africana*.
- Trees (>3 m) have a mean canopy cover of 13% and are characterised by *Vachellia karroo*, *Searsia leptodictya*, *Searsia pyroides*, *Ziziphus mucronata* and *Scolopia zeyheri*.
- Shrubs cover on average 11% of the area and the most prominent species are *Gymnosporia polyacantha*, *Ehretia rigida*, *Euclea crispa*, *Zanthoxylum capense*, *Searsia rigida* and *Gymnosporia buxifolia*
- Dwarf shrubs cover 3% of the habitat and include *Solanum lichtensteinii*, *Lippia scaberrima*, *Asparagus laricinus* and *Asparagus setaceus* and the naturalised alien *Solanum pseudocapsicum*.
- The grass layer is well developed and covers approximately 74% of the area. The dominant grass species include *Cynodon dactylon*, *Themeda triandra*, *Setaria sphacelata* and *Eragrostis plana*. Other common grass species are *Digitaria eriantha*, *Eragrostis curvula*, *Aristida congesta*, *Melinis repens*, *Eragrostis chloromelas*, *Urochloa mosambicensis* and *Hyparrhenia hirta*.
- Herbaceous species have a mean canopy cover of approximately 7%. The most common species include *Conyza podocephala*, *Senecio inornatus*, *Selago densiflora*, *Glandularia aristigera*, *Pentarrhinum insipidum* and *Leonotis martinicensis*, and the naturalised aliens *Achyranthes aspera*, *Schkuhria pinnata* and *Gomphrena celosioides*.
- The following alien invasive plant species were recorded: *Verbena brasiliensis*, *Cuscuta campestris*, *Solanum elaeagnifolium*, *Campyloclinium macrocephalum* and *Opuntia ficus-indica*.

Threatened (red listed) and/or protected species recorded in plant community 6:

IUCN list:	None
NEM:BA (ToPS):	None
NFA:	None
GDARD:	None
CITES:	None
Endemic species:	None

a.



b.



Figure 13 (a & b): Habitat 6: *Vachellia karroo* - *Ehretia rigida* rocky bushveld on the plains and koppies.

**Habitat 7.** *Salix babylonica* - *Phragmites australis* riverine vegetation

This riparian habitat occurs in the west and the east along perennial streams (Figures 7 & 14). Surface rocks and gravel are absent from this habitat. The deep, poorly drained, dark, clayloam to clayey soils are alluvial in origin. The diagnostic species for this habitat (community) are *Phragmites australis*, *Paspalum urvillei*, *Hemarthria altissima*, *Cyperus congestus*, *Typha capensis* and the alien trees *Salix babylonica*, *Populus x canescens*, *Acacia mearnsii*, *Acacia dealbata* and *Eucalyptus camaldulensis* (species group 15, Appendix A).

- Tall trees (>6 m) have a mean canopy cover of 27% and are characterised by the alien tree species *Populus x canescens*, *Salix babylonica*, *Eucalyptus camaldulensis*, *Acacia dealbata* and *Acacia mearnsii*.
- Trees (>3 m) have a mean canopy cover of 7% and are represented by *Celtis africana*, *Searsia pyroides*, *Vachellia karroo*, *Buddleja saligna* and *Kiggelaria africana*.
- Shrubs cover on average 2% of the area and the most prominent species is *Pyracantha angustifolia*.
- Dwarf shrubs cover 3% of the habitat and include *Asparagus laricus*.
- The grass layer is moderately developed and covers approximately 53% of the area. The dominant grass

species are *Phragmites australis* and *Paspalum dilatatum*. Other grass species include *Panicum maximum*, *Eragrostis plana*, *Paspalum urvillei* and *Hemarthria altissima*.

- Herbaceous species have a mean canopy cover of approximately 8%. The most common species are the sedges *Cyperus congestus*, *Schoenoplectus corymbosus*, the bulrush *Typha capensis* and naturalised alien forbs such as *Tagetes minuta*, *Bidens bipinnata* and *Achyranthes aspera*.
- The following alien invasive plant species were recorded: *Populus x canescens*, *Acacia dealbata*, *Acacia mearnsii*, *Pyracantha angustifolia*, *Pyracantha crenulata*, *Verbena bonariensis*, *Ricinus communis* and *Ipomoea purpurea*.

a.



b.



Figure 14 (a & b): Habitat 7: *Salix babylonica* - *Phragmites australis* riverine vegetation.

Threatened (red listed) and/or protected species recorded in plant community 7:

IUCN list: None  
 NEM:BA (ToPS): None  
 NFA: None  
 GDARD: None  
 CITES: None  
 Endemic species: None

**Habitat 8.** *Hyparrhenia tamba* floodplains

This floodplain habitat occurs in the east of the site next to a stream (Figures 7 & 15). Surface rocks and gravel are absent from this habitat. The deep, poorly drained, dark clayloam to clayey soils are alluvial in origin.



Figure 15. Habitat 8: floodplains characterised by *Hyparrhenia tamba*, *Asparagus laricinus* and *Senecio imornatus*.

The diagnostic species of this habitat (community) are *Hyparrhenia tamba*, *Buddleja salviifolia* and *Sorghum halepense* (species group 16, Appendix A).

- Tall trees (>6 m) have a mean canopy cover of 2% and are characterised by *Vachellia karroo*.
- Trees (>3 m) have a mean canopy cover of 5% and are characterised by *Searsia pyroides*, *Celtis africana* and *Vachellia karroo*.
- Shrubs cover on average 3% of the area and the most prominent species are *Vachellia karroo* and *Searsia pyroides*.
- Dwarf shrubs cover less than 1% of the habitat and include *Asparagus laricinus*.
- The grass layer is well developed and covers approximately 80% of the area. The dominant grass species are *Hyparrhenia tamba*, *Hyparrhenia hirta* and *Cynodon dactylon*. Other grass species include *Paspalum dilatatum*, *Sorghum halepense* and *Urochloa mosambicensis*.
- Herbaceous species have a mean canopy cover of approximately 10%. The most common species are *Senecio inornatus*, *Berkheya radula* and the naturalised aliens *Verbena bonariensis*, *Erigeron sumatrensis*, *Tagetes minuta* and *Bidens bipinnata*.
- The following alien invasive plant species was recorded: *Verbena bonariensis*.

Threatened (red listed) and/or protected species recorded in plant community 8:

IUCN list: None  
 NEM:BA (ToPS): None  
 NFA: None  
 GDARD: None  
 CITES: None  
 Endemic species: None

**Habitat 9.** *Eragrostis tef* - *Tagetes minuta* abandoned cropland

This abandoned cropland occurs in the east of the site (Figures 7 & 16). Surface rocks and gravel are absent from this habitat. The deep, well-drained, red, clayloam soils are derived from shale.



Figure 16. Habitat 9: *Eragrostis tef* - *Tagetes minuta* abandoned cropland.

The diagnostic species in this habitat (community) include *Eragrostis tef*, *Amaranthus* sp., *Eleusine coracana* and *Datura ferox* (species group 20, Appendix A).

No trees or shrubs were noted in this habitat, but scattered individuals of *Celtis africana*, *Melia azedarach* and *Prunus* sp. occur on the boundary of the cropland.

- Dwarf shrubs cover 5% of the habitat and include *Asparagus larycinus* and the aliens *Datura ferox* and *Xanthium spinosum*.
- The grass layer is poorly developed and covers approximately 30% of the area. The dominant grass species are *Eragrostis tef* and *Cynodon dactylon*. Other grass species include *Eleusine coracana*, *Urochloa mosambicensis*, *Aristida congesta* subsp. *congesta* and *Sorghum halepense*.
- Herbaceous species have a mean canopy cover of approximately 35%. The most common species are *Helichrysum rugulosum*, *Erigeron sumatrensis*, *Verbena bonariensis*, *Tagetes minuta*, *Bidens pilosa*, *Zinnia peruviana*, *Cosmos bipinnatus* and *Amaranthus* sp.
- The following alien invasive plant species were recorded: *Datura ferox*, *Xanthium spinosum* and *Verbena bonariensis*.

Threatened (red listed) and/or protected species recorded in plant community 9:

IUCN list: None  
 NEM:BA (ToPS): None  
 NFA: None  
 GDARD: None  
 CITES: None  
 Endemic species: None

**Habitat 10.** Planted pasture

This pasture occurs in the east of the site and is dominated by *Digitaria eriantha* (Figure 17).



Figure 17. Habitat 10: grassland dominated by *Digitaria eriantha*.

**Habitat 11.** Degraded plantations/woodlots

These degraded plantations, consisting mainly of *Eucalyptus camaldulensis* and *Pinus* spp. occur in the east of the site along some of the drainage lines (Figure 18). Other species in this unit include *Searsia pyroides*, *Asparagus larycinus*, *Verbena bonariensis*, *Hyparrhenia hirta*, *Themeda triandra*, *Urochloa mosambicensis*, *Melinis repens*, *Eragrostis chloromelas* and *Digitaria eriantha*.



Figure 18. Habitat 11: *Eucalyptus camaldulensis* woodlots.

**Habitat 12.** Hedges/windbreaks

These hedges or windbreaks occur in the west near abandoned habitation and consist of a hedge of the alien *Robinia pseudoacacia* and a hedge of the alien *Pyracantha angustifolia*, a hedge dominated by the alien *Cedrus deodora* and one dominated by *Searsia pyroides* (Figures 19 & 20).



Figure 19. Habitat 12: Hedge of *Pyracantha angustifolia*.



Figure 20. Habitat 12: Lane of *Cedrus deodora*.

### 13. Dams

Two dams occur in the west in the Kraalkopspruit with some smaller dams in the north and west of the site (Figure 21). They form part of Community 7 with *Phragmites australis*, *Celtis africana*, *Searsia pyroides*, *Kiggelaria africana* and alien trees such as *Salix babylonica* and *Acacia dealbata*.





Figure 21. Dam in the Kraalkopspruit.

14. Habitation/infrastructure

These include three sites with homesteads, one site with farm infrastructure (sheds, workshop and farm machinery) and some chalets next the dam in the Kraalkopspruit.

## 6. ALIEN INVASIVE PLANT SPECIES

### 6.1 Introduction

An “invasive species” is any species whose establishment and spread outside of its natural distribution range (i) threatens ecosystems, habitats or other species or has a demonstrable potential to threaten ecosystems, habitats or other species; and (ii) may result in economic or environmental harm or harm to human health. Invasive alien plant species are globally considered as one of the greatest threats to biodiversity and ecosystems integrity.

The Alien and Invasive Species (AIS) Regulations and the Alien and Invasive Species (AIS) list was published in 2020 (NEM:BA 2020a & b).

Forty-nine (49) alien plant species were recorded on the Igolide site of which 21 are currently declared alien invasive species and 27 naturalised alien species (Appendix B). Another 46 alien species were listed by NewPosa for the region.

The following categories of declared weeds and invader plants are recognised in South Africa:

**Category 1a Listed Invasive Species** refers to species that must be combatted or eradicated. Landowners are obliged to take immediate steps to combat or eradicate Category 1a species.

**Category 1b Listed Invasive Species** refers to species that must be controlled. If an Invasive Species Management Programme has been developed, landowners are obliged to control the species in accordance with such a programme. The following species were recorded on Igolide:

<i>Campuloclinium macrocephalum</i>	<i>Cirsium vulgare</i>
<i>Cuscuta campestris</i>	<i>Datura ferox</i>
<i>Eucalyptus camaldulensis*</i>	<i>Ipomoea purpurea</i>
<i>Melia azedarach</i>	<i>Opuntia ficus-indica</i>
<i>Pyracantha angustifolia</i>	<i>Pyracantha crenulata</i>
<i>Robinia pseudoacacia</i>	<i>Solanum elaeagnifolium</i>
<i>Solanum pseudocapsicum</i>	<i>Solanum sisymbriifolium</i>
<i>Verbena bonariensis</i>	<i>Verbena brasiliensis</i>
<i>Xanthium spinosum</i>	
<i>*exempted for an existing plantation</i>	

Other 1b AIS listed for the region by NewPosa:

<i>Agrimonia procera</i>	<i>Araujia sericifera</i>
<i>Argemone ochroleuca</i>	<i>Cestrum parqui</i>
<i>Datura stramonium</i>	<i>Phytolacca octandra</i>
<i>Xanthium strumarium</i>	

**Category 2 Listed Invasive Species** refers to species that require a permit to carry out a restricted activity e.g. cultivation, within an area specified in the Notice or an area specified in the permit, as the case may be. Category 2 includes plant species that have economic, recreational, aesthetic or other valued properties, notwithstanding their invasiveness. It is important to note that a Category 2 species that falls outside the demarcated area specified in the

permit, becomes a Category 1b invasive species. Permit-holders must take all the necessary steps to prevent the escape and spread of the species outside of the land or the area specified in the Notice or permit. The following species were recorded on Igolide:

*Acacia dealbata*

*Acacia mearnsii\**

*Ricinus communis*

*Populus canescens*

\*exempted for an existing plantation

**Category 3 Listed Invasive Species** refers to species that are subject to exemptions and prohibitions as specified in the Notice. Category 3 species are less-transforming invasive species that are regulated by activity. The principal focus with these species is to ensure that they are not introduced, sold or transported. However, a Category 3 plant species becomes a Category 1b species within riparian areas.

Twenty-seven naturalised weedy alien species were recorded on the Igolide site. Another 39 naturalised weedy alien species were also listed by NewPosa for the region (Appendix B).

One non-declared alien tree species was recorded on the Igolide site: *Cedrus deodora* and one non-declared alien tree species was listed by NewPosa for the region: *Ulmus parvifolia*

## 6.2 Prevention and control of alien invasive plant species

There are a number of strategies that can be employed to prevent the introduction of new invasive plant species:

- Limiting their introductions by humans;
- Creating a buffer zone of alien-free vegetation around the site;
- Integrated catchment management with the surrounding neighbours because areas around and upstream of the site provide an unlimited source of seed which invade downstream areas; and
- Maintening a healthy grass cover by sound veld management and judicious burning of the grass sward.

Alien invaders should be controlled by mechanical and/or chemical means. Mechanical means include ringbarking (girdling), uprooting, chopping, slashing and felling. An axe or chain saw or brush cutter can be used. Stumps or ringbarked stems should be treated immediately with a chemical weed killer. Follow-up treatment is sometimes needed.

## 7. FLORA: CHECKLISTS AND RED-LISTED AND/OR PROTECTED SPECIES

A list of plant species (the term species is used here in a general sense to denote species, subspecies and varieties) that could be found in the region (quarter degree grids: 2627 BC; 2627 AD) was downloaded from the South African Biodiversity Institute's website (SANBI: [newposa.sanbi.org](http://newposa.sanbi.org) – accessed October 2021) (Appendix B). During the field surveys, 205 plant species were recorded on the Igolide site (Appendix A). Combined, the NewPosa list and the list for the current study yielded 624 species for the region.

The South African Threatened Species Programme website ([redlist.sanbi.org](http://redlist.sanbi.org)) of SANBI; the National Forests Act (Act No. 84 of 1998) (NFA 2021); the National Environmental Management: Biodiversity Act (NEMBA 2007c) (ToPS list); CITES (2023) appendices and the lists of protected plant species of Gauteng (Transvaal Nature Conservation Ordinance (No. 12 of 1983) were consulted to classify the species in the study area into the relevant IUCN or protected categories (GDARD 1983; Appendix B). The draft list of the Gauteng Nature Conservation Bill of 2014 was also consulted (GDARD 2014a).

### 7.1 IUCN Red-listed species

For the IUCN Categories, the following definitions were applied (see Figure 22). **The colours in Figure 22 were applied to the checklist of plants and animals in this section as well as in Appendices B and C.**

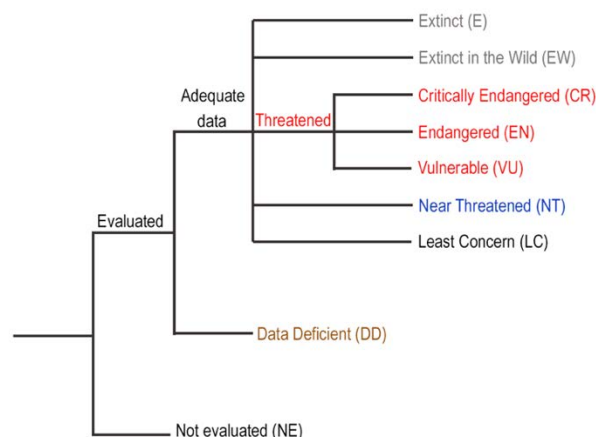


Figure 22: Schematic representation of the relationship between the various IUCN Red List Categories.

#### Extinct Categories:

- Extinct (E):** A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
- Extinct in the Wild (EW):** A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalised population (or populations) well outside the past range.

#### Threatened Categories:

- Critically Endangered (CR):** A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
- Endangered (EN):** A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that it is facing a very high risk of extinction.
- Vulnerable (VU):** A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that it is facing a high risk of extinction.

**Not Threatened Categories but regarded as SCC by SANBI:**

- **Near Threatened (NT):** A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.
- **Data Deficient (DD):** A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. In this case the species would be classified as DDD. If however, taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible, the species is classified as DDT. The latter category cannot be considered as SCC.
- **Additional categories recognised by SANBI:** Although not threatened categories, SANBI have added the species classified as Critically Rare, Rare and Declining to their SCC.

**Not Threatened Categories and not considered as SCC by SANBI**

- **Least Concern (LC):** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.
- **Not Evaluated (NE):** A taxon is Not Evaluated when it has not yet been evaluated against the five IUCN criteria. This category often applies to alien species.

*Khadia beswickii* (VU) is the only IUCN threatened species occurring in the region according to the NewPosa list (Appendix B). Near Threatened (NT), Data Deficient (DDD) and Data Deficient (Taxonomically) (DDT) species are not classified as threatened according to the IUCN classification.

## 7.2 SANBI: Species of Conservation Concern

According to the South African National Biodiversity Institute (SANBI 2020), SCCs include all species that have been assessed according to the IUCN Threatened or Red-List Criteria as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD), as well as range-restricted species which are not declining and are nationally listed as Rare or Critically Rare. The DD category is split into those that are taxonomically unresolved (DDT) and those where insufficient data (DDD) are available to make a judgement on endangered status. The Taxonomically Data Deficient (DDT) species were excluded as SCC since taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of extinction risk is not possible.

The SCC species listed for the region (NewPosa list, SANBI) are *Khadia beswickii* (VU) and *Adromischus umbraticola* subsp. *umbraticola* (NT). These two species were not recorded on the Igolide site. Furthermore, two near threatened species, *Gnaphalium nelsonii* and *Cineraria austrotransvaalensis*, could potentially occur on site according to the Gauteng C-plan.

## 7.3 Screening Tool

The Screening Tool highlighted four plant species as being of concern. None of the SCC, including *Khadia beswickii*, were recorded on site and the Gauteng C-Plan did not reflect their possible occurrence on site.

## 7.4 Protected species

### 7.4.1 Gauteng (GDARD 1983; 2014a)

Thirteen (13) plant species are listed as protected in the region according to the GDARD (1983, 2014a). Most of these Schedule 11 species are members of the Asphodelaceae and Iridaceae.

One Schedule 11 Protected Plant Species was recorded during the site survey in January 2021 (see Appendix B):

*Gladiolus permeabilis* Iridaceae

Two rare plant species could potentially occur on the Igolide site according to data provided by GDARDE (2011, C-Plan). They are *Cineraria austrotransvaalensis* and *Gnaphalium nelsonii*, both with a Near Threatened status. Neither species are listed in the NewPosa species list for the region or were recorded on site during the site survey.

## 7.5 ToPS list (NEM:BA 2007c)

No species classified as protected within the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA 2007c) is listed for the study area and none were found at the site.

## 7.6 CITES appendices

Appendix II of CITES lists species that are not necessarily now threatened with extinction, but that may become so unless trade is closely controlled. Thirteen (13) Appendix II species are listed for the region including mostly *Aloe* species and species of the Orchidaceae. None of the CITES listed species were recorded during the site survey (Appendix B).

## 7.7 Protected Tree Species - National Forests Act (Act No. 84 of 1998)

No nationally protected tree species is listed for the site (NFA 2023) and none were recorded during the site visit.

## 7.8 Endemic species

Plant species endemic to the Rand Highveld Grassland Vegetation Type include the following (Mucina & Rutherford 2006):

*Anacampteros subnuda* subsp. *lubberrisii*  
*Delosperma purpureum*  
*Encephalartos middelburgensis*  
*Melanospermum rudolfii*

*Crassula arborescens* subsp. *undulatifolia*  
*Encephalartos lanatus*  
*Frithia humilis*  
*Polygala spicata*

None of the listed species were recorded on the Igolide site.

No endemic species are listed for the Gauteng Shale Mountain Bushveld Vegetation Type.

## 7.9 Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA) and the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA 2020a &amp; b)

A total of 49 alien species were recorded for the Igolide site (Appendix B) of which 21 species are categorised as invasive, 27 species as naturalised alien species and one alien tree species. Alien species with an invasive categorisation will have to be controlled during the construction and operational stages of the project. Alien invasive species listed for the study area include the following (the 21 species recorded during the site survey are marked with an asterisk):

*Acacia dealbata*\*

*Opuntia ficus-indica*

*Acacia mearnsii\**  
*Agrimonia procera*  
*Araujia sericifera*  
*Argemone ochroleuca* subsp. *ochroleuca*  
*Campuloclinium macrocephalum\**  
*Cestrum parqui*  
*Cirsium vulgare\**  
*Cuscuta campestris\**  
*Datura ferox\**  
*Datura stramonium*  
*Eucalyptus camaldulensis\**  
*Ipomoea purpurea\**  
*Melia azedarach\**  
*Opuntia ficus-indica\**

*Phytolacca octandra*  
*Populus canescens\**  
*Pyracantha angustifolia\**  
*Pyracantha crenulata\**  
*Ricinus communis\**  
*Robinia pseudoacacia\**  
*Solanum elaeagnifolium\**  
*Solanum pseudocapsicum\**  
*Solanum sisymbriifolium\**  
*Verbena bonariensis\**  
*Verbena brasiliensis\**  
*Xanthium spinosum\**  
*Xanthium strumarium*

## 8. FAUNA: CHECKLISTS AND RED-LISTED AND/OR PROTECTED SPECIES

Species lists (the term species is used here in a general sense to denote species, subspecies and varieties) of the faunal component were sourced for the study area from the Animal Demography Unit, University of Cape Town website (<http://vmus.adu.org.za>) and supplemented by relevant literature to determine the conservation status.

### 8.1 Mammals

The site falls within the distribution range of 85 terrestrial mammal species (<http://vmus.adu.org.za>) (Appendix C). Note: This list was drawn from a far larger area than the site and includes several game farms.

#### 8.1.1 IUCN threatened mammal species

Five IUCN threatened mammal species were listed for the environs of the Igolide site on the website of the Animal Demography Unit, University of Cape Town. None of these species were listed as SCC by the Screening Tool. The threatened category include species that are Critically Endangered (CR), Endangered (EN) and Vulnerable (VU):

<i>Redunca fulvorufula</i>	Mountain reedbuck*	EN
<i>Acinonyx jubatus</i>	Cheetah	VU
<i>Panthera pardus</i>	Leopard	VU
<i>Cloeotis percivali</i>	Percival's short-eared trident bat	EN
<i>Mystromys albicaudatus</i>	African white-tailed rat	VU

\*species recorded on site or confirmed by landowner

Six mammal species were listed as Near Threatened (a category that is not a threatened category in the IUCN classification) (none were recorded on the site):

<i>Atelerix frontalis</i>	Southern African Hedgehog	NT
<i>Leptailurus serval</i>	Serval	NT
<i>Aonyx capensis</i>	African clawless otter	NT
<i>Miniopterus schreibersii</i>	Schreibers's long-fingered bat	NT
<i>Pipistrellus rusticus</i>	Rusty pipistrelle	NT
<i>Hydrictis maculicollis</i>	Spotted-necked otter	VU

Mammals that were either sighted or confirmed by the landowner on site are indicated in Appendix C.

#### **Southern Mountain reedbuck (*Redunca fulvorufula fulvorufula*)**

The southern mountain reedbuck is listed as **Endangered A2b** (Taylor *et al.* 2016) due to large population declines in all protected areas for which long-term count data are available. However, the species has been extensively reintroduced into parts of its former range (Taylor *et al.* 2016). A large portion of the Igolide site is currently a game farm and the species could have been introduced.

It is important to note that because of their specialised habitat requirements, the distribution of the mountain reedbuck is patchy and discontinuous and that they are found only where there is suitable habitat. They favour grass-covered ridges and hillsides in broken, rocky country or high-altitude grasslands. They are dependent on steep



slopes, a well-developed grass layer and some scattered woody cover to evade predators. According to Rowe-Rowe (1983) the mountain reedbeek favours slopes with a gradient of 20° or more. In regions where cover is locally more abundant in lower valleys than on upper slopes and ridges, it often prefers the lower slopes. They avoid the open conditions with no cover associated with the summits of mountainous areas as well as dense woody cover (Mason 1977; Oliver *et al.* 1978; Skinner & Chimimba 2005). They also occur in dry hilly areas (such as the Nama-Karoo), utilising steep slopes and the bases of hills for grazing. The extent of available slopes for predator evasion is regarded as an indicator of the quality of their territory (Dunbar & Roberts 1992).

**Note:** The Screening Tool did not list the Southern mountain reedbeek for the site and it could thus have been introduced on site. Its presence on site and its status of “Endangered” should be taken into account when developing the Igolide site.

The Screening Tool highlighted the following two mammal species in the region. Neither of them were recorded on site during the survey although they may occur in the region:

**Spotted-necked otter (*Hydrictis maculicollis*):** Suitable habitat for the Spotted-necked otter is potentially available on site. It occurs widespread, but it is restricted to areas of permanent fresh water offering good shoreline cover and an abundant prey base. Overall, the population may be declining as river habitat is lost to development and infestations of alien species in riparian areas, and riverside vegetation degradation from overgrazing. The main interventions revolve around riparian protection. Thus, rivers should be carefully managed to increase flow and reduce turbidity, and development on banks should be restricted. The Igolide development will avoid all rivers and wetlands.

**Maquassie musk shrew (*Crocidura maquassiensis*):** This species is classified as Vulnerable (Taylor *et al.* 2016). It depends on wetlands as suitable habitat in savanna and grassland. Although it has a wide inferred extent of occurrence, it appears to be patchily distributed. The main threats to shrews are the loss or degradation of moist, productive areas such as wetlands and rank grasslands within suitable habitat. *Crocidura maquassiensis* has not been reported from Gauteng or North West Province post-1999 and thus there is a low probability for it to occur on site.

### 8.1.2 Provincially protected mammal species (GDARD 1983)

Ten of the terrestrial mammal species listed in Appendix C are Schedule 2 Protected Game in Gauteng. However, the hippopotamus was not recorded on site. The following nine species were recorded on the Igolide site:

<i>Alcelaphus buselaphus caama</i>	Red hartebeest
<i>Connochaetes gnou</i>	Black wildebeest
<i>Kobus ellipsiprymnus ellipsiprymnus</i>	Waterbuck
<i>Oryx gazella</i>	Gemsbok
<i>Raphicerus campestris</i>	Steenbok
<i>Redunca fulvorufula</i>	Mountain reedbeek
<i>Taurotragus oryx</i>	Cape eland
<i>Giraffa giraffa giraffa</i>	Giraffe
<i>Lepus saxatilis</i>	Scrub hare

Three mammal species listed in the ADU database for the region are Schedule 4 Protected Wild Animals (not recorded on site):

<i>Acinonyx jubatus</i>	Cheetah
<i>Panthera leo</i>	Lion

*Panthera pardus* Leopard

Three species are listed as Schedule 8 Problem Animals (all recorded on site):

<i>Canis mesomelas</i>	Black-backed jackal
<i>Chlorocebus pygerythrus pygerythrus</i>	Vervet monkey
<i>Caracal caracal</i>	Caracal

### 8.1.3 Nationally Threatened or Protected Species: ToPS

According to ToPS legislation (NEMBA 2007c), three mammal species are listed as Vulnerable and five species are Protected (Appendix C).

Vulnerable:

<i>Acinonyx jubatus</i>	Cheetah
<i>Panthera leo</i>	Lion
<i>Panthera pardus</i>	Leopard

Protected:

<i>Atelerix frontalis</i>	Southern African hedgehog
<i>Aonyx capensis</i>	African Clawless otter
<i>Connochaetes gnou</i>	Black wildebeest*
<i>Leptailurus serval</i>	Serval
<i>Hydrictis maculicollis</i>	Spotted-necked otter

\*recorded on site

## 8.2 Reptiles

Forty-four (44) reptile species are listed for the region (Appendix C). The list includes one IUCN threatened (Vulnerable) species, i.e. *Crocodylus niloticus* for the region, although not on site. Provincially protected reptile species include 26 Schedule 2 Protected Game and 17 Schedule 5 snakes. The python *Python natalensis* is the only protected reptile species according to the ToPS list (NEMBA 2007c).

## 8.3 Frogs

Sixteen species were listed for the region and the Giant Bull Frog *Pyxicephalus adspersus* is listed as Near Threatened and is also on the ToPS list as a protected species (NEMBA 2007c).

## 8.4 Lepidoptera

One of the 100 species of the Lepidoptera for the region is listed as Endangered, i.e. *Lepidochrysops praeterita* (Highveld giant cupid).

The two Lepidopteran species listed by the Screening Tool are unlikely to occur on site because their host plant was not recorded on site. According to the National Sensitive Species List of SANBI *Lepidochrysops praeterita* is not ranked as sensitive although it has an IUCN global status of Endangered. The species is not exploited, collected, traded or utilised in a targeted manner (<http://nssl.sanbi.org.za/species/lepidochrysops-praeterita>). This taxon is confined to grassy, rocky, typically south-facing slopes, where its host plant (*Ocimum obovatum*) and, presumably,

its host ant occur. Most localities are within an altitudinal band between 1500 m and 1750 m. *Lepidochrysops praeterita* is highly localized and appears to have a very specific habitat niche.

*Lepidochrysops procera*: Although the species has a IUCN global status of Least Concern, it is a habitat specialist and rated as Rare. It is not regarded as sensitive in the National Sensitive Species List of SANBI and is not exploited, collected, traded or utilised in a targeted manner (<http://nssl.sanbi.org.za/species/lepidochrysops-procera>). Its habitat is rocky areas in grassland (and grassy areas in savanna), where its larval host plant, *Ocimum obovatum*, occurs. The host plant was not recorded on site.

## 8.5 Odonata

Fifty-three species of Odonata were listed for the region and all have a status of Least Concern according to the IUCN classification.

## 8.6 Scorpions

Four scorpion species are listed for the region and two are listed as ToPS species (NEMBA 2007c).

## 8.7 Spiders

All baboon spiders are provincially protected. One of the listed baboon spiders *Harpactira hamiltoni* is a ToPS protected species (NEMBA 2007c).

## 8.8 Other insects

According to the RSA Red List, *Clonia uvarovi* is rated as Vulnerable. It inhabits tall savanna woodland. The habitat on site has been described as bushveld which may be marginally suitable for the species. However, its habitat will not be affected by the turbines.

**Note: Bird and bat checklists will be provided and discussed in the avifaunal and bat specialist assessments.**

## 9. CONSERVATION

### 9.1 National Environmental Management: Protected Areas Act (Act No. 10 of 2003)

The study site is not located in a protected area.

### 9.2 National Protected Areas Expansion Strategy (NPAES)

The study site is part of the NPAES (NPAES 2018). None of the turbines is located in the areas demarcated by the NPAES (Figure 23).

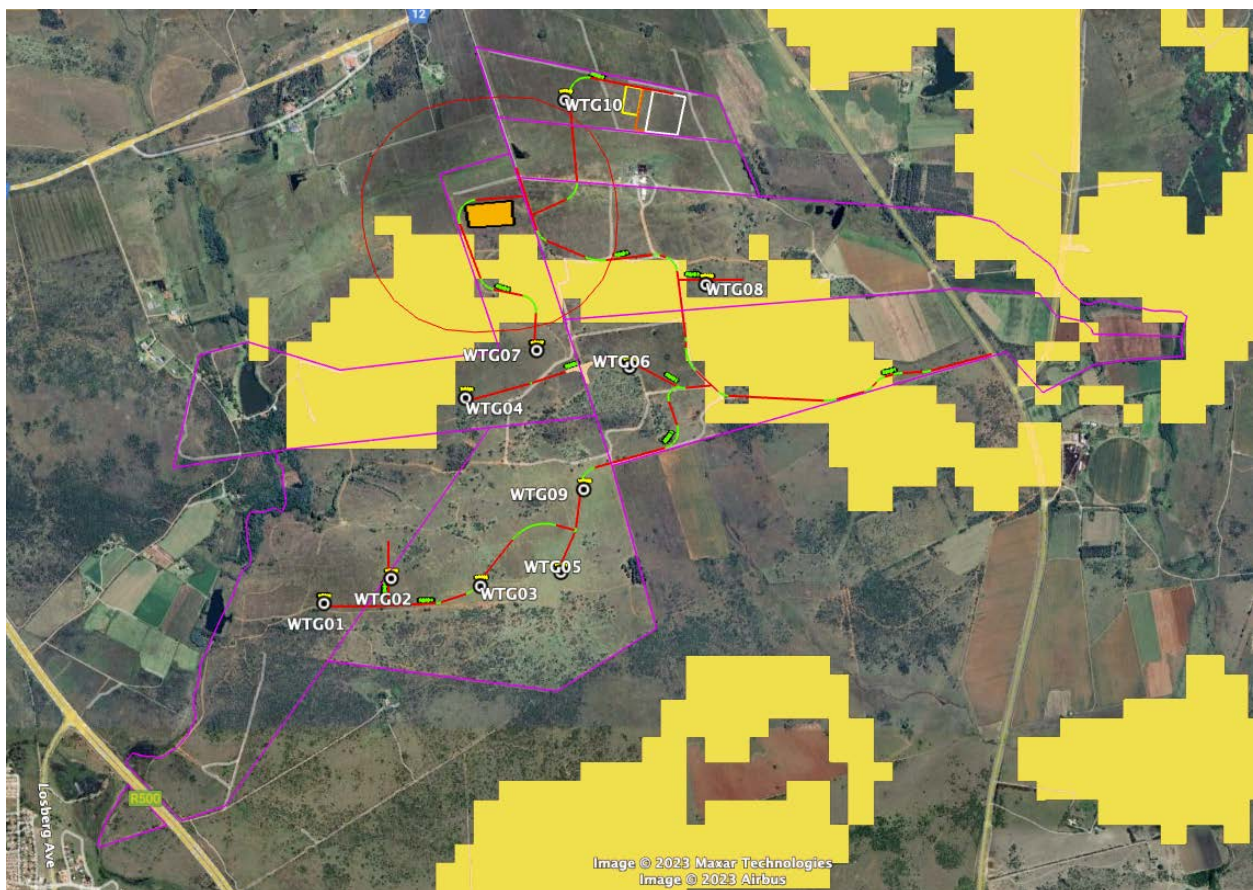


Figure 23. NPAES map of the Igolide WEF site (NPAES 2018, Yellow polygons) with proposed roads and location of 10 turbines (WTG) indicated. Orange rectangle = on-site IPP substation/BESS; red/yellow/white rectangles = other ancillary areas (batching plant, construction camp and laydown).

### 9.3 National list of ecosystems that are threatened and in need of protection

The site is located in the Gauteng Shale Mountain Bushveld and Rand Highveld Grassland (Mucina & Rutherford 2006, SANBI 2006-2018) vegetation types, that are classified as "Least Concern" and "Vulnerable" respectively (NEMA 2011, Skowno *et al.* 2019).

### 9.4 Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and Other Natural Areas (ONAs)

Critical Biodiversity Areas (CBAs) are areas required to meet biodiversity targets for ecosystems, species or ecological processes. CBAs are regarded as areas of high biodiversity and ecological value and need to be kept in a natural or near-natural state, with no further loss of habitat or species. The definitions for CBAs are (SANBI 2018):

- CBA 1 (CBA irreplaceable): Areas that are irreplaceable for meeting biodiversity targets. There are no other options for conserving the ecosystems, species or ecological processes in these areas (SANBI 2018).
- CBA 2 (CBA Important areas): Areas that are the best option for meeting biodiversity targets, in the smallest area, while avoiding conflict with other land uses.

The main reasons provided for the mapping of the CBAs (GDARDE 2011) were:

- Orange list plant habitat
- Red list invertebrate habitat
- Primary vegetation

The CBA map in Figure 24 indicates the presence of a CBA2 (Important area) on the rocky grassland habitats (Habitat 2 and Habitat 3, Figure 7) and parts of the rocky bushveld (Habitat 6) as well as grassland on the plains (Habitat 4).

The ESAs cover parts of the rocky grassland (Habitat 3), some of the rocky bushveld (Habitat 6) and wetlands/floodplains (Habitat 5). The ESAs also cover areas of abandoned cropland (Habitat 9) and planted pasture (Habitat 10) (Figure 7; CPlanV33\_1110\_ge 2017). Turbines 04, 07 and 08 lie in ESAs but outside the NPAES and their locations could be reconsidered.

According to the land use guidelines supplied by SANBI (2021) the loss of natural habitat should be avoided in CBAs and these areas should be maintained with natural vegetation as far as possible. Formal protection of CBAs should be actively promoted, together with the implementation of management plans to maintain or enhance biodiversity importance. Infrastructure development should be limited to existing degraded/modified footprints. Linear infrastructure is not desirable and should only be considered if all alternative alignments and design options have been assessed and are found to be unavailable. Where CBAs occur across part of a property, split zoning should be used, where feasible, to demarcate sensitive areas.

An Ecological Support Area (ESA) is not essential for meeting biodiversity targets, but plays an important role in supporting the ecological functioning in a CBA. ESAs need to be maintained in at least a functional and often natural state (SANBI 2021). It is important that a project should not result in impacts to threatened species or ecological processes. Infrastructure should be designed to avoid additional impacts on ecological processes.

Other Natural Areas (ONAs) have not been identified as a priority, but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Land use guidelines for Terrestrial Other Natural Areas (ONAs) are not required to meet biodiversity targets. ONAs represent a substantial part of the site and form a matrix within which the CBAs and ESAs occur (Figure 24). The site options for the on-site IPP substation/BESS facility and the other ancillary areas (batching plant, construction camp and laydown) fall in ONAs.

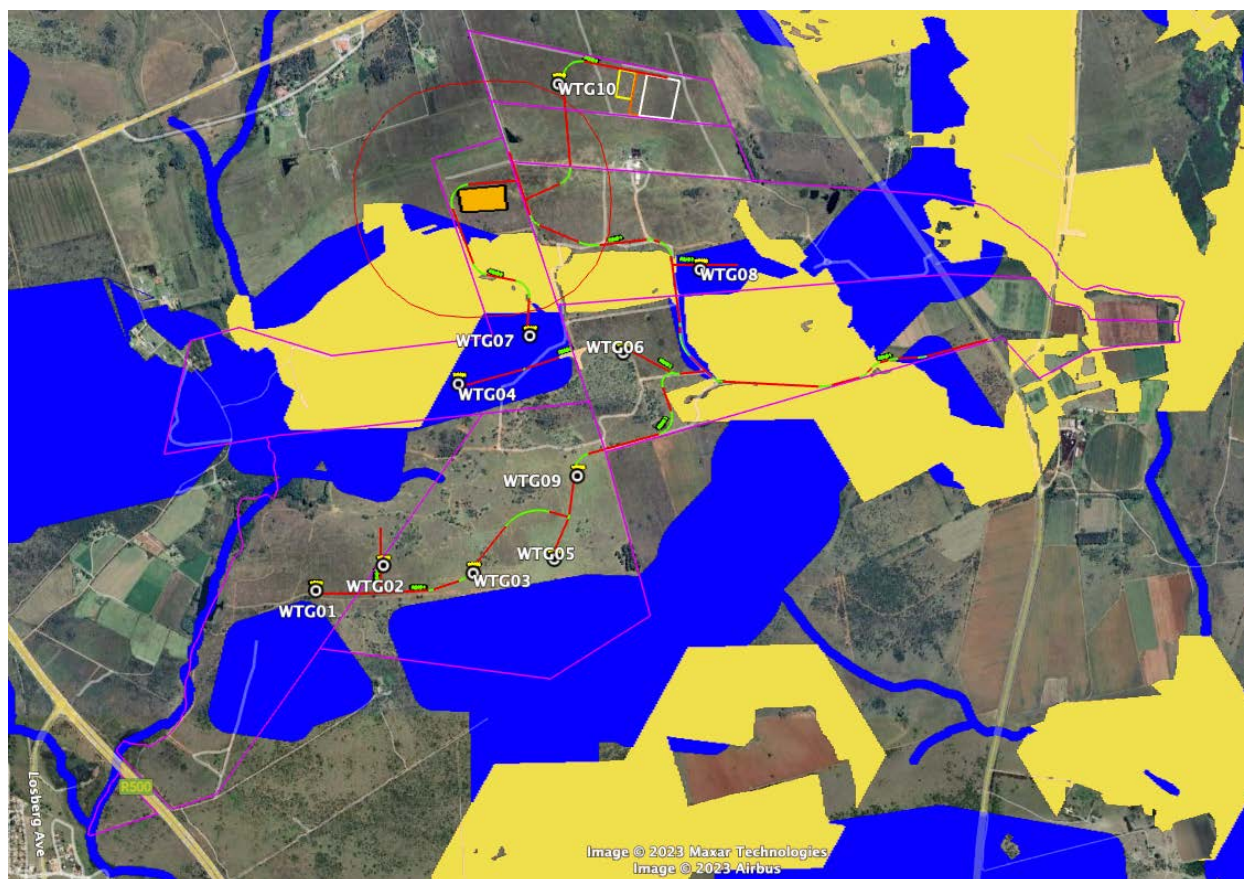


Figure 24: Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and Other Natural Areas (ONAs) of the Igolide site and environs (biodiversityadvisor.sanbi.org) with proposed roads and location of 10 turbines (WTG) indicated. Orange rectangle = on-site IPP substation/BESS; red/yellow/white rectangles = other ancillary areas (batching plant, construction camp and laydown); Yellow polygons = CBA2 (important area); blue polygons = ESAs; not coloured areas = ONAs.

## 9.5 Freshwater Ecosystem Priority Areas (FEPAs)

Freshwater Ecosystem Priority Areas (FEPA) are priority areas for conserving freshwater ecosystems and supporting sustainable use of water resources and upstream management areas (Driver *et al.* 2012). According to the NFEPA there are two rivers/streams traversing the site – one on the western side and one on the eastern side. Additionally, there are several wetlands along the watercourses on site, particularly along the Kaalkopspruit. The buffers specified by the aquatic specialist should be observed. The current layout avoids the wetlands.

## 9.6 Ecological processes, functioning and drivers

Ecological processes include primary production, decomposition, nutrient cycling and fluxes of nutrients and energy. These processes will be altered by the clearing of the vegetation at the footprint of the WEF infrastructure. The impact is expected to be fairly small in relation to the adjacent landscape where no change to the ecological processes is anticipated. The relatively small footprint of the infrastructure will not hinder pollination by airborne pollinators. Migration of ground-dwelling organisms will be hindered locally at the construction sites, but ecological connectivity should not be disrupted during the operational phase. Overall, it is unlikely that the project will contribute to the disruption of broad-scale ecological processes such as dispersal, migration or the ability of fauna

to respond to fluctuations in climate or other conditions. The infrastructure will not cause any additional impediment to ecological corridors and habitat fragmentation should not be an issue

The disturbance caused during construction will create conditions favourable for invasion by alien species. Since, the level of alien infestation at the site was moderate to high, an alien invasive plant species monitoring and control programme needs to be initiated to control invasions.

Fire is considered an important driver of vegetation dynamics in the Grassland and Savanna Biomes and can occur when the fuel load is high. To avoid damage to the infrastructure, fire will have to be suppressed. If the grass layer is regularly mowed/brush cut, it should prevent grasses from becoming moribund in the absence of fire although mowing or brushcutting would reduce seed set. Should fire be suppressed on site this could have long-term effects on the vegetation dynamics.

Grasslands have evolved under the grazing pressure from large ungulates. Mesic Highveld Grasslands are reasonably well adapted to grazing pressure under low to moderate stocking rates with adequate rest periods. The WEF development will still allow livestock or wildlife grazing.

## 9.7 Indigenous forests

No indigenous forests occur on the site.

# 10. ECOLOGICAL SENSITIVITY ANALYSIS: VEGETATION

## 10.1 Introduction

It should be clearly stated that the sensitivity model applied to the **vegetation data** in this report is not regarded as a substitute for defining a CBA. The sensitivity model scores ten different criteria for each habitat (plant community) and derives a sensitivity rating for each of the habitats (plant communities). The CBAs are delineated by the provinces and different criteria are used to delineate these areas (not only the vegetation), e.g. climate change land facets, wetland clusters, intact grassland patches and critical linkages.

Sensitivity is the vulnerability of a plant community or habitat to an impact, for example a wetland or ridge system would be more vulnerable to development than would a sandy plain. Several features of a site can be assessed to derive a sensitivity score, such as:

1. Threatened status of the regional vegetation types wherein the proposed site is situated:
2. Percentage of IUCN threatened (red-listed) plant species per habitat:
3. Number of protected tree species per habitat:
4. Percentage of provincially protected plant species per habitat:
5. Presence of endemic plant species per habitat or site (endemic to vegetation type):
6. Conservation value of plant community (habitat):
7. Species richness per habitat or per sample plot (number of plant species):
8. Degree of connectivity and/or fragmentation of the habitat, i.e. high connectivity and low fragmentation infers a low rating:
9. Soil erosion potential:
10. Resilience (this is a measure of the ability of a particular habitat to recover after an impact, i.e. high resilience infers low rating).

## 10.2 Sensitivity model

During the field survey, 31 sample plots were surveyed on the Igolide site.

The following **sensitivity model** (Table 5, Figure 25) was applied to the data for each habitat on site. This was achieved by weighting each criterion and calculating the sum for the habitat, which reflects the sensitivity and sensitivity ranking. A brief description of the sensitivity rating of the parameters is provided below:

1. **Threatened status of the ecosystem** (depends on the percentage area intact, or degree of transformation) (Mucina & Rutherford 2006, NEM:BA 2011, Skowno *et al.* 2019). The ecosystems are classified into the following categories:
  - Low sensitivity: If "Least Concern", the vegetation type has most of its habitat intact, i.e. more than 80%; or the vegetation type is adequately statutory or formally conserved in parks and reserves.
  - Moderate sensitivity: If "Vulnerable", the vegetation type has from 60% to 80% of the ecosystem intact; less than 40% has been transformed which could result in some ecosystem functioning being altered, and/or the ecosystem is statutory poorly conserved. For example, the vegetation type is rich in plant species, but is not a pristine example of a vegetation type, therefore some transformation or disturbance occurred, such as human structures and degraded veld due to overgrazing and/or bush encroachment.



- High sensitivity: If “Endangered”, the vegetation type has from 40% to 60% of the ecosystem intact; or 40% to 60% transformed due to disturbance, cultivation or alien species; or the ecosystem is statutory poorly conserved e.g. less than about 3% conserved.
- Very high sensitivity: If “Critically Endangered”, the vegetation type has only 16% to 36% of the ecosystem intact. The richer the ecosystem is in terms of species, the higher the percentage threshold.

*Category rating:*

Low	(LT)	= 1
Moderate	(VU)	= 2
High	(EN)	= 3
Very high	(CE)	= 4

2. **Percentage of threatened (red-listed) plant species** (IUCN threatened status): The rating is determined by the presence of red-listed flora in a habitat (calculated as percentage of the total number of species per habitat).

*Category rating:*

None	(0%)	= 0
Low	(>0 – 2%)	= 1
Moderate	(>2 – 5%)	= 2
High	(>5%)	= 3

3. **Presence of protected tree species** (NFA 2021): The presence protected tree species in a habitat is rated as follows:

*Category rating:*

None	(0 species)	= 0
Low	(1 - 2 species)	= 1
Moderate	(3 – 4 species)	= 2
High	(>4 species)	= 3

4. **Percentage of Gauteng protected plant species:** (Transvaal Nature Conservation Ordinance 1983) (GDARD 1983). The rating depends on the percentage of protected species in relation to the total plant species per habitat.

*Category rating:*

None	(0%)	= 0
Low	(>0 - 10%)	= 1
Moderate	(>10 – 20%)	= 2
High	(>20%)	= 3

5. **Percentage of plant species endemic to the particular vegetation type of Mucina & Rutherford** (2006): Refers to the number of species expressed as a percentage of the total number of species per habitat.

*Category rating:*

None	(0%)	= 0
Low	(>0 - 2%)	= 1
Moderate	(2–5%)	= 2
High	(>5%)	= 3

6. **Species richness per habitat:** Expressed as mean number of species per plot in a habitat.

*Category rating:*

Low	(<15)	= 1
Moderate	(15 – 30)	= 2
High	(>30)	= 3

7. **Conservation value of the habitat:** The assessment is made for the habitat in the broader region.

*Category rating:*

Low		= 1
Moderate		= 2
High		= 3

8. **Degree of connectivity and/or fragmentation of the ecosystem:** The degree of connectivity with surrounding or adjacent natural areas and/or fragmentation of habitats, thus high degree of connectivity and low degree of fragmentation infer a high rating.

*Category rating (note reverse order):*

Low		= 3
Moderate		= 2
High		= 1

9. **Erosion potential of the soil:** The erosion potential of the soil is indicated as low, moderate or high, e.g. coarse sandy soils on plains have a low erosion potential.

*Category rating:*

Low		= 1
Moderate		= 2
High		= 3

10. **Resilience:** Is a measure of the ability of a particular habitat to recover to its current state after an impact, i.e. high resilience infers low rating.

*Category rating (note reverse order):*

Low		= 3
Moderate		= 2
High		= 1

Each criterium is weighted as follows in the model:

Threatened status of the vegetation type	x5
Percentage of threatened plant species	x4
Presence of protected tree species	x3
Percentage of Gauteng protected species	x4
Percentage of endemic species to vegetation type	x2
Species richness	x2
Conservation value (habitat)	x4
Degree of connectivity/fragmentation of habitat	x2

Erosion potential	x2
Resilience	x3

### 10.2.2 Sensitivity rating

The sum of all criteria is obtained per habitat and the sensitivity rating interpreted as follows:

≤ 39	= low	(L)	(rating scale = 1)
40 – 54	= moderate	(M)	(rating scale = 2)
55 – 69	= high	(H)	(rating scale = 3)
> 70	= very high	(VH)	(rating scale = 4)

In general, these sensitivity ratings are interpreted as follows:

- Low** sensitivity means the sensitivity should not have an influence on the decision about the project. It is usually applicable to habitats that have been transformed, especially by human activities. However, no protected species may be removed/destroyed without a permit.
- Moderate** means a sensitivity rating that is real and sufficiently important to require management, e.g. mitigation measures, management or protection of the rare/threatened fauna and flora, protection of a specific habitat on the property and/or rehabilitation.
- High** means a sensitivity rating where the habitat should be excluded from any development.
- Very high** means a sensitivity rating that should influence the decision whether or not to proceed with the project.

Table 5: Sensitivity of the different plant communities (habitats) identified on site (see Figure 25)

Community/Habitat	1	2	3	4	5	6	7	8	9	10	11	12
Threatened status (x5)	10	10	5	10	10	10	10	10	10	5	5	5
% Threatened species (x4)	0	0	0	0	0	0	0	0	0	0	0	0
Number of protected trees (x3)	0	0	0	0	0	0	0	0	0	0	0	0
Gauteng species (x4)	0	4	4	0	0	0	0	0	0	0	0	0
Endemic species (x2)	0	0	0	0	0	0	0	0	0	0	0	0
Species richness (x2)	2	4	6	4	4	4	4	4	2	0	0	0
Conservation value (x4)	4	8	8	8	12	8	12	8	4	0	0	0
Connectivity (x2)	2	6	4	2	4	4	2	4	2	4	6	6
Erosion (x2)	4	2	4	4	4	4	6	4	4	2	2	2
Resilience (x3)	3	9	6	3	6	6	6	6	3	3	3	3
Sum:	25	43	37	31	40	36	40	36	25	19	16	16
<b>Sensitivity rating:</b>	<b>L</b>	<b>M</b>	<b>L</b>	<b>L</b>	<b>M</b>	<b>L</b>	<b>M</b>	<b>L</b>	<b>L</b>	<b>L</b>	<b>L</b>	<b>L</b>

Overall, the rocky outcrop (Habitat 2) and drainage lines (Habitats 5 & 7) were more sensitive than the other habitats on site. Habitats 9 – 12 are man-made habitats, e.g. cropland, planted pasture, plantations and wind breaks and all have a very low sensitivity rating. The dams are included in Habitat 7 and have been assigned a medium sensitivity in Figure 25.

The site options for the on-site IPP substation and BESS facility and the other ancillary areas (batching plant, construction camp and laydown) are shown in Figures 2, 23, 24 & 25. This site falls in an area with low habitat sensitivity. The WEF infrastructure is currently located predominantly in Habitat 4 (Grassland) and all rocky hills,

rocky outcrops (sheets) and drainage lines are avoided (Figures 7, 24 & 25). The ten turbines are located in a habitat with a low sensitivity rating for the vegetation (Habitat 4).

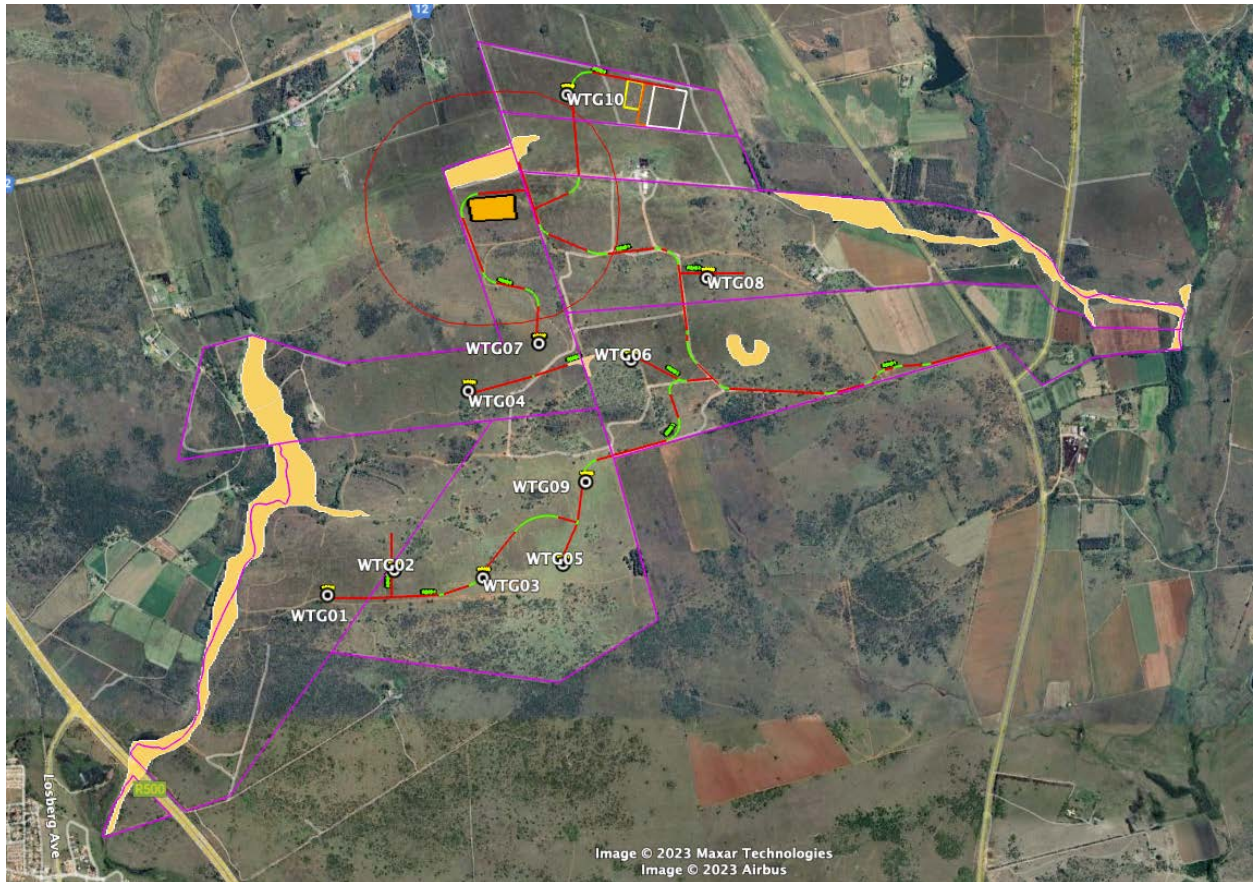


Figure 25. Sensitivity map of the plant communities (habitats) of the Igolide WEF site. Areas marked in yellow were classified as Medium Sensitivity in the Terrestrial Biodiversity and Species Specialist Assessment while the remainder of the habitats are indicated as low sensitivity. The proposed roads and location of 10 turbines (WTG) are indicated. Orange rectangle = on-site IPP substation/BESS; red/orange/white rectangles = other ancillary areas (batching plant, construction camp and laydown).

Buffers are applicable to the development along the watercourses. A buffer zone of 32 m is usually applied to drainage lines, but the bat and aquatic specialists may apply wider buffer zones along these habitats. It is recommended that the buffer zones specified in the aquatic report are used as guideline.

Only one species recorded on site is provincially protected (*Gladiolus permeabilis*) and no CITES listed species were encountered on site. Protected and CITES listed species were not considered as being of conservation concern because none of them qualify as SCC according to the SANBI definition (SANBI 2020). Furthermore, no ToPS listed species or species endemic to one of the national vegetation types were recorded on site.

# 11. SCREENING REPORT

## 11.1 Summary of Screening Tool results

### 11.1.1 Plant Species Theme

The Screening Tool rated the sensitivity of the Plant Species Theme as Medium (Figure 26).

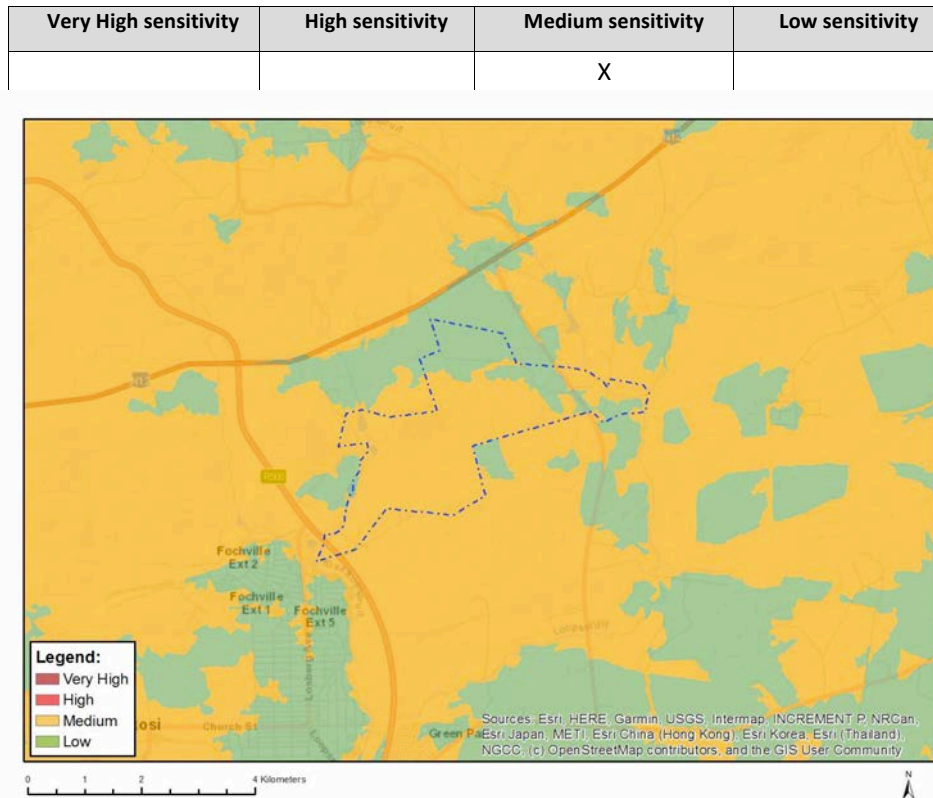


Figure 26: Map and outcome of the Plant Species Theme sensitivity generated by the Screening Tool.

The following plant species were highlighted as being of concern:

Sensitivity	Feature(s)
Medium	Sensitive species 1252
Medium	<i>Khadia beswickii</i>
Medium	Sensitive species 691
Medium	Sensitive species 1248

### 11.1.2 Animal Species Theme

The Screening Tool rated the sensitivity of the Animal Species Theme as Medium (Figure 27).

Very high sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

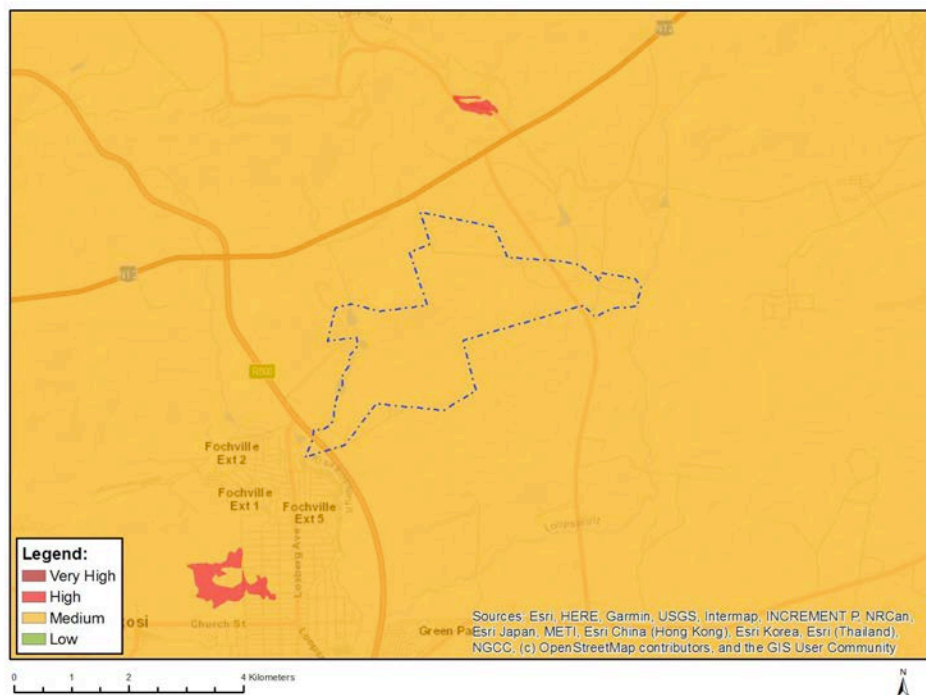


Figure 27: Map and outcome of Animal Species Theme sensitivity generated by the Screening Tool.

Animal species highlighted by the Screening Tool for the region:

Sensitivity	Feature(s)
Medium	Aves- <i>Tyto capensis</i>
Medium	Aves- <i>Hydroprogne caspia</i>
Medium	Aves- <i>Eupodotis senegalensis</i>
Medium	Insecta- <i>Lepidochrysops praeterita</i>
Medium	Insecta- <i>Lepidochrysops procera</i>
Medium	Mammalia- <i>Crocidura maquassiensis</i>
Medium	Mammalia- <i>Hydricotis maculicollis</i>
Medium	Invertebrate- <i>Clonia uvarovi</i>

### 11.1.3 Relative Terrestrial Biodiversity theme

The Screening Tool rated the sensitivity of the Relative Terrestrial Biodiversity theme as **Very High** (Figure 28). The following features were highlighted:

Very high sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity	Feature(s)
Very high	Critical Biodiversity Area
Very high	Ecological Support Area
Very high	Vulnerable ecosystem
Very high	Protected Areas Expansion Strategy

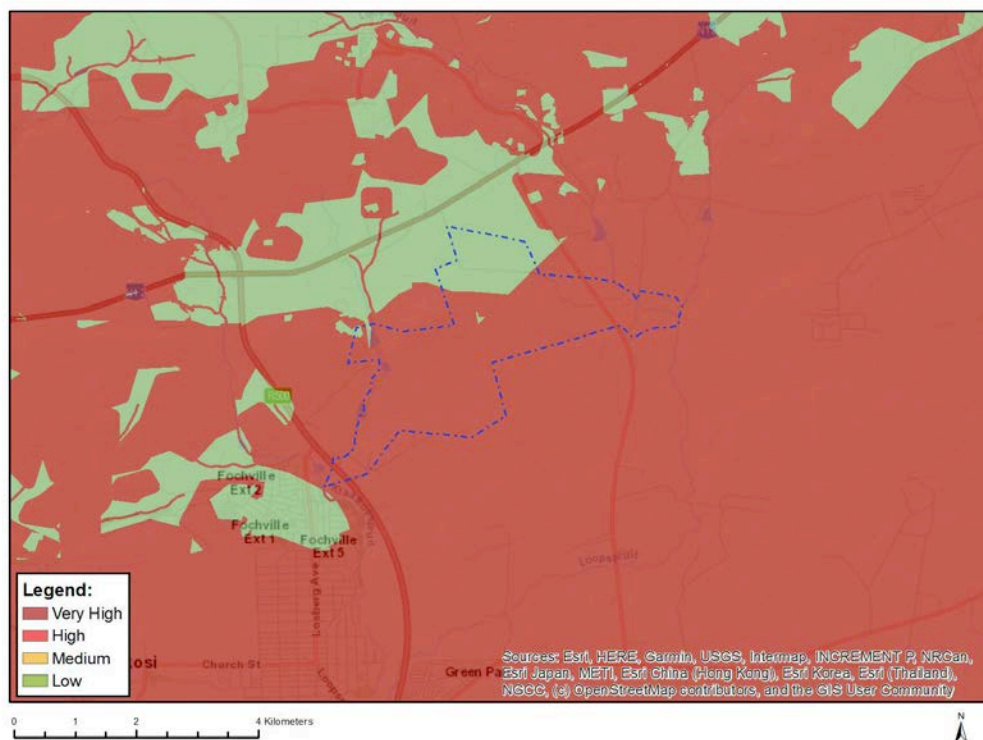


Figure 28: Map and outcome of Relative Terrestrial Biodiversity sensitivity generated by the Screening Tool.

## 11.2 Screening Tool in relation to background study and site verification

### 11.2.1 Plant Species Theme

The Screening Tool rated the sensitivity of the Plant Species Theme as medium. None of the SCC highlighted by the Screening Tool were recorded on site and the Gauteng C-Plan did not reflect their possible occurrence on site.

- Khadia beswickii* (VU) occurs in rocky habitats on shallow soil (sheetrock) but was not recorded on site.
- Species 691 occurs in damp depressions in shallow soil over rock sheets. This type of habitat occurs in a small area on site but the species was not encountered during the vegetation survey.
- The wooded habitats on site may present suitable habitat for sensitive plant species 1248 and 1252 on the Screening Tool list, but they were not encountered during the site survey. Furthermore, the rocky habitats (sheets) and wooded habitats were avoided in the layout of the infrastructure on the Igolide site, thus these species should not be affected by the proposed development.
- Two near threatened species, *Gnaphalium nelsonii* and *Cineraria austrotransvaalensis*, could potentially occur on site according to the Gauteng C-plan, but these species were not mentioned by the screening tool.
- Considering the vegetation as a whole, our site surveys and sensitivity model applied to the vegetation data indicated that the vegetation across most of the site had a low sensitivity.
- Because none of the SCC highlighted by the Screening Tool were found on site, we suggest that the Plant Species Theme's site sensitivity is rated as **Low**.

### 11.2.2 Animal Species Theme

- The Screening Tool rated the sensitivity of the Animal Species Theme as medium.
- The two Lepidopteran species in the region (*Lepidochrysoys praeterita* and *L. procera*) were not recorded and their host plant (*Ocimum obovatum*) was not encountered during the site survey. None of the

Lepidopteran species highlighted by the Screening Tool are listed on the ADU database for the site. According to the RSA Red List, *Clonia uvarovi* (Orthoptera) is rated as Vulnerable. It inhabits tall woodland savanna (<http://speciesstatus.sanbi.org/assessment/last-assessment/4333/>), and no tall woodland savanna is present on site. The habitat on site could be described as bushveld which may be marginally suitable for the species.

- The Maquassie Musk Shrew *Crocidura maquassiensis* (VU) depends on wetlands as suitable habitat in savanna and grassland. Although it has a wide inferred extent of occurrence, it appears to be patchily distributed. It has not been reported from Gauteng or North West Province post-1999 and thus there is a low probability for it to occur on site.
- Suitable habitat for the spotted-necked otter *Hydriactis maculicollis* is available on site. It occurs widespread, but it is restricted to areas of permanent fresh water offering good shoreline cover and an abundant prey base. The watercourses were avoided by the proposed development and bufferzones are applicable.
- **The avifaunal component will be addressed by the avifaunal specialist.**
- **Excluding the bird and bat components**, we would thus rate the sensitivity of the Animal Theme as **Low - Medium** based on the information provided above.

### 11.2.3 Relative Terrestrial Biodiversity Theme

- The Screening Tool rated the sensitivity of the Relative Terrestrial Biodiversity Theme as very high based on the presence of CBAs, ESAs, NPAES and a vulnerable ecosystem.
- The study area is not located in a nationally protected area.
- The study site is part of the NPAES (NPAES 2018) and all turbines are located outside the NPAES.
- CBAs and ESAs are present on the site (CPlanV33\_1110\_ge 2017) and development within the CBAs should best be avoided. Turbines WTG04, WTG07 and WTG08 lie in ESAs but outside the NPAES and their locations may be reconsidered.
- Our background study confirmed that the Rand Highveld Grassland vegetation type on site is listed as Vulnerable whereas the Gauteng Shale Mountain Bushveld is Least Concern. The turbines are currently located in both the Rand Highveld Grassland (7 turbines) and the Gauteng Shale Mountain Bushveld (3 turbines).
- The Freshwater Ecosystem Priority Areas (FEPAs) were not flagged by the Screening Tool.
- The current site clearly includes areas of very high sensitivity (CBA, ESAs and NPAES), but it also includes a large portion that has not been demarcated as very high sensitivity, thus ONA. According to the land use guidelines supplied by SANBI (2021), split zoning should be used, where feasible, to demarcate sensitive areas, where CBAs occur across part of a property. The development has been largely contained within areas that do not qualify as very high sensitivity, although three turbines are located in ESAs.



# 12. ENVIRONMENTAL IMPACTS

## 12.1 Introduction

In this section the issues, risks and impacts associated with the project from a terrestrial biodiversity and species viewpoint is presented.

## 12.2 Key issues

- A sizeable portion of the site falls within a 'Vulnerable' national vegetation type, i.e. the Rand Highveld Grassland and some of the proposed infrastructure is located in this vegetation type. However, from a **vegetation** point of view, the specific area where the turbines are placed (Habitat 4) has a low sensitivity and large areas are old abandoned fields.
- The footprint of the development is relatively small and has been estimated at 50 ha according to the project description provided by the applicant.

## 12.3 Impacts during the construction phase

### 12.3.1 Direct impacts during the construction phase

- Potential impact 1: Loss of vegetation/habitat
- Potential impact 2: The potential loss of threatened, protected, CITES listed and/or endemic plants/animals
- Potential impact 3: Loss of faunal habitat
- Potential impact 4: Direct faunal mortalities due to construction and increased traffic
- Potential impact 5: Increased dust deposition
- Potential impact 6: Increased human activity, noise and light levels
- Potential impact 7: Impact of roads

### 12.3.2 Indirect impacts during the construction phase

- Potential impact 1: Establishment of alien vegetation
- Potential impact 2: Increased water run-off and erosion
- Potential impact 3: Changes in animal behaviour

## 12.4 Impacts during the operational phase

### 12.4.1 Direct impacts during the operational phase

- Potential impact 1: Direct faunal mortalities
- Potential impact 2: Increased light and noise levels and changes in animal behaviour

### 12.4.2 Indirect impacts during the operational phase

- Potential impact 1: Establishment of alien vegetation
- Potential impact 2: Increased water run-off and erosion

## 12.5 Impacts during the decommissioning phase

### *12.5.1 Direct impacts during the decommissioning phase*

- **Potential impact 1: Direct faunal mortalities**
- **Potential impact 2: Increased dust deposition**

### *12.5.2 Indirect impacts during the decommissioning phase*

- **Potential impact 1: Establishment of alien vegetation**
- **Potential impact 2: Increased water run-off and erosion**

## 12.6 Cumulative impacts

- **Cumulative impact 1: Vegetation loss and habitat destruction**
- **Cumulative impact 2: Compromising integrity of CBAs, ESAs and NPAES**
- **Cumulative impact 3: Reduced ability to meet conservation obligations & targets**
- **Cumulative impact 4: Loss of landscape connectivity and disruption of broad-scale ecological processes**

# 13. ASSESSMENT OF SIGNIFICANCE OF ENVIRONMENTAL IMPACT

## 13.1 Introduction

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct, indirect, secondary as well as cumulative impacts.

Potential impacts and risks have been rated in terms of the direct, indirect and cumulative impacts:

- **Direct impacts:** Impacts that arise directly from activities that form an integral part of the Project. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- **Indirect or secondary impacts:** Impacts that arise indirectly from activities not explicitly forming part of the Project. These impacts include induced changes (secondary impact) that may occur as a result of the activity and do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- **Cumulative impacts:** Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts. The cumulative impacts are assessed by identifying other wind and solar energy project proposals and other applicable projects, such as construction and upgrade of electricity generation, and transmission or distribution facilities in the local area (i.e. within 30 km of the proposed Igolide site) that have been approved (i.e. positive EA has been issued) or is currently underway.

A standard risk assessment methodology, provided by WSP, has been used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria presented in **Error! Reference source not found.6**.

**Table 6:** Impact criteria and the scores applied

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
<b>Impact Magnitude (M)</b> The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
<b>Impact Extent (E)</b> The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
<b>Impact Reversibility (R)</b> The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
<b>Impact Duration (D)</b> The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
<b>Probability of Occurrence (P)</b> The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	[S = (E + D + R + M) X P] <i>Significance = (Extent + Duration + Reversibility + Magnitude) x Probability</i>				
IMPACT SIGNIFICANCE RATING					
<b>Total Score</b>	<b>4 to 15</b>	<b>16 to 30</b>	<b>31 to 60</b>	<b>61 to 80</b>	<b>81 to 100</b>
<b>Environmental Significance Rating (Negative (-))</b>	Very low	Low	Moderate	High	Very High
<b>Environmental Significance Rating (Positive (+))</b>	Very low	Low	Moderate	High	Very High

The significance of an impact is interpreted as follows (provided by WSP):

- Very low - the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making;
- Low - the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making;
- Moderate - the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated;
- High - the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making; and
- Very high - the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating).

The impacts of the proposed development on the terrestrial biodiversity and species were assessed based on the knowledge gained during the site visit and literature review. Each of the impacts is briefly described below in terms of the nature, status (positive, negative or neutral) and proposed mitigation measures. The significance of the impact without and with the mitigation measures applied is derived from the assessments of the extent, duration, magnitude, magnitude and probability of the impact by means of an equation.

### Impact Mitigation

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in Figure 29 below.

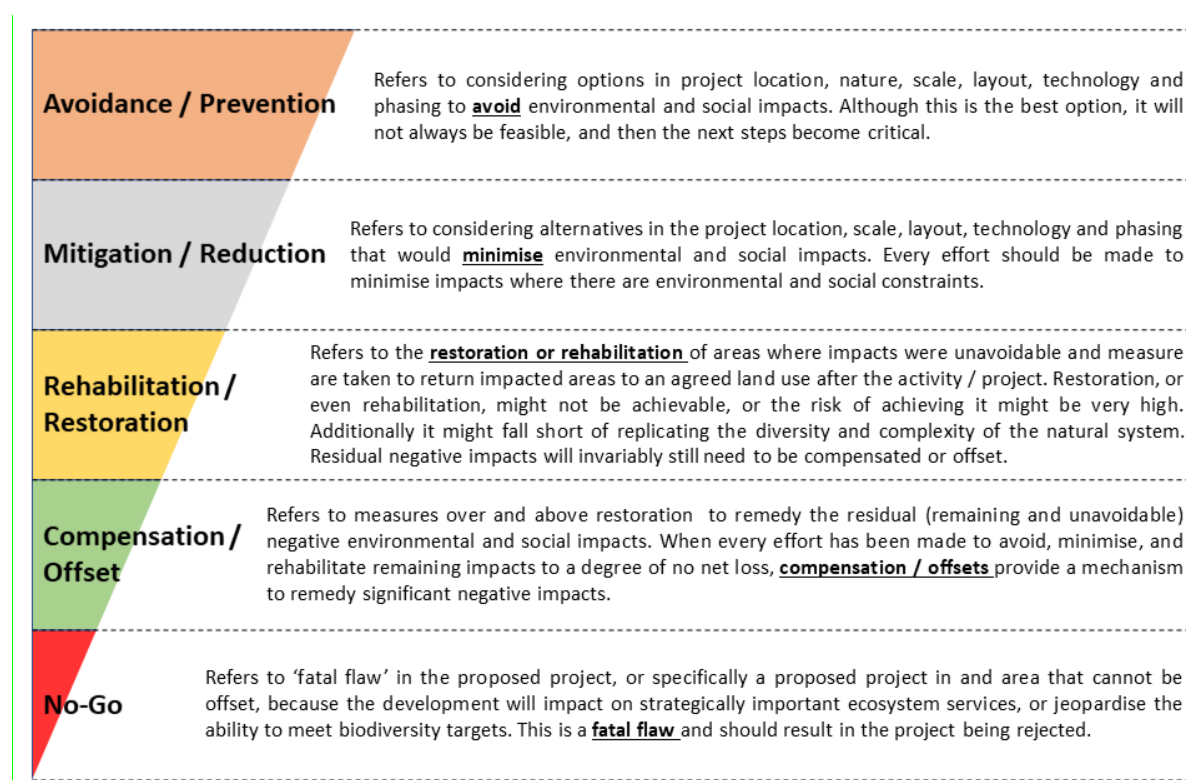


Figure 29: Schematic representation of the mitigation sequence/hierarchy.

## 13.2 Impacts during the construction phase and their significance

### 13.2.1 Direct impacts during the construction phase

#### Loss of vegetation/habitat

**Nature:** Natural vegetation will be cleared for new access roads, upgrading of existing tracks, laydown and construction sites, compound areas, substation, turbines and crane pads. The removal of indigenous vegetation may cause a loss of individuals of threatened, protected and/or endemic species and will also be accompanied by a loss of faunal habitat. However, no threatened or endemic species were found on site and only one provincially protected species with a Least

Concern status was recorded. None of the SCC listed by the Screening Tool, were recorded on site. Vegetation loss is generally also associated with increased water run-off and erosion (see indirect impacts).

Since the turbine footprint is relatively small and spread across the site, the loss of prime habitat within the Gauteng Shale Mountain Bushveld and the Rand Highveld Grassland vegetation types will be small. However, it is suggested that existing tracks should be followed wherever possible. Service roads generally have a larger impact on vegetation clearance than the turbines, however since the roads will have a gravel surface animal movement should still be possible. Beyond the permanent infrastructure footprint, environmental functions and processes should however, not be altered. The ancillary areas are located in the Gauteng Shale Mountain Bushveld which is classified as Least Concern.

#### Proposed mitigation measures:

- A walkthrough would be needed prior to construction to inform permit applications for protected plant species.
- Where possible, ESAs that are located in the Vulnerable Rand Highveld Grassland should be avoided.
- Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns. This includes awareness as to remaining within demarcated construction areas, no littering, handling of pollution and chemical spills, avoiding fire hazards and minimising wildlife interactions.
- Ensure that all temporary use areas e.g. laydown areas and construction camp, are located in areas of low sensitivity.
- Footprints of the turbines, crane pads, roads, construction and substation locations should be clearly demarcated. Vegetation clearance should be confined to the footprint of the development and unnecessary clearance should be avoided.
- The watercourses, rocky outcrops and rocky sheets should be avoided.
- All vehicles are to remain on demarcated roads and no driving through the veld should be allowed.
- No collection of 'fuelwood' should be allowed on site.
- The ECO is to provide supervision on vegetation clearing activities and other activities which may cause damage to the environment, especially when construction commences and most vegetation clearing is taking place.
- River/stream crossings should be placed in areas without extensive wetlands and preferably in areas where the risk of disruption and erosion is low. River/stream crossings should be specifically designed not to impede or disrupt the direction and flow of the water. Specific guidelines of the aquatic specialist should be followed.
- No plants may be translocated or otherwise uprooted or disturbed without express permission from the ECO.
- Permits are required for the destruction or removal of provincially specially protected or protected species.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	4	4
Reversibility (R)	3	3
Magnitude (M)	3	2
Probability (P)	4	3
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>44</b>	<b>30</b>

#### The potential loss of threatened, SCC, protected & endemic plant species

**Nature:** The clearance of the vegetation for new access roads, upgrading of existing tracks, construction site, substation, turbines and crane pads may cause a loss of individuals of threatened, protected or endemic plant species. The site visit did however, not reveal the presence of any species with an IUCN threatened status or SCC mentioned by the Screening Tool. Only one provincially protected plant species was present on site, i.e. *Gladiolus permeabilis*. As the protected plant species at the site is not threatened, the loss of a small number of individuals (if any should mitigation be applied) is not likely to threaten the local or regional population of this species. The loss of some individuals of protected species is unlikely to alter the patterns or processes of the natural system, in the sense that environmental functions and processes will temporarily or permanently cease. *Gladiolus permeabilis* is found in Habitats 2 & 3 which were avoided by the development. Nevertheless, permits need to be obtained for the destruction or removal of provincially specially protected or protected species.

**Proposed mitigation measures:**

- A walkthrough would be needed prior to construction to inform permit applications for protected plant species.
- Placement of infrastructure should be done in such a way as to minimise the impact on SCC or protected species.
- Construction crew, in particular the drivers, should undergo environmental training (induction) to make them aware of the importance of SCC and protected species.
- Permits are required for removal of protected species prior to construction, should avoidance not be possible.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	4	4
Reversibility (R)	4	4
Magnitude (M)	3	2
Probability (P)	2	1
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>24</b>	<b>11</b>

**Loss of faunal habitat**

**Nature:** Clearance of the vegetation due to new access roads, upgrading of existing tracks, construction site, substation, turbines and crane pads will be accompanied by a loss of faunal habitat.

The rare species reported for the Igolide site is the mountain reedbuck *Redunca fulvorufula* and its presence and its status of “Endangered” should be taken into account when developing the Igolide site. However, the species was probably reintroduced to the game farm.

The Screening Report refers to the Maquassie musk shrew *Crocidura maquassiensis* and the spotted-necked otter *Hydriectus maculicollis* as species of concern. *Crocidura maquassiensis* depends on wetlands as suitable habitat, whereas *Hydriectus maculicollis* is restricted to areas of permanent fresh water, offering good shoreline cover and an abundant prey base. *Crocidura maquassiensis* has not been reported from Gauteng or North West Province post-1999 and thus there is a very low probability for it to occur on site. Marginally suitable habitat for the spotted-necked otter is available on site. However, even if the species did occur on site it is unlikely that they would be affected by the development since their habitats will be avoided by the development. The two Lepidopteran species are unlikely to occur on site because their host plant was not recorded on site. The insect *Clonia uvarovi* inhabits tall woodland savanna, while the habitat on site could be described as bushveld. The bushveld may be marginally suitable for the species. Furthermore, the turbines are not located in any bushveld habitats.

**Proposed mitigation measures:**

- Vegetation clearance should be confined to the smallest possible footprint of the development and unnecessary clearance should be avoided.
- Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns.
- A speed limit (of e.g. 40 km/h or appropriate limit) should be set on all roads and strictly adhered to.
- Development should avoid drainage lines and rocky outcrops. The outcrops may be favoured habitat for reptiles and other species since they offer protection from predators.
- Proper waste management procedures should be in place to avoid waste lying around and to remove all waste material from the sites.
- Observe buffer zones along drainage lines.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	4	4
Reversibility (R)	3	3
Magnitude (M)	3	2
Probability (P)	4	3
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>44</b>	<b>30</b>

**Direct faunal mortalities due to construction and increased traffic**

**Nature:** Faunal mortalities may be caused by construction at the footprint of the infrastructure, construction vehicles or other operational activities and by electrical fences, should they be erected around the construction site and substation. In particular slow-moving species such as tortoises, might be prone to these mortalities. When animals ingest waste material or become ensnared in wires, fatalities might occur.

Larger more mobile fauna such as antelope and larger predators will most likely move away from areas of high activity during the construction phase. Smaller and less-mobile animals are not as capable of moving away and may seek shelter down burrows and other shelter sites. None of the SCC listed in the Screening Tool were encountered on site and generally the protected species listed for the region occur at a low density and thus it is unlikely that they would be directly encountered by people at the Igolide WEF.

**Proposed mitigation measures:**

- Construction crew, in particular the drivers, should undergo environmental training to increase their awareness of environmental concerns in order to reduce the number of road kills. The crew should also be made aware of not harming or collecting species such as snakes, tortoises and owls which are often persecuted.
- Proper waste management procedures should be in place to avoid litter, food or other foreign material from lying around and all waste material should be removed from the site.
- Speed limits (e.g. 40 km/h or appropriate limit) should be set on all roads on site.
- Personnel should not be allowed to roam into the veld.
- Ensure that cabling and electrical infrastructure at the site are buried sufficiently deeply to avoid being excavated by fauna and that where such infrastructure emerges above-ground that it is sufficiently protected from gnawing animals.



- Any dangerous fauna (e.g. snakes, scorpions) that are encountered during construction should not be handled or molested by construction staff and the ECO or other suitably qualified persons should be contacted to remove the animals to safety.
- Holes and trenches should not be left open for extended periods of time and should only be dug when needed for immediate construction. Trenches that may stand open for some days, should have an escape ramp to allow any fauna that fall in to escape.
- Should electrical fences be erected it must be done according to the norms and standards of the Nature Conservation Authorities in Gauteng.
- Access to the site should be strictly regulated to reduce the opportunities for poaching.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	2	2
Reversibility (R)	4	4
Magnitude (M)	2	1
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>27</b>	<b>16</b>

#### Increased dust deposition

**Nature:** Increased dust deposition may harm physiological processes of plants and a reduction in the photosynthetic capacity of the plants may occur. The dust layer on the vegetation may also discourage herbivores from grazing or browsing. The increased dust levels will be temporary.

#### Proposed mitigation measures:

- Excessive dust must be reduced by spraying water onto the soil.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	2	2
Reversibility (R)	1	1
Magnitude (M)	2	2
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>18</b>	<b>12</b>

#### Increased human activity, noise and light levels

**Nature:** Construction activities will increase human presence, noise and light levels at the site. These activities may affect animal behaviour. Increased noise and light levels associated with the construction phase are temporary.

#### Proposed mitigation measures:

- The SANS standards should be adhered to in terms of noise levels.
- No major construction should be done at night.

- If there is any part of the site that needs to be lit at night for security reasons, then appropriate lighting should be installed to minimise negative effects on nocturnal animals. Motion-detecting lights should also be considered.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	2	2
Reversibility (R)	1	1
Magnitude (M)	3	2
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>21</b>	<b>12</b>

#### Impacts of roads

**Nature:** Roads are referred to under several impacts, but a summary is provided in this section. Even in natural regions roads are intrusive and destructive and cause a disturbance. Their construction destroys the vegetation, leads to compaction of the soil and loss of habitat for small animals. Roads can create barriers for small animals, cutting off dispersal routes and fragmenting habitats. Animals crossing or moving along roads can also become easy targets for predators. Compacted roads also impact on the movement of subterranean and burrowing animals. Dust kicked up by vehicles coat the roadside plants making them less attractive to animals. Poorly planned roads often result in water erosion problems and busy roads affect the movement of especially shy animals. Some destruction of the vegetation adjacent to the footprint will also inevitably occur when preparing the sites. Unnecessary clearing of vegetation beyond the footprint of the development can however, largely be avoided.

#### Proposed mitigation measures:

- Wherever possible, existing roads/tracks should be used.
- The construction of a road should be done in the most environmentally sensitive manner possible.
- A suitably qualified person should plan, design and supervise the proper construction of roads to minimize the impact on the environment.
- Roads should be provided with run-off structures to reduce the risk of erosion.
- Proper road maintenance procedures should be in place.
- A long-term commitment to the maintenance of the road should be accepted. Roads can easily become ruts and erosion gullies if not properly planned and maintained.
- Driving in wet clayey soils after rain also result in deep tracks that damage the road surface and lead to other users bypassing such areas, thereby forming new tracks alongside the original ones.
- River/stream crossings should not be placed in areas with extensive wetlands and preferably in areas where the risk of disruption and erosion is low. All river/stream crossings should be inspected by the aquatic specialist during final design of the layout to ensure that optimal and acceptable locations have been chosen for river crossings.
- River/stream crossings should be specifically designed not to impede or disrupt the direction and flow of the water. Specific guidelines of the aquatic specialist should be followed.
- Roads should not have steep curbs.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1

Duration (D)	4	4
Reversibility (R)	3	3
Magnitude (M)	4	2
Probability (P)	4	3
Significance (S) [ $S = (E + D + R + M) \times P$ ]	48	30

### 13.2.2 Indirect impacts during the construction phase

#### Establishment of alien vegetation

**Nature:** As a result of the clearance of indigenous vegetation and resulting degradation, alien species might invade the area. At present the level of alien infestation on site was rated as moderate to high. Twenty-one declared invasive species were noted on site and increased vehicle traffic may further facilitate the introduction of seeds of alien species. Infestation by invasive alien species may cause changes to the structure and functioning of the ecosystem which often exacerbate the further loss of indigenous vegetation. Bare areas that are not actively rehabilitated and areas receiving runoff are particularly vulnerable to alien infestation.

#### Proposed mitigation measures:

- Implement a monitoring program for the early detection of alien invasive plant species.
- A control program should be employed to combat declared alien invasive plant species in the most environmentally friendly manner that does not result in undesirable secondary impacts.
- Herbicides for the control of alien species should be applied according to the relevant instructions and by appropriately trained personnel.
- No alien species should be used in rehabilitation or landscaping.
- Use only plants and seed collected on-site for revegetation.
- Cleared areas may need to be fenced-off during rehabilitation to exclude livestock and wildlife.
- Material brought onto site e.g. building sand should be regularly checked for the germination of alien species.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	2	1
Duration (D)	4	3
Reversibility (R)	3	3
Magnitude (M)	3	2
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	36	18

#### Increased water run-off and erosion

**Nature:** Increased erosion (water and wind) and water run-off will be caused by the clearing of the indigenous vegetation and compaction of soil. The roads traversing hill slopes will be the main source of erosion if not properly constructed and provided with water run-off structures. In addition, the hardened surfaces created by the roads, crane pads and other infrastructure elements will increase runoff, which will pose an erosion risk in the areas receiving the water, even if these areas have not been disturbed. Increased run-off and erosion could affect hydrological processes in the area and change water and silt discharge into the streams.

The site lies within the summer rainfall region and can experience intense thundershowers, which will increase the potential for erosion. On slopes, active rehabilitation and mitigation measures to prevent erosion will be required.

#### Proposed mitigation measures:

- Clearing of vegetation, compaction and levelling should be restricted to the footprint of the proposed development.
- All roads should have water diversion structures with energy dissipation features to slow and disperse the water into the receiving area.
- A rehabilitation and revegetation plan should be developed as part of the EMP.
- Regular monitoring of the site during construction for erosion problems.
- Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas.
- If applicable, topsoil should be removed and stockpiled, then reapplied as soon as possible in order to facilitate regeneration of the natural vegetation on cleared areas.
- Where applicable, construct stabilisation structures on slopes to prevent erosion.
- Reduce activity on site after large rainfall events when the soils are wet. No driving off hardened roads until soils have dried out and the risk of bogging down has decreased.
- A suitably qualified person should plan, design and supervise the proper construction of roads to minimise the impact on the environment.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	3	2
Duration (D)	4	4
Reversibility (R)	4	3
Magnitude (M)	3	3
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>42</b>	<b>24</b>

#### Changes in animal behaviour

**Nature:** The increased human presence and/or construction operations will increase noise levels as well as light levels at night. The increased human presence, elevated noise and light levels, loss of animal habitat and compaction of soils may alter the behavioural patterns of some animals. Some of these changes may favour certain species and negatively affect others and consequently change the composition of the animal communities. Species with small territories will be negatively affected as well as species that live in the soil.

Research elsewhere showed that the response of animals to wind energy facilities was **highly species-specific** and could range from avoidance to a positive reaction. The response was apparently also depended on the level of predation, with no impact noted where predation pressure was low. Wind farms affect large terrestrial mammals mainly through an increase in human activity within the wind farm area. During the construction phase, the mobile large-mammal carnivores and ungulates may temporarily avoid the site, but when construction ceases and human presence decreases, these animals generally acclimate to the wind energy infrastructure. The impact on burrowing fauna may be higher, since these animals are usually sensitive to soil tremors and disturbances, and consequently they will likely move away from construction areas. It is anticipated that the impact of the Igolide site on the fauna would mostly be temporary, i.e. during the construction phase.

**Proposed mitigation measures:**

- Construction crew should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns.
- Development should avoid rocky outcrops and wetlands.
- Soil compaction should be kept to a minimum by restricting driving to designated roads.
- If there is any part of the site that needs to be lit at night for security reasons, then appropriate lighting should be installed to minimise negative effects on nocturnal animals. Motion-detecting lights should also be considered.
- The mitigation measures as indicated by the noise specialist must be adhered to.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	3	2
Reversibility (R)	1	1
Magnitude (M)	3	2
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>24</b>	<b>12</b>

### 13.3 Impacts during the operational phase and their significance

#### 13.3.1 Direct impacts during the operational phase

---

##### Direct faunal mortalities

---

**Nature:** Faunal mortalities may be caused by maintenance vehicles or other maintenance activities, electric fences and ingestion of waste material. In particular slow-moving species such as tortoises, might be prone to road mortalities. Fatalities might also arise when animals become ensnared in wires or in electric fences. Bird collisions with the wind turbine blades will be addressed by the avifaunal and bat specialists.

Although activity at the site is likely to be relatively low during operation, some impact on fauna may still occur as a result of personnel present on site as well as the operation of maintenance vehicles. Direct interactions between the turbines and terrestrial fauna (excluding avifauna and bats) are likely to be low. Major risk factors during operation are likely to be from vehicle collisions with fauna.

**Proposed mitigation measures:**

- Maintenance crew should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns.
- Access to the site should be strictly controlled.
- All excess wires, cables and waste material should be removed from the site.
- All vehicles at the site should adhere to a low speed limit (of e.g. 40 km/h (or whatever is appropriate) and slow-moving fauna such as tortoises on roads should be moved off the road.

**Additional mitigation measures proposed:**

- Electrical fences should be erected according to the norms and standards of the Nature Conservation Authorities in Gauteng.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	4	4
Reversibility (R)	4	4
Magnitude (M)	2	2
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>36</b>	<b>22</b>

**Increased light and noise levels and changes in animal behaviour**

**Nature:** The loss of vegetation cover, compacting of soils, increased noise levels and the increased human presence will alter animal behavioural patterns by making certain areas unavailable and making roads difficult to traverse. Some animal species will be more affected than others. These species might undergo a reduction in their population size.

According to Todd & Skowno (2014), small mammals, reptiles and amphibians are not likely to move away from the turbines on account of the noise as these animals do not rely on sound to forage and rely largely on plant cover and other avoidance measures to avoid predators. Although frogs communicate with their calls, the pitch of the noise generated by the turbines is not likely to be similar to that of the frogs and a significant impact is unlikely. Fauna which rely heavily on hearing for foraging or predator avoidance are potentially worst affected by the noise. This would include species that rely extensively on hearing for prey detection or predator avoidance. However, it is difficult to predict the impact on these species without entering into a high degree of speculation as there has been little research on this topic and hence there is no baseline in terms of known impacts due to turbine noise on fauna, especially within the South African context. However, noise due to turbines at the site will be variable and related to wind direction and operating conditions among other factors. As most fauna are adaptable with regards to noise, it is likely that any affected fauna would adapt to the local conditions and it is not likely that there would be any ecosystem-level or trophic impacts due to turbine noise. According to Todd & Skowno (2014) the possibility that predators such as jackal and caracal would prey more heavily on livestock or wildlife as a result of turbine noise, is not a likely scenario.

**Proposed mitigation measures:**

- The mitigation measures as indicated by the noise specialist must be adhered to.
- Maintenance crew should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns.
- Soil compaction should be kept to a minimum by restricting driving to designated roads.
- If there is any part of the site that needs to be lit at night for security reasons, then appropriate lighting should be installed to minimise negative effects on nocturnal animals. Motion-detecting lights should also be considered.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	4	4
Reversibility (R)	3	1
Magnitude (M)	3	2
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>33</b>	<b>16</b>

### 13.3.2 Indirect impacts during the operational phase

#### Establishment of alien vegetation

**Nature:** As a result of the loss of indigenous vegetation and resulting degradation, primarily during the construction phase, alien species might invade the area. Alien invasive species are generally more common in road reserves than the adjacent undisturbed farmland. The invasion by alien species will continue unless controlled. Increased vehicle traffic may further facilitate the introduction of seeds of alien species. If not controlled, infestation by invasive alien species may eventually cause changes to the structure and functioning of the ecosystem which often exacerbate the further loss of indigenous vegetation.

#### Proposed mitigation measures:

- Implement a monitoring program for the early detection of alien invasive plant species and a control program to combat declared alien invasive plant species should be employed.
- No alien species should be used for landscaping, rehabilitation or any other purpose.
- Clearing of alien species should be done on a regular basis.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	2	1
Duration (D)	4	3
Reversibility (R)	3	3
Magnitude (M)	3	2
Probability (P)	3	2
Significance (S) $[S = (E + D + R + M) \times P]$	<b>36</b>	<b>18</b>

#### Increased water run-off and erosion

**Nature:** Disturbance created during construction will take several years to fully stabilise and the increase in compacted areas as a result of roads, turbines and crane pads may increase runoff which will pose an erosion risk. Particular areas of concern would be roads traversing slopes as well as any infrastructure on slopes with erodible soils. Consequently, erosion risk during operation is likely to be centred on areas disturbed during construction and on areas receiving runoff from roads and similar hardened surfaces. Increased run-off and erosion could affect hydrological processes in the area and may change water discharge into the streams and increase silt load.

#### Proposed mitigation measures:

- Proper road maintenance procedures should be in place.
- Regular monitoring of the site during operation for erosion problems.
- Should new sections of the road be needed, a suitably qualified person should plan, design and supervise the proper construction of roads.
- Reduced activity at the site after large rainfall events when the soils are wet.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	2	2
Duration (D)	4	4
Reversibility (R)	3	3
Magnitude (M)	3	3
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>36</b>	<b>24</b>

## 13.4 Impacts during the decommissioning phase and their significance

## 13.4.1 Direct impacts during the decommissioning phase

**Faunal mortalities**

**Nature:** Faunal mortalities may be caused by vehicles or other decommissioning activities and waste. In particular slow-moving species such as tortoises, might be prone to road mortalities. When animals ingest waste material or become ensnared in it fatalities might also occur.

**Proposed mitigation measures:**

- Decommissioning crew should undergo environmental training to increase their awareness of environmental concerns.
- Speed limits (of e.g. 40 km/h) should be adhered to.
- Proper waste management procedures should be in place and no material should be left on site in order to prevent instances of ensnarement or ingestion of foreign material.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	1	1
Reversibility (R)	4	4
Magnitude (M)	2	1
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>24</b>	<b>12</b>

**Increased dust deposition**

**Nature:** Increased dust deposition may harm physiological processes of plants and a reduction in the photosynthetic capacity of the plants may occur. The dust layer on the vegetation may also discourage herbivores from grazing or browsing the dust covered vegetation. The increased dust levels will be temporary.

**Proposed mitigation measures:**

- Excessive dust must be reduced by spraying water onto the soil.



**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	1	1
Duration (D)	2	2
Reversibility (R)	1	1
Magnitude (M)	2	1
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>18</b>	<b>9</b>

*13.4.2 Indirect impacts during the decommissioning phase***Establishment of alien vegetation**

**Nature:** As a result of the decommissioning activities, areas will be disturbed and alien species might invade. Increased vehicle traffic may facilitate the introduction of seeds of alien species.

**Proposed mitigation measures:**

- Implement a monitoring program (e.g. at three month intervals) for at least three years after decommissioning to document alien infestation across the site.
- A control program to combat declared alien invasive plant species should be employed.
- Areas where turbines, crane pads or other infrastructure are removed, must be revegetated with indigenous plant species.
- No alien species should be used for rehabilitation/revegetation or any other purpose.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	2	1
Duration (D)	4	3
Reversibility (R)	3	1
Magnitude (M)	3	2
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>36</b>	<b>14</b>

**Increased water run-off and erosion**

**Nature:** Some of the existing roads might have to be upgraded and increased erosion and water run-off will thus be caused by the clearing of the indigenous vegetation and soil disturbance. Decommissioning would involve the removal of the infrastructure of the facility and the rehabilitation of the roads and other hard infrastructure of the facility. If the rehabilitation is not successful, this would leave the site vulnerable to erosion. Without management, increased run-off and erosion could affect hydrological processes in the area and may change water discharge into the streams and increase silt load.

**Proposed mitigation measures:**

- No new roads should be built.
- Proper road maintenance procedures should be in place during the decommissioning phase.
- Removal of all infrastructure components from the site.

- Rehabilitation of all cleared and disturbed areas with local species. Implement a monitoring programme (e.g. at six month intervals) for at least three years after decommissioning to document vegetation recovery on site.
- Off-site disposal of all facility components such as cabling and turbine parts.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	2	2
Duration (D)	4	4
Reversibility (R)	3	3
Magnitude (M)	3	3
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>36</b>	<b>24</b>

## 13.5 Cumulative impacts

The existing and proposed developments within 30 km from the site that were taken into consideration for cumulative impacts include:

- Renewable energy projects:

Only one renewable energy development occurs in the region within a 30 km radius from the Igolide site: (DFFE EGIS; [REEA Quarter 1, 2023](#))

EAP: Aurecon SA Pty Ltd  
 Applicant: Sibanye Gold Limited  
 Development: Solar PV 200 MW  
 Status: Approved  
 DEA Reference: 14/12/16/3/3/2/919

This Sibanye Gold Limited development falls in the Gauteng Shale Mountain Bushveld vegetation type that has a status of “Least Concern”.

Since the final grid route has not yet been determined, the cumulative assessment does not consider the grid.

### Vegetation loss and habitat destruction

**Nature:** Vegetation loss, habitat destruction and possibly loss of SCC and protected species, can occur when considering all developments. The habitat destruction will lead to changes in the physical features of the habitat, with concomitant changes in ecological processes. Secondary vegetation may develop at sites where the vegetation was cleared or the soil compacted. The species composition may change and alien species might invade. Vegetation loss will also constitute the loss of animal habitat. It should however be noted that in the case of wind energy facilities vegetation loss due to habitat destruction is far more contained than in the case of solar facilities. The contribution by the Igolide site to the cumulative impact will likely be small.

**Proposed mitigation measures:**

- All projects should adhere to the site-specific recommendations of the ecologists to ensure that impacts are mitigated where possible.
- Placement of infrastructure should be done in such a way that no SCC or protected species are affected and

CBA's avoided and therefore a walkthrough before construction is commenced is required.

- Positioning of the wind turbines (i.e. avoiding CBA's and wherever possible ESA's) in the most environmentally responsible manner is crucial.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	3	3
Duration (D)	4	4
Reversibility (R)	3	3
Magnitude (M)	3	2
Probability (P)	3	2
Significance (S) $[S = (E + D + R + M) \times P]$	<b>39</b>	<b>24</b>

#### Compromising integrity of CBA, ESA and NPAES

**Nature:** According to the mapping of CBA's in Gauteng, all turbines fall outside the CBA2 (Important area) and NPAES. Development within a CBA should not be allowed as such development may result in biodiversity loss and therefore compromise the integrity of the CBA. Since ESA's have also been awarded a 'Very High' sensitivity in the Screening Tool, the micrositing or repositioning of those turbines within ESA's should be considered. The on-site substation/BESS as well as the other ancillary areas (batching plant, construction camp and laydown) avoid CBA's and ESA's. Thus, the contribution of Igolide WEF to the cumulative impact will likely be small. It is assumed that authorisation would only be granted to projects that have similarly avoided CBA's and NPAES.

#### Proposed mitigation measures:

- A walkthrough would be needed prior to construction to inform permit applications for protected plant species.
- Avoid placing turbines and other large infrastructure in CBA's and wherever possible ESA's.
- Minimise the development footprint as far as possible.
- Stringent construction-phase monitoring of activities at the site to ensure that mitigation measures are adhered to and that the overall ecological impact of the development is maintained at a low level.
- Align roads and other infrastructure so that transformation within the CBA's and ESA's is minimised.
- The use of structures which may inhibit movement of fauna, e.g. mesh or electric fencing should be avoided where feasible.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	3	3
Duration (D)	4	4
Reversibility (R)	3	3
Magnitude (M)	3	2
Probability (P)	3	2
Significance (S) $[S = (E + D + R + M) \times P]$	<b>39</b>	<b>24</b>

#### Reduced ability to meet conservation obligations & targets

**Nature:** The loss of unprotected vegetation types on a cumulative basis from the area may impact the countries'

ability to meet its conservation targets. The 'Vulnerable' Rand Highveld Grassland is a large national vegetation type but only 1.8% is currently conserved, with a conservation target of 24%. However, the direct physical impact of the Igolide WEF on the vegetation type will be small in extent (estimated at 50 ha by Enertrag) and the Igolide site is not located in a protected area but it does fall within the protected area expansion strategy (NPAES). No Special Conservation Zone occurs in the region (GDARDE 2011).

#### Proposed mitigation measures:

- A walkthrough would be needed prior to construction to inform permit applications for protected plant species.
- Ensure that habitats with a high to very high sensitivity are avoided.
- Minimise the development footprint as far as possible.
- Minimise placement of infrastructure within the Vulnerable Rand Highveld Grassland.

#### Significance without and with mitigation measures:

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	3	3
Duration (D)	4	4
Reversibility (R)	3	3
Magnitude (M)	3	2
Probability (P)	3	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>39</b>	<b>24</b>

#### Loss of landscape connectivity and disruption of broad-scale ecological processes

**Nature:** The presence of the facility and the associated transformation of intact vegetation, could pose a threat to the connectivity of the landscape. For fauna the disruption is largely due to the hardened surfaces of the facility which also create open areas. Subterranean species that have to emerge from the soil to cross roads will be most affected. The severity of any these impacts for faunal species is likely to be relatively low as the roads required for operation are likely to still be of a natural surface such as gravel and would experience low traffic volumes.

Because of the relatively small footprint of the wind turbines, the facility is unlikely to disrupt pollination and dispersal processes that could cause spatial fragmentation of plant populations. The facility would still allow grazing by wildlife and livestock to continue. Fire would need to be controlled and this could affect the vegetation dynamics.

In the long-term the facility is not likely to create significant local or regional population-level impact on fauna or vegetation.

#### Proposed mitigation measures:

- Minimising the development footprint wherever possible.
- Revegetation of all cleared and bare areas created by the facility with local species.
- Fences and other structures which impede faunal movement should be avoided.
- Roads should not have steep curbs.

**Significance without and with mitigation measures:**

Parameter	Score without mitigation	Score with mitigation
Status	Negative	Negative
Extent (E)	3	3
Duration (D)	4	4
Reversibility (R)	3	3
Magnitude (M)	3	2
Probability (P)	2	2
Significance (S) [ $S = (E + D + R + M) \times P$ ]	<b>26</b>	<b>24</b>

**Table 7: Overall Impact Significance (Post Mitigation)**

Phase and impact	Significance before mitigation	Significance after mitigation
<b>Construction</b>		
<i>Direct impacts</i>		
Loss of vegetation/habitat	44	30
Potential loss of threatened, SCC, protected & endemic plant species	24	11
Loss of faunal habitat	44	30
Direct faunal mortalities due to construction and increased traffic	27	16
Increased dust deposition	18	12
Increased human activity, noise and light levels	21	12
Impacts of roads	48	30
<i>Indirect impacts</i>		
Establishment of alien vegetation	36	18
Increased water run-off and erosion	42	24
Changes in animal behaviour	24	12
<b>Operational</b>		
<i>Direct impacts</i>		
Direct faunal mortalities	36	22
Increased light and noise levels and changes in animal behaviour	33	16
<i>Indirect impacts</i>		
Establishment of alien vegetation	36	18
Increased water run-off and erosion	36	24
<b>Decommissioning</b>		
<i>Direct impacts</i>		
Direct faunal mortalities	24	12
Increased dust deposition	18	9
<i>Indirect impacts</i>		
Establishment of alien vegetation	36	14
Increased water run-off and erosion	36	24
<b>Cumulative</b>		
Vegetation loss and habitat destruction	39	24
Compromising integrity of CBA, ESA and NPAES	39	24
Reduced ability to meet conservation obligations & targets	39	24
Loss of landscape connectivity and disruption of broad-scale ecological processes	26	24

# 14. LEGISLATIVE AND PERMIT REQUIREMENTS

The following legislation is relevant to the development and may require permits from the relevant authority.

## 14.1 National Forest Act (Act No. 84 of 1998)(NFA 2021)

The National Forest Act provides for the protection of forests, as well as for specific tree species. In the case where a protected tree would have to be destroyed by the development an application for a license would have to be made. However, **no protected trees**, according to the protected tree list (NFA 2023), were observed and it is unlikely that any such species occur within the development footprint.

## 14.2 National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (ToPS list) (NEMBA 2007c)

NEMBA also deals with endangered, threatened and otherwise controlled species, under the ToPS Regulations (Threatened or Protected Species Regulations). A ToPS permit is required for any activities involving a ToPS listed species.

The only threatened or protected animal species (ToPS; NEMA 2007c) that was recorded on site was the black wildebeest (*Connochaetus gnou*). None of the mammals or carnivores are expected to be negatively affected by the development, but avifaunal and bat collisions need to be monitored (see avifaunal and bat specialist reports).

The following **threatened or protected faunal species** (ToPS) are listed for the general region:

### Mammals:

<i>Acinonyx jubatus</i>	Cheetah	Vulnerable
<i>Aonyx capensis</i>	African Clawless Otter	Protected
<i>Atelerix frontalis</i>	Southern African Hedgehog	Protected
<i>Connochaetes gnou</i>	Black Wildebeest*	Protected
<i>Hydrictis maculicollis</i>	Spotted-necked Otter	Protected
<i>Leptailurus serval</i>	Serval	Protected
<i>Panthera leo</i>	Lion	Vulnerable
<i>Panthera pardus</i>	Leopard	Vulnerable
*species recorded on site		

### Reptiles:

<i>Python natalensis</i>	Southern African Python	Protected
--------------------------	-------------------------	-----------

### Amphibians:

<i>Pyxicephalus adspersus</i>	Giant Bull Frog	Protected
-------------------------------	-----------------	-----------

### 14.3 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

The Conservation of Agricultural Resources Act provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. A total of 49 alien species were recorded for the Igolide site (Appendix B) of which 21 species are categorised as invasive, 27 species as naturalised alien species and one alien tree species.

Currently alien species abundance at the site is moderate except along the drainage lines where many alien invasive species are present. Disturbance associated with the construction phase would encourage alien invasion and the alien invasive species would need to be cleared on a regular basis. No permitting would be required for such activities, but an alien invasive species control programme should be initiated. Invasive alien species (and their category) likely to occur on site as listed in Chapter 6 and Appendix B.

### 14.4 Gauteng (GDARD 1983) – permit requirements

GDARDE is the regulatory authority in Gauteng for the issuing of permits for fauna, flora, hunting and CITES.

#### 14.4.1 Flora (see Appendix B):

Subject to the provisions of the Transvaal Nature Conservation Ordinance (No. 12 of 1983), no person shall pick a protected plant or flower of such plant unless he is the holder of a permit which authorises him to do so unless the person is the owner of the land or a relative (Section 87 (1), GDARD 1983).

Subject to the provisions of this Ordinance, no person shall possess, pick, sell, purchase, donate or receive as a donation, import into or convey within the Province, export or remove from the Province a specially protected plant, unless he is the holder of a permit which authorises him to do so (Section 96 (1), GDARD 1983).

#### **Schedule 12: Specially Protected Plants**

No Schedule 12 plant species were recorded on site.

#### **Schedule 11: Protected Plants**

Thirteen (13) plant species in Appendix B are listed for the region as protected (Schedule 11: Protected Plants) according to GDARDE (1983), but only one Schedule 11 plant species was recorded on site: *Gladiolus permeabilis*.

#### 14.4.2 Fauna (see Appendix C)

At the time of the survey the site was managed as a game farm. Under the Ordinance (GDARD 1983), the majority of mammals, reptiles and amphibians are listed as Schedule 2: Protected Game (see Appendix C). Twenty-three (23) mammal species were recorded on site (Appendix C). Eight species were classified as Schedule 2: Protected Game and two were classified as Schedule 8: Problem Animals.

However, no permits are required for animal species since none should be harmed by the development.

## 14.5 CITES (Convention on the International Trade in Endangered Species of Wild Fauna and Flora)

South Africa is a signatory to CITES and as such must comply with the import, export and re-export procedure as stipulated by CITES. GDARDE is the CITES Management and Scientific Authority for exports out of and imports into the respective province from or to other countries. According to GDARD (1983), every species of fauna and flora referred to in Appendix I and Appendix II of CITES shall be an endangered species or a rare species of fauna and flora respectively. Therefore no person shall import into or export or remove from the Province an endangered species or a rare species, unless he is the holder of a permit which authorises him to do so.

The following species occurring in the study area are CITES listed. However, no permits are required for animal species since none should be harmed by the development on Igolide.

The following species occurring in the region are CITES listed fauna:

### **Fauna:**

#### Mammals:

<i>Acinonyx jubatus</i>	Cheetah	Appendix I
<i>Aonyx capensis</i>	African clawless otter	Appendix II
<i>Caracal caracal</i> *	Caracal	Appendix II
<i>Giraffa giraffa giraffa</i> *	Giraffe	Appendix II
<i>Hippopotamus amphibius</i>	Hippopotamus	Appendix II
<i>Leptailurus serval</i>	Serval	Appendix II
<i>Panthera leo</i>	Lion	Appendix II
<i>Panthera pardus</i>	Leopard	Appendix I

\*Species recorded on site

#### Reptiles:

<i>Kinixys lobatsiana</i>	Lobatse hinged-back tortoise	Appendix II
<i>Stigmochelys pardalis</i>	Leopard tortoise	Appendix II

### **Flora:**

The following are CITES listed plant species for the region, but **none were** recorded on site:

<i>Aloe</i> spp. (4 species listed for the region)	Asphodelaceae
<i>Anacampseros filamentosa</i> subsp. <i>filamentosa</i>	Anacampserotaceae
<i>Anacampseros subnuda</i> subsp. <i>subnuda</i>	Anacampserotaceae
<i>Euphorbia clavarioides</i>	Euphorbiaceae
<i>Euphorbia spartaria</i>	Euphorbiaceae
Orchidaceae (all species) – 6 species listed for the region	



# 15. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUT

Impact	Mitigation / Management Objectives	Mitigation / Management actions	Monitoring		
			Methodology	Frequency	Responsibility
<b>A. IMPACTS ON TERRESTRIAL BIODIVERSITY AND SPECIES</b>					
<b>A. DESIGN PHASE</b>					
Potential impact on terrestrial biodiversity and species as a result of the proposed WEF.	Avoid or minimise impacts on terrestrial biodiversity and species on site regarding the placement of the infrastructure. Avoiding ridges, rocky sheets and drainage lines will reduce the chances of loss of protected species and SCC (Screening Tool).	A walkthrough would be needed prior to construction to inform permit applications for protected plant species.  Ensure that the placing of infrastructure takes the sensitivity mapping of the ecological assessment into account to avoid and reduce impacts on sensitive habitats and protected species.	Ensure that this is taken into consideration during the planning and design phase.	During design cycle and before construction commences.	Project Developer
<b>B. CONSTRUCTION PHASE (consult Chapter 13 for more detail on mitigation)</b>					
Loss of vegetation/habitat	Confine vegetation clearance to footprint and minimise disturbance of adjacent areas.	Demarcate all infrastructure sites clearly to avoid unnecessary clearance of the vegetation.  Permits have to be obtained for the removal of Gauteng protected species within the footprint of the development.	Ensure that mitigation measures are enforced.	Daily	The Environmental Control Officer (ECO) should monitor and report any incidents to the Holder of the EA
Impact on animal species	Avoid or minimise impacts that could potentially affect animal behaviour.	Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns.  Holes and trenches should not be left open for long periods of time. These should be regularly inspected for the presence of trapped animals.  Proper waste management procedures should be in place to avoid waste lying around and to remove all waste material from the site.  Speed limit (of e.g. 40 km/h) should be strictly adhered to.	Ensure compliance with these mitigation measures.	Daily	The ECO should monitor and report to the Holder of the EA.
Increased dust levels	Avoid or minimise increased dust levels.	Dust control measures should be implemented.	Ensure that dust control measures are in place.	Daily	The ECO should monitor and report to the Holder of the EA.
Alien species invasion	Avoid invasion by alien species.	Implement a monitoring program for the early detection of alien invasive plant species.	Ensure implementation of a control programme	Daily	The ECO should monitor and report to the Holder of the EA.

Impact	Mitigation / Management Objectives	Mitigation / Management actions	Monitoring		
			Methodology	Frequency	Responsibility
		Employ a control program to combat declared alien invasive plant species.	to combat alien invasive plants.		
Run-off and erosion control	Avoid negative effects of run-off and water erosion by applying appropriate mitigation measures	All roads should have water diversion structures with energy dissipation features to slow and disperse the water into the receiving area.  Road maintenance procedures should be in place.  Vegetation clearance and soil compaction should be minimized.	Ensure compliance with these mitigation measures.	Weekly	The ECO should monitor and report to the Holder of the EA.
<b>C. OPERATIONAL PHASE (consult Chapter 13 for more detail on mitigation)</b>					
Impact on animal species	Avoid or minimise impacts that could potentially affect animal behaviour.	Proper waste management procedures should be put in place.  If there is any part of the site that needs to be lit at night for security reasons, then appropriate lighting should be installed to minimise negative effects on nocturnal animals. Motion-detecting lights should also be considered.	Ensure compliance with these mitigation measures.	Monthly	The EO should monitor and report to the Holder of the EA.
Alien species invasion	Avoid invasion by alien species.	Implement a monitoring program for the early detection of alien invasive plant species and employ a control program to combat declared alien invasive plant species.	Ensure implementation of a control programme to combat alien invasive plants.	Every three months	The EO should monitor and report to the Holder of the EA.
Run-off and erosion control	Avoid negative effects of run-off and water erosion by applying appropriate mitigation measures	All roads should have water diversion structures with energy dissipation features to slow and disperse the water into the receiving area.  Road maintenance procedures should be in place.  Vegetation clearance and soil compaction should be minimized.	Ensure compliance with these mitigation measures.	Weekly	The EO should monitor and report to the Holder of the EA.
<b>C. DECOMMISSIONING PHASE (consult Chapter 13 for more detail on mitigation)</b>					
Loss of vegetation/habitat	Minimise disturbance and clearance of vegetation.	Unnecessary clearance of natural vegetation should be avoided.	Ensure that mitigation measures are enforced.	Monthly	The EO should monitor and report to the Holder of the EA.
Impact on animal behaviour	Avoid or minimise impacts that could potentially affect animal behaviour.	Proper waste management procedures should be put in place.	Ensure compliance with these mitigation measures.	Monthly	The EO should monitor and report to the Holder of the EA.
Alien species invasion	Avoid invasion by alien species.	Implement a monitoring program for the early detection of alien invasive plant species and employ a control program to combat declared alien invasive plant species.	Ensure implementation of a control programme to combat alien invasive plants.	Every three months	The EO should monitor and report to the Holder of the EA.

## 16. Final Specialist Statement and Authorisation Recommendation

The low impact significance, after mitigation, and low sensitivity rating for many of the habitats means the project could go ahead without major constraints, provided the mitigation measures and management actions proposed to conserve protected fauna and flora on the site are applied. **We thus recommend authorisation of the project provided all mitigation measures are implemented.**

A brief summary of the most important considerations is provided below:

### **Vegetation and flora:**

- **Vegetation types:** The Rand Highveld Grassland vegetation type is listed as “Vulnerable”, while the Gauteng Shale Mountain Bushveld vegetation type is listed as “Least Concern”. The placement of the turbines has avoided pristine habitat within the Rand Highveld Grassland. Since the turbine footprint is relatively small and spread across the site, the loss of prime habitat within the ‘Vulnerable’ Rand Highveld Grassland vegetation type is small in relation to the remaining extent of the vegetation type and ecosystem threat status will not be affected.
- **Screening Tool:** None of the plant species highlighted by the Screening Tool were encountered on site.
- **Threatened plant species:** No IUCN threatened or red listed plant species were encountered during the field survey.
- **Near Threatened plant species:** Two near threatened species, *Gnaphalium nelsonii* and *Cineraria austrotransvaalensis*, could potentially occur on site according to the Gauteng C-plan.
- **Protected plant species:** No CITES listed species, ToPS species or protected tree species were recorded on site.
- **Provincially protected species:** Only one provincially protected species with a Least Concern status, was recorded on site, i.e. *Gladiolus permeabilis* (Iridaceae).
- **Habitats:** Ten of the 13 habitats had a low sensitivity rating for the vegetation with three habitats rated as medium sensitivity (streams, wetlands and rocky outcrops).
- **Statement:** The Screening Tool rated the sensitivity of the Plant Species Theme as Medium. Because none of the SCC highlighted by the Screening Tool were found on site and large parts of the site were degraded due to previous cultivation, we suggest that the Plant Species Theme's site sensitivity is rated as **Low**.

### **Fauna**

- **Note: bird and bat components – see avifaunal report.**
- **Screening Tool:** None of the animal species highlighted by the Screening Tool were encountered on site.
- **Threatened animal species:** The key faunal issue is the presence of the endangered mountain reedbuck, which could possibly have been re-introduced to the game farm. The mountain reedbuck was not listed by the Screening Tool.
- **Overall sensitivity of animal species theme:** This is rated as medium by the Screening Tool. Excluding the avifaunal component, we would suggest a **Low - Medium** sensitivity. If the suggested mitigation measures are followed, the threatened animal species should not be negatively affected by the WEF.

### **Conservation:**

- **Vulnerable ecosystem:** The Rand Highveld Grassland vegetation type is listed as “Vulnerable” and covers a large portion of the site. Seven of the ten turbines are situated in this vegetation type.
- **Protected Areas:** The study area is not located in a protected area and the closest protected area, Abe Bailey Provincial Nature Reserve, is approximate 20 km to the northwest of the site.

- **National Protected Areas Expansion Strategy (NPAES):** The study site is part of the NPAES (NPAES 2018) and all turbines are located outside the NPAES.
- **Critical Biodiversity Areas (CBAs):** CBA2s (Important area) are present on the site (GDARDE 2011, C-Plan V3.3) and development within the CBAs should best be avoided. All turbines fall outside the CBA2s.
- **Ecological Support Areas (ESAs):** Turbines WTG04, WTG07 and WTG08 lie in ESAs. The extent of the development is relatively small and will not have a negative impact on the functionality of the broader ESA. Thus no additional loss of ecological connectivity in relation to the broader landscape is likely.
- **Other Natural Areas (ONAs):** Seven of the ten turbines are situated in ONAs.
- **Freshwater Ecosystem Priority Area (FEPA):** Two rivers cross the site with some wetlands delineated along the rivers. The development will avoid the rivers and wetlands. FEPAs were not highlighted by the Screening Tool.
- **Terrestrial Biodiversity Theme:** Although portions of the site qualify as CBA2s and ESAs and parts have been included in the NPAES, a substantial portion of the site has been identified as ONAs (even when in the Vulnerable vegetation type). The development has been largely contained in the ONAs. In the Screening Tool the Terrestrial Biodiversity Theme allocated a Very High sensitivity to the entire site. Although we agree that the current site clearly includes areas of very high sensitivity (CBA, ESAs and NPAES), it also includes a substantial portion that has **not** been demarcated as very high sensitivity, thus ONA. According to the land use guidelines supplied by SANBI (2021), split zoning should be used, where feasible, to demarcate sensitive areas, where CBAs occur across part of a property.

#### ***Ecological processes, function and drivers:***

- Overall, it is unlikely that the development will contribute to the disruption of broad-scale ecological processes such as dispersal, migration or the ability of fauna to respond to fluctuations in climate or other conditions.
- The disturbance caused by the construction of the WEF will create conditions favourable for invasion by alien species.
- Fire is an important driver of vegetation dynamics in the Grassland Biome and can occur when the fuel load is high. To avoid damage to the infrastructure, fire will have to be suppressed. If the grass layer is regularly mowed/brush cut, it should prevent grasses from becoming moribund in the absence of fire although mowing or brushcutting would reduce seed set.
- Grasslands have evolved under the grazing pressure from large ungulates. Mesic Highveld Grasslands are reasonably well adapted to grazing pressure under low to moderate stocking rates with adequate rest periods. The WEF development will still allow livestock or wildlife grazing.

#### ***Significance of environmental impacts:***

Overall the significance of the environmental impacts was rated as low to very low after mitigation, with only vegetation loss being rated as moderate after mitigation. Before mitigation many impacts were rated as moderate. In summary:

- Since the development footprint is small, the loss of habitat or species will be limited.
- Since the turbine footprint is relatively small and spread across the site, the loss of prime habitat within the 'Vulnerable' Rand Highveld Grassland vegetation type can be constrained by well-planned positioning of the turbines. Service roads generally have a larger impact on vegetation clearance, however since the roads will have a gravel surface animal movement should not be impaired. Furthermore, exiting tracks should be preferred for upgrading to service roads. Beyond the permanent infrastructure footprint, environmental functions and processes should however, not be altered.
- The extent of clearing activities in the Rand Highveld Grassland vegetation type is small in relation to the remaining extent of the vegetation type and ecosystem threat status will not be affected.
- The vegetation in none of the habitats identified were rated as highly sensitive, and the overall impact per habitat type will be small.

- The impact on overall species and ecosystem diversity of the adjacent land will not be affected and the impact will be small.
- The impact on populations of threatened or protected species will be small if mitigation measures are applied.
- Depending on the type of fencing to be erected at some of the infrastructure, the WEF will contribute minimally to obstruction of animal movement.

#### Key environmental mitigation and management actions proposed

- A walkthrough would be needed prior to construction to inform permit applications for protected plant species.
- Ensure that the placing of infrastructure takes the sensitivity mapping of the ecological assessment into account to avoid and reduce impacts on species and habitats of conservation concern.
- Demarcate all infrastructure sites clearly to avoid unnecessary clearance of the vegetation.
- Avoid or minimise impacts that could potentially affect animal behaviour.
- Trenches should not be left open for long periods of time. Trenches should be inspected regularly for the presence of trapped animals.
- Construction crew, in particular the drivers, should undergo environmental training (induction) to increase their awareness of environmental concerns.
- Proper waste management procedures should be in place to avoid waste lying around and to remove all waste material from the site.
- Speed limits should be strictly adhered to.
- Dust control measures should be implemented.
- Permits have to be obtained for the removal of GDARDE protected species.
- Implement a monitoring program for the early detection of alien invasive plant species.
- Employ a control program to combat declared alien invasive plant species.

#### Preferred infrastructure locations

##### Access route:

- The access road is currently from an unnamed road to the east. The access road follows existing farm tracks more or less to the centre of the site. Although the road does cross a CBA2 (Important area) and ESAs it is acceptable because it follows an existing farm road.

##### Turbines:

- Turbines WTG04, WTG07 and WTG08 lie in ESAs and where possible the number of turbines should be limited within the ESA.
- All other turbines are situated in ONAs.

##### Ancillary areas (On-site IPP substation, batching plant, construction camp, laydown):

- These ancillary areas fall in a Least Concern ecosystem and outside of CBA2s, ESAs and NPAES.

##### Roads:

- The road network within CBAs (only CBA2s are present on site) and ESAs should be minimised.
- Wherever possible, existing roads should be used.
- The construction of a road should be done in the most environmentally sensitive manner possible.
- A suitably qualified person should plan, design and supervise the proper construction of roads to minimize the impact on the environment.
- Roads should be provided with run-off structures to reduce the risk of erosion.
- Proper road maintenance procedures should be in place.

# References and Bibliography

- ALEXANDER, G. & MARAIS, J. 2007. *A guide to the reptiles of southern Africa*. Struik Nature, Cape Town.
- BATES, M.F., BRANCH, W.R., BAUER, A.M., BURGER, M., MARAIS, J., ALEXANDER, G.L. & DE VILLIERS, M.S. (eds). 2014 Atlas and Red List of reptiles of South Africa, Lesotho and Swaziland. *Suricata* 1. South African National Biodiversity Institute, Pretoria.
- BROMILOW, C. 2010. *Probleemplanten en Inringeronkruid van Suid-Afrika*. Briza Publications, Pretoria.
- CADMAN, M. 2016. *Ecosystem Guidelines for Environmental Assessment in the Western Cape*. Edition 2. Fynbos Forum, Cape Town.
- CARA. 1983. *Conservation of Agricultural Resources Act* (No 43 of 1983), as amended 2001. Government Printer, Pretoria.
- CARA. 2001. *Regulations in terms of the Conservation of Agricultural Resources Act* (Act No. 43 of 1983). Department of Agriculture, Forestry and Fisheries, South Africa.
- CEQ. 1997. *Considering cumulative effects under the National Environmental Policy Act*. Council on Environmental Quality. Executive Office of the President, Washington, D.C.
- CHILD, M.F., ROXBURGH, L., DO LINH SAN, E., RAIMONDO, D., DAVIES-MOSTERT, H.T. (Eds). 2016. The 2016 Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa. Available at [<https://www.ewt.org.za/reddata>].
- CITES. 2023. APPENDICES I, II & III. January 2023
- COATES-PALGRAVE, K. & COATES-PALGRAVE, M. 2003. *Trees of southern Africa*. 3<sup>rd</sup> edition. Struik, Cape Town.
- COURT, D. 2010. *Succulent flora of southern Africa*. Third revised edition. Struik Nature. Cape Town.
- CSIR. 2017. *Strategic Water Source Areas*. Council for Scientific and Industrial Research. Available at <http://bgis.sanbi.org/Projects/Detail/207>
- DEA. 2016a. Distribution maps of mammals of South Africa. Website: [www.environment.gov.za/distributionmapsmammals](http://www.environment.gov.za/distributionmapsmammals) southafrica. Department of Environmental Affairs (DEA).
- DEA. 2016b. National Protected Areas Expansion Strategy for South Africa 2016. Department of Environmental Affairs, Pretoria, South Africa.
- DEAT. 2006. *Guideline 5: Assessment of alternatives and impacts in support of the Environmental Impact Assessment Regulations, 2006*. Integrated Environmental Management Guideline Series, Department of Environmental Affairs and Tourism (DEAT), Pretoria.
- DEAT. 2008. *The National Protected Area Expansion Strategy 2008-2012: A framework for implementation*. SANBI. Department of Environmental Affairs & Tourism.
- DRIVER A., SINK, K.J., NEL, J.N., HOLNESS, S., VAN NIEKERK, L., DANIELS, F., JONAS, Z., MAJIEDT, P.A., HARRIS, L. & MAZE, K. 2012. *National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems*. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.
- DU PLESSIS, S.F. 1969. *Past and present geographical distribution of the Perissodactyla and Artiodactyla in southern Africa*. M.Sc. dissertation, University of Pretoria, Pretoria.
- FISH, L., MASHAU, A.C., MOEAHA, M.J. & NEMBUDANI, M.T. 2015. Identification guide to southern African grasses. *Strelitzia* 36. SANBI, Pretoria.
- FRIEDMANN, Y. & DALY, B. (eds). 2004. *Red Data Book of the Mammals of South Africa: A Conservation Assessment*. IUCN SSC Conservation Breeding Specialist Group, Endangered Wildlife Trust, South Africa.
- GDARD. 1983. Transvaal Nature Conservation Ordinance (No. 12 of 1983).
- GDARDE. 2011. Gauteng Conservation Plan (C-plan 3.3, GIDS V10). Department of Agriculture, Rural Development and Environment.
- GDARD. 2014a. Draft Gauteng Nature Conservation Bill 2014. Provincial Gazette Extraordinary Vol 20, No 278, 1

- October 2014.
- GDARD. 2014b. Technical Report for the Gauteng Conservation Plan (Gauteng v3.3). Gauteng Department of Agriculture and Rural Development: Nature Conservation Directorate. 60 pages.
- GEOLOGICAL SURVEY. 1986. 2626 WES-RAND. 1: 250 000 Geological Series. Government Printer, Pretoria.
- GERBER, A., CILLIERS, C.J., VAN GINKEL, C. & GLEN, RENE. 2004. *Aquatic plants*. Department of Water Affairs and Forestry.
- GLEN, H. & VAN WYK, A.E. 2016. *Guide to trees introduced into southern Africa*. Struik Nature, Cape Town.
- HENDERSON, L. 2001. *Alien weeds and invasive plants*. Plant Protection Research Institute Handbook no. 12, Agricultural Research Council, Pretoria.
- HENNEKENS, S.M. & SCHAMINEE, J.H.J. 2001. TURBOVEG, A comprehensive database management system for vegetation data. *Journal of Vegetation Science* 12: 589-591.
- IUCN. 2021. *IUCN Red List Categories*. Prepared by the IUCN Species Survival Commission. Gland, Switzerland.
- KELLERMAN, T.S., COETZER, J.A.W. & NAUDE, T.W. 1988. *Plant poisonings and mycotoxicoses of livestock in southern Africa*. Oxford University Press, Cape Town.
- LAND TYPE SURVEY. 1979. 2626 WES-RAND. 1: 250 000 Land Type Series. Government Printer, Pretoria.
- LEEMING, J. 2003. *Scorpions of southern Africa*. Struik, Cape Town.
- LEROY, A. & LEROY, J. 2003. *Spiders of southern Africa*. Struik, Cape Town.
- MANNING, J. 2003. *Wildflowers of South Africa*. Briza, Pretoria.
- MECENERO, S., BALL, J.B., EDGE, D.A., HAMER, M.L., HENNING, G.A., KRÜGER, M., PRINGLE, E.L., TERBLANCHE, R.F. & WILLIAMS, M.C. 2013. *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas*. Animal Demography Unit, University of Cape Town, Cape Town.
- MILLS, G. & HES, L. 1997. *The complete book of southern African mammals*. Struik, Cape Town.
- MILTON, S. 2017. *Alien invasive plant species assessment and management guidelines*. Renu-Karoo Veld Restoration cc.
- MÖLLER, A. & BECKER, R. 2019. *Field guide to the succulent Euphorbias of southern Africa*. Briza, Pretoria.
- MUCINA, L. & RUTHERFORD, M.C. (Eds). 2006. *Vegetation of South Africa, Swaziland and Lesotho*. *Strelitzia* 19. South African National Biodiversity Institute (SANBI), Pretoria.
- NEMA. 2011. National Environmental Management Act (Act No. 107 of 1998). *National list of threatened ecosystems*. General Notice 1002, 9 December 2011 Government Gazette No 34809. Department of Environmental Affairs.
- NEMA. 2014. National Environmental Management Act (Act No. 107 of 1998). *Environmental Impact Assessment Regulations, 2014*. Government Notice R. 982 and Listings Notices R. 983, R. 984 & R.985. *Government Gazette* Vol. 594, No. 38282 of 4 December 2014.
- NEMA. 2017. National Environmental Management Act (Act No. 107 of 1998). *Amendments to the Environmental Impact Assessment Regulations, 2014. Listing Notices GRN 324, 325, 326 & 327*. Government Gazette No. 40772, 7 April 2017. Department of Environmental Affairs, Pretoria.
- NEMA. 2020a. National Environmental Management Act (Act No. 107 of 1998). *Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA 1998, when applying for Environmental Authorisation*. Government Gazette 43110, No 320, 20 March 2020.
- NEMA. 2020b. National Environmental Management Act (Act No. 107 of 1998). *Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA 1998, when applying for Environmental Authorisation*. Government Gazette 43855, No. 1150, 30 October 2020.
- NEMBA. 2004. National Environmental Management: Biodiversity Act (Act No. 10 of 2004). Government Printer, Pretoria.
- NEMBA. 2007a. National Environmental Management: Biodiversity Act (Act No. 10 of 2004). *Threatened or protected species regulations*. *Government Gazette* No. 29657, Notice R152, 23 February 2007.
- NEMBA. 2007b. National Environmental Management: Biodiversity Act (Act No. 10 of 2004). *Lists of critically*

- endangered, endangered, vulnerable and protected species*. Government Gazette. No. 29657, Notice R151, 23 February 2007.
- NEMBA. 2007c. National Environmental Management: Biodiversity Act (Act No. 10 of 2004). *Amendment of critically endangered, endangered, vulnerable and protected species list*. Government Gazette No. 30568, Notice R.1187, 14 December 2007.
- NEMBA. 2020a. National Environmental Management: Biodiversity Act (Act No. 10 of 2004). *Alien and Invasive Species lists*. Government Gazette, No 43726, 18 September 2020. Department of Environmental Affairs, South Africa.
- NEMBA. 2020b. National Environmental Management: Biodiversity Act (Act No. 10 of 2004). *Alien and Invasive Species regulations*. Government Gazette, No 43735, 25 September 2020. Department of Environmental Affairs, South Africa.
- NEM:PAA. 2003. *National Environmental Management: Protected Areas Act* (Act No. 10 of 2003). Department of Environmental Affairs, South Africa.
- NFA. 1998. *National Forests Act* (Act No. 84 of 1998). Department of Agriculture, Forestry and Fisheries. Government Printer, Pretoria.
- NFA. 2023. *Notice of the list of protected tree species under the National Forest Act 1998* (Act No. 84 of 1998). Government Printer. Government Gazette 47927 No. 2984. 27 January 2023.
- NPAES. 2018. *National Protected Area Expansion Strategy for South Africa*. DEFFE, Pretoria.
- NWA. 1998. *National Water Act* (Act No. 36 of 1998). Department of Water Affairs. Government Printer.
- RAIMONDO, D., VON STADEN, L., FODEN, W., VICTOR, J.E., HELME, N.A., TURNER, R.C., KAMUNDI, D.A. & MANYAMA, P.A. (Eds). 2009. Red lists of South African plants 2009. *Strelitzia* 25. South African National Biodiversity Institute (SANBI), Pretoria.
- POOL-STANVLIET, R., DUFFEL-CANHAM, A., PENCE, G. & SWART, R. 2017. *Western Cape Biodiversity Spatial Plan Handbook*. CapeNature, Stellenbosch.
- SANBI (2006-2018). The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors), Online, <http://bgis.sanbi.org/Projects/Detail/186>, Version 2018.
- SANBI. 2018. Using CBA Maps to support land-use planning and decision-making. SANBI Factsheet Series. South African National Biodiversity Institute, Pretoria.
- SANBI. 2020. *Species, Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa*. South African National Biodiversity Institute, Pretoria.
- SANBI (South African National Biodiversity Institute). 2021. Guideline for Incorporating Biodiversity into Land-Use Schemes: Addendum to the National Land-Use Scheme Guidelines. South African National Biodiversity Institute, an entity of the Department of Forestry, Fisheries and the Environment, Pretoria. pp. 1–38.
- SKINNER, J.D. & CHIMIMBA C.T. 2005. *The mammals of the southern African subregion*. Third edition. Cambridge University Press, Cambridge, UK.
- SKOWNO, A. L., POOLE, C. J., RAIMONDO, D. C., SINK, K. J., VAN DEVENTER, H., VAN NIEKERK, L., HARRIS, L. R., SMITH-ADAO, L. B., TOLLEY, K. A., ZENGEYA, T. A., FODEN, W. B., MIDGLEY, G. F. and DRIVER, A. 2019. National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. Pretoria, South Africa. 214 pp.
- TAYLOR, P.J., BAXTER, R., POWER, R.J., MONADJEM, A. & CHILD, M.F. 2016. A conservation assessment of *Crocodylus maurassiensis*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
- TICHY, L. 2002. JUICE, Software for vegetation classification. *Journal of Vegetation Science* 13: 451-453.
- TICHY, L., HOLT, J. & NEJEZCHLEBOVA, M. 2011. *JUICE program for management, analysis and classification of ecological data*. Vegetation Science Group, Masaryk University, Brno.
- TOPOCADASTRAL MAP. 2010. 2627 BC Westonaria 1: 50 000. Government Printer, Pretoria.
- TOPOCADASTRAL MAP. 2010. 2627 AD Carltonville. 1: 50 000. Government Printer, Pretoria.



- VAN OUDTSHOORN, F. 2012. *Guide to grasses of southern Africa*. 3rd Edition. Briza, Pretoria.
- VAN WYK, A.E. & SMITH, G.F. 1998. *Regions of Floristic Endemism in southern Africa*. Umdaus Press, Pretoria.
- VAN WYK, A.E. & VAN WYK, P. 2013. *Field guide to trees of southern Africa*. Second edition. Struik, Cape Town.
- VAN WYK, B-E. & SMITH, G. 1996. *Guide to the Aloes of South Africa*. Briza, Pretoria.
- VAN WYK, B-E., VAN HEERDEN, F. & VAN OUDTSHOORN, B. 2002. *Poisonous plants of South Africa*. Briza, Pretoria.
- VAN WYK, B-E, VAN OUDTSHOORN, B. & GERICKE, N. 1997. *Medicinal plants of South Africa*. Briza, Pretoria.
- VAN WYK, B-E. & GERICKE, N. 2000. *Peoples Plants*. Briza, Pretoria.
- VAN ZYL, K. 2012. *Problem plant control compendium*. AVCASA, Halfway House.
- WATT, J.M. & BREYER-BRANDWIJK, M.G. 1962. *The medicinal and poisonous plants of southern and eastern Africa*. 2<sup>nd</sup> ed. Livingstone, London.
- WEATHER BUREAU. 1988. *Climate of South Africa*. WB 40. Government Printer, Pretoria.
- WEATHER BUREAU. 1998. *Climate of South Africa*. Government Printer, Pretoria.
- WHITE, F. 1983. *The vegetation of Africa. A descriptive memoir to accompany the UNESCO/AETFAT/UNSO vegetation map of Africa*. UNESCO, Paris.

# APPENDIX A: PHYTOSOCIOLOGICAL TABLE OF PLANT COMMUNITIES

Plant community	1	2	3	4	5	6	7	8	9																						
Sample plots	2	1	1	1	2	2	1	1	1	2	2	1	3	3	2	2	2	2	2	1											
	9	6	1	2	4	9	9	7	8	6	4	1	2	0	7	3	3	1	5	6	0	8	5	0	1	4	3	5	7	8	2
<b>Species group 1</b>																															
<i>Trachypogon spicatus</i>	5		+	b													+	1													
<b>Species group 2</b>																															
<i>Selaginella dregei</i>	a																														
<i>Cyanotis speciosa</i>	+																														
<i>Hermannia transvaalensis</i>	+																														
<i>Oldenlandia herbacea</i>	+																														
<i>Oropetium capense</i>	+																														
<i>Searsia magalimontana</i>	+																														
<i>Sphedamnocarpus pruriens</i>	+																														
<b>Species group 3</b>																															
<i>Indigofera hiliaris</i>	+		+		+		+														+										
<i>Elionurus muticus</i>	+		+		+		+																								
<i>Brachiaria serrata</i>	+		+				+																								
<i>Scabiosa columbaria</i>	+		+		+																										
<i>Striga elegans</i>	+		+		+																										
<i>Exochaenium grande</i>	+														+																
<i>Striga bilabiata</i>	+		+																												
<i>Pentanisia angustifolia</i>	+		+																												
<i>Solanum sisymbriifolium</i>	+		+																												
<i>Bulbostylis hispidula</i>	+		+																												
<i>Hermannia lancifolia</i>	+		+																												
<i>Ledebouria ovatifolia</i>	+		+																												
<i>Aristida canescens</i>	1																														
<b>Species group 4</b>																															
<i>Microchloa caffra</i>	1		+		+		a																								
<i>Searsia rigida</i>	+		+		+		+														+										
<i>Gladiolus permeabilis</i>	+		+		+																										
<b>Species group 5</b>																															
<i>Crassula lanceolata</i>	+		+		+		+		+										+												
<i>Lippia scaberrima</i>	+		+		+		+		+										+												
<i>Tephrosia capensis</i>	+		+		+		+		+																						
<i>Eragrostis racemosa</i>	+		+		+		+		+																						
<i>Richardia brasiliensis</i>	+		+		+		a		+		+		+		+		+														
<i>Hermannia depressa</i>	+		+		+		+		+		+		+		+		+														
<i>Heteropogon contortus</i>	+		+		+		+		+		+		+		+		+														
<i>Seriphium plumosum</i>	+		+		+		+		+		+		+		+		+														
<i>Trichoneura grandiglumis</i>	+		+		+		+		+		+		+		+		+														
<i>Taraxacum officinale</i>	+		+		+		+		+		+		+		+		+														
<i>Crabbea acaulis</i>	+																														
<b>Species group 6</b>																															
<i>Sida rhombifolia</i>	+														+	+															
<i>Triraphis andropogonoides</i>	+																														
<i>Aristida bipartita</i>	+		+		+																										
<i>Wahlenbergia virgata</i>	+		+		+																										
<b>Species group 7</b>																															
<i>Trisetopsis imberbis</i>	a																														
<i>Andropogon eucomus</i>	+																														
<i>Panicum schinzii</i>	1																														
<i>Eragrostis rotifer</i>	a																														
<i>Cirsium vulgare</i>	+																														
<i>Berkheya radula</i>	+														+																
<b>Species group 8</b>																															
<i>Cyperus rupestris</i>	+		+		+		+										+														
<i>Dichondra micrantha</i>	+		+		+		+																								
<b>Species group 9</b>																															
<i>Plantago lanceolata</i>	+		+		+		+		+		+		+		+		+				+										
<i>Nidorella anomala</i>	+		+		+		+		+		+		+		+		+														
<i>Oxalis obliquifolia</i>	+		+		+		+		+		+		+		+		+				+										
<i>Lactuca inermis</i>	+		+		+		+		+		+		+		+		+				+										

**Species group 10**

*Cymbopogon caesius*  
*Eragrostis gummiflua*

a	4	4	b	1	b	4	+	+	+	+	+
+			a				+	1	1	a	+

**Species group 11**

*Ehretia rigida*  
*Searsia leptodictya*  
*Gymnosporia polyacantha*  
*Digitaria eriantha*  
*Glandularia aristigera*  
*Pentarrhinum insipidum*  
*Asparagus suaveolens*  
*Aristida adscensionis*  
*Asparagus setaceus*  
*Viscum rotundifolium*  
*Senegalia caffra*  
*Euphorbia hirta*  
*Senegalia hereroensis*

						1	+	1	1	+	+	+	+	1
+		+						+	+	+	+	+	+	+
							+	+	+					1
+							1	+	+	1	+	+	+	+
						+	+	+	+	+	+	+	+	+
	+						+	+	+					+
		+					+	+		+				+
						+			+	+				+
									+					+
										a				+
								+	+					+
						a								

**Species group 12**

*Solanum lichtensteinii*  
*Schkuhria pinnata*  
*Eragrostis curvula*  
*Arctotis arctotoides*  
*Aristida congesta barbicollis*  
*Verbena brasiliensis*  
*Gomphrena celosioides*  
*Leonotis martinicensis*  
*Oxalis corniculata*  
*Sida alba*  
*Euphorbia inaequilatera*  
*Teucrium trifidum*  
*Commelina africana*

+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
+			a	+	+	+	+	+	+	+	+	+	+	+
	+	+	+	+	+	+	+	a	+	+	a	+	+	a
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
+						1	a		+	+		1	+	+
+									+	+			+	+
+	+	+	+	+						+	+	+	+	+
+									+	+				+
									+	+				+
									+					+
														+
														+
														+
														+
														+
														+
														+
														+
														+

**Species group 13**

*Setaria sphacelata*  
*Selago densiflora*  
*Aristida congesta congesta*  
*Melinis repens*  
*Monsonia angustifolia*  
*Diospyros lycioides*

+	1	+	3	1	+	b	+	+	+	+	+	+	a	a	+	1	b	+
1	+	+	+	+	+	+	+	+	+	1	+	+	+	+	+	+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
a	+	a	+	+	+	+	+	+	+	b	+	+	+	+	+	+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
+	1	+								+								

**Species group 14**

*Eragrostis chloromelas*  
*Themeda triandra*

+	+	+	1	+	1	a	1	1	1	+	1	1	1	+	a	+	a	a	1	
+	+	+	+	+	a	+	a	b	+	+	+	+	3	a	1	+	a	1	+	a

**Species group 15**

*Phragmites australis*  
*Salix babylonica*  
*Paspalum urvillei*  
*Schoenoplectus corymbosus*  
*Cyperus congestus*  
*Hemarthria altissima*  
*Populus x canescens*  
*Acacia dealbata*  
*Acacia mearnsii*  
*Eucalyptus camaldulensis*  
*Panicum maximum*  
*Typha capensis*

4	1	a
+	1	+
+		1
+		
1		
+		
		b
		1
		1
		1
		1
		1

**Species group 16**

*Hyparrhenia tamba*  
*Buddleja salviifolia*  
*Sorghum halepense*  
*Ursinia nana*

+	3
+	
+	
+	

**Species group 17**

*Searsia pyroides*  
*Celtis africana*  
*Asparagus laricus*  
*Achyranthes aspera*  
*Ziziphus mucronata*  
*Setaria pumila*  
*Senecio inornatus*

+	+	+	+	1	+	+	+	+	+	1	+	1
				+	+	a	+	1	+	+	+	+
+	+			+	+	a	+		+	+	+	+
+				+	+		1					+
						a	+	+	+	+	+	+
1						+	+					+
										1		+

**Species group 18**

*Paspalum dilatatum*

+	+	+	+	+	b	a							1	+	1	+
---	---	---	---	---	---	---	--	--	--	--	--	--	---	---	---	---

**Species group 19**

<i>Eragrostis plana</i>	++	++	+	b	a	1	+	b	b	3	a	1	a	+	a	a	1	+				
<i>Vachellia karroo</i>	++	1		++		1				+	3	a	3	a	b	a	a	a	b	+	1	1
<i>Hyparrhenia hirta</i>	+	++	+	a	1	5	5	3	1	5	5	a	3	+		a	a	1	+	+	+	1
<i>Conyza podocephala</i>	1			+	++	+	+			+						++	++	+				+
<i>Bidens bipinnata</i>		+		++				+										+	++	++		+

**Species group 20**

<i>Eragrostis tef</i>																						a
<i>Amaranthus sp.</i>													+									a
<i>Eleusine coracana</i>																				+		1
<i>Datura ferox</i>																						1
<i>Xanthium spinosum</i>				+																		+

**Species group 21**

<i>Erigeron sumatrensis</i>																						++
<i>Verbena bonariensis</i>																						+++
<i>Tagetes minuta</i>				+																		+++
<i>Bidens pilosa</i>																						+
<i>Zinnia peruviana</i>																						1

**Species group 22**

<i>Cynodon dactylon</i>	+	+	++	+	b	a	+	1	+	4	3	a	+	5	+	4	+	a	+			a	
<i>Urochloa mosambicensis</i>		+						1	+					+	+	1	+	+	a	1	+	+	1
<i>Helichrysum rugulosum</i>	++	+	a	+	+	+	+	a	+													1	

**Species group 23**

<i>Hilliardiella elaeagnoides</i>	+	+																				++
<i>Pellaea calomelanos</i>	+	+																				+
<i>Euclea crispa</i>	+	+																				++
<i>Zanthoxylum capense</i>	+	+																				+
<i>Pyracantha angustifolia</i>		++																				+++
<i>Gnidia capitata</i>			+																			+
<i>Aerva leucura</i>				+																		+
<i>Hibiscus trionum</i>					+							+										+
<i>Hypoxis rigidula</i>																						+
<i>Felicia muricata</i>						1																+
<i>Helichrysum nudifolium</i>							++															+
<i>Cyperus esculentus</i>																						+
<i>Oenothera rosea</i>																						+
<i>Cymbopogon pospischilii</i>																						++
<i>Helichrysum coriaceum</i>	+																					+
<i>Senecio harveianus</i>																						+
<i>Tragus berteronianus</i>																						+
<i>Digitaria diagonalis</i>																						+
<i>Hilliardiella aristata</i>																						+
<i>Gomphocarpus fruticosus</i>																						+
<i>Kalanchoe paniculata</i>																						+
<i>Linum thunbergii</i>																						+
<i>Polygala hottentotta</i>																						+
<i>Chlorophytum recurvifolium</i>																						+
<i>Delosperma herbeum</i>																						+
<i>Oxalis sp.</i>																						+
<i>Senecio oxyriifolius</i>																						+
<i>Tolpis capensis</i>																						+
<i>Ziziphus zeyheriana</i>																						+
<i>Panicum natalense</i>																						+
<i>Diheteropogon amplexans</i>																						+
<i>Indigofera sp.</i>																						+
<i>Geigeria burkei</i>																						+
<i>Orchidaceae</i>																						+
<i>Ajuga ophrydis</i>																						+
<i>Aristida spectabilis</i>																						+
<i>Berkheya carlinopsis</i>																						+
<i>Wahlenbergia sp.</i>																						+
<i>Tephrosia sp.</i>																						+
<i>Osteospermum muricatum</i>																						+
<i>Pseudognaphalium luteo-album</i>																						+
<i>Pimpinella transvaalensis</i>																						+
<i>Oenothera indecora</i>																						+
<i>Hypoxis argentea</i>																						+
<i>Cyperus sp.</i>																						+
<i>Kyllinga erecta</i>																						+
<i>Helichrysum aureonitens</i>																						+
<i>Lobelia sp.</i>																						+
<i>Cuscuta campestris</i>																						+

<i>Solanum elaeagnifolium</i>	+			
<i>Chlorophytum fasciculatum</i>		+		
<i>Eragrostis capensis</i>		+		
<i>Gymnosporia buxifolia</i>			+	
<i>Cleome monophylla</i>			+	
<i>Lansea discolor</i>				+
<i>Lepidium africanum</i>				+
<i>Chamaecrista mimosoides</i>				+
<i>Cynoglossum hispidum</i>				+
<i>Albica virens</i>				+
<i>Portulaca sp.</i>				+
<i>Solanum pseudocapsicum</i>				+
<i>Sporobolus fimbriatus</i>				+
<i>Ipomoea bathycolpos</i>				+
<i>Ledebouria revoluta</i>				+
<i>Scolopia zeyheri</i>				+
<i>Andropogon schirensis</i>				+
<i>Campuloclinium macrocephalum</i>				+
<i>Opuntia ficus-indica</i>				+
<i>Senecio sp.</i>				+
<i>Searsia lancea</i>				+
<i>Kiggelaria africana</i>				+
<i>Paspalum notatum</i>				+
<i>Persicaria lapathifolia</i>				+
<i>Ricinus communis</i>				+
<i>Buddleja saligna</i>				+
<i>Ipomoea purpurea</i>				+
<i>Pyracantha crenulata</i>				+

## APPENDIX B: PLANT SPECIES CHECKLISTS

<sup>1</sup>IUCN category<sup>2</sup>GDARD (1983)<sup>3</sup>CITES = Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES 2020)<sup>4</sup>AIS = Alien and invasive species<sup>5</sup>NAT = Naturalised alien species<sup>6</sup>Plants observed during January 2021 site survey

Note: Species list based on NewPosa list for 2627BC and 2627AD and supplemented by own survey

Note: No ToPS species are listed

Note: No species endemic to the Rand Highveld Grassland are listed

Family	Species	Current survey <sup>6</sup>	IUCN <sup>1</sup>	GDARDE <sup>2</sup>	CITES <sup>3</sup>	NAT <sup>5</sup>	IAS 2020 <sup>4</sup>
Cyperaceae	<i>Abildgaardia ovata</i>		LC				
Malvaceae	<i>Abutilon austro-africanum</i>		LC				
Fabaceae	<i>Acacia dealbata</i>	X					2
Fabaceae	<i>Acacia mearnsii</i>	X					2
Euphorbiaceae	<i>Acalypha angustata</i>	X	LC				
Euphorbiaceae	<i>Acalypha caperonioides</i> var. <i>caperonioides</i>		DDT				
Cucurbitaceae	<i>Acanthosicyos naudinianus</i>		LC				
Asteraceae	<i>Acanthospermum glabratum</i>					X	
Amaranthaceae	<i>Achyranthes aspera</i> var. <i>aspera</i>	X				X	
Amaranthaceae	<i>Achyranthes aspera</i> var. <i>sicula</i>					X	
Apocynaceae	<i>Acokanthera oppositifolia</i>		LC				
Lamiaceae	<i>Acrotome hispida</i>		LC				
Crassulaceae	<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>		NT	2014 Bill			
Amaranthaceae	<i>Aerva leucura</i>	X	LC				
Cyperaceae	<i>Afroscirpoides dioeca</i>		LC				
Rosaceae	<i>Agrimonia procera</i>						1b
Poaceae	<i>Agrostis lachnantha</i> var. <i>lachnantha</i>		LC				
Lamiaceae	<i>Ajuga ophrydis</i>	X	LC				
Hyacinthaceae	<i>Albuca virens</i> subsp. <i>virens</i>	X	LC				
Poaceae	<i>Alloteropsis semialata</i> subsp. <i>eckloniana</i>		LC				
Asphodelaceae	<i>Aloe bergeriana</i>		LC	Sch 11	App II		
Asphodelaceae	<i>Aloe subspicata</i>		LC	Sch 11	App II		
Asphodelaceae	<i>Aloe transvaalensis</i>		LC	Sch 11	App II		
Asphodelaceae	<i>Aloe verecunda</i>		LC	Sch 11	App II		
Amaranthaceae	<i>Alternanthera pungens</i>					X	
Amaranthaceae	<i>Amaranthus deflexus</i>					X	
Amaranthaceae	<i>Amaranthus hybridus</i> subsp. <i>hybridus</i> var. <i>hybridus</i>	X				X	
Amaranthaceae	<i>Amaranthus thunbergii</i>		LC				
Amaryllidaceae	<i>Ammocharis coranica</i>		LC				
Anacampserotaceae	<i>Anacampseros filamentosa</i> subsp. <i>filamentosa</i>		LC		App II		
Anacampserotaceae	<i>Anacampseros subnuda</i> subsp. <i>subnuda</i>		LC		App II		
Poaceae	<i>Andropogon eucomus</i>	X	LC				
Poaceae	<i>Andropogon schirensis</i>	X	LC				
Rubiaceae	<i>Anthospermum hispidulum</i>		LC				
Rubiaceae	<i>Anthospermum rigidum</i> subsp. <i>rigidum</i>		LC				
Menispermaceae	<i>Antizoma angustifolia</i>		LC				
Apocynaceae	<i>Araujia sericifera</i>						1b
Asteraceae	<i>Arctotis arctotoides</i>	X	LC				
Papaveraceae	<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>						1b
Poaceae	<i>Aristida adscensionis</i>	X	LC				
Poaceae	<i>Aristida aequiglumis</i>		LC				
Poaceae	<i>Aristida bipartita</i>	X	LC				
Poaceae	<i>Aristida canescens</i> subsp. <i>canescens</i>	X	LC				
Poaceae	<i>Aristida congesta</i> subsp. <i>barbicollis</i>	X	LC				
Poaceae	<i>Aristida congesta</i> subsp. <i>congesta</i>	X	LC				

Poaceae	<i>Aristida diffusa</i> subsp. <i>burkei</i>		LC	
Poaceae	<i>Aristida spectabilis</i>	X	LC	
Poaceae	<i>Aristida stipitata</i> subsp. <i>graciliflora</i>		LC	
Asteraceae	<i>Artemisia afra</i> var. <i>afra</i>		LC	
Apocynaceae	<i>Asclepias adscendens</i>		LC	
Apocynaceae	<i>Asclepias brevipes</i>		LC	
Apocynaceae	<i>Asclepias eminens</i>		LC	
Apocynaceae	<i>Asclepias fallax</i>		LC	
Apocynaceae	<i>Asclepias fulva</i>		LC	
Apocynaceae	<i>Asclepias meyeriana</i>		LC	
Cyperaceae	<i>Ascolepis capensis</i>		LC	
Asparagaceae	<i>Asparagus asparagoides</i>		LC	
Asparagaceae	<i>Asparagus larycinus</i>	X	LC	
Asparagaceae	<i>Asparagus setaceus</i>	X	LC	
Asparagaceae	<i>Asparagus suaveolens</i>	X	LC	
Apocynaceae	<i>Aspidoglossum biflorum</i>		LC	
Apocynaceae	<i>Aspidoglossum glabrescens</i>		LC	
Apocynaceae	<i>Aspidoglossum interruptum</i>		LC	
Apocynaceae	<i>Aspidoglossum ovalifolium</i>		LC	
Aspleniaceae	<i>Asplenium aethiopicum</i>		LC	
Aspleniaceae	<i>Asplenium cordatum</i>		LC	
Iridaceae	<i>Babiana bainesii</i>		LC	
Acanthaceae	<i>Barleria macrostegia</i>		LC	
Asteraceae	<i>Berkheya carlinopsis</i>	X	LC	
Asteraceae	<i>Berkheya radula</i>	X	LC	
Asteraceae	<i>Berkheya zeyheri</i> subsp. <i>zeyheri</i>		LC	
Apiaceae	<i>Berula repanda</i>		LC	
Poaceae	<i>Bewsia biflora</i>		LC	
Asteraceae	<i>Bidens bipinnata</i>	X		X
Asteraceae	<i>Bidens pilosa</i>	X		X
Acanthaceae	<i>Blepharis angusta</i>		LC	
Acanthaceae	<i>Blepharis innocua</i>		LC	
Acanthaceae	<i>Blepharis squarrosa</i>		LC	
Acanthaceae	<i>Blepharis stainbankiae</i>		LC	
Orchidaceae	<i>Bonatea antennifera</i>		LC	App II
Amaryllidaceae	<i>Boophone disticha</i>		LC	
Poaceae	<i>Brachiaria deflexa</i>		LC	
Poaceae	<i>Brachiaria serrata</i>	X	LC	
Apocynaceae	<i>Brachystelma chloranthum</i>		LC	
Apocynaceae	<i>Brachystelma circinatum</i>		LC	
Apocynaceae	<i>Brachystelma foetidum</i>		LC	
Apocynaceae	<i>Brachystelma oianthum</i>		LC	
Poaceae	<i>Bromus catharticus</i>			X
Scrophulariaceae	<i>Buddleja saligna</i>	X	LC	
Scrophulariaceae	<i>Buddleja salviifolia</i>	X	LC	
Asphodelaceae	<i>Bulbine abyssinica</i>		LC	
Asphodelaceae	<i>Bulbine capitata</i>		LC	
Asphodelaceae	<i>Bulbine narcissifolia</i>		LC	
Cyperaceae	<i>Bulbostylis burchellii</i>		LC	
Cyperaceae	<i>Bulbostylis hispidula</i>	X	LC	
Cyperaceae	<i>Bulbostylis oritrephes</i>		LC	
Asteraceae	<i>Campuloclinium macrocephalum</i>	X		1b
Cyperaceae	<i>Carex cognata</i>		LC	
Cyperaceae	<i>Carex glomerabilis</i>		LC	
Pinaceae	<i>Cedrus deodora</i>	X		Alien
Cannabaceae	<i>Celtis africana</i>	X	LC	
Dipsacaceae	<i>Cephalaria pungens</i>		LC	
Dipsacaceae	<i>Cephalaria zeyheriana</i>		LC	
Apocynaceae	<i>Ceropegia rendallii</i>		LC	
Solanaceae	<i>Cestrum parqui</i>			1b
Scrophulariaceae	<i>Chaenostoma leve</i>		LC	
Fabaceae	<i>Chamaecrista biensis</i>	X	LC	
Fabaceae	<i>Chamaecrista comosa</i> var. <i>capricornia</i>		LC	

Verbenaceae	<i>Chascanum adenostachyum</i>		LC	
Verbenaceae	<i>Chascanum pinnatifidum var. pinnatifidum</i>		LC	
Pteridaceae	<i>Cheilanthes hirta var. hirta</i>		LC	
Pteridaceae	<i>Cheilanthes viridis var. viridis</i>		LC	
Amaranthaceae	<i>Chenopodium album</i>			X
Poaceae	<i>Chloris pycnothrix</i>		LC	
Poaceae	<i>Chloris virgata</i>		LC	
Agavaceae	<i>Chlorophytum angulicaule</i>		LC	
Agavaceae	<i>Chlorophytum bowkeri</i>		LC	
Agavaceae	<i>Chlorophytum cooperi</i>		LC	
Agavaceae	<i>Chlorophytum fasciculatum</i>	X	LC	
Agavaceae	<i>Chlorophytum recurvifolium</i>	X	LC	
Agavaceae	<i>Chlorophytum transvaalense</i>		LC	
Agavaceae	<i>Chlorophytum trichophlebium</i>		LC	
Asteraceae	<i>Chrysocoma ciliata</i>		LC	
Asteraceae	<i>Cineraria albicans</i>		LC	
Asteraceae	<i>Cineraria aspera</i>		LC	
Asteraceae	<i>Cirsium vulgare</i>	X		1b
Cucurbitaceae	<i>Citrullus lanatus</i>		LC	
Cyperaceae	<i>Cladium mariscus subsp. jamaicense</i>		LC	
Ranunculaceae	<i>Clematis brachiata</i>		LC	
Cleomaceae	<i>Cleome maculata</i>		LC	
Cleomaceae	<i>Cleome monophylla</i>	X	LC	
Peraceae	<i>Clutia pulchella var. pulchella</i>		LC	
Cucurbitaceae	<i>Coccinia sessilifolia</i>		LC	
Cyperaceae	<i>Coleochloa setifera</i>		LC	
Commelinaceae	<i>Commelina africana var. barberae</i>	X	LC	
Commelinaceae	<i>Commelina africana var. lancispatha</i>		LC	
Commelinaceae	<i>Commelina benghalensis</i>		LC	
Commelinaceae	<i>Commelina livingstonii</i>		LC	
Convolvulaceae	<i>Convolvulus multifidus</i>		LC	
Convolvulaceae	<i>Convolvulus sagittatus</i>		LC	
Asteraceae	<i>Conyza podocephala</i>	X	LC	
Malvaceae	<i>Corchorus asplenifolius</i>		LC	
Asteraceae	<i>Coreopsis lanceolata</i>			X
Asteraceae	<i>Cosmos bipinnatus</i>	X		X
Acanthaceae	<i>Crabbea acaulis</i>	X	LC	
Acanthaceae	<i>Crabbea angustifolia</i>		LC	
Acanthaceae	<i>Crabbea hirsuta</i>		LC	
Crassulaceae	<i>Crassula capitella subsp. nodulosa</i>		LC	
Crassulaceae	<i>Crassula dependens</i>		LC	
Crassulaceae	<i>Crassula lanceolata subsp. transvaalensis</i>	X	LC	
Crassulaceae	<i>Crassula setulosa var. setulosa</i>		NE	
Crassulaceae	<i>Crassula setulosa var. setulosa forma setulosa</i>		NE	
Apocynaceae	<i>Cryptolepis oblongifolia</i>		LC	
Cucurbitaceae	<i>Cucumis heptadactylus</i>		LC	
Cucurbitaceae	<i>Cucumis hirsutus</i>		LC	
Cucurbitaceae	<i>Cucumis zeyheri</i>		LC	
Convolvulaceae	<i>Cuscuta campestris</i>	X		1b
Araliaceae	<i>Cussonia paniculata subsp. sinuata</i>		LC	
Araliaceae	<i>Cussonia spicata</i>		LC	
Commelinaceae	<i>Cyanotis speciosa</i>	X	LC	
Amaranthaceae	<i>Cyathula uncinulata</i>		LC	
Poaceae	<i>Cymbopogon caesius</i>	X	LC	
Poaceae	<i>Cymbopogon pospischilii</i>	X	LC	
Poaceae	<i>Cynodon dactylon</i>		LC	
Poaceae	<i>Cynodon dactylon</i>	X	LC	
Poaceae	<i>Cynodon hirsutus</i>		LC	
Boraginaceae	<i>Cynoglossum hispidum</i>	X	LC	
Boraginaceae	<i>Cynoglossum lanceolatum</i>		LC	
Cyperaceae	<i>Cyperus capensis</i>		LC	
Cyperaceae	<i>Cyperus congestus</i>	X	LC	
Cyperaceae	<i>Cyperus esculentus var. esculentus</i>	X	LC	



Cyperaceae	<i>Cyperus longus</i> var. <i>tenuiflorus</i>		NE	
Cyperaceae	<i>Cyperus margaritaceus</i> var. <i>margaritaceus</i>		LC	
Cyperaceae	<i>Cyperus rupestris</i>	X	LC	
Cyperaceae	<i>Cyperus semitrifidus</i>		LC	
Lobeliaceae	<i>Cyphia persicifolia</i>		LC	
Amaranthaceae	<i>Cyphocarpa angustifolia</i>		LC	
Solanaceae	<i>Datura ferox</i>	X		1b
Solanaceae	<i>Datura stramonium</i>			1b
Aizoaceae	<i>Delosperma herbeum</i>	X	LC	
Asteraceae	<i>Denekia capensis</i>		LC	
Apiaceae	<i>Deverra burchellii</i>		LC	
Caryophyllaceae	<i>Dianthus mooiensis</i> subsp. <i>mooiensis</i> var. <i>mooiensis</i>		NE	
Fabaceae	<i>Dichilus gracilis</i>		LC	
Fabaceae	<i>Dichilus lebeckioides</i>		LC	
Convolvulaceae	<i>Dichondra micrantha</i>	X		X
Asteraceae	<i>Dicoma anomala</i> subsp. <i>anomala</i>		LC	
Asteraceae	<i>Dicoma anomala</i> subsp. <i>gerrardii</i>		LC	
Asteraceae	<i>Dicoma macrocephala</i>		LC	
Urticaceae	<i>Didymodoxa caffra</i>		LC	
Poaceae	<i>Digitaria diagonalis</i>	X	LC	
Poaceae	<i>Digitaria eriantha</i>	X	LC	
Poaceae	<i>Digitaria tricholaenoides</i>		LC	
Poaceae	<i>Digitaria velutina</i>		LC	
Poaceae	<i>Diheteropogon amplexens</i> var. <i>amplexens</i>	X	LC	
Asteraceae	<i>Dimorphotheca spectabilis</i>		LC	
Ebenaceae	<i>Diospyros lycioides</i> subsp. <i>guerkei</i>	X	LC	
Ebenaceae	<i>Diospyros whyteana</i>		LC	
Hyacinthaceae	<i>Dipcadi viride</i>		LC	
Brassicaceae	<i>Diplotaxis muralis</i>			X
Orchidaceae	<i>Disperis micrantha</i>		LC	App II
Droseraceae	<i>Drosera collinsiae</i>		LC	
Acanthaceae	<i>Dyschoriste costata</i>		LC	
Amaranthaceae	<i>Dysphania ambrosioides</i>			X
Amaranthaceae	<i>Dysphania carinata</i>			X
Amaranthaceae	<i>Dysphania multifida</i>			X
Poaceae	<i>Echinochloa colona</i>		LC	
Boraginaceae	<i>Ehretia rigida</i> subsp. <i>nervifolia</i>	X	LC	
Poaceae	<i>Ehrharta erecta</i> var. <i>natalensis</i>		LC	
Amaranthaceae	<i>Einadia nutans</i> subsp. <i>nutans</i>			X
Fabaceae	<i>Elephantorrhiza elephantina</i>		LC	
Poaceae	<i>Eleusine coracana</i> subsp. <i>africana</i>	X	LC	
Poaceae	<i>Elionurus muticus</i>	X	LC	
Poaceae	<i>Enneapogon scoparius</i>		LC	
Poaceae	<i>Eragrostis biflora</i>		LC	
Poaceae	<i>Eragrostis capensis</i>	X	LC	
Poaceae	<i>Eragrostis chloromelas</i>	X	LC	
Poaceae	<i>Eragrostis cilianensis</i>		LC	
Poaceae	<i>Eragrostis curvula</i>	X	LC	
Poaceae	<i>Eragrostis gummiflua</i>	X	LC	
Poaceae	<i>Eragrostis obtusa</i>		LC	
Poaceae	<i>Eragrostis patentipilosa</i>		LC	
Poaceae	<i>Eragrostis plana</i>	X	LC	
Poaceae	<i>Eragrostis racemosa</i>	X	LC	
Poaceae	<i>Eragrostis rotifer</i>	X	LC	
Poaceae	<i>Eragrostis sclerantha</i> subsp. <i>sclerantha</i>		LC	
Poaceae	<i>Eragrostis stapfii</i>		LC	
Poaceae	<i>Eragrostis superba</i>		LC	
Poaceae	<i>Eragrostis tef</i>	X		X
Poaceae	<i>Eragrostis trichophora</i>		LC	
Ericaceae	<i>Erica alopecurus</i> var. <i>alopecurus</i>		LC	
Asteraceae	<i>Erigeron bonariensis</i>			X
Asteraceae	<i>Erigeron canadensis</i>	X		X

Fabaceae	<i>Eriosema burkei</i> var. <i>burkei</i>		LC		
Fabaceae	<i>Eriosema cordatum</i>		LC		
Brassicaceae	<i>Erucastrum austroafricanum</i>		LC		
Fabaceae	<i>Erythrina zeyheri</i>		LC		
Myrtaceae	<i>Eucalyptus camaldulensis</i>	X			1b exempted
Ebenaceae	<i>Euclea crispa</i> subsp. <i>crispa</i>	X	LC		
Hyacinthaceae	<i>Eucomis autumnalis</i> subsp. <i>clavata</i>		NE	Sch 11	
Orchidaceae	<i>Eulophia hians</i> var. <i>hians</i>		LC		App II
Orchidaceae	<i>Eulophia ovalis</i> var. <i>ovalis</i>		LC		App II
Euphorbiaceae	<i>Euphorbia clavarioides</i>		LC		App II
Euphorbiaceae	<i>Euphorbia hirta</i>	X			X
Euphorbiaceae	<i>Euphorbia inaequilatera</i>	X	LC		
Euphorbiaceae	<i>Euphorbia spartaria</i>		LC		App II
Euphorbiaceae	<i>Euphorbia striata</i>		LC		
Poaceae	<i>Eustachys paspaloides</i>		LC		
Gentianaceae	<i>Exochaenium grande</i>	X	LC		
Convolvulaceae	<i>Falkia oblonga</i>		LC		
Asteraceae	<i>Felicia muricata</i>	X	LC		
Iridaceae	<i>Freesia grandiflora</i> subsp. <i>grandiflora</i>		LC		
Cyperaceae	<i>Fuirena pubescens</i> var. <i>pubescens</i>		LC		
Asteraceae	<i>Galinsoga parviflora</i>				X
Asteraceae	<i>Gazania krebsiana</i> subsp. <i>serrulata</i>		LC		
Asteraceae	<i>Geigeria burkei</i> subsp. <i>burkei</i> var. <i>burkei</i>	X	NE		
Asteraceae	<i>Gerbera piloselloides</i>		LC		
Iridaceae	<i>Gladiolus antholyzoides</i>		LC	Sch 11	
Iridaceae	<i>Gladiolus crassifolius</i>		LC	Sch 11	
Iridaceae	<i>Gladiolus elliotii</i>		LC	Sch 11	
Iridaceae	<i>Gladiolus papilio</i>		LC	Sch 11	
Iridaceae	<i>Gladiolus permeabilis</i>	X	LC	Sch 11	
Verbenaceae	<i>Glandularia aristigera</i>	X	LC		
Thymelaeaceae	<i>Gnidia capitata</i>	X	LC		
Apocynaceae	<i>Gomphocarpus fruticosus</i> subsp. <i>fruticosus</i>	X	LC		
Apocynaceae	<i>Gomphocarpus rivularis</i>		LC		
Amaranthaceae	<i>Gomphrena celosioides</i>	X			X
Orobanchaceae	<i>Graderia subintegra</i>		LC		
Malvaceae	<i>Grewia flava</i>		LC		
Malvaceae	<i>Grewia occidentalis</i> var. <i>occidentalis</i>		LC		
Amaranthaceae	<i>Guilleminia densa</i>				X
Gunneraceae	<i>Gunnera perpensa</i>		LC		
Celastraceae	<i>Gymnosporia buxifolia</i>	X	LC		
Celastraceae	<i>Gymnosporia polyacantha</i> subsp. <i>vaccinifolia</i>	X	LC		
Orchidaceae	<i>Habenaria galpinii</i>		LC		App II
Amaryllidaceae	<i>Haemanthus montanus</i>		LC		
Asteraceae	<i>Helichrysum aureonitens</i>	X	LC		
Asteraceae	<i>Helichrysum aureum</i> var. <i>monocephalum</i>		NE		
Asteraceae	<i>Helichrysum caespititium</i>		LC		
Asteraceae	<i>Helichrysum callicomum</i>		LC		
Asteraceae	<i>Helichrysum cerastioides</i> var. <i>cerastioides</i>		LC		
Asteraceae	<i>Helichrysum chionosphaerum</i>		LC		
Asteraceae	<i>Helichrysum coriaceum</i>	X	LC		
Asteraceae	<i>Helichrysum dregeanum</i>		LC		
Asteraceae	<i>Helichrysum lepidissimum</i>		LC		
Asteraceae	<i>Helichrysum nudifolium</i> var. <i>nudifolium</i>	X	LC		
Asteraceae	<i>Helichrysum nudifolium</i> var. <i>pilosellum</i>		LC		
Asteraceae	<i>Helichrysum paronychioides</i>		LC		
Asteraceae	<i>Helichrysum rugulosum</i>	X	LC		
Asteraceae	<i>Helichrysum setosum</i>		LC		
Rhamnaceae	<i>Helinus integrifolius</i>		LC		
Poaceae	<i>Hemarthria altissima</i>	X	LC		
Malvaceae	<i>Hermannia cordata</i>		LC		
Malvaceae	<i>Hermannia depressa</i>	X	LC		
Malvaceae	<i>Hermannia lancifolia</i>	X	LC		
Malvaceae	<i>Hermannia tomentosa</i>		LC		

Malvaceae	<i>Hermannia transvaalensis</i>	X	LC	
Apiaceae	<i>Heteromorpha arborescens var. abyssinica</i>		LC	
Poaceae	<i>Heteropogon contortus</i>	X	LC	
Malvaceae	<i>Hibiscus aethiopicus var. ovatus</i>		LC	
Malvaceae	<i>Hibiscus calyphyllus</i>		LC	
Malvaceae	<i>Hibiscus microcarpus</i>		LC	
Malvaceae	<i>Hibiscus trionum</i>	X		X
Asteraceae	<i>Hilliardiella aristata</i>	X	LC	
Asteraceae	<i>Hilliardiella elaeagnoides</i>	X	LC	
Asteraceae	<i>Hilliardiella hirsuta</i>		LC	
Poaceae	<i>Hyparrhenia anamesa</i>		LC	
Poaceae	<i>Hyparrhenia dregeana</i>		LC	
Poaceae	<i>Hyparrhenia hirta</i>	X	LC	
Poaceae	<i>Hyparrhenia tamba</i>	X	LC	
Hypericaceae	<i>Hypericum lalandii</i>		LC	
Hypoxidaceae	<i>Hypoxis acuminata</i>		LC	
Hypoxidaceae	<i>Hypoxis argentea var. argentea</i>	X	LC	
Hypoxidaceae	<i>Hypoxis interjecta</i>		LC	
Hypoxidaceae	<i>Hypoxis iridifolia</i>		LC	
Hypoxidaceae	<i>Hypoxis rigidula var. rigidula</i>	X	LC	
Aquifoliaceae	<i>Ilex mitis var. mitis</i>		LC	
Fabaceae	<i>Indigastrum burkeanum</i>		LC	
Fabaceae	<i>Indigofera confusa</i>		LC	
Fabaceae	<i>Indigofera cryptantha var. cryptantha</i>		LC	
Fabaceae	<i>Indigofera hedyantha</i>		LC	
Fabaceae	<i>Indigofera hilaris var. hilaris</i>	X	LC	
Fabaceae	<i>Indigofera melanadenia</i>		LC	
Fabaceae	<i>Indigofera oxytropis</i>		LC	
Fabaceae	<i>Indigofera zeyheri</i>		LC	
Convolvulaceae	<i>Ipomoea bathycolpos</i>	X	LC	
Convolvulaceae	<i>Ipomoea crassipes var. crassipes</i>		LC	
Convolvulaceae	<i>Ipomoea oblongata</i>		LC	
Convolvulaceae	<i>Ipomoea obscura var. obscura</i>		LC	
Convolvulaceae	<i>Ipomoea ommanneyi</i>		LC	
Convolvulaceae	<i>Ipomoea purpurea</i>	X		1b
Cyperaceae	<i>Isolepis costata</i>		LC	
Scrophulariaceae	<i>Jamesbrittenia atropurpurea subsp. atropurpurea</i>		LC	
Scrophulariaceae	<i>Jamesbrittenia aurantiaca</i>		LC	
Juncaceae	<i>Juncus effusus</i>		LC	
Juncaceae	<i>Juncus exsertus</i>		LC	
Juncaceae	<i>Juncus oxycarpus</i>		LC	
Acanthaceae	<i>Justicia anagalloides</i>		LC	
Crassulaceae	<i>Kalanchoe paniculata</i>	X	LC	
Cucurbitaceae	<i>Kedrostis africana</i>		LC	
<b>Aizoaceae</b>	<b><i>Khadia beswickii</i></b>		<b>VU</b>	<b>Bill 2014</b>
Achariaceae	<i>Kiggelaria africana</i>	X	LC	
Asphodelaceae	<i>Kniphofia porphyrantha</i>		LC	
Rubiaceae	<i>Kohautia amatymbica</i>		LC	
Rubiaceae	<i>Kohautia caespitosa subsp. brachyloba</i>		LC	
Rubiaceae	<i>Kohautia cynanchica</i>		LC	
Cyperaceae	<i>Kyllinga alba</i>		LC	
Cyperaceae	<i>Kyllinga erecta var. erecta</i>	X	LC	
Asteraceae	<i>Lactuca inermis</i>	X		X
Asteraceae	<i>Lactuca serriola</i>			X
Anacardiaceae	<i>Lannea discolor</i>	X	LC	
Verbenaceae	<i>Lantana rugosa</i>		LC	
Boraginaceae	<i>Lappula heteracantha</i>			X
Thymelaeaceae	<i>Lasiosiphon canoargenteus</i>		LC	
Thymelaeaceae	<i>Lasiosiphon capitatus</i>		LC	
Thymelaeaceae	<i>Lasiosiphon kraussianus</i>		LC	
Thymelaeaceae	<i>Lasiosiphon sericocephalus</i>		LC	
Asteraceae	<i>Launaea rarifolia var. rarifolia</i>		LC	

Hyacinthaceae	<i>Ledebouria burkei</i> subsp. <i>burkei</i>		LC	
Hyacinthaceae	<i>Ledebouria cooperi</i>		LC	
Hyacinthaceae	<i>Ledebouria luteola</i>	X	LC	
Hyacinthaceae	<i>Ledebouria marginata</i>		LC	
Hyacinthaceae	<i>Ledebouria revoluta</i>	X	LC	
Poaceae	<i>Leersia hexandra</i>		LC	
Fabaceae	<i>Leobordea divaricata</i>		LC	
Fabaceae	<i>Leobordea hirsuta</i>		LC	
Fabaceae	<i>Leobordea mucronata</i>		LC	
Lamiaceae	<i>Leonotis martinicensis</i>	X	LC	
Brassicaceae	<i>Lepidium africanum</i> subsp. <i>africanum</i>	X	LC	
Fabaceae	<i>Lessertia frutescens</i> subsp. <i>microphylla</i>		LC	
Limeaceae	<i>Limeum viscosum</i> subsp. <i>viscosum</i> var. <i>glomeratum</i>		NE	
Limeaceae	<i>Limeum viscosum</i> subsp. <i>viscosum</i> var. <i>kraussii</i>		NE	
Scrophulariaceae	<i>Limosella longiflora</i>		LC	
Linaceae	<i>Linum thunbergii</i>	X	LC	
Verbenaceae	<i>Lippia scaberrima</i>	X	LC	
Boraginaceae	<i>Lithospermum cinereum</i>		LC	
Lobeliaceae	<i>Lobelia sonderiana</i>	X	LC	
Poaceae	<i>Lolium multiflorum</i>			X
Asteraceae	<i>Lopholaena coriifolia</i>		LC	
Fabaceae	<i>Lotononis laxa</i>		LC	
Poaceae	<i>Loudetia simplex</i>		LC	
Malvaceae	<i>Malva parviflora</i> var. <i>parviflora</i>			X
Scrophulariaceae	<i>Manulea paniculata</i>		LC	
Fabaceae	<i>Medicago sativa</i>			X
Meliaceae	<i>Melia azedarach</i>	X		1b; 3 in urban areas
Fabaceae	<i>Melilotus albus</i>			X
Poaceae	<i>Melinis nerviglumis</i>		LC	
Poaceae	<i>Melinis repens</i> subsp. <i>repens</i>	X	LC	
Fabaceae	<i>Melolobium microphyllum</i>		LC	
Oleaceae	<i>Menodora africana</i>		LC	
Lamiaceae	<i>Mentha aquatica</i>		LC	
Poaceae	<i>Microchloa caffra</i>	X	LC	
Phrymaceae	<i>Mimulus gracilis</i>		LC	
Cucurbitaceae	<i>Momordica balsamina</i>		LC	
Poaceae	<i>Monocymbium ceresiiforme</i>		LC	
Geraniaceae	<i>Monsonia angustifolia</i>	X	LC	
Geraniaceae	<i>Monsonia burkeana</i>		LC	
Iridaceae	<i>Moraea pallida</i>		LC	
Myrothamnaceae	<i>Myrothamnus flabellifolius</i>		DDT	
Scrophulariaceae	<i>Nemesia fruticans</i>		LC	
Amaryllidaceae	<i>Nerine laticoma</i>		LC	Sch 11
Lythraceae	<i>Nesaea cordata</i>		LC	
Asteraceae	<i>Nidorella anomala</i>	X	LC	
Asteraceae	<i>Nidorella hottentotica</i>		LC	
Asteraceae	<i>Nidorella resedifolia</i> subsp. <i>resedifolia</i>		LC	
Asteraceae	<i>Nolletia rarifolia</i>		LC	
Nymphaeaceae	<i>Nymphaea nouchali</i> var. <i>caerulea</i>		LC	
Lamiaceae	<i>Ocimum obovatum</i> subsp. <i>obovatum</i> var. <i>obovatum</i>		NE	
Onagraceae	<i>Oenothera indecora</i>	X		X
Onagraceae	<i>Oenothera jamesii</i>			X
Onagraceae	<i>Oenothera rosea</i>	X		X
Onagraceae	<i>Oenothera stricta</i> subsp. <i>stricta</i>			X
Onagraceae	<i>Oenothera tetraptera</i>			X
Rubiaceae	<i>Oldenlandia herbacea</i>	X	LC	
Oleaceae	<i>Olea europaea</i> subsp. <i>cuspidata</i>		LC	
Ophioglossaceae	<i>Ophioglossum polyphyllum</i> var. <i>polyphyllum</i>		LC	
Cactaceae	<i>Opuntia ficus-indica</i>	X		1b
Apocynaceae	<i>Orbea lutea</i> subsp. <i>lutea</i>		LC	
Poaceae	<i>Oropetium capense</i>	X	LC	

Apocynaceae	<i>Orthanthera jasminiflora</i>		LC		
Orchidaceae	<i>Orthochilus leontoglossus</i>		LC	App II	
Asteraceae	<i>Osteospermum muricatum subsp. muricatum</i>	X	LC		
Asteraceae	<i>Osteospermum scariosum var. scariosum</i>		NE		
Santalaceae	<i>Osyris lanceolata</i>		LC		
Oxalidaceae	<i>Oxalis corniculata</i>	X			X
Oxalidaceae	<i>Oxalis obliquifolia</i>	X	LC		
Polygonaceae	<i>Oxygonum dregeanum subsp. canescens var. canescens</i>		NE		
Apocynaceae	<i>Pachycarpus schinzianus</i>		LC		
Poaceae	<i>Panicum maximum</i>	X	LC		
Poaceae	<i>Panicum natalense</i>	X	LC		
Poaceae	<i>Panicum repens</i>		LC		
Poaceae	<i>Panicum schinzii</i>	X	LC		
Papaveraceae	<i>Papaver aculeatum</i>		LC		
Chrysobalanaceae	<i>Parinari capensis subsp. capensis</i>		LC		
Poaceae	<i>Paspalum dilatatum</i>	X			X
Poaceae	<i>Paspalum distichum</i>				X
Poaceae	<i>Paspalum notatum</i>	X			X
Poaceae	<i>Paspalum urvillei</i>	X			X
Malvaceae	<i>Pavonia burchellii</i>		LC		
Fabaceae	<i>Pearsonia cajanifolia subsp. cajanifolia</i>		LC		
Fabaceae	<i>Pearsonia sessilifolia subsp. sessilifolia</i>		LC		
Fabaceae	<i>Pearsonia uniflora</i>		LC		
Geraniaceae	<i>Pelargonium luridum</i>		LC		
Pteridaceae	<i>Pellaea calomelanos var. calomelanos</i>	X	LC		
Poaceae	<i>Pennisetum thunbergii</i>		LC		
Rubiaceae	<i>Pentanisia angustifolia</i>	X	LC		
Apocynaceae	<i>Pentarrhinum insipidum</i>	X	LC		
Cucurbitaceae	<i>Peponium mackenii</i>		LC		
Poaceae	<i>Perotis patens</i>		LC		
Polygonaceae	<i>Persicaria lapathifolia</i>	X			X
Poaceae	<i>Phragmites australis</i>	X	LC		
Phyllanthaceae	<i>Phyllanthus incurvus</i>		LC		
Phyllanthaceae	<i>Phyllanthus parvulus var. parvulus</i>		LC		
Phytolaccaceae	<i>Phytolacca octandra</i>				1b
Apiaceae	<i>Pimpinella transvaalensis</i>	X	LC		
Pittosporaceae	<i>Pittosporum viridiflorum</i>		LC		
Plantaginaceae	<i>Plantago lanceolata</i>	X	LC		
Plantaginaceae	<i>Plantago major</i>				X
Lamiaceae	<i>Plectranthus ramosior</i>		LC		
Poaceae	<i>Pogonarthria squarrosa</i>		LC		
Caryophyllaceae	<i>Pollichia campestris</i>		LC		
Asteraceae	<i>Polydora angustifolia</i>		LC		
Polygalaceae	<i>Polygala gracilentia</i>		LC		
Polygalaceae	<i>Polygala hottentotta</i>	X	LC		
Polygalaceae	<i>Polygala rehmannii</i>		LC		
Polygalaceae	<i>Polygala transvaalensis subsp. transvaalensis</i>		LC		
Polygalaceae	<i>Polygala uncinata</i>		LC		
Polygonaceae	<i>Polygonum aviculare</i>				X
Salicaceae	<i>Populus canescens</i>	X			2
Portulacaceae	<i>Portulaca quadrifida</i>	X	LC		
Potamogetonaceae	<i>Potamogeton schweinfurthii</i>		LC		
Verbenaceae	<i>Priva meyeri var. meyeri</i>		LC		
Proteaceae	<i>Protea caffra subsp. caffra</i>		LC		
Rosaceae	<i>Prunus sp.</i>	X			
Asteraceae	<i>Pseudognaphalium luteoalbum</i>	X			X
Asteraceae	<i>Pseudognaphalium oligandrum</i>		LC		
Asteraceae	<i>Pseudopegolettia tenella</i>		LC		
Pteridaceae	<i>Pteris vittata</i>		LC		
Cyperaceae	<i>Pycreus mundii</i>		LC		
Rubiaceae	<i>Pygmaeothamnus zeyheri var. zeyheri</i>		LC		
Rosaceae	<i>Pyracantha angustifolia</i>	X			1b

Rosaceae	<i>Pyracantha crenulata</i>	X			1b
Brassicaceae	<i>Raphanus raphanistrum</i>			X	
Apocynaceae	<i>Raphionacme hirsuta</i>		LC		
Apocynaceae	<i>Raphionacme velutina</i>		LC		
Fabaceae	<i>Rhynchosia pedunculata</i>		LC		
Cyperaceae	<i>Rhynchospora brownii</i>		LC		
Rubiaceae	<i>Richardia brasiliensis</i>	X		X	
Euphorbiaceae	<i>Ricinus communis</i>	X			2
Apocynaceae	<i>Riocrexia polyantha</i>		LC		
Fabaceae	<i>Robinia pseudoacacia</i>	X			1b
Lamiaceae	<i>Rotheca hirsuta</i>		LC		
Rubiaceae	<i>Rubia horrida</i>		LC		
Polygonaceae	<i>Rumex crispus</i>			X	
Salicaceae	<i>Salix babylonica var. babylonica</i>	X		X	
Lamiaceae	<i>Salvia stenophylla</i>		LC		
Dipsacaceae	<i>Scabiosa columbaria</i>	X	LC		
Amaryllidaceae	<i>Scadoxus puniceus</i>		LC		
Poaceae	<i>Schizachyrium sanguineum</i>		LC		
Asteraceae	<i>Schkuhria pinnata</i>	X		X	
Cyperaceae	<i>Schoenoplectus brachyceras</i>		LC		
Cyperaceae	<i>Schoenoplectus corymbosus</i>	X	LC		
Cyperaceae	<i>Schoenoplectus tabernaemontani</i>			X	
Cyperaceae	<i>Scirpoides burkei</i>		LC		
Salicaceae	<i>Scolopia zeyheri</i>	X	LC		
Anacardiaceae	<i>Searsia discolor</i>		LC		
Anacardiaceae	<i>Searsia lancea</i>	X	LC		
Anacardiaceae	<i>Searsia leptodictya</i>	X	LC		
Anacardiaceae	<i>Searsia magalismsontana subsp. magalismsontana</i>	X	LC		
Anacardiaceae	<i>Searsia pyroides var. gracilis</i>		LC		
Anacardiaceae	<i>Searsia pyroides var. integrifolia</i>		LC		
Anacardiaceae	<i>Searsia pyroides var. pyroides</i>	X	LC		
Anacardiaceae	<i>Searsia rigida var. dentata</i>		LC		
Anacardiaceae	<i>Searsia rigida var. margaretae</i>	X	LC		
Selaginellaceae	<i>Selaginella dregei</i>	X	LC		
Scrophulariaceae	<i>Selago densiflora</i>	X	LC		
Asteraceae	<i>Senecio affinis</i>		LC		
Asteraceae	<i>Senecio burchellii</i>		LC		
Asteraceae	<i>Senecio coronatus</i>		LC		
Asteraceae	<i>Senecio erubescens var. crepidifolius</i>		NE		
Asteraceae	<i>Senecio harveianus</i>	X	LC		
Asteraceae	<i>Senecio hieracioides</i>		LC		
Asteraceae	<i>Senecio inornatus</i>	X	LC		
Asteraceae	<i>Senecio isatideus</i>		LC		
Asteraceae	<i>Senecio oxyriifolius subsp. oxyriifolius</i>	X	LC		
Asteraceae	<i>Senecio venosus</i>		LC		
Fabaceae	<i>Senegalia caffra</i>	X	LC		
Fabaceae	<i>Senegalia hereroensis</i>	X	LC		
Asteraceae	<i>Seriphium plumosum</i>	X	LC		
Poaceae	<i>Setaria nigrirostris</i>		LC		
Poaceae	<i>Setaria pumila</i>	X	LC		
Poaceae	<i>Setaria sphacelata var. sphacelata</i>	X	LC		
Poaceae	<i>Setaria sphacelata var. torta</i>		LC		
Poaceae	<i>Setaria verticillata</i>		LC		
Malvaceae	<i>Sida chrysantha</i>		LC		
Malvaceae	<i>Sida alba</i>	X	LC		
Malvaceae	<i>Sida dregei</i>		LC		
Malvaceae	<i>Sida rhombifolia</i>	X	LC		
Caryophyllaceae	<i>Silene burchellii subsp. pilosellifolia</i>		LC		
Brassicaceae	<i>Sisymbrium turczaninowii</i>		LC		
Solanaceae	<i>Solanum elaeagnifolium</i>	X			1b
Solanaceae	<i>Solanum lichtensteinii</i>	X	LC		
Solanaceae	<i>Solanum nigrum</i>			X	

Solanaceae	<i>Solanum pseudocapsicum</i>	X			1b
Solanaceae	<i>Solanum sisymbriifolium</i>	X			1b
Asteraceae	<i>Sonchus dregeanus</i>		LC		
Asteraceae	<i>Sonchus oleraceus</i>			X	
Orobanchaceae	<i>Sopubia cana var. cana</i>		LC		
Poaceae	<i>Sorghum halepense</i>	X		X	
Fabaceae	<i>Spartium junceum</i>			X	
Caryophyllaceae	<i>Spergularia media</i>			X	
Malpighiaceae	<i>Sphedamnocarpus pruriens</i>	X	LC		
Fabaceae	<i>Sphenostylis angustifolia</i>		LC		
Poaceae	<i>Sporobolus congoensis</i>		LC		
Poaceae	<i>Sporobolus discosporus</i>		LC		
Poaceae	<i>Sporobolus fimbriatus</i>	X	LC		
Poaceae	<i>Sporobolus stapfianus</i>		LC		
Lamiaceae	<i>Stachys hyssopoides</i>		LC		
Lamiaceae	<i>Stachys natalensis var. galpinii</i>		LC		
Orobanchaceae	<i>Striga asiatica</i>		LC		
Orobanchaceae	<i>Striga bilabiata</i>	X	LC		
Orobanchaceae	<i>Striga elegans</i>	X	LC		
Asteraceae	<i>Symphotrichum squamatum</i>			X	
Lamiaceae	<i>Syncolostemon canescens</i>		LC		
Asteraceae	<i>Tagetes minuta</i>	X		X	
Talinaceae	<i>Talinum caffrum</i>		LC		
Asteraceae	<i>Taraxacum brunneum</i>			X	
Asteraceae	<i>Taraxacum officinale</i>	X		X	
Asteraceae	<i>Tarchoanthus camphoratus</i>		LC		
Fabaceae	<i>Tephrosia capensis var. capensis</i>	X	LC		
Fabaceae	<i>Tephrosia elongata var. elongata</i>		LC		
Fabaceae	<i>Tephrosia semiglabra</i>		LC		
Lamiaceae	<i>Teucrium trifidum</i>	X	LC		
Poaceae	<i>Themeda triandra</i>	X	LC		
Santalaceae	<i>Thesium magalimontanum</i>		LC		
Santalaceae	<i>Thesium multiramulosum</i>		LC		
Santalaceae	<i>Thesium procerum</i>		LC		
Santalaceae	<i>Thesium resedoides</i>		LC		
Santalaceae	<i>Thesium transvaalense</i>		LC		
Santalaceae	<i>Thesium utile</i>		LC		
Asteraceae	<i>Tolpis capensis</i>	X	LC		
Asphodelaceae	<i>Trachyandra saltii var. saltii</i>		LC		
Poaceae	<i>Trachypogon spicatus</i>	X	LC		
Asteraceae	<i>Tragopogon dubius</i>			X	
Poaceae	<i>Tragus berteronianus</i>	X	LC		
Zygophyllaceae	<i>Tribulus terrestris</i>		LC		
Poaceae	<i>Trichoneura grandiglumis</i>	X	LC		
Poaceae	<i>Triraphis andropogonoides</i>	X	LC		
Poaceae	<i>Trisetopsis imberbis</i>	X	LC		
Poaceae	<i>Tristachya leucothrix</i>		LC		
Poaceae	<i>Tristachya rehmannii</i>		LC		
Iridaceae	<i>Tritonia nelsonii</i>		LC		
Malvaceae	<i>Triumfetta sonderi</i>		LC		
Fabaceae	<i>Tylosema esculentum</i>		LC		
Typhaceae	<i>Typha capensis</i>	X	LC		
Ulmaceae	<i>Ulmus parvifolia</i>			X	
Poaceae	<i>Urochloa mosambicensis</i>	X	LC		
Poaceae	<i>Urochloa panicoides</i>		LC		
Asteraceae	<i>Ursinia nana subsp. leptophylla</i>	X	LC		
Fabaceae	<i>Vachellia karroo</i>	X	LC		
Fabaceae	<i>Vachellia nilotica subsp. kraussiana</i>		LC		
Fabaceae	<i>Vachellia permixta</i>		LC		
Rubiaceae	<i>Vangueria pygmaea</i>		LC		
Verbenaceae	<i>Verbena bonariensis</i>	X			1b
Verbenaceae	<i>Verbena brasiliensis</i>	X			1b
Asteraceae	<i>Verbesina encelloides</i>	X		X	

Fabaceae	<i>Vigna unguiculata subsp. stenophylla</i>		LC	
Fabaceae	<i>Vigna vexillata var. vexillata</i>		LC	
Santalaceae	<i>Viscum rotundifolium</i>	X	LC	
Campanulaceae	<i>Wahlenbergia denticulata var. transvaalensis</i>		LC	
Campanulaceae	<i>Wahlenbergia undulata</i>	X	LC	
Campanulaceae	<i>Wahlenbergia virgata</i>	X	LC	
Solanaceae	<i>Withania somnifera</i>		LC	
Asteraceae	<i>Xanthium spinosum</i>	X		1b
Asteraceae	<i>Xanthium strumarium</i>			1b
Convolvulaceae	<i>Xenostegia tridentata subsp. angustifolia</i>		LC	
Xyridaceae	<i>Xyris capensis</i>		LC	
Scrophulariaceae	<i>Zaluzianskya elongata</i>		LC	
Scrophulariaceae	<i>Zaluzianskya katharinae</i>		LC	
Rutaceae	<i>Zanthoxylum capense</i>	X	LC	
Asteraceae	<i>Zinnia peruviana</i>	X		X
Rhamnaceae	<i>Ziziphus mucronata subsp. mucronata</i>	X	LC	
Rhamnaceae	<i>Ziziphus zeyheriana</i>	X	LC	
Fabaceae	<i>Zornia milneana</i>		LC	



# APPENDIX C: FAUNA CHECKLISTS (ADU DATABASE)

Database: ADU 2627B

<sup>1</sup>IUCN red list category<sup>2</sup>GDARD (1983)<sup>3</sup>CITES<sup>4</sup>NEMBA (ToPS) - Threatened or Protected Species

Note: Current survey based on own observations and supplemented by observations from farm owners

## MAMMALS

Family	Scientific name	Common name	IUCN RSA <sup>1</sup>	GDARD <sup>2</sup>	CITES <sup>3</sup>	NEMBA (ToPS) <sup>4</sup>	Current survey
Bathyergidae	<i>Cryptomys hottentotus</i>	Southern African Mole-rat	LC				
Bovidae	<i>Aepyceros melampus</i>	Impala	LC				X
Bovidae	<i>Alcelaphus buselaphus caama</i>	Red Hartebeest	LC	Sch 2			X
Bovidae	<i>Antidorcas marsupialis</i>	Springbok	LC				X
Bovidae	<i>Connochaetes gnou</i>	Black Wildebeest	LC	Sch 2		Prot	X
Bovidae	<i>Connochaetes taurinus taurinus</i>	Blue Wildebeest	LC				X
Bovidae	<i>Damaliscus pygargus phillipsi</i>	Blesbok	LC				X
Bovidae	<i>Kobus ellipsiprymnus ellipsiprymnus</i>	Waterbuck	LC	Sch 2			X
Bovidae	<i>Oryx gazella</i>	Gemsbok	LC	Sch 2			X
Bovidae	<i>Raphicerus campestris</i>	Steenbok	LC	Sch 2			X
Bovidae	<i>Redunca fulvorufula</i>	Mountain Reedbuck	EN	Sch 2			X
Bovidae	<i>Sylvicapra grimmia</i>	Grey Duiker	LC				
Bovidae	<i>Taurotragus oryx</i>	Cape Eland	LC	Sch 2			X
Bovidae	<i>Tragelaphus strepsiceros</i>	Greater Kudu	LC				X
Canidae	<i>Canis mesomelas</i>	Black-backed Jackal	LC	Sch 8			X
Cercopithecidae	<i>Chlorocebus pygerythrus pygerythrus</i>	Vervet Monkey	LC	Ssh 8			X
Cervidae	<i>Dama dama</i>	Fallow Deer	Introduced				X
Equidae	<i>Equus quagga</i>	Plains Zebra	LC				X
Erinaceidae	<i>Atelerix frontalis</i>	Southern African Hedgehog	NT	Sch 2		Prot	
Felidae	<i>Acinonyx jubatus</i>	Cheetah	VU	Sch 4	App I	VU	
Felidae	<i>Caracal caracal</i>	Caracal	LC	Sch 8	App II		X
Felidae	<i>Felis catus</i>	Domestic Cat	Introduced				
Felidae	<i>Leptailurus serval</i>	Serval	NT		App II	Prot	
Felidae	<i>Panthera leo</i>	Lion	LC	Sch 4	App II	VU	
Felidae	<i>Panthera pardus</i>	Leopard	VU	Sch 4	App I	VU	
Giraffidae	<i>Giraffa giraffa giraffa</i>	South African Giraffe	LC	Sch 2	App II		X
Herpestidae	<i>Atilax paludinosus</i>	Marsh Mongoose	LC				
Herpestidae	<i>Cynictis penicillata</i>	Yellow Mongoose	LC				X
Herpestidae	<i>Herpestes sanguineus</i>	Slender Mongoose	LC				X
Hippopotamidae	<i>Hippopotamus amphibius</i>	Hippopotamus	LC	Sch 2	App II		
Hipposideridae	<i>Cloeotis percivali</i>	Percival's Short-eared Trident Bat	EN				
Hystricidae	<i>Hystrix africaeaustralis</i>	Cape Porcupine	LC				
Leporidae	<i>Lepus saxatilis</i>	Scrub Hare	LC				X
Leporidae	<i>Pronolagus randensis</i>	Jameson's Red Rock Hare	LC				
Macroscelididae	<i>Elephantulus sp.</i>	Elephant Shrews					
Macroscelididae	<i>Elephantulus myurus</i>	Eastern Rock Elephant Shrew	LC				
Muridae	<i>Bla</i>	Veld rats					
Muridae	<i>Lemniscomys sp.</i>	Grass Mice					
Muridae	<i>Lemniscomys rosalia</i>	Single-Striped Lemniscomys	LC				
Muridae	<i>Mastomys sp.</i>	Multimammate Mice					
Muridae	<i>Mastomys coucha</i>	Southern African Mastomys	LC				
Muridae	<i>Mastomys natalensis</i>	Natal Mastomys	LC				
Muridae	<i>Otomys sp.</i>	Vlei Rats					
Muridae	<i>Otomys angoniensis</i>	Angoni Vlei Rat	LC				
Muridae	<i>Rhabdomys pumilio</i>	Xeric Four-striped Grass Rat	LC				
Muridae	<i>Tatera sp.</i>						

Mustelidae	<i>Aonyx capensis</i>	African Clawless Otter	NT	App II	Prot
Mustelidae	<i>Hydrictis maculicollis</i>	Spotted-necked Otter	VU		Prot
Mustelidae	<i>Ictonyx striatus</i>	Striped Polecat	LC		
Mustelidae	<i>Mellivora capensis</i>	Honey Badger	LC		
Nesomyidae	<i>Dendromus mystacalis</i>	Chestnut African Climbing Mouse	LC		
Nesomyidae	<i>Mystromys albicaudatus</i>	African White-tailed Rat	VU		
Nesomyidae	<i>Steatomys sp.</i>	Fat Mice			
Nycteridae	<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	LC		
Procaviidae	<i>Procavia capensis</i>	Cape Rock Hyrax	LC		
Rhinolophidae	<i>Rhinolophus sp.</i>	Horseshoe Bats			
Rhinolophidae	<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	LC		
Rhinolophidae	<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	LC		
Rhinolophidae	<i>Rhinolophus simulator</i>	Bushveld Horseshoe Bat	LC		
Sciuridae	<i>Xerus inauris</i>	South African Ground Squirrel	LC		X
Soricidae	<i>Crocidura sp.</i>	Shrews			
Soricidae	<i>Myosorex varius</i>	Forest Shrew	LC		
Soricidae	<i>Suncus sp.</i>	Dwarf Shrews			
Soricidae	<i>Suncus infinitesimus</i>	Least Dwarf Shrew	LC		
Suidae	<i>Phacochoerus africanus</i>	Warthog	LC		X
Vespertilionidae	<i>Miniopterus sp.</i>	Long-fingered Bats			
Vespertilionidae	<i>Miniopterus natalensis</i>	Natal Long-fingered Bat	LC		
Vespertilionidae	<i>Miniopterus schreibersii</i>	Schreibers's Long-fingered Bat	LC		
Vespertilionidae	<i>Myotis tricolor</i>	Temminck's Myotis	LC		
Vespertilionidae	<i>Neoromicia capensis</i>	Cape Serotine	LC		
Vespertilionidae	<i>Pipistrellus (Pipistrellus) rusticus</i>	Rusty Pipistrelle	LC		
Vespertilionidae	<i>Scotophilus dinganii</i>	Yellow-bellied House Bat	LC		
Viveridae	<i>Genetta maculata</i>	Common Large-spotted Genet	LC		
Viverridae	<i>Genetta genetta</i>	Common Genet	LC		
Viverridae	<i>Genetta tigrina</i>	Cape Genet (Cape Large-spotted Genet)	LC		

## REPTILES

Family	Scientific name	Common name	IUCN RSA	GDARD	CITES ToPS
Agamidae	<i>Agama aculeata distanti</i>	Distant's Ground Agama	LC	Sch 2	
Agamidae	<i>Agama atra</i>	Southern Rock Agama	LC	Sch 2	
Chamaeleonidae	<i>Chamaeleo dilepis</i>	Common Flap-neck Chameleon	LC	Sch 2	
Colubridae	<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	LC	Sch 2	
Colubridae	<i>Dasypeltis scabra</i>	Rhombic Egg-eater	LC	Sch 2	
Colubridae	<i>Dispholidus typus</i>	Boomslang	LC	Sch 2	
Colubridae	<i>Philothamnus semivariiegatus</i>	Spotted Bush Snake	LC	Sch 2	
Colubridae	<i>Telescopus semiannulatus semiannulatus</i>	Eastern Tiger Snake	LC	Sch 2	
Cordylidae	<i>Cordylus vittifer</i>	Common Girdled Lizard	LC	Sch 2	
Cordylidae	<i>Smaug vandami</i>	Van Dam's Dragon Lizard	LC	Sch 2	
Crocodylidae	<i>Crocodylus niloticus</i>	Nile Crocodile	VU (RSA)	Sch 2	
Elapidae	<i>Hemachatus haemachatus</i>	Rinkhals	LC	Sch 5	
Elapidae	<i>Naja annulifera</i>	Snouted Cobra	LC	Sch 5	
Gekkonidae	<i>Lygodactylus capensis</i>	Common Dwarf Gecko	LC	Sch 2	
Gekkonidae	<i>Lygodactylus ocellatus</i>	Spotted Dwarf Gecko	LC	Sch 2	
Gekkonidae	<i>Pachydactylus sp.</i>			Sch 2	
Gekkonidae	<i>Pachydactylus affinis</i>	Transvaal Gecko	LC	Sch 2	
Gekkonidae	<i>Pachydactylus capensis</i>	Cape Gecko	LC	Sch 2	
Gerrhosauridae	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	LC	Sch 2	
Lacertidae	<i>Nucras holubi</i>	Holub's Sandveld Lizard	LC	Sch 2	
Lacertidae	<i>Nucras lalandii</i>	Delalande's Sandveld Lizard	LC	Sch 2	
Lacertidae	<i>Pedioplanis lineoocellata lineoocellata</i>	Spotted Sand Lizard	LC	Sch 2	
Lamprophiidae	<i>Aparallactus capensis</i>	Black-headed Centipede-eater	LC	Sch 5	
Lamprophiidae	<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	LC	Sch 5	
Lamprophiidae	<i>Boaedon capensis</i>	Common House Snake	LC	Sch 5	
Lamprophiidae	<i>Lamprophis aurora</i>	Aurora Snake	LC	Sch 5	
Lamprophiidae	<i>Lycodonomorphus inornatus</i>	Olive Ground Snake	LC	Sch 5	
Lamprophiidae	<i>Lycodonomorphus rufulus</i>	Brown Water Snake	LC	Sch 5	
Lamprophiidae	<i>Prosymna sundevallii</i>	Sundevall's Shovel-snout	LC	Sch 5	
Lamprophiidae	<i>Psammophis brevirostris</i>	Short-snouted Grass Snake	LC	Sch 5	

Lamprophiidae	<i>Psammophylax rhombeatus</i>	Spotted Grass Snake	LC	Sch 5	
Lamprophiidae	<i>Pseudaspis cana</i>	Mole Snake	LC	Sch 5	
Pelomedusidae	<i>Pelomedusa galeata</i>	South African Marsh Terrapin	NE	Sch 2	
Pythonidae	<i>Python natalensis</i>	Southern African Python	LC	Sch 5	Prot
Scincidae	<i>Afroablepharus wahlbergii</i>	Wahlberg's Snake-eyed Skink	LC	Sch 2	
Scincidae	<i>Trachylepis capensis</i>	Cape Skink	LC	Sch 2	
Scincidae	<i>Trachylepis punctatissima</i>	Speckled Rock Skink	LC	Sch 2	
Scincidae	<i>Trachylepis varia sensu lato</i>	Variable Skink	LC	Sch 2	
Testudinidae	<i>Kinixys lobatsiana</i>	Lobatse Hinged-back Tortoise	LC	Sch 2	App II
Testudinidae	<i>Stigmochelys pardalis</i>	Leopard Tortoise	LC	Sch 2	App II
Typhlopidae	<i>Afrotyphlops bibronii</i>	Bibron's Blind Snake	LC	Sch 5	
Typhlopidae	<i>Rhinotyphlops lalandei</i>	Delalande's Beaked Blind Snake	LC	Sch 5	
Viperidae	<i>Bitis arietans arietans</i>	Puff Adder	LC	Sch 5	
Viperidae	<i>Causus rhombeatus</i>	Rhombic Night Adder	LC	Sch 5	

## FROGS

Family	Scientific name	Common name	IUCN			
			RSA	GDARD	CITES	ToPS
Bufonidae	<i>Schismaderma carens</i>	Red Toad	LC			
Bufonidae	<i>Sclerophrys capensis</i>	Raucous Toad	LC			
Bufonidae	<i>Sclerophrys gutturalis</i>	Guttural Toad	LC			
Hyperoliidae	<i>Kassina senegalensis</i>	Bubbling Kassina	LC			
Hyperoliidae	<i>Semnodactylus wealii</i>	Rattling Frog	LC			
Pipidae	<i>Xenopus laevis</i>	Common Platanna	LC			
Ptychadenidae	<i>Ptychadena anchietae</i>	Plain Grass Frog	LC			
Pyxicephalidae	<i>Amietia sp.</i>	Delalande's River Frog				
Pyxicephalidae	<i>Amietia delalandii</i>	Cape River Frog	LC			
Pyxicephalidae	<i>Amietia fuscigula</i>	Poynton's River Frog	LC			
Pyxicephalidae	<i>Amietia poyntoni</i>	Common Caco	LC			
Pyxicephalidae	<i>Cacosternum boettgeri</i>	Giant Bull Frog	NT			Prot
Pyxicephalidae	<i>Tomopterna sp.</i>	Tremelo Sand Frog	LC			
Pyxicephalidae	<i>Tomopterna cryptotis</i>	Natal Sand Frog	LC			
Pyxicephalidae	<i>Tomopterna natalensis</i>					

## LEPIDOPTERA

Family	Scientific name	Common name	IUCN
EREBIDAE	<i>Ochrota unicolor</i>		Not listed
HESPERIIDAE	<i>Afrogegenes sp.</i>		
HESPERIIDAE	<i>Coeloides pistratus</i>	Two-pip policeman	LC
HESPERIIDAE	<i>Eretis umbra umbra</i>	Small marbled elf	LC
HESPERIIDAE	<i>Gegenes pumilio gambica</i>	Dark dodger	LC
HESPERIIDAE	<i>Kedestes barberae barberae</i>	Freckled ranger	LC
HESPERIIDAE	<i>Kedestes lepenula</i>	Chequered ranger	LC
HESPERIIDAE	<i>Kedestes mohozutza</i>	Fulvous ranger	LC
HESPERIIDAE	<i>Kedestes nerva nerva</i>	Magaliesberg ranger	LC
HESPERIIDAE	<i>Metisella malgacha malgacha</i>	Grassveld sylph	LC
HESPERIIDAE	<i>Platylesches ayresii</i>	Peppered hopper	LC
HESPERIIDAE	<i>Platylesches dolomitica</i>	Spring hopper	LC
HESPERIIDAE	<i>Platylesches neba</i>	Flower-girl hopper	LC
HESPERIIDAE	<i>Spialia asterodia</i>	Star sandman	LC
HESPERIIDAE	<i>Spialia dromus</i>	Forest sandman	LC
HESPERIIDAE	<i>Spialia ferax</i>	Striped sandman	LC
HESPERIIDAE	<i>Spialia mafa mafa</i>	Mafa sandman	LC
HESPERIIDAE	<i>Spialia spio</i>	Mountain sandman	LC

HESPERIIDAE	<i>Tsitana tsita</i>	Dismal sylph	LC
LYCAENIDAE	<i>Actizera lucida</i>	Rayed blue	LC
LYCAENIDAE	<i>Aloeides aranda</i>	Yellow russet	LC
LYCAENIDAE	<i>Aloeides henningi</i>	Hillside russet	LC
LYCAENIDAE	<i>Aloeides molomo coalescens</i>	Mottled russet	LC
LYCAENIDAE	<i>Aloeides molomo molomo</i>	Mottled russet	LC
LYCAENIDAE	<i>Aloeides taikosama</i>	Dusky russet	LC
LYCAENIDAE	<i>Aloeides trimeni trimeni</i>	Brown russet	LC
LYCAENIDAE	<i>Anthene livida livida</i>	Pale ciliate blue	LC
LYCAENIDAE	<i>Axiocerses tjoane tjoane</i>	Eastern scarlet	LC
LYCAENIDAE	<i>Azanus jesous</i>	Topaz babul blue	LC
LYCAENIDAE	<i>Azanus moriqua</i>	Black-bordered babul blue	LC
LYCAENIDAE	<i>Azanus ubaldus</i>	Velvet-spotted babul blue	LC
LYCAENIDAE	<i>Cacyreus fracta fracta</i>	Water geranium bronze	LC
LYCAENIDAE	<i>Cacyreus marshalli</i>	Common geranium bronze	LC
LYCAENIDAE	<i>Cacyreus virilis</i>	Mocker bronze	LC
LYCAENIDAE	<i>Capys disjunctus</i>	Russet protea	LC
LYCAENIDAE	<i>Chilades trochylus</i>	Grass jewel blue	LC
LYCAENIDAE	<i>Cigaritis ella</i>	Ella's silverline	LC
LYCAENIDAE	<i>Cigaritis mozambica</i>	Mozambique silverline	LC
LYCAENIDAE	<i>Cigaritis natalensis</i>	Natal silverline	LC
LYCAENIDAE	<i>Cupidopsis cissus cissus</i>	Meadow blue	LC
LYCAENIDAE	<i>Cupidopsis jobates jobates</i>	Tailed meadow blue	LC
LYCAENIDAE	<i>Deudorix antalus</i>	Brown playboy	LC
LYCAENIDAE	<i>Eicochrysops messapus mahallakoena</i>	Cupreous ash blue	LC
LYCAENIDAE	<i>Euchrysops dolorosa</i>	Sabie smoky blue	LC
LYCAENIDAE	<i>Euchrysops osiris</i>	Osiris smoky blue	LC
LYCAENIDAE	<i>Euchrysops subpallida</i>	Ashen smoky blue	LC
LYCAENIDAE	<i>Iolaus trimeni</i>	Protea sapphire	LC
LYCAENIDAE	<i>Lampides boeticus</i>	Pea blue	LC
LYCAENIDAE	<i>Lepidochrysops glauca</i>	Silvery giant cupid	LC
LYCAENIDAE	<i>Lepidochrysops ortygia</i>	Koppie giant cupid	LC
LYCAENIDAE	<i>Lepidochrysops patricia</i>	Patrician giant cupid	LC
LYCAENIDAE	<i>Lepidochrysops plebeia plebeia</i>	Twin-spot giant cupid	LC
LYCAENIDAE	<i>Lepidochrysops praeterita</i>	Highveld giant cupid	EN
LYCAENIDAE	<i>Lepidochrysops procera</i>	Potchefstroom giant cupid	LC
LYCAENIDAE	<i>Leptomyrina henningi henningi</i>	Plain black-eye	LC
LYCAENIDAE	<i>Leptotes pirithous pirithous</i>	Common zebra blue	LC
LYCAENIDAE	<i>Lycena clarki</i>	Eastern sorrel copper	LC
LYCAENIDAE	<i>Stugeta bowkeri henningi</i>	Bowker's marbled sapphire	LC
LYCAENIDAE	<i>Tarucus sybaris sybaris</i>	Dotted pierrot	LC
LYCAENIDAE	<i>Thestor basutus capeneri</i>	Basuto skolly	LC
LYCAENIDAE	<i>Tuxentius melaena melaena</i>	Black pie	LC
LYCAENIDAE	<i>Uranotauma nubifer nubifer</i>	Black heart	LC
LYCAENIDAE	<i>Deudorix dinochares</i>	Apricot playboy	LC
LYCAENIDAE	<i>Zintha hintza hintza</i>	Hintza pierrot	LC
LYCAENIDAE	<i>Zizeeria knysna knysna</i>	African grass blue	LC
LYCAENIDAE	<i>Zizula hylax</i>	Tiny grass blue	LC
			Not listed
NOCTUIDAE	<i>Brephos festiva festiva</i>		
NYMPHALIDAE	<i>Acraea aglaonice</i>	Clear-spotted acraea	LC
NYMPHALIDAE	<i>Acraea barberi</i>	Waterberg acraea	LC
NYMPHALIDAE	<i>Acraea horta</i>	Garden acraea	LC
NYMPHALIDAE	<i>Acraea neobule neobule</i>	Wandering donkey acraea	LC
NYMPHALIDAE	<i>Byblia ilithyia</i>	Spotted joker	LC
NYMPHALIDAE	<i>Catacroptera cloanthe cloanthe</i>	Pirate	LC
NYMPHALIDAE	<i>Danaus chrysippus orientis</i>	African plain tiger	LC
NYMPHALIDAE	<i>Hamanumida daedalus</i>	Guineafowl	LC
NYMPHALIDAE	<i>Hypolimnas misippus</i>	Common diadem	LC
NYMPHALIDAE	<i>Junonia hierta cebrene</i>	Yellow pansy	LC
NYMPHALIDAE	<i>Junonia oenone oenone</i>	Dark blue pansy	LC
NYMPHALIDAE	<i>Junonia orithya madagascariensis</i>	African blue pansy	LC
NYMPHALIDAE	<i>Melanitis leda</i>	Common evening brown	LC
NYMPHALIDAE	<i>Paternympha narycia</i>	Spotted-eye small ringlet	LC
NYMPHALIDAE	<i>Precis archesia archesia</i>	Garden inspector	LC
NYMPHALIDAE	<i>Stygionympha wichgrafi wichgrafi</i>	Wichgraf's hillside brown	LC
NYMPHALIDAE	<i>Telchinia rahira rahira</i>	Marsh telchinia	LC
NYMPHALIDAE	<i>Telchinia serena</i>	Dancing telchinia	LC

NYMPHALIDAE	<i>Vanessa cardui</i>	Painted lady	LC
PAPILIONIDAE	<i>Papilio demodocus demodocus</i>	Citrus swallowtail	LC
PIERIDAE	<i>Belenois aurota</i>	Pioneer caper white	LC
PIERIDAE	<i>Catopsilia florella</i>	African migrant	LC
PIERIDAE	<i>Colias electo electo</i>	African clouded yellow	LC
PIERIDAE	<i>Colotis annae annae</i>	Scarlet tip	LC
PIERIDAE	<i>Colotis euipe omphale</i>	Southern round-winged orange tip	LC
PIERIDAE	<i>Colotis evagore antigone</i>	Small orange tip	LC
PIERIDAE	<i>Colotis evenina evenina</i>	African orange tip	LC
PIERIDAE	<i>Colotis lais</i>	Kalahari orange tip	LC
PIERIDAE	<i>Eurema brigitta brigitta</i>	Broad-bordered grass yellow	LC
PIERIDAE	<i>Mylothris rueppellii haemus</i>	Twin dotted border	LC
PIERIDAE	<i>Pinacopteryx eriphia eriphia</i>	Zebra white	LC
PIERIDAE	<i>Pontia helice helice</i>	Southern meadow white	LC
PIERIDAE	<i>Teracolus subfasciatus</i>	Lemon traveller	LC

## SPIDERS

Family	Scientific name	Common name	IUCN	GDARD	ToPS
Agelenidae	FAMILY Agelenidae	Funnel-web spiders			
Araneidae	<i>Nephila fenestrata</i>	Black legged golden orb-web spider			
Araneidae	FAMILY Araneidae	Araneid orb-web spiders			
Araneidae	<i>Cyrtophora citricola</i>	Tropical tent-web spiders			
Araneidae	<i>Neoscona sp.</i>	Neoscona hairy field spiders			
Corinnidae	FAMILY Corinnidae	Dark sac spiders and ant-imitating sac spiders			
Dysderidae	<i>Dysdera crocata</i>	Long jawed 6 eyed or woodlouse spiders			
Eresidae	<i>Gandanameno sp.</i>	Tree velvet spiders			
Eutichuridae	FAMILY Eutichuridae	Sac spiders and long-legged sac spiders			
Gnaphosidae	<i>Camillina sp.</i>	Pearly-eyed ground spiders			
Hersiliidae	<i>Hersilia sp.</i>	Long-spinnered bark spiders			
Lycosidae	FAMILY Lycosidae	Wolf spiders			
Nephilidae	FAMILY Nephilidae	Golden orb-web spiders			
Oxyopidae	FAMILY Oxyopidae	Lynx spiders			
Oxyopidae	<i>Oxyopes sp.</i>	Grass lynx spiders			
Oxyopidae	<i>Peucetia sp.</i>	Green lynx spiders			
Philodromidae	<i>Philodromus sp.</i>	Shouldered running spiders			
Pholcidae	FAMILY Pholcidae	Daddy longlegs spiders			
Pholcidae	<i>Smeringopus sp.</i>	Common daddy longlegs spiders			
Pisauridae	<i>Nilus sp.</i>	Fish-eating or fishing spiders			
Pisauridae	<i>Rothus sp.</i>	Crowned pisaurids			
Salticidae	FAMILY Salticidae	Jumping spiders			
Salticidae	<i>Heliophanus sp.</i>	jumping spiders			
Salticidae	<i>Heliophanus pauper</i>	Kenyan heliophanus			
Salticidae	<i>Hyllus sp.</i>	Large jumping spiders			
Salticidae	<i>Nigorella hirsuta</i>	White-spotted nigorella jumping spiders			
Salticidae	<i>Thyene natalii</i>	Natal thyene jumping spiders			
Scytodidae	<i>Scytodes sp.</i>	spitting spiders			
Sparassidae	<i>Palystes sp.</i>	Rain spiders			
Tetragnathidae	FAMILY Tetragnathidae	Water orb-web spiders			
Tetragnathidae	<i>Leucauge sp.</i>	Silvr vlei or silver swamp spiders			
Tetragnathidae	<i>Tetragnatha sp.</i>	Long-jawed water orb-web spiders			
Theraphosidae	<i>Brachionopus sp.</i>	baboon spider		X	
Theraphosidae	<i>Harpactira hamiltoni</i>	babon spider		X	Prot
Theridiidae	<i>Enoplognatha sp.</i>	comb-footed or cobweb spiders			
Theridiidae	<i>Latrodectus geometricus</i>	Common brown button spiders			
Theridiidae	<i>Theridion sp.</i>	comb-footed or cobweb spiders			
Thomisidae	FAMILY Thomisidae	Crab spiders			
Thomisidae	<i>Misumenops</i>				
Thomisidae	<i>rubrodecoratus</i>	Common rosy banded crab spiders			
Thomisidae	<i>Oxytate sp.</i>	crab spiders			
Thomisidae	<i>Thomisus sp.</i>	Flower crab spiders			
Thomisidae	<i>Thomisus citrinellus</i>	Variable spotted thomisus crab spiders			
Trochanteriidae	<i>Platyoides sp.</i>	scorpion spiders			
Trochanteriidae	<i>Platyoides walteri</i>	Common scorpion spiders			
Uloboridae	FAMILY Uloboridae	Hackled orb-web spiders			

---

Uloboridae      *Uloborus plumipes*      Feather legged spiders

---

## SCORPIONS

Family	Scientific name	ToPS
BUTHIDAE	<i>Pseudolychas ochraceus</i>	
BUTHIDAE	<i>Uroplectes triangulifer</i>	
HORMURIDAE	<i>Hadogenes gunningi</i>	Prot
SCORPIONIDAE	<i>Opisththalmus pugnax</i>	Prot

# APPENDIX D: SITE SENSITIVITY VERIFICATION

Prior to commencing with the Terrestrial Biodiversity Specialist Assessment in accordance with the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity (Government Notice 320, dated 20 March 2020), a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool.

The details of the site sensitivity verification are noted below:

<b>Date of site visit</b>	January 2021
<b>Specialist name</b>	Dr. Noel van Rooyen; Prof. Gretel van Rooyen
<b>Professional registration number</b>	401430/83 Botanical Science (NvR); 400509/14 Ecological Science (GvR)
<b>Specialist affiliation / company</b>	Ekotrust cc

The site sensitivity verification was undertaken using the following means:

- desk top analysis using satellite imagery;
- consulting geological, land type and vegetation type maps of the region;
- consulting provincial datasets on the latest versions of the mapping of CBAs, ESAs, ONAs, NPAES and PAs;
- checking distribution ranges of IUCN red-listed species and species highlighted by the Screening Tool;
- compiling plant and animal species checklist for the region; and
- on-site inspection.

To verify the site sensitivity of the Screening Tool, Google satellite images were studied beforehand and the site stratified into relatively homogenous physiographic-physionomic units or habitats. Sites were then selected to represent these habitats. During the field survey, 31 sampling sites were surveyed at the proposed Igolide development.

Animal Species Theme (bird and bat components are excluded – see specialist reports)

**Screening Tool:** The Screening Tool rated the sensitivity of the Animal Species Theme as **Medium**.

<b>Sensitivity</b>	<b>Feature(s)</b>
Medium	<i>Aves-Tyto capensis</i>
Medium	<i>Aves-Hydroprogne caspia</i>
Medium	<i>Aves-Eupodotis senegalensis</i>
Medium	<i>Insecta-Lepidochrysops praeterita</i>
Medium	<i>Insecta-Lepidochrysops procera</i>
Medium	<i>Mammalia-Crocidura maquassiensis</i>
Medium	<i>Mammalia-Hydrictis maculicollis</i>
Medium	<i>Invertebrate-Clonia uvarovi</i>

*Site verification:*

- **The avifaunal component will be addressed by the avifaunal specialist.**
- None of the animals listed in the Screening Tool were encountered on site.
- The Screening Tool listed *Lepidochrysops praeterita* and *Lepidochrysops procera* (Lepidoptera) as SCC for the site. Neither species was recorded on site and they are unlikely to occur there because their host plant (*Ocimum obovatum*) was not recorded on site.
- The Screening Tool listed *Clonia uvarovi* (Orthoptera) as SCC. *Clonia uvarovi* (Orthoptera) inhabits tall woodland savanna (<http://speciesstatus.sanbi.org/assessment/last-assessment/4333/>), and no tall woodland savanna is present on site. The woody habitat on site could be described as bushveld which may be marginally suitable for the species. Furthermore, the turbines are not located in any bushveld habitats.
- The Maquassie Musk Shrew *Crocidura maquassiensis* (VU) depends on wetlands as suitable habitat in savanna and grassland. Although it has a wide inferred extent of occurrence, it appears to be patchily distributed. It has not been reported from Gauteng or North West Province post-1999 and thus there is a very low probability for it to occur on site. It was also not listed on the ADU database for the region.
- Marginally suitable habitat for the spotted-necked Otter *Hydricis maculicollis* is available on site. It occurs widespread, but it is restricted to areas of permanent fresh water offering good shoreline cover and an abundant prey base. The watercourses were however avoided by the development and bufferzones are applicable.
- Excluding the avifaunal component, we would thus rate the sensitivity of the Animal Theme as **Low - Medium** based on the information provided above.

## Plant Species Theme

*Screening Tool:* The Screening Tool rated the sensitivity of the Plant Species Theme as **Medium**.

Sensitivity	Feature(s)
Medium	Sensitive species 1252
Medium	<i>Khadia beswickii</i>
Medium	Sensitive species 691
Medium	Sensitive species 1248

*Site verification:*

- Our site surveys and sensitivity model applied to the site data indicated that the vegetation of most of site had a low sensitivity.
- None of the SCC highlighted by the Screening Tool were recorded on site.
- *Khadia beswickii* occurs in rocky habitats on shallow soil (sheetrock), but was not recorded on site.
- Species 691 occurs in damp depressions in shallow soil over rock sheets. This type of habitat occurs on a small area on site, but was avoided by the development and the species was not encountered during the vegetation survey.
- The wooded habitats on site may present suitable habitat for plant species 1248 and 1252 on the list, but they were not encountered during the site survey. Furthermore, the rocky habitats (sheets) and wooded habitats were avoided in the layout of the infrastructure on the Igolide site.
- Two near threatened species, *Gnaphalium nelsonii* and *Cineraria austrotransvaalensis*, could potentially occur on site according to the Gauteng C-plan.
- Because none of the SCC highlighted by the Screening Tool were found on site, we suggest that the Plant Species Theme's site sensitivity is rated as **Low**.



## Relative Terrestrial Biodiversity Theme

*Screening Tool:* The Screening Tool rated the sensitivity of the Relative Terrestrial Biodiversity theme as **Very High**.

Sensitivity	Feature(s)
Very high	Critical Biodiversity Area 2
Very high	Ecological Support Area
Very high	Vulnerable ecosystem
Very high	Protected Areas Expansion Strategy

### Site verification:

- The Screening Tool rated the sensitivity of the Relative Terrestrial Biodiversity Theme as very high based on the presence of CBAs, ESAs, NPAES and a vulnerable ecosystem.
- The study area is not located in a protected area.
- The study site is part of the NPAES (NPAES 2018) and all turbines are located outside the NPAES.
- CBAs and ESAs are present on the site (CPlanV33\_1110\_ge 2017) and development within the CBAs should best be avoided. Turbines WTG04, WTG07 and WTG08 lie in ESAs and their positions may be reconsidered.
- Our background study confirmed that the Rand Highveld Grassland vegetation type on site is listed as Vulnerable whereas the Gauteng Shale Mountain Bushveld is Least Concern. The turbines are currently located in both the Rand Highveld Grassland (7 turbines) and the Gauteng Shale Mountain Bushveld (3 turbines). Since the turbine footprint is relatively small and spread across the site, the loss of prime habitat within the 'Vulnerable' Rand Highveld Grassland vegetation type is small in relation to the remaining extent of the vegetation type and ecosystem threat status will not be affected. Furthermore, most of the turbines in the Rand Highveld Grassland are not located in either CBAs or ESAs, but within areas demarcated a ONA. Although we agree that the current site clearly includes areas of very high sensitivity (CBA, ESAs and NPAES), it also includes a large portion that has not been demarcated as very high sensitivity, thus ONA. According to the land use guidelines supplied by SANBI (2021), split zoning should be used, where feasible, to demarcate sensitive areas, where CBAs occur across part of a property.
- The Freshwater Ecosystem Priority Areas (FEPAs) were not flagged by the Screening Tool.

### Outcome of the site sensitivity verification:

- We suggest that the Plant Species Theme's site sensitivity is rated as **Low**.
- We would suggest the Animal Theme's (**bird and bat components excluded**) site sensitivity to be rated as **Low – Medium**.
- According to the land use guidelines supplied by SANBI (2021) split zoning should be used where CBAs occur across part of a property to demarcate sensitive areas. The current site clearly includes areas of very high sensitivity (CBA, ESAs and NPAES), but it also includes a large portion that has not been demarcated as very high sensitivity, thus ONA. According to the land use guidelines supplied by SANBI (2021), split zoning should be used, where feasible, to demarcate sensitive areas, where CBAs occur across part of a property. The development has been largely contained within areas that do not qualify as very high sensitivity, although three turbines are located in ESAs.

# APPENDIX E: COMPLIANCE WITH THE TERRESTRIAL BIODIVERSITY PROTOCOL (GN 320, 20 MARCH 2020)

<b>Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity</b>	<b>Section where this has been addressed in the Specialist Report</b>
<i>The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:</i>	
2.3.1. <i>a description of the ecological drivers or processes of the system and how the proposed development will impact these;</i>	Chapters 9, Section 9.6; Chapter 17
2.3.2. <i>ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the preferred site;</i>	Chapter 9, Section 9.6
2.3.3. <i>the ecological corridors that the proposed development would impede including migration and movement of flora and fauna;</i>	Chapter 9, Sections 9.4 & 9.6
2.3.4. <i>the description of any significant terrestrial landscape features (including rare or important flora- faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments;</i>	Chapters 4 – 9
2.3.5. <i>a description of terrestrial biodiversity and ecosystems on the preferred site, including:</i> a) <i>main vegetation types;</i> b) <i>threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;</i> c) <i>ecological connectivity, habitat fragmentation, ecological processes and fine-scale habitats; and</i> d) <i>species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;</i>	(a) Chapter 5 (b) Chapters 5 & 9 (c) Chapters 5 & 9 (d) Chapters 5 – 9; Appendix A, B & C
2.3.6. <i>the assessment must identify any alternative development footprints within the preferred site which would be of a “low” sensitivity as identified by the Screening Tool and verified through the site sensitivity verification; and</i>	Chapter 9 & 10
2.3.7. <i>the assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:</i> 2.3.7.1. <i>terrestrial critical biodiversity areas (CBAs), including:</i> a) <i>the reasons why an area has been identified as a CBA;</i> b) <i>an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;</i> c) <i>the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);</i> d) <i>the impact on ecosystem threat status;</i> e) <i>the impact on explicit subtypes in the vegetation;</i> f) <i>the impact on overall species and ecosystem diversity of the site; and</i> g) <i>the impact on any changes to threat status of populations of species of conservation concern in the CBA;</i>	(a) Chapter 9, Appendix D (b) Chapter 9; Section 9.4 (c) Chapter 12, 13 & 17 (d) Chapter 17 (e) n.a. (f) Chapters 12 & 13 (g) Chapters 12 & 13
2.3.7.2. <i>terrestrial ecological support areas (ESAs), including:</i> a) <i>the impact on the ecological processes that operate within or across the site;</i> b) <i>the extent the proposed development will impact on the functionality of the ESA; and</i> c) <i>loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;</i>	(a) Chapter 9 (b) Chapter 9 (c) Chapter 9
2.3.7.3. <i>protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including-</i> a) <i>an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;</i>	n.a.
2.3.7.4. <i>priority areas for protected area expansion, including-</i> a) <i>the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;</i>	n.a.
2.3.7.5. <i>SWSAs including:</i> a) <i>the impact(s) on the terrestrial habitat of a SWSA; and</i>	n.a. (Chapter 9 (section 9.8))

<b>Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity</b>	<b>Section where this has been addressed in the Specialist Report</b>
b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in watercourses);	
2.3.7.6. FEPA subcatchments, including- a) the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;	Chapter 9; Section 9.5
2.3.7.7. indigenous forests, including: a) impact on the ecological integrity of the forest; and b) percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.	n.a.
3.1. The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:	
3.1.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix F
3.1.2. a signed statement of independence by the specialist;	p. vii
3.1.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Chapter 2
3.1.4. a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Chapter 2
3.1.5. a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	p. xv
3.1.6. a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Chapters 9, 10, 12, 13; Figures 23, 24 & 25; Sensitivity.kmz file
3.1.7. additional environmental impacts expected from the proposed development;	n.a.
3.1.8. any direct, indirect and cumulative impacts of the proposed development;	Chapters 12 & 13
3.1.9. the degree to which impacts and risks can be mitigated;	Chapters 12 & 13
3.1.10. the degree to which the impacts and risks can be reversed;	Chapters 12 & 13
3.1.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;	Chapters 12 & 13
3.1.12. proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	Chapter 15
3.1.13. a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	n.a.
3.1.14. a substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Chapter 17
3.1.15. any conditions to which this statement is subjected.	Chapter 17
3.2. The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr, where relevant.	For EAP to incorporate
3.2.1. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	For EAP to append

# APPENDIX F: Curriculum vitae: DR NOEL VAN ROOYEN

## 1. Biographical information

Surname	Van Rooyen
First names	Noel
ID number	501225 5034 084
Citizenship	South African
Business address	Ekotrust CC 7 St George Street Lionviham 7130 Somerset West South Africa
Mobile	082 882 0886
e-mail	<a href="mailto:noel@ekotrust.co.za">noel@ekotrust.co.za</a>
Current position	Member of Ekotrust cc
Professional registration	Botanical Scientist : Pr.Sci.Nat; Reg no. 401430/83

Academic qualifications include BSc (Agric), BSc (Honours), MSc (1978) and DSc degrees (1984) in Plant Ecology at the University of Pretoria, South Africa. Until 1999 I was Professor in Plant Ecology at the University of Pretoria and at present I am a member of Ekotrust cc.

## 2. Publications

I am the author/co-author of 128 peer reviewed research publications in national and international scientific journals and was supervisor or co-supervisor of 9 PhD and 33 MSc students. More than 400 projects were undertaken by Ekotrust cc as consultant over a period of more than 40 years.

### Books

VAN ROOYEN, N. 2001. *Flowering plants of the Kalahari dunes*. Ekotrust CC, Pretoria. (In collaboration with H. Bezuidenhout & E. de Kock).

VAN ROOYEN, N. & VAN ROOYEN, M.W. 2019. *Flowering plants of the southern Kalahari*. Somerset West.

Author / co-author of various chapters on the Savanna and Grassland Biomes in:

LOW, B. & REBELO, A.R. 1996. *Vegetation types of South Africa, Lesotho and Swaziland*, Department of Environmental Affairs and Tourism, Pretoria.

KNOBEL, J. (Ed.) 1999, 2006. *The Magnificent Natural Heritage of South Africa*. (Chapters on the Kalahari and Lowveld).

VAN DER WALT, P.T. 2010. *Bushveld*. Briza, Pretoria. (Chapter on Sour Bushveld).

Contributed to chapters on vegetation, habitat evaluation and veld management in the book:

BOTHMA, J. du P. & DU TOIT, J.G. (Eds). 2016. *Game Ranch Management*. 5th edition. Van Schaik, Pretoria.

BOTHMA, J. du P. & DU TOIT, J.G. (Eds). 2021. *Wildplaasbestuur*. 5th edition. Van Schaik, Pretoria.

Co-editor of the book:

BOTHMA, J. du P. & VAN ROOYEN, N. (eds). 2005. *Intensive wildlife production in southern Africa*. Van Schaik, Pretoria.

### 3. Ekotruster CC: Core Services

Ekotruster CC specializes in vegetation surveys, classification and mapping, wildlife management, wildlife production and economic assessments, vegetation ecology, veld condition assessment, carrying capacity, biodiversity assessments, rare species assessments, carbon pool assessments and alien plant management.

### 4. Examples of projects previously undertaken

Numerous vegetation surveys and vegetation impact assessments for Baseline, Scoping and Environmental Impact Assessments (BAs & EIA's) were made both locally and internationally.

Numerous projects have been undertaken in game ranches and conservation areas covering aspects such as vegetation surveys, range condition assessments and wildlife management. Of note is the Kgalagadi Transfrontier Park; iSimangaliso Wetland Park, Ithala Game Reserve, Phinda Private Game Reserve, Mabula Game Reserve, Tswalu Kalahari Desert Reserve, Maremani Nature Reserve and Associate Private Nature Reserve (previously Timbavati, Klaserie & Umbabat Private Game Reserve).

Involvement in various research programmes: vegetation of the northern Kruger National Park, Savanna Ecosystem Project at Nylsvley, Limpopo; Kuiseb River Project (Namibia); Grassland Biome Project; Namaqualand and Kruger Park Rivers Ecosystem research programme.

### 5. Selected references of other projects done by Ekotruster CC

- VAN ROOYEN, N., THERON, G.K., BREDEKAMP, G.J., VAN ROOYEN, M.W., DEUTSCHLÄNDER, M. & STEYN, H.M. 1996. *Phytosociology, vegetation dynamics and conservation of the southern Kalahari*. Final report: Department of Environmental Affairs & Tourism, Pretoria.
- VAN ROOYEN, N. 1999 & 2017. The vegetation types, veld condition and game of Tswalu Kalahari Desert Reserve.
- VAN ROOYEN, N. 2000. Vegetation survey and mapping of the Kgalagadi Transfrontier Park. Peace Parks Foundation, Stellenbosch.
- VAN ROOYEN, N., VAN ROOYEN, M.W. & GROBLER, A. 2004. Habitat evaluation and stocking rates for wildlife and livestock - PAN TRUST Ranch, Ghanzi, Botswana.
- VAN ROOYEN, N. 2004. Vegetation and wildlife of the Greater St Lucia Wetland Park, KZN.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2008. Vegetation classification, habitat evaluation and wildlife management of the proposed Royal Big Six Nsubane-Pongola Transfrontier Park, Swaziland. Ekotruster cc.
- VAN ROOYEN, N., VAN DER MERWE, H. & Van Rooyen, M.W. 2011. The vegetation of the NECSA Vaalputs site. Report to NECSA.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2014. Ecological evaluation and wildlife management on Ndzalama Nature Reserve and adjacent farms, Gravelotte, Limpopo province.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2016. Ecological evaluation of the farm Springbokoog in the Van Wyksvlei region of Northern Cape, including a habitat assessment for the introduction of black rhinoceros. Ekotruster.
- VAN ROOYEN, M.W. & VAN ROOYEN, N. & VAN DEN BERG, H. 2016. Kathu Bushveld study: Research offset for first development phase of Adams Solar Energy Facility. Project conducted for Department of Environment and Nature Conservation Northern Cape (DENC) and the Department of Agriculture, Forestry and Fisheries (DAFF).
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2018. Environmental screening study for the proposed essential oils and Moringa oil enterprise on Ferndale farm, Bathurst, Eastern Cape. Ekotruster cc, Somerset West.
- VAN ROOYEN, M.W., GAUGRIS, J.Y. & VAN ROOYEN, N. 2018. Dish Mountain gold project, Republic of Ethiopia: Natural resource use evaluation - baseline report. FFMES, Report to SRK Consulting.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2018. Report on the terrestrial ecology (flora & fauna). Basic assessment report for the proposed development of the 325 MW Kudusberg Wind Energy Facility in the Northern and Western Cape. Ekotruster cc, Somerset West.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2019. Proposed amendments to the Ishwati Emoyeni Wind Energy Facility (WEF) of Special Energy Project (PTY) LTD, a subsidiary of Windlab Systems (PTY) LTD. Ekotruster cc, Somerset West.

### 6. Selected peer-reviewed research publications

- VAN ROOYEN, N. 1978. A supplementary list of plant species for the Kruger National Park from the Pafuri area.

- Koedoe* 21: 37 - 46.
- VAN ROOYEN, N., THERON, G.K. & GROBBELAAR, N. 1981. A floristic description and structural analysis of the plant communities of the Punda Milia - Pafuri - Wambiya area in the Kruger National Park, Republic of South Africa. 2. The sandveld communities. *Jl S. Afr. Bot.* 47: 405 - 449.
- VAN ROOYEN, N., THERON, G.K. & GROBBELAAR, N. 1986. The vegetation of the Roodeplaat Dam Nature Reserve. 4. Phenology and climate. *S. Afr. J. Bot.* 52: 159 - 166.
- VAN ROOYEN, N. 1989. Phenology and water relations of two savanna tree species. *S. Afr. J. Sci.* 85: 736 - 740.
- VAN ROOYEN, N., BREDENKAMP, G.J. & THERON, G.K. 1991. Kalahari vegetation: Veld condition trends and ecological status of species. *Koedoe* 34: 61 - 72.
- VAN ROOYEN, M.W., GROBBELAAR, N., THERON, G.K. & VAN ROOYEN, N. 1992. The ephemerals of Namaqualand: effect of germination date on development of three species. *J. Arid. Environ.* 22: 51 - 66.
- VAN ROOYEN, N., BREDENKAMP, G.J., THERON, G.K., BOTHMA, J. DU P. & LE RICHE, E.A.N. 1994. Vegetational gradients around artificial watering points in the Kalahari Gemsbok National Park. *J. Arid Environ.* 26: 349-361.
- STEYN, H.M., VAN ROOYEN, N., VAN ROOYEN, M.W. & THERON, G.K. 1996. The phenology of Namaqualand ephemeral species: the effect of sowing date. *J. Arid Environ.* 32: 407 - 420.
- JELTSCH, F., MILTON, S.J., DEAN, W.R.J. & VAN ROOYEN, N. 1997. Analyzing shrub encroachment in the southern Kalahari: a grid-based modelling approach. *Journal of Applied Ecology* 34 (6): 1497 - 1509.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 1998. Vegetation of the south-western arid Kalahari: an overview. *Trans. Roy. Soc. S. Afr.* 53: 113 -140.
- DE VILLIERS, A.J., VAN ROOYEN, M.W., THERON, G.K. & VAN ROOYEN, N. 1999. Vegetation diversity of the Brand-se-Baai coastal dune area, West Coast, South Africa: a pre-mining benchmark survey for rehabilitation. *Land Degradation & Development* 10: 207 - 224.
- VAN ESSEN, L.D., BOTHMA, J. DU P., VAN ROOYEN, N. & TROLLOPE, W.S.W. 2002. Assessment of the woody vegetation of Ol Choro Oiroua, Masai Mara, Kenya. *Afr. J. Ecol.* 40: 76 - 83.
- MATTHEWS, W.S., VAN WYK, A.E., VAN ROOYEN, N. & BOTHA, G.A. 2003. Vegetation of the Tembe Elephant Park, Maputaland, South Africa. *South African Journal of Botany* 67: 573-594.
- BOTHMA, J. DU P., VAN ROOYEN, N. & VAN ROOYEN, M.W. 2004. Using diet and plant resources to set wildlife stocking densities in African savannas. *Wildlife Society Bulletin* 32 (3): 840-851.
- VAN ROOYEN, M.W., THERON, G.K., VAN ROOYEN, N., JANKOWITZ, W.J. & MATTHEWS, W.S. 2004. Mysterious circles in the Namib Desert: review of hypotheses on their origin. *Journal of Arid Environments* 57: 467-48.
- STEENKAMP, J.C. VOGEL, A., VAN ROOYEN, N., & VAN ROOYEN, M.W. 2008. Age determination of *Acacia erioloba* trees in the Kalahari. *Journal of Arid Environments* 72: 302 - 313.
- VAN DER MERWE, H., VAN ROOYEN, M.W. & VAN ROOYEN, N. 2008. Vegetation of the Hantam-Tanqua-Roggeveld subregion, South Africa Part 2. Succulent Karoo Biome-related vegetation. *Koedoe* 50: 160-183.
- VAN ROOYEN, M.W., VAN ROOYEN, N. & BOTHMA, J. DU P. 2008. Landscapes in the Kalahari Gemsbok National Park, South Africa. *Koedoe*: 50: 32-41.
- VAN ROOYEN, M.W., HENSTOCK, R., VAN ROOYEN, N. & VAN DER MERWE, H. 2010. Plant diversity and flowering displays on old fields in the arid Namaqua National Park, South Africa. *Koedoe* 52: Art. #1004, 7 pages. DOI: 10.4102/koedoe.v52i1.1004.
- VAN ROOYEN, M.W., LE ROUX, A., GELDENHUYS, C., VAN ROOYEN, N., BROODRYK, N. & VAN DER MERWE, H. 2015. Long-term vegetation dynamics (40 yr) in the Succulent Karoo South Africa: effects of rainfall and grazing. *Applied Vegetation Science* 18: 311-322.
- VAN ROOYEN, M.W., VAN ROOYEN, N., ORBAN, B., GAUGRIS, B., MOUTSAMBOTÉ, J.M., NSONGOLA G. & MIABANGANA, E.S. 2016. Floristic composition, diversity and stand structure of the forest communities in the Kouilou Département, Republic of Congo. *Tropical Ecology*: 54: 805-824.
- VAN ROOYEN, M.W., VAN ROOYEN, N., MIABANGANA, E.S., NSONGOLA, G., GAUGRIS, V. & GAUGRIS, J.Y. 2019. Floristic composition, diversity and structure of the rainforest in the Mayoko District, Republic of Congo. *Open Journal of Forestry* 9: 16-69. <https://doi.org/10.4236/ojf.2019.91002>.
- VAN DER MERWE, H., VAN ROOYEN, N., BEZUIDENHOUT, H., BOTHMA, J. DU P. VAN ROOYEN, M.W. 2019. *Vachellia erioloba* dynamics over 38 years in the Kalahari Gemsbok National Park, South Africa. *Koedoe* a1534. <https://doi.org/10.4102/koedoe.v61i1.1534>
- VAN DER MERWE, H., VAN ROOYEN, N., BEZUIDENHOUT, H., BOTHMA, J. DU P. & VAN ROOYEN, M.W. 2020. Woody vegetation change over more than 30 years in the interior duneveld of the Kalahari Gemsbok National Park. *Bothalia* 50 (1), a2 <http://dx.doi.org/10.38201/btha.abc.v50.i1.2>

# Curriculum vitae

## PROF GRETEL VAN ROOYEN

### 1. Biographical information

Surname	Van Rooyen
First names	Margaretha Wilhelmine
ID number	5004130033084
Home address	7 St George Street Lionviham 7130 Somerset West South Africa
Mobile	072 025 3386
e-mail	Gretel@ekotrust.co.za
Current position	Professor in Plant Ecology Scientific advisor - Ekotrust
Academic qualifications	BSc; BSc (Hons), HNOD, MSc (Botany), PhD (Plant ecology)

### 2. Books or book chapters

- Van Rooyen, M.W. 1999. Functional aspects of short-lived plants. In: W.R.J. Dean & S.J. Milton (Eds) *The Karoo: Ecological patterns and processes*. Cambridge University Press, Cambridge. pp. 107-122.
- Le Roux, A. & Van Rooyen, M.W. 1999. The Succulent Karoo. In: J. Knobel (ed.) *The magnificent heritage of South Africa*. Sunbird Publishing, Llandudno. pp. 94-107.
- Van Rheede Van Oudtshoorn, K. & Van Rooyen, M.W. 1999. *Dispersal biology of desert plants*. Springer Verlag, Berlin.
- VAN ROOYEN, G., STEYN, H. & DE VILLIERS, R. 1999. *Cederberg, Clanwilliam and Biedouw Valley*. Wild Flower Guide of South Africa no 10. Botanical Society of South Africa, Kirstenbosch.
- Schmiedel, U., Linke, T., Christiaan, R.A., Falk, T., Gröngröft, A., Haarmeyer, D.H., Hanke, W., Henstock, R., Hoffman, M.T., Kunz, N., Labitzky, T., Luther-Mosebach, J., Lutsch, N., Meyer, S., Petersen, A., Röwer, I.U., Van Der Merwe, H., Van Rooyen, M.W., Vollar, B., Weber, B. 2010. Environmental and socio-economic patterns and processes in the Succulent Karoo frame conditions for the management of this biodiversity hotspot. In: Hoffman, M. T., Schmiedel, U., Jürgens, N. [Eds.]: *Biodiversity in southern Africa. Volume 3: Implications for landuse and management*: 109–150, Klaus Hess Publishers, Göttingen & Windhoek.
- Wesuls, D., Strohbach, M., Horn, A., Kos, M., Zimmermann, J., Hoffmann, J., Geldenhuys, C., Dreber, N., Kellermann, L., Van Rooyen, M.W., Poschlod, P. 2010. Plant functional traits and types as a tool to analyse landuse impacts on vegetation. In: Schmiedel, U., Jürgens, N. [Eds.]: *Biodiversity in southern Africa. Volume 2: Patterns and processes at regional scale*: 222-232, Klaus Hess Publishers, Göttingen & Windhoek.
- Van Der Merwe, H. & Van Rooyen, G. 2010. Wild flowers of the Roggeveld and Tanqua.
- Stoffberg, H. & Van Rooyen, M.W. 2012. Estimates of carbon storage by Jacaranda street trees in the City of Tshwane, South Africa. In: Stoffberg, H., Hinds, C. & Muller, L. *South African Landscape Architecture: A Compendium and A Reader*. Chapter 10, pp. 129 – 140.
- Stoffberg, H. & Van Rooyen, M.W. 2012. An international perspective on growth rate and carbon sequestration of trees used in the urban landscape. In: Stoffberg, H., Hinds, C. & Muller, L. *South African Landscape Architecture: A Compendium and A Reader*. Chapter 11, pp. 141 – 146.
- Van Rooyen, N. & Van Rooyen, G. 2019. Flowering plants of the southern Kalahari. Private, Somerset West.

### 3. Selected project references

- UYS, N. & VAN ROOYEN, M.W. 2008. The status of *Aloe dichotoma* subsp. *dichotoma* (quiver tree) populations in Goegap Nature Reserve. Report to Northern Cape Nature Conservation.
- VAN ROOYEN, M.W., VAN ROOYEN, N., BOTHMA, J. DU P. & VAN DEN BERG, H.M. 2007. Landscapes in the Kalahari Gemsbok National Park, South Africa. Report to SANParks.
- VAN ROOYEN, M.W. 2000. Effect of disturbance on the annual vegetation in Namaqualand. Final Report for South African National Parks on Skilpad Disturbance Plots.
- VAN ROOYEN, M.W., THERON, G.K. & VAN ROOYEN, N. 1997. Studies on the ephemerals of Namaqualand. Report on a project executed on behalf of the Department of Environmental Affairs and Tourism 1994 – 1996.

- VAN ROOYEN, N., THERON, G.K., BREDEKAMP, G.J., VAN ROOYEN, M.W., DEUTSCHLÄNDER, M. & STEYN, H.M. 1996. *Phytosociology, vegetation dynamics and conservation of the southern Kalahari*. Final report on a project executed on behalf of the Department of Environmental Affairs & Tourism, Pretoria.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2000. Environmental audit of Namakwa Sands Mine at Brand-se-Baai, Western Cape. Report for Namaqua Sands to Department of Mineral Affairs and Energy.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2004. Vegetation of the Langer Heinrich area, Swakopmund, Namibia. Report to SoftChem.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2004. Vegetation of the Power Line Route from Walvisbaai to Langer Heinrich. Namibia. Ekotrust cc, Pretoria.
- VAN ROOYEN, N., VAN ROOYEN, M.W. & GROBLER, A. 2004. Habitat evaluation and stocking rates for livestock and wildlife - PAN TRUST RANCH, Ghanzi, Botswana. Report to People and Nature TRUST, Botswana.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2010. Vegetation of the Inca, Tubas and Shiyela sites of Reptile Uranium Namibia, Swakopmund, Namibia. Ekotrust cc, Pretoria.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2011. Ecological evaluation of Kalahari Game Lodge, Namibia. Ekotrust cc, Pretoria.
- VAN ROOYEN, N., VAN DER MERWE, M.W. & VAN ROOYEN, M.W. 2011. The vegetation, veld condition and wildlife of Vaalputs. Report to NECSA.
- VAN ROOYEN, N., VAN ROOYEN, M.W. & VAN DER MERWE, H. 2012. The vegetation of Ratelkraal, Northern Cape. Report to Northern Cape Nature Conservation.
- VAN ROOYEN, N., & VAN ROOYEN, M.W. 2013. Vegetation of the Ongolo and Tumas sites of Reptile Uranium Namibia (RUN), Swakopmund, Namibia. Ekotrust cc, Pretoria.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 2013. Vegetation Monitoring Report: 2013 Veld condition Vaalputs. Report to NECSA.
- VELDSMAN, S. & VAN ROOYEN, M.W. 2003. An analysis of the vegetation of the Witsand Nature Reserve. Report to Northern Cape Nature Conservation.

#### 4. Selected research publications

- BENEKE, K., VAN ROOYEN, M.W., THERON, G.K. & VAN DE VENTER, H.A. 1993. Fruit polymorphism in ephemeral species of Namaqualand: III. Germination differences between polymorphic diaspores. *Journal of Arid Environments* 24: 333-344.
- BENEKE, K., VON TEICHMAN, I., VAN ROOYEN, M.W. & THERON, G.K. 1992. Fruit polymorphism in ephemeral species of Namaqualand: I. Anatomical differences between polymorphic diaspores of two *Dimorphotheca* species. *South African Journal of Botany* 58: 448 - 455.
- DE VILLIERS, A.J., VAN ROOYEN, M.W., THERON, G.K. & VAN DE VENTER, H.A. 1994. Germination of three Namaqualand pioneer species, as influenced by salinity, temperature and light. *Seed Science & Technology* 22: 427-433.
- DE VILLIERS, A.J., VAN ROOYEN, M.W. & THERON, G.K. 1994. Comparison of two methods for estimating the size of the viable seed bank of two plant communities in the Strandveld of the West Coast, South Africa. *South African Journal of Botany* 60: 81-84.
- DE VILLIERS, A.J., VAN ROOYEN, M.W., THERON, G.K. & VAN ROOYEN, N. 1999. Vegetation diversity of the Brand-se-Baai coastal dune area, West Coast, South Africa: a pre-mining benchmark survey for rehabilitation. *Land Degradation and Development* 10: 207-224.
- DE VILLIERS, A.J., VAN ROOYEN, M.W. & THERON, G.K. 2001. The role of facilitation in seedling recruitment and survival patterns in the Strandveld Succulent Karoo, South Africa. *Journal of Arid Environments* 49: 809-821.
- DE VILLIERS, A.J., VAN ROOYEN, M.W. & THERON, G.K. 2002a. Germination strategies of Strandveld Succulent Karoo plant species for revegetation purposes: I. Temperature and light requirements. *Seed Science & Technology* 30: 17-33.
- DE VILLIERS, A.J., VAN ROOYEN, M.W. & THERON, G.K. 2002b. Germination strategies of Strandveld Succulent Karoo plant species for revegetation purposes. II. Dormancy-breaking treatments. *Seed Science & Technology* 30: 35-49.
- DE VILLIERS, A.J., VAN ROOYEN, M.W. & THERON, G.K. 2002c. Seed bank classification of the Strandveld Succulent Karoo, South Africa. *Seed Science Research* 12: 57-67.
- DE VILLIERS, A.J., VAN ROOYEN, M.W. & THERON, G.K. 2003. Similarity between the soil seed bank and the standing vegetation in the Strandveld Succulent Karoo, South Africa. *Land Degradation & Development* 14: 527-540.
- DE VILLIERS, A.J., VAN ROOYEN, M.W. & THERON, G.K. 2004. The restoration of Strandveld Succulent Karoo degraded by mining: an enumeration of topsoil seed banks. *South African Journal of Botany* 70: 1-9.
- DREBER, N., OLDELAND, J. & VAN ROOYEN, M.W. 2011. Impact of severe grazing on soil seed bank composition and its implications for rangeland regeneration in arid Namibia. *Agriculture, Ecosystems and Environment* 141: 399-409.
- GAUGRIS, J.Y. & VAN ROOYEN, M.W. 2010. Evaluating the adequacy of reserves in the Tembe-Tshanini complex: a case study in Maputaland, South Africa. *Oryx* 44: 399-410.
- JANKOWITZ, W.J., VAN ROOYEN, M.W., SHAW, D., KAUMBA, J.S. & VAN ROOYEN, N. 2008. Mysterious Circles in the Namib Desert. *South African Journal of Botany* 74:332-334.
- LAUCLAN H.F., PITHER, J., JENTSCH, A., STERNBERG, M., ZOBEL, M., ASKARIZADEH, D., BARTHA, S., BEIERKUHNEIN, C., BENNETT, J., BITTEL, A., BOLDRINI, I.I., BORK, E., BROWN, L., CABIDO, M., CAHILL, J., CARLYLE, C.N., CAMPETELLA, G., CHELLI, S., COHEN, O., CSERGO, A., DÍAZ, S., ENRICO, L., ENSING, D., FIDELIS, A., FOSTER, B., GARRIS, H., GOHEEN, J.R., HENRY, H.A.L., HOHN, M., JOURI, M.H., KLIRONOMOS, J., KOOREM, K., LKHAGVA, A., LODGE, R.L.,



- LONG, R., PETE MANNING, P., RANDALL MITCHELL, R., MOORA, M., MÜLLER, S.C., NABINGER, C., NASERI, K., OVERBECK, G.E., PALMER, T.M., PARSONS, S., PESEK, M., PILLAR, V.D., PRINGLE, R.M., ROCCAFORTE, K., SCHMIDT, A., SHANG, Z., STAHLMANN, R., STOTZ, G., SUGIYAMA, S., SZENTES, S., THOMPSON, D., TUNGALAG, R., UNDRAKHBOLD, S., VAN ROOYEN, M., WELLSTEIN, C., WILSON, J.B., ZUPO, T. 2015. Worldwide Evidence of the Unimodal Relationship Between Productivity and Plant Species Richness. *Science* 349: 302 – 305.
- NAUDE, Y., VAN ROOYEN, M.W. & ROHWER, E.R. 2011. Evidence for a geochemical origin of the mysterious circles in the Pro-Namib desert. *Journal of Arid Environments* 75: 446-456.
- OOSTHUIZEN, M.A., VAN ROOYEN, M.W. & THERON, G.K. 1996. A replacement series evaluation of competition between three Namaqualand ephemeral plant species. *South African Journal of Botany* 62: 342-345.
- RÖSCH, H., VAN ROOYEN, M.W. & THERON, G.K. 1997a. Competitive effect and response of ten Namaqualand pioneer plant species at two nutrient levels. *South African Journal of Botany* 63: 210-215.
- RÖSCH, H., VAN ROOYEN, M.W. & THERON, G.K. 1997b. Predicting competitive interactions between pioneer plant species on the basis of plant traits. *Journal of Vegetation Science* 8: 489-494.
- STAPELBERG, F.H., VAN ROOYEN, M.W. & BOTHMA, J. DU P. 2008. Seasonal nutrient fluctuation in selected plant species in the Kalahari. *African Journal of Range & Forage Science* 25(3):
- STEENKAMP, C.J., VOGEL, J.C., FULS, A., VAN ROOYEN, N., & VAN ROOYEN, M.W. 2008. Age determination of *Acacia erioloba* trees in the Kalahari. *Journal of Arid Environments* 72: 302 - 313.
- STEYN, H.M., VAN ROOYEN, N., VAN ROOYEN, M.W. & THERON, G.K. 1996a. The phenology of Namaqualand ephemeral species. The effect of water stress. *Journal of Arid Environments* 33: 49-62.
- STEYN, H.M., VAN ROOYEN, N., VAN ROOYEN, M.W. & THERON, G.K. 1996b. The prediction of phenological stages in four Namaqualand ephemeral species using thermal unit indices. *Israel Journal of Plant Sciences* 44: 147-160.
- STOFFBERG, G.H., VAN ROOYEN, M.W., VAN DER LINDE, M.L. & GROENEVELD, H.T. 2010. Carbon sequestration estimates of indigenous street trees in the City of Tswane, South Africa. *Urban Forestry and Urban Greening*.
- THERON, G.K., VAN ROOYEN, N. & VAN ROOYEN, M.W. 1980. The vegetation of the Lower Kuiseb River. *Madoqua* 11: 327-345.
- UECKERMANN, C. & VAN ROOYEN, M.W. 2000. Insect pollination and seed set in four Namaqualand plant species. *South African Journal of Botany* 66: 28-30.
- VAN DER MERWE, H., VAN ROOYEN, M.W. & VAN ROOYEN, N. 2008a. The vegetation of the Hantam-Tanqua-Roggeveld subregion, South Africa. Part 1: Fynbos Biome related vegetation. *Koedoe* 50: 61-81.
- VAN DER MERWE, H., VAN ROOYEN, M.W. & VAN ROOYEN, N. 2008b. The vegetation of the Hantam-Tanqua-Roggeveld subregion, South Africa. Part 2: Succulent Karoo Biome related vegetation. *Koedoe* 50: 160-183.
- VAN DER MERWE, H. & VAN ROOYEN, M.W. 2011a. Guiding conservation efforts in the Hantam-Tanqua-Roggeveld (South Africa) using diversity parameters. *Koedoe* 53: doi:10.4102/koedoe.v53i1.1018.
- VAN DER MERWE, H. & VAN ROOYEN, M.W. 2011b. Life form spectra in the Hantam-Tanqua-Roggeveld, South Africa. *South African Journal of Botany* 77: 371-380.
- VAN DER MERWE, H. & VAN ROOYEN, M.W. 2011c. Life-form and species diversity on abandoned croplands, Roggeveld, South Africa. *African Journal of Range and Forage Science* 28: 99-110.
- VAN DER MERWE, H. & VAN ROOYEN, M.W. 2011d. Species–area relationships in the Hantam-Tanqua-Roggeveld, Succulent Karoo, South Africa. *Biodiversity and Conservation* 20: 1183-1201.
- VAN DER MERWE, H. & VAN ROOYEN, M.W. 2011e. Vegetation trends following fire in the Roggeveld, Mountain Renosterveld, South Africa. *South African Journal of Botany* 77: 127-136.
- VAN DER MERWE, H., VAN ROOYEN, N., BEZUIDENHOUT, H., BOTHMA, J. DU P. VAN ROOYEN, M.W. 2019. *Vachellia erioloba* dynamics over 38 years in the Kalahari Gemsbok National Park, South Africa. *Koedoe*, 61, <https://doi.org/10.4102/koedoe.v61i1>.
- VAN ROOYEN, M.W. 2002. Management of the old field vegetation in the Namaqua National Park, South Africa: conflicting demands of conservation and tourism. *Geographical Journal* 168: 211-223.
- VAN ROOYEN, M.W., GROBBELAAR, N. & THERON, G.K. 1979. Phenology of the vegetation in the Hester Malan Nature Reserve in the Namaqualand Broken Veld: 2. The therophyte population. *Journal of South African Botany* 45: 433 - 452.
- VAN ROOYEN, M.W., GROBBELAAR, N., THERON, G.K. & VAN ROOYEN, N. 1991. The ephemerals of Namaqualand: Effects of photoperiod, temperature and moisture stress on development and flowering of three species. *Journal of Arid Environments* 20: 15 - 29.
- VAN ROOYEN, M.W., GROBBELAAR, N., THERON, G.K. & VAN ROOYEN, N. 1992a. The ephemerals of Namaqualand. Effect of germination date on development of three species. *Journal of Arid Environments* 22: 51 - 66.
- VAN ROOYEN, M.W., GROBBELAAR, N., THERON, G.K. & VAN ROOYEN, N. 1992b. The ephemerals of Namaqualand. Effect of germination date on parameters of growth analysis of three species. *Journal of Arid Environments* 22: 117 - 136.
- VAN ROOYEN, M.W., HENSTOCK, R., VAN ROOYEN, N. & VAN DER MERWE, H. 2010. Plant diversity and flowering displays on old fields in the arid Namaqua National Park, South Africa. *Koedoe* 52: Art. #1004, 7 pages. DOI: 10.4102/koedoe.v52i1.1004.
- VAN ROOYEN, M.W., THERON, G.K. & GROBBELAAR, N. 1979. Phenology of the vegetation in the Hester Malan Nature Reserve in the Namaqualand Broken Veld: 1. General observations. *Journal of South African Botany* 45: 279 - 293.
- VAN ROOYEN, M.W., THERON, G.K. & GROBBELAAR, N. 1990. Life forms and dispersal spectra of the Namaqualand flora. *Journal of Arid Environments* 19: 133-145.
- VAN ROOYEN, M.W., THERON, G.K. & VAN ROOYEN, N. 1992. The ephemerals of Namaqualand: effect of density on yield and biomass allocation. *Journal of Arid Environments* 23: 249 - 262.

- VAN ROOYEN, M.W., THERON, G.K., VAN ROOYEN, N., JANKOWITZ, W.J. & MATTHEWS, W.S. 2004. Mysterious circles in the Namib Desert: Review of hypotheses on their origin. *Journal of Arid Environments* 57: 467-485.
- VAN ROOYEN, M.W., VAN ROOYEN, N. & BOTHMA, J. DU P. 2008. Landscapes in the Kalahari Gemsbok National Park, South Africa. *Koedoe* 50: 32-41.
- VAN ROOYEN, M.W., VAN ROOYEN, N. & STOFFBERG, G.H. 2013. Carbon sequestration potential of post-mining reforestation activities on the KwaZulu-Natal coast, South Africa. *Forestry* 86:211-233.
- VAN ROOYEN, M.W., LE ROUX, A., GELDENHUYS, C., VAN ROOYEN, N., BROODRYK, N. & VAN DER MERWE, H. 2015. Long-term vegetation dynamics (40 yr) in the Succulent Karoo South Africa: effects of rainfall and grazing. *Applied Vegetation Science* 18: 311-322.
- VAN ROOYEN, M.W., LE ROUX, A., VAN DER MERWE, H., VAN ROOYEN, N. & GELDENHUYS, C. 2018. Long-term vegetation change (>20 years) in the plains habitat on the Goegap Nature Reserve, Succulent Karoo, South Africa. *African Journal of Range & Forage Science* 35: 289 – 302.
- VAN ROOYEN, N. & VAN ROOYEN, M.W. 1998. Vegetation of the south-western arid Kalahari: an overview. *Transactions of the Royal Society of South Africa*. 53: 113-140.